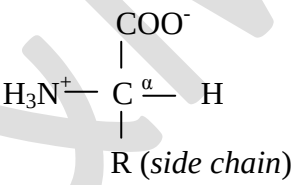
## Amino acids

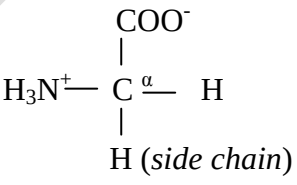
Proteins are the most important of the bio molecules. These may be defined as the polymers of amino acids. Amino acids are compound containing carbon, hydrogen, oxygen and nitrogen. They serve as monomers (building blocks) of proteins and composed of an amino group, a carboxyl group, a hydrogen atom and a distinctive side chain, all bounded to a carbon atom, the α carbon.

The general structure of an amino acid has a central tetrahedral carbon the α carbon to which are attached-

1. An amino group -$NH_2$, which changes a simple carboxylic acid to an amino acid. It also adds properties of a base.
2. A carboxylic group -COOH, which means it an acid.
3. A hydrogen -H
4. A side chain (R) which may be as simple as a single hydrogen or a long chain of varying sizes and structures giving different properties and names to different properties and names to different properties and names to different amino acids.



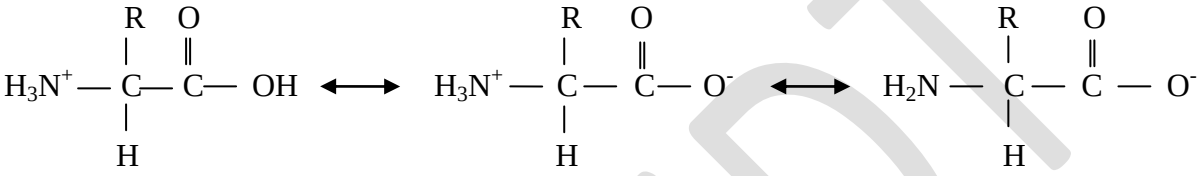

This structure is common to all except one of the amino acid is **glycine**.




The α carbon is bonded to four different groups in all amino acids except glycine and thus makes the chiral centre of a tetrahedral complex. Such molecules can, therefore exist in two different arrangements. These isomeric forms are known as enantiomers and are also named as L and D forms. It may be noted that these L and D designations are different from optical isomers ***d*** an ***l*** (*dextrorotatory* & *levorotatory*). All amino acids in proteins are in L form.

**Amino acids can acts as acids and bases:**

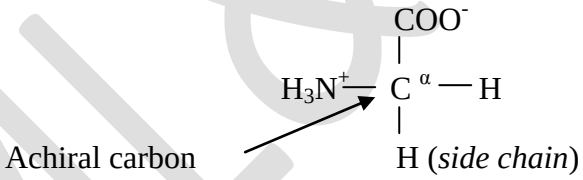
When an amino acid is dissolved in water, it exists in solution as the dipolar ion or zwitteration. Zwitterions can act as either an acid (proton donor) or base (proton acceptor). Hence an amino acid is an amphoteric molecule. At high concentrations of hydrogen ions (low $P^H$), the carboxyl group accepts a proton and becomes uncharged, so that the overall charge on the molecule is positive. Similarly at low concentration of hydrogen ion (high $P^H$) the amino group loses its proton and becomes uncharged, thus the overall charge on the molecule is negative.



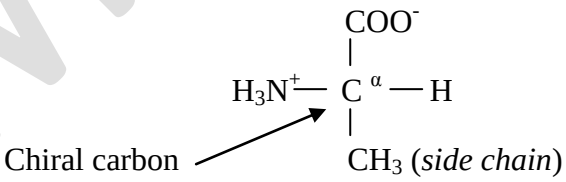
Low $P^H$ ($P^H < P^I$) Intermediate $P^H$ ($P^H = P^I$) High $P^H$ ($P^H > P^I$)

**Optical properties:**

All amino acids except glycine are optically active i.e. they rotate the plane of plane polarized light. Optically active molecules contain chiral carbon. All amino acids except glycine have chiral carbon and they are optically active.



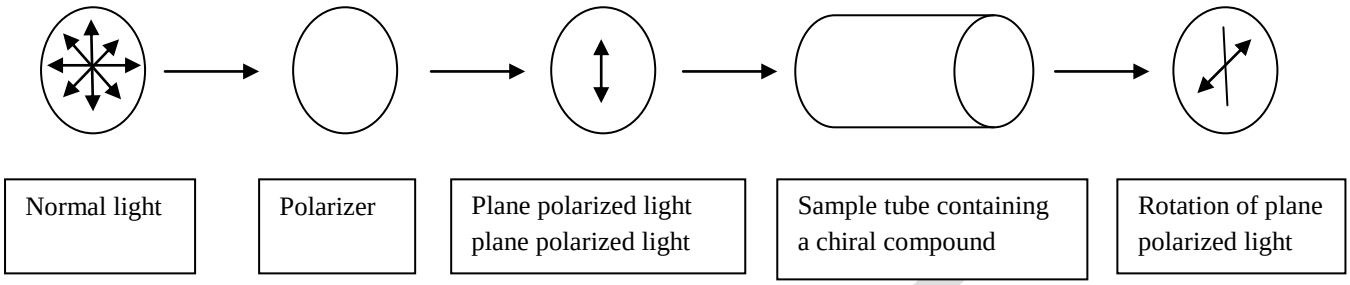

***Glycine***




***Alanine***

An optically active compound can rotate the plane of polarized light either clockwise (*to the right*) or counter clockwise (*to the left*). Optically active compounds that rotate the plane of polarized light clockwise are said to be dextrorotatory (***d***). By convention, this direction is designated by a plus sign (+). Optically active compounds that rotate the plane of polarized

light counter clockwise are said to be levorotatory (***l***). This is designated by minus sign (-). The **"+"** and **"-"**forms have also been termed ***d*** and ***l*** respectively.




**Types of amino acids:**

1. Amino acids with non polar side chain
2. Amino acids with uncharged polar side chain
3. Amino acids with charged polar side chain
   A. Positively charged
   B. Negatively charged

**Essential and non-essential amino acids:**

The ability to synthesize all twenty amino acids required in protein synthesis varies in different living systems. These amino acids, which can be synthesized in the human system, are called non-essential amino acids. While others, which are not be synthesized and have to be obtained through the diet, are called essential amino acids.

**Essential amino acids are-**

1. Histidine
2. Lsoleucine
3. Leucine
4. Lysine
5. Methionine
6. Phenylalanine
7. Threonine
8. Tryptophan
9. Valine.

**Non essential amino acids are-**

1. Alanine
2. Arginine
3. Asparagine
4. Aspartic acid (Aspartate)
5. Cytosine
6. Glutamic acid (Glutamate)
7. Glutamine
8. Glycine
9. Proline
10. Serine
11. Tyrosine