



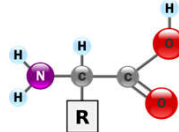
- white biotechnology -

# BIOTECHNOLOGY ON AMINO-ACIDS

Luca D., Tom-Lukas L.

## What are amino-acids?

First of all, amino-acids are organic compounds containing both an amino group (NH<sub>2</sub>) and a carboxyl group (COOH) connected by a CH group with a specific R compound connected to the carbon in the middle. The generic formula for an amino-acid is H<sub>2</sub>N-CH-R-COOH.



<https://commons.wikimedia.org/wiki/File:AminoAcidball.svg>

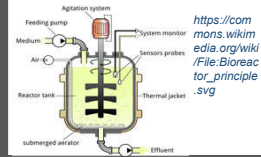
The amino-acids differ from each other in the R group, which can be organic compounds alone or after a polymer chain. Based on the number of carbons in this chain, they are divided in classes using Greek alphabet letters.

As part of proteins, which make up cells and our whole body, the amino-acids are the most important basic components in our body and they are responsible for our metabolism in muscles, organs and the cells themselves. But they also have other functions: they are optimal for transportation or storage of nutrients, like water or fats, they can be oxidized to produce energy, or they can be used to synthesize other molecules used in our body, like neurotransmitters.

## Production

The chemical production usually uses the Strecker-amino-acid-synthesis, also known as Strecker synthesis, where aldehydes (RCHO), ammonia (NH<sub>3</sub>) and hydrogen cyanide (HCN) react to form an α-amino-nitrile, which is subsequently hydrolysed to give the desired amino-acid.

Biotechnological production of amino-acids consists in a synthesis process that goes through bacteria cultures and fermentation. The first bacteria used for the culture were E. Coli but then C. Glutamicum was discovered for the production of glutamic acid and it replaced Coli in all the other fields of amino acid production.



[https://commons.wikimedia.org/wiki/File:Bioreactor\\_principle.svg](https://commons.wikimedia.org/wiki/File:Bioreactor_principle.svg)

## Usage

In first place, for the animals, essential amino-acids are used to feed them to increase the profit. In common animal food you have deficiency of some amino-acids, like Lysine, so by feeding them with these types of amino-acids you can control their health and meanwhile also increase the production with less food.

They are also used to treat nutrient deficiency or increase energy in the human patients. Some non-proteic amino-acids are instead produced and used in the pharmaceutical industry because they can be converted to neurotransmitters, like tryptophan.

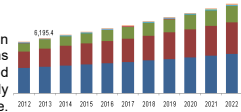
### Limiting Amino Acid



<http://www.nutrientsreview.com/wp-content/uploads/2014/10/Limiting-Amino-Acid.jpg>

## Industry

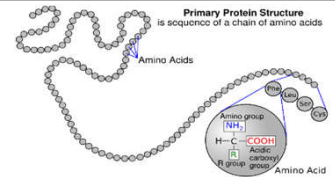
The amino-acids industry is a field in development: in 2013 there were 6.19 million tons produced worldwide. The production is expected to grow continuously in the next years, especially for L-Glutamate, Lysine and also Methionine. There are various industries that are specialized in the amino-acids production: for instance Evonik Industries is a worldwide famous German company that uses biotechnological techniques to produce amino-acids for the animal food industry.



<https://www.grandviewresearch.com/industry-analysis/amino-acids-market>

## Conclusion

In conclusion, amino-acids are one of the most important factors for life and we are not able to produce all of them by ourselves, so it is fundamental to have renewable and effective ways to produce them. The biotechnological way is by far the best method that can be utilized, because it uses natural instruments and it is quite self-sustainable. Manufacturing is already using this method in the most part and research is also considered really important to further develop it in the best way possible. Biotechnology is already a big sector and it will grow faster than any other, as technology did in the past 20 years.



[https://upload.wikimedia.org/wikipedia/commons/thumb/3/38/Protein\\_primary\\_structure.svg/200px-Protein\\_primary\\_structure.svg.png](https://upload.wikimedia.org/wikipedia/commons/thumb/3/38/Protein_primary_structure.svg/200px-Protein_primary_structure.svg.png)



This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.