

18.4: Amino Acids

Athletics are very competitive these days at all levels, from school sports to the pros. Everybody is looking for that edge that will make them faster, stronger, and more physically fit. One approach taken by many athletes is the use of amino acid supplements. The theory is that the increase in amino acids in the diet will lead to increased protein for muscles. However, the only real benefit comes to the people who make and sell the pills. Studies have not shown any advantage obtained by the athletes themselves; they are better off just maintaining a healthy diet.

Amino Acids

An **amino acid** is a compound that contains both an amine group ($-\text{NH}_2$) and a carboxyl group ($-\text{COOH}$) in the same molecule. While any number of amino acids can be imagined, biochemists generally reserve the term for a group of 20 amino acids which are formed and used by living organisms. The figure below shows the general structure of an amino acid.

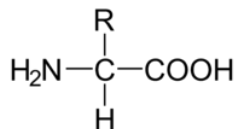


Figure 18.4.1: An amino acid is an organic molecule that contains an amine group, a carboxyl group, and a side chain (R), all bonded to a central carbon atom.

The amino acid and carboxyl group of an amino acid are both covalently bonded to a central carbon atom. That carbon atom is also bonded to a hydrogen atom and an R group. It is this R group which varies from one amino acid to another and is called the amino acid side chain.

The nature of the side chains accounts for the variability in physical and chemical properties of the different amino acids. Some side chains consist of nonpolar aliphatic or aromatic hydrocarbons. Other side chains are polar, while some are acidic or basic.

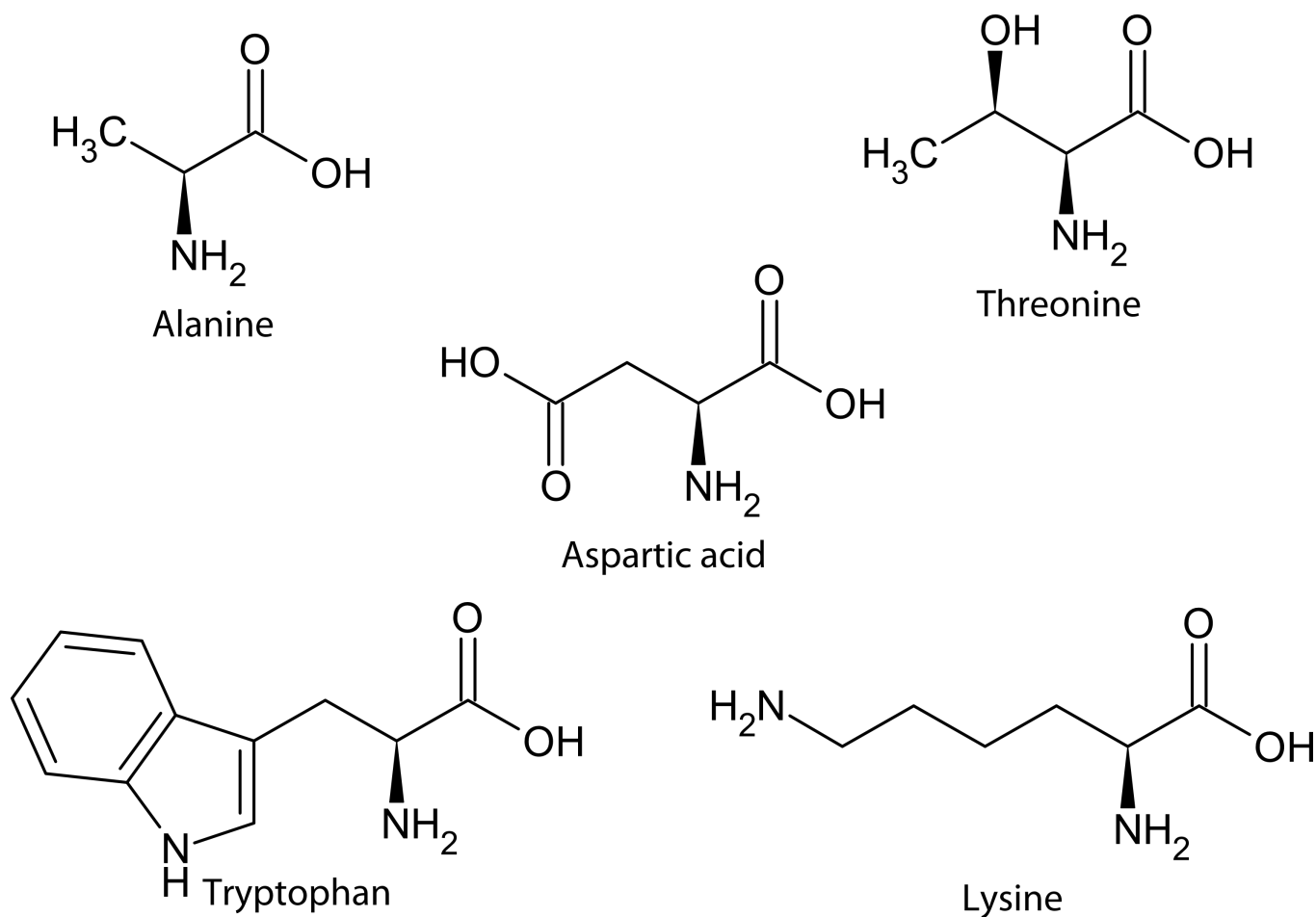


Figure 18.4.2: Five of the twenty biologically relevant amino acids, each having a distinct side chain (R). Alanine's side chain is nonpolar, while threonine's is polar. Tryptophan is one of several amino acids whose side chain is aromatic. Aspartic acid has an acidic side chain, while lysine has a basic side chain.

The table below lists the names of the 20 naturally occurring amino acids along with a three-letter abbreviation which is used to describe sequences of linked amino acids.

Table 18.4.1: Amino acids and Abbreviations

Amino acids and Abbreviations			
Amino Acid	Abbreviation	Amino Acid	Abbreviation
Alanine	Ala	Leucine	Leu
Arginine	Arg	Lysine	Lys
Asparagine	Asp	Methionine	Met
Aspartic acid	Asp	Phenylalanine	Phe
Cysteine	Cys	Proline	Pro
Glutamine	Gln	Serine	Ser
Glutamic acid	Glu	Threonine	Thr
Glycine	Gly	Tryptophan	Trp
Histidine	His	Tyrosine	Tyr
Isoleucine	Ile	Valine	Val

Another more recent set of abbreviations employs only one letter. Leucine would be designated by L, serine by S, tyrosine by Y. The advantage of this system comes when listing the amino acid sequence of a protein that may contain over 100 amino acids in its chain.

Summary

- An amino acid is a compound that contains both an amine group ($-\text{NH}_2$) and a carboxyl group ($-\text{COOH}$) in the same molecule.
- The nature of an amino acid's side chain accounts for the variability in chemical and physical properties of amino acids.
- There are 20 amino acids formed and used by living organisms.

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