DANTULARI NARAYANA RAJU COLLEGE (ATONOMUS)

ADIKAVI NANNAYA UNIVERSITY

SEASON – 2022

DEPARTMENT OF BIOCHEMISTRY

GUIDANCE BY

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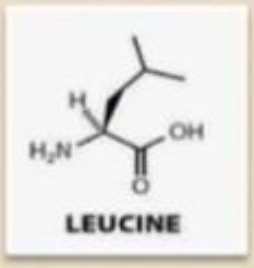
Introduction

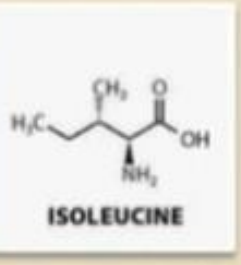
Amino acids

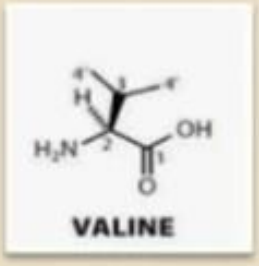


Amino acids are organic molecules that, when linked together with other amino acids, form a protein.

Amino acids are essential to life because the proteins they form are involved in virtually all cell functions.

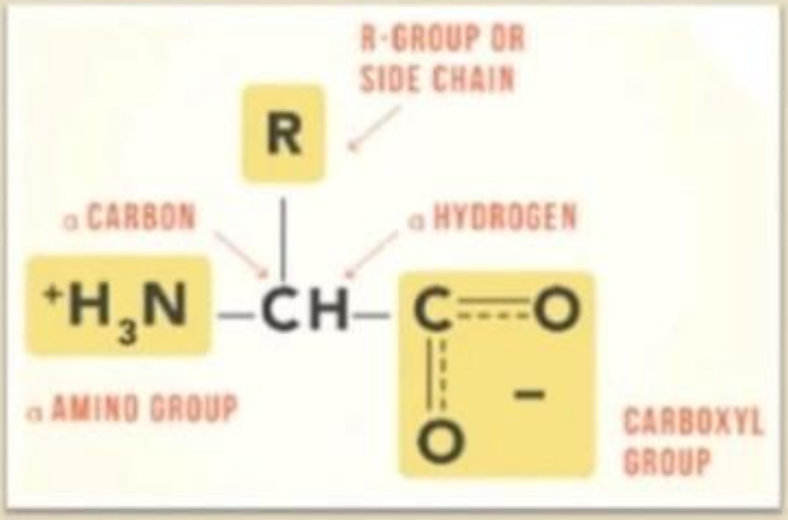
(make up 75% of the body)





Although there are hundreds of amino acids found in nature, proteins are constructed from a set of 20 amino acids.

Amino acids general structure



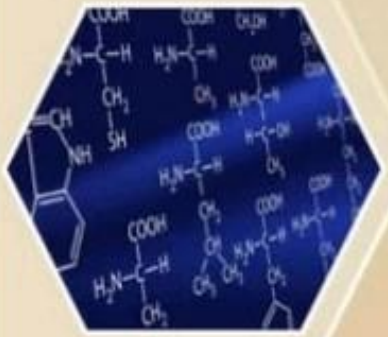
A general representation of a non-ionized amino acid showing

- the carboxylic acid group,
- the α-amino group,
- the hydrogen bonded to the α-carbon, and
- the R group (side chain)

that gives the amino acid its unique properties.

Amino acids in our daily life

These are essential for our daily well-being as it has high nutritive value



Involved in body functions like growth, development healing and other metabolic activities

Obtained from various sources & is considered to be the building blocks of life

Nutritionists divide amino acids into

Essential

(must be in the diet because cells can't synthesize them)

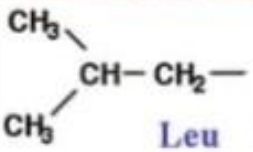
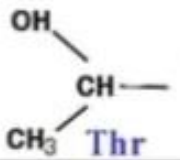
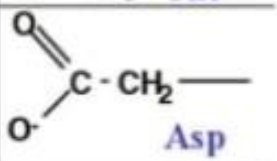
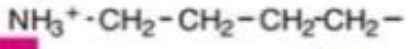
Histidine,
Isoleucine,
Leucin,
Lysine,
Methionine,
Phenylalanine,
Threonine,
Tryptophan,
Valine.

Non-Essential

(can be made by cells)

Alanine,
Arginine,
Asparagine,
Aspartic acid,
Cysteine,
Glutamic acid,
Glutamine,
Glycine,
Proline,
Selenocysteine,
Serine,
Tyrosine.

Amino acid groups

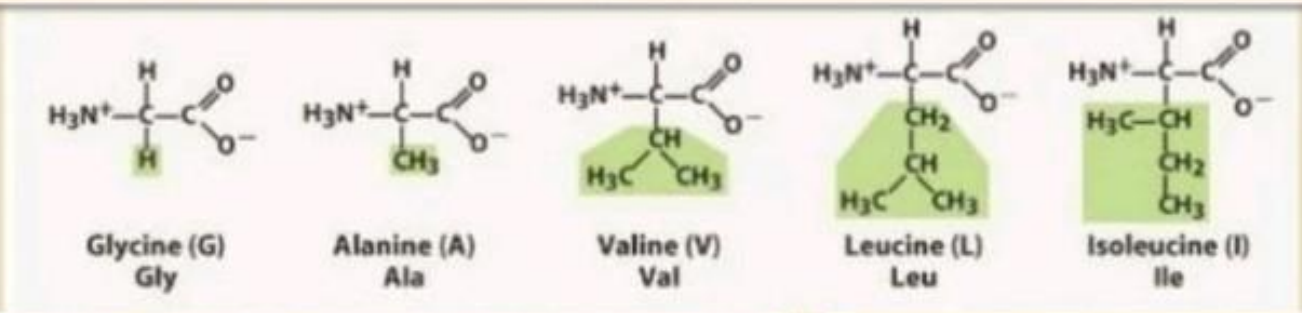
Group	Characteristics	Names	Example (-Rx)
non-polar	hydrophobic	Ala, Val, Leu, Ile, Pro, Phe Trp, Met	 Leu
polar	hydrophilic (non-charged)	Gly , Ser, Thr, Cys, Tyr, Asn Gln	 Thr
acidic	negatively charged	Asp, Glu	 Asp
basic	positively charged	Lys, Arg, His	 Lys

Total = 20

Structures

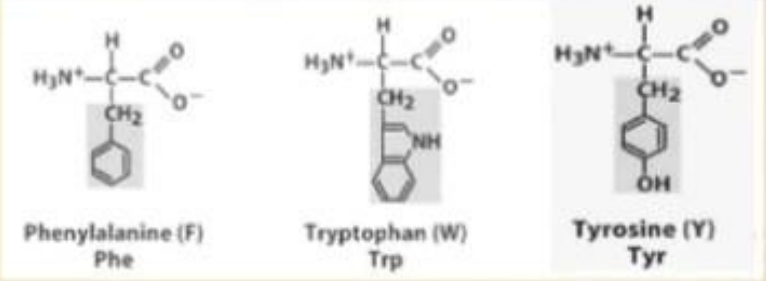
Non Polar side chains

Amino acids with Nonpolar **Aliphatic** Side Chains



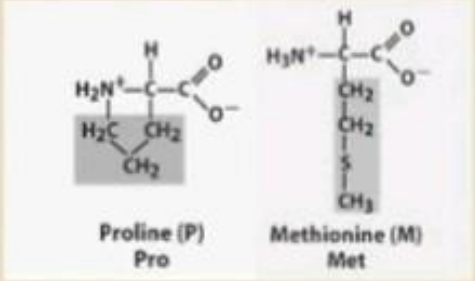
Glycine (G) Gly | Alanine (A) Ala | Valine (V) Val | Leucine (L) Leu | Isoleucine (I) Ile

Amino acids with Nonpolar **Aromatic** Side Chains



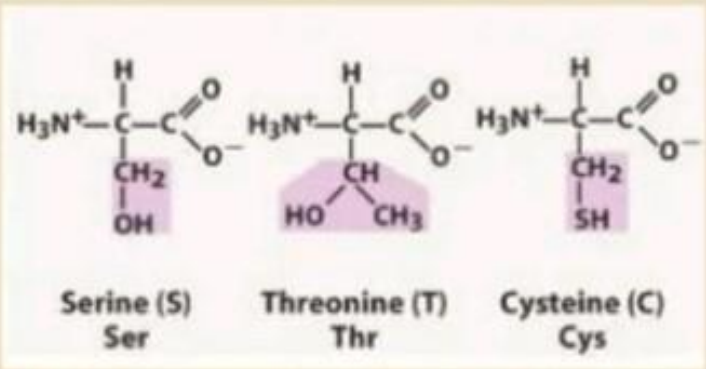
Phenylalanine (F) Phe | Tryptophan (W) Trp | Tyrosine (Y) Tyr

Other Nonpolar Amino acids

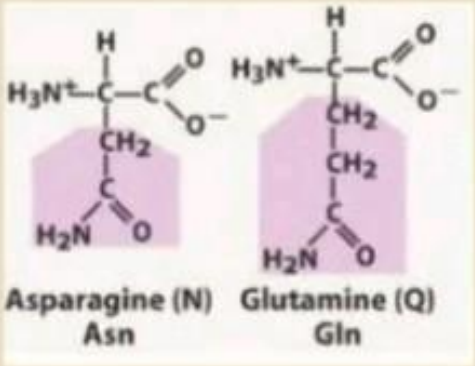


Proline (P) Pro | Methionine (M) Met

Polar Side chains



Serine (S) Ser | Threonine (T) Thr | Cysteine (C) Cys



Asparagine (N) Asn | Glutamine (Q) Gln

Properties

- Amino acids constitute a group of neutral products clearly distinguished from other natural compounds chemically, mainly because of their properties and biochemically; mainly because of their role as protein constituents.
- An amino acid is a carboxylic acid-containing an aliphatic primary amino group in the α position to the carboxyl group and with a characteristic stereochemistry.
- **Proteins** are biosynthesized from 20 amino acids in a system involving strict genetic control. Thus, amino acids are the basic unit of proteins.

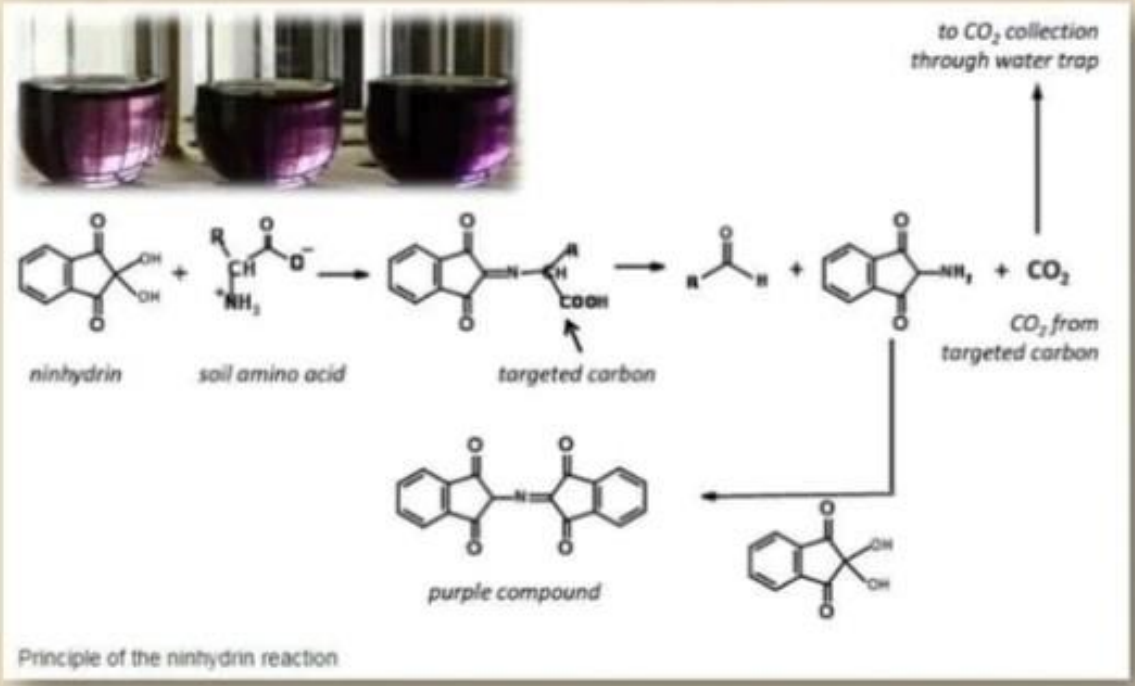
Physical Properties

1. Amino acids are colourless, crystalline solid.
2. All have a high melting point greater than 200°C
3. Solubility: They are soluble in water, slightly soluble in alcohol and dissolve with difficulty in methanol, ethanol, and propanol.

   R-group of amino acids and pH of the solvent play important role in solubility.
4. On heating to high temperatures, they decompose.
5. All amino acids (except glycine) are optically active.
6. Peptide bond formation: Amino acids can connect with a peptide bond involving their amino and carboxylate groups. A covalent bond formed between the alpha-amino group of one amino acid and an alpha-carboxyl group of other forming -CO-NH-linkage. Peptide bonds are planar and partially ionic.

Ninhydrin test

When 1 ml of Ninhydrin solution is added to a 1 ml protein solution and heated, the formation of a violet color indicates the presence of α-amino acids.

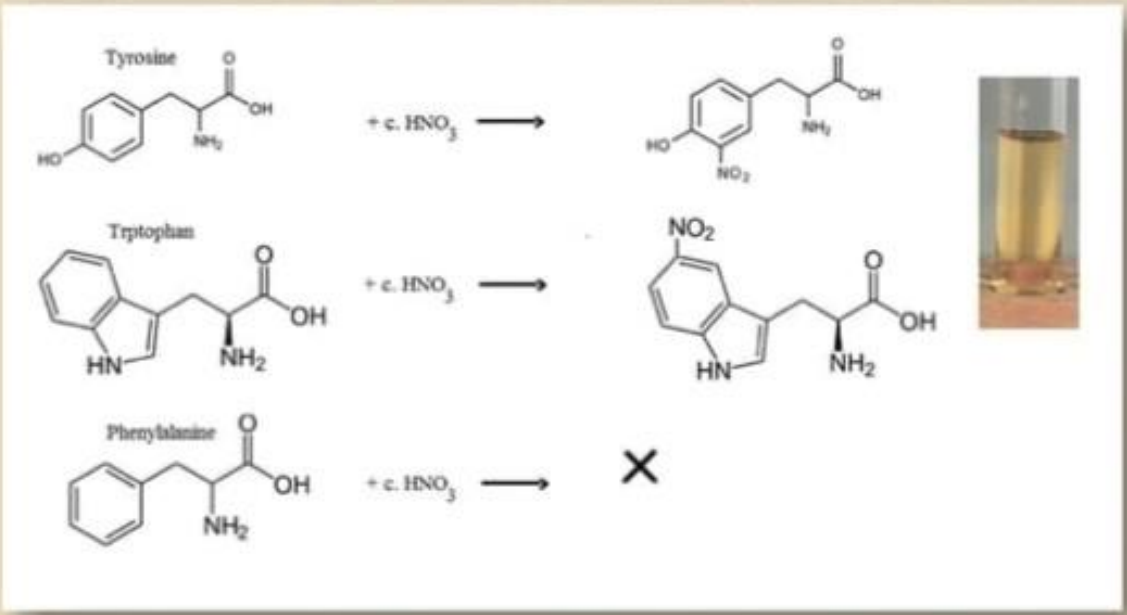


Principle of the ninhydrin reaction

16

Xanthoproteic test

The xanthoproteic test is performed for the detection of aromatic amino acids (tyrosine, tryptophan, and phenylalanine) in a protein solution. The nitration of benzoid radicals present in the amino acid chain occurs due to reaction with nitric acid, giving the solution yellow coloration.



17

Functions of Amino aci

1. In particular, 20 very important amino acids are crucial for life as they contain peptides and proteins and are known to be the building blocks for all living things.

2. The linear sequence of amino acid residues in a polypeptide chain determines the three-dimensional configuration of a protein, and the structure of a protein determines its function.

3. Amino acids are imperative for sustaining the health of the human body.

They largely promote the:
- Production of hormones
- Structure of muscles
- Human nervous system's healthy functioning
- The health of vital organs
- Normal cellular structure

4. The amino acids are used by various tissues to synthesize proteins and to produce nitrogen-containing compounds

e.g., purines, heme, creatine, epinephrine), or they are oxidized to produce energy.

5. The breakdown of both dietary and tissue proteins yields nitrogen-containing substrates and carbon skeletons.

6. The nitrogen-containing substrates are used in the biosynthesis of purines, pyrimidines, neurotransmitters, hormones, porphyrins, and nonessential amino acids.

7. The carbon skeletons are used as a fuel source in the citric acid cycle, used for gluconeogenesis, or used in fatty acid synthesis.


Thank
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for
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