

Table.11.4: Twenty proteogenic amino acids specified by genetic code (Major amino acids).

Sl. No.	Amino acid	3-letter abbreviation	1-letter symbol	Sl. No.	Amino acid	3-letter abbreviation	1-letter symbol
1	Alanine	Ala	A	11	Leucine	Leu	L
2	Arginine	Arg	R	12	Lysine	Lys	K
3	Asparagine	Asn	N	13	Methionine	Met	M
4	Aspartic acid	Asp	D	14	Phenylalanine	Phe	F
5	Cysteine	Cys	C	15	Proline	Pro	P
6	Glutamine	Gln	Q	16	Serine	Ser	S
7	Glutamic acid	Glu	E	17	Threonine	Thr	T
8	Glycine	Gly	G	18	Tryptophan	Trp	W
9	Histidine	His	H	19	Tyrosine	Tyr	Y
10	Isoleucine	Ile	I	20	Valine	Val	V

### Structure of Amino Acids

Amino acid is an *amino carboxylic acid*. They are the **building blocks** of proteins. An amino acid is made up of five components, namely

1. A carbon atom-**C**
2. A hydrogen atom-**H**
3. An amino group-**NH<sub>2</sub>**
4. A carboxyl group-**COOH**
5. A side chain or residue-**R**.

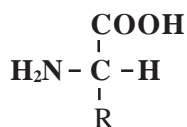


Fig.11.50: Parts of a typical amino acid.

**R** is the *side chain* or *residue*. It may be a hydrogen atom (H) or a methyl group (CH<sub>3</sub>) or an aliphatic group or an aromatic group or a heterocyclic group. In *glycine*, the simplest amino acid, 'R' represents a H atom. In *alanine*, it is a methyl(CH<sub>3</sub>) group. In *serine*, it is CH<sub>2</sub>OH.

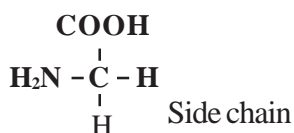


Fig.11.51: A simple amino acid, glycine.

### $\alpha$ , $\beta$ and $\gamma$ - Amino Acids

In amino acids, the numbering of carbon atoms, is made from the carbon atom situated next to the COOH group. The carbon atom situated next to the COOH group is carbon atom

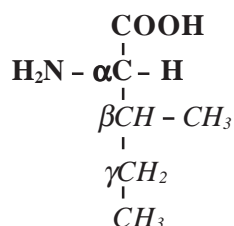


Fig.11.52: Isoleucine, an amino acid showing the positions of  $\alpha$ ,  $\beta$  and  $\gamma$ -carbon atoms.

number 1 and is called  **$\alpha$ -carbon atom**. The second carbon atom is called  **$\beta$ -carbon atom** and the third carbon atom is called  **$\gamma$ -carbon atom**.

The amino acids are named as  $\alpha$ ,  $\beta$  and  $\gamma$ -amino acids according to the position of amino group. When the amino group is attached to the  **$\alpha$ -carbon atom**, the amino acid is called  **$\alpha$ -amino acid**. Eg. Isoleucine.

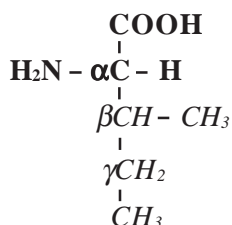


Fig.11.53: Isoleucine, an amino acid showing the positions of  $\alpha$ ,  $\beta$  and  $\gamma$ -carbon atoms.

When the amino group is attached to the  **$\beta$ -carbon atom**, the amino acid is called  **$\beta$ -amino acid**.

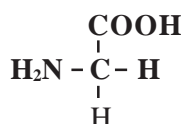
When the amino group is attached to the  **$\gamma$ - carbon atom**, the amino acid is called  **$\gamma$ -amino acid**.

### **Imino acids**

Some amino acids contains imino group (NH) in the place of **amino group** (NH<sub>2</sub>). These amino acids are called **imino acids**. (Fig.11.67) Eg. Proline, hydroxyproline, etc.

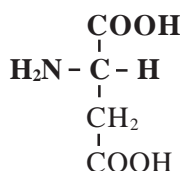
### Number of amino and acid groups

Some amino acids contain only one amino group and only one acid group. These amino acids are called *monoamino monocarboxylic acids*. Eg. *Glycine*.



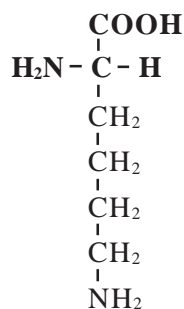
*Fig.11.54: A simple amino acid, glycine.*

Some amino acids contain one amino group and two acid groups. These amino acids are called *monoamino dicarboxylic acids*. Eg. *Aspartic acid*.



*Fig.11.55: Aspartic acid.*

Another group of amino acid contains two amino groups but only one acid group. These amino acids are called *diamino-monocarboxylic acids*. Eg. *Lysine*.



*Fig.11.56: Lysine.*

The amino acids containing two amino groups and two acid groups are called *diamino-dicarboxylic acids*. Eg. *Cystine*.