Lecture title: **General nature of amino acids**

Lecturer Affiliation: *Department of Physiology, Biochemistry, and Pharmacology*
College of Veterinary Medicine, University of Mosul, Mosul, Iraq

Summary: Amino acids are molecules that combine to form proteins. Amino acids and proteins are the building blocks of life. In this unit, you have learnt that:

• amino acids are the building blocks of proteins

• twenty amino acids occur commonly as part of proteins, although some uncommon amino acids do also occur in nature

• each of the twenty common amino acids is identified with the aid of a three letter or one letter abbreviation

• all common Amino acids with the exception of glycine are chiral compounds

• the structures of the common amino acids are essentially similar except with their side chains.

WHAT ARE AMINO ACIDS.

 Amino acids are organic compounds, they are backbone of protein synthesis and they are considers the building units of proteins

Amino acids can be categorized by structural features, including the location of their functional groups (such as alpha- (α-), beta- (β-), and gamma- (γ-) amino acids) and the nature of their side chains (which can be aliphatic, acyclic, aromatic, or polar).

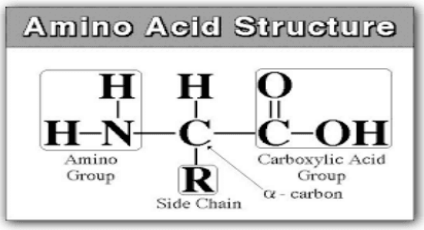
There are about 300 amino acids occur in nature. Only 20 of them enter in proteins synthesis

.Amino acid : Recommended daily allowances (mg/ 1 kg body weight)

General structure of amino acid:

Each amino acid has 4 different groups attached to α- carbon (which is C-atom next to COOH). These 4 groups are :

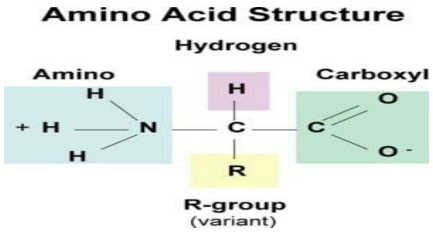
- Amine group [- NH2]
- Carboxyl group [-COOH]
- Side chain [R group]
- Hydrogen atom



Amino acids functional groups:

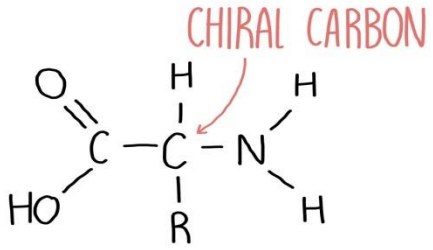
include NH2 and COOH compounds of amino acids bounded by peptide bond CO - NH

All 20 of the common amino acids are alpha-amino acids. They contain a carboxyl group, an amino group, and a side chain (R group), all attached to the α-carbon.



Chirality in Amino Acids

Chiral compounds are compounds which possess at least one chiral carbon atom or chiral centre. A chiral carbon or centre is a carbon atom to which four different functional groups are covalently linked.



For a typical amino acid, the four different functional groups include:

1. Carboxyl group (-COOH) or its carboxylate ion form (-COO-)

2. Amino group (-NH2) or its ammonium ion form)

3. Hydrogen atom (H)

4. A variable side chain (Also called R group). The R group gives each amino acid its identity. All amino acids with the exception of glycine possess a chiral center at the alpha carbon (Cα).

D- and L-Configurations of Amino acid:

• L and D Isomers of amino acids:

• An amino acid is L if its α-amino group is oriented to the left

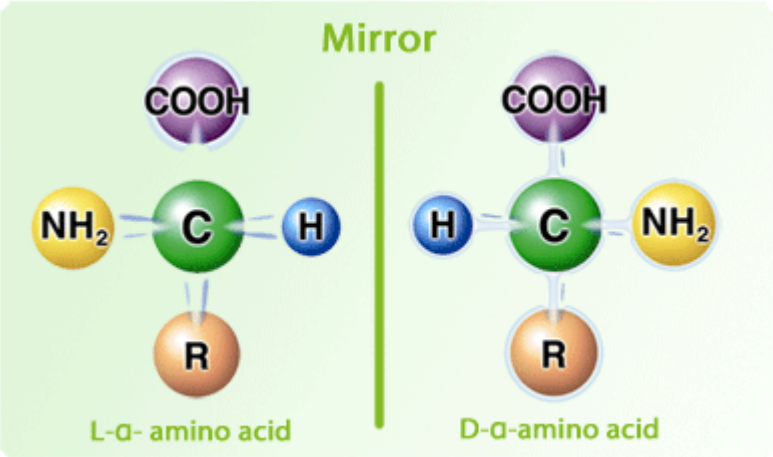
• An amino acid is D- if its α-amino group is oriented to the right..

• Both L and D forms are chemically same.

• All mammalian amino acids are found in L-configuration.

• D-amino acids are found in antibiotics, plants and in the cell wall of microorganisms.

D and L isomers are important in pharmacology, as chiral forms of molecules (only the L or D isomer for that molecule) have different physiological effects. For this reason, the isomers can now be selectively produced, this allows the delivery of medicines containing chiral molecules in a more targeted, efficacious, and safer way.



Optical properties

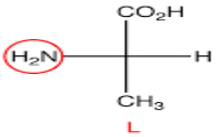
• The α-carbon of most of the amino acids is attached to four different chemical groups.

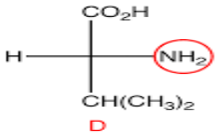
• Thus, asymmetric molecules are optically active, and symmetric molecules are optically inactive.

• All mammalian amino acids are optically active except glycine.

Optically active of amino acids : they are interact with light, which substances that can rotate plane-polarized light to left orient or to right orient side .

These rotate the plane clockwise (to the right) are said to be dextrorotatory (dexter, "right"). Or rotate the plane clockwise (to the left) are said to be Levorotatory (Levo , "left").



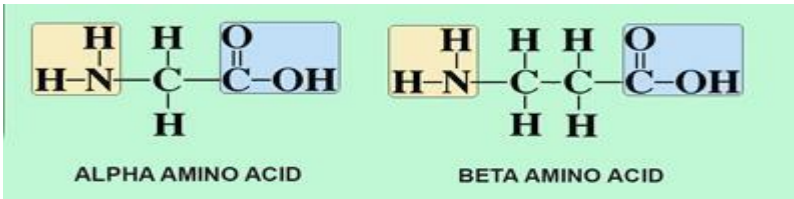


Levo- oriented amino acid **Dextro- oriented amino acid**

Alpha and Beta amino acids :

Alpha amino acids :The amino- and carboxylic groups are attached to the same carbon, the alpha carbon.

Beta amino acids: are formed when the amino group is attached to a different carbon and carboxylic group is attached to the beta carbon (not same carbon) . This arrangement is rarely found in nature.



Amino acid abbreviations

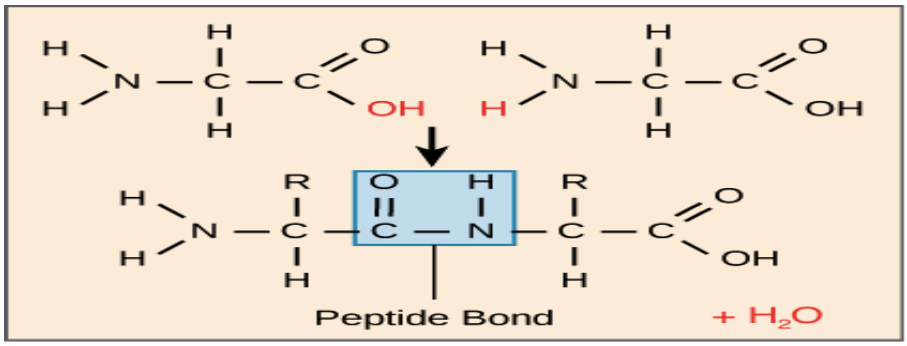
Amino acids are generally represented by a three letter symbol, sometimes one letter symbol is also used.

This table shows the abbreviations and single letter codes used for the 20 amino acids found in proteins.

Amino Acid	3-Letters	1-Letter
Alanine	Ala	A
Arginine	Arg	R
Asparagine	Asn	N
Aspartic acid	Asp	D
Cysteine	Cys	C
Glutamic acid	Glu	E
Glutamine	Gln	Q
Glycine	Gly	G
Histidine	His	H
Isoleucine	Ile	I
Leucine	Leu	L
Lysine	Lys	K
Methionine	Met	M
Phenylalanine	Phe	F
Proline	Pro	P
Serine	Ser	S
Threonine	Thr	T
Tryptophan	Trp	W
Tyrosine	Tyr	Y
Valine	Val	V

Peptide bond

Amino acids can be linked by a condensation reaction in which an —OH is lost from the carboxyl group of one amino acid along with a hydrogen from the amino group of a second, forming a molecule of water and forming -CO-NH-linkage (Peptide bonds or an amide—called.)



condensation reaction Condensation reaction in which three molecules of the amino acid produce a tripeptide chain, with the elimination of two molecules of water (H_2O).