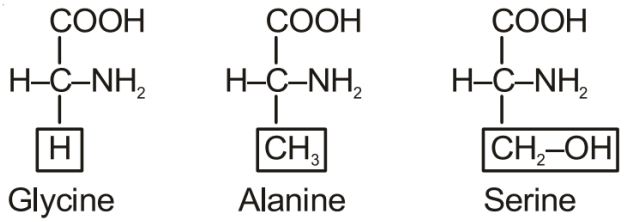
## AMINO ACIDS

- Amino acids are organic compounds characterized by the presence of both an amino group (-$NH_2$) and a carboxylic group (-COOH) attached to the same carbon, known as the alpha-carbon (α-carbon). This alpha-carbon also bears a hydrogen atom and a variable R group, making amino acids substituted methanes. Due to the attachment of both functional groups to the alpha-carbon, they are termed alpha-amino acids.
- There exist numerous amino acids based on the nature of their R groups. However, only twenty types of amino acids occur in proteins. The R group in proteinaceous amino acids varies and can be a hydrogen (as in glycine), a methyl group (as in alanine), or a hydroxy methyl group (as in serine).
- Essential amino acids, constituting half of the standard 20 amino acids, cannot be synthesized by the human body and must be obtained through the diet. Examples include lysine, methionine, phenylalanine, tryptophan, valine, isoleucine, leucine, and threonine. Semi essential amino acids, such as arginine and histidine, can be synthesized slowly by humans.
- Amino acids synthesized in the body are termed non-essential amino acids, as they are not required in the diet. Examples include alanine, cysteine, glutamate, glycine, and proline.

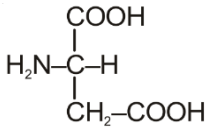


**Amino acids**

- The physical and chemical properties of amino acids are primarily due to the amino, carboxyl, and R functional groups. Based on the relative number of amino and carboxyl groups, amino acids can be categorized as acidic, basic, or neutral.

### Acidic amino acids:

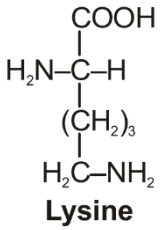
- Contain an extra carboxylic group.
- Examples include glutamic acid (glutamate) and aspartic acid (aspartate).



**Aspartic acid**

### Basic amino acids:

- Contain an additional amino group.
- Examples include lysine and arginine.



**Lysine**

**Neutral amino acids:**

- Contain one amino group and one carboxylic group.
- Examples include valine, alanine, glycine, leucine, and isoleucine.

**Sulphur-containing amino acids:**

- Contain Sulphur.
- Examples include cysteine and methionine, with cystine formed by joining two cysteine residues with a disulfide bond.

**Alcoholic amino acids:**

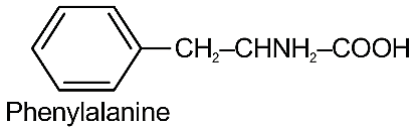
- Contain an -OH group.
- Examples include serine and threonine.

**Heterocyclic amino acids:**

- Contain a ring with N (nitrogen).
- Examples include proline, histidine, and hydroxy proline.

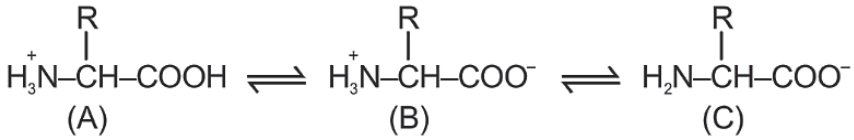
**Aromatic amino acids:**

- Possess a cyclic structure with a straight side chain bearing carboxylic and amino groups.

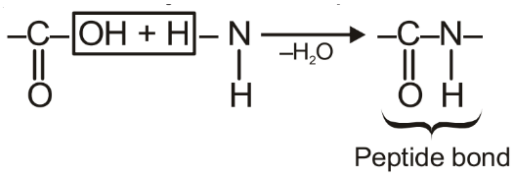


Phenylalanine

A unique characteristic of amino acids is their ionizable nature, specifically the $NH_2$ and COOH groups. Zwitterions, fully ionized species with both positive and negative charges, are formed. At the isoelectric point, an amino acid exists as a dipolar ion or Zwitterion. The term "Zwitterion" originates from the German word "Zwitter," meaning "hermaphrodite" or "hybrid." Consequently, the structure of amino acids changes in solutions of different PHS.




Amino acids can form peptide bonds through the amino group of one and the carboxylic group of another, resulting in the creation of oligopeptides when a few amino acids are joined and polypeptides when many amino acids are linked.



Peptide bond