University of Mosul
Lecture No.: 2
College of Veterinary Medicine
Date:
Unit of Scientific Affairs
Website:

Lecture title: **Classification of amino acids**

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Summary: **Classification of amino acids include three categories:**

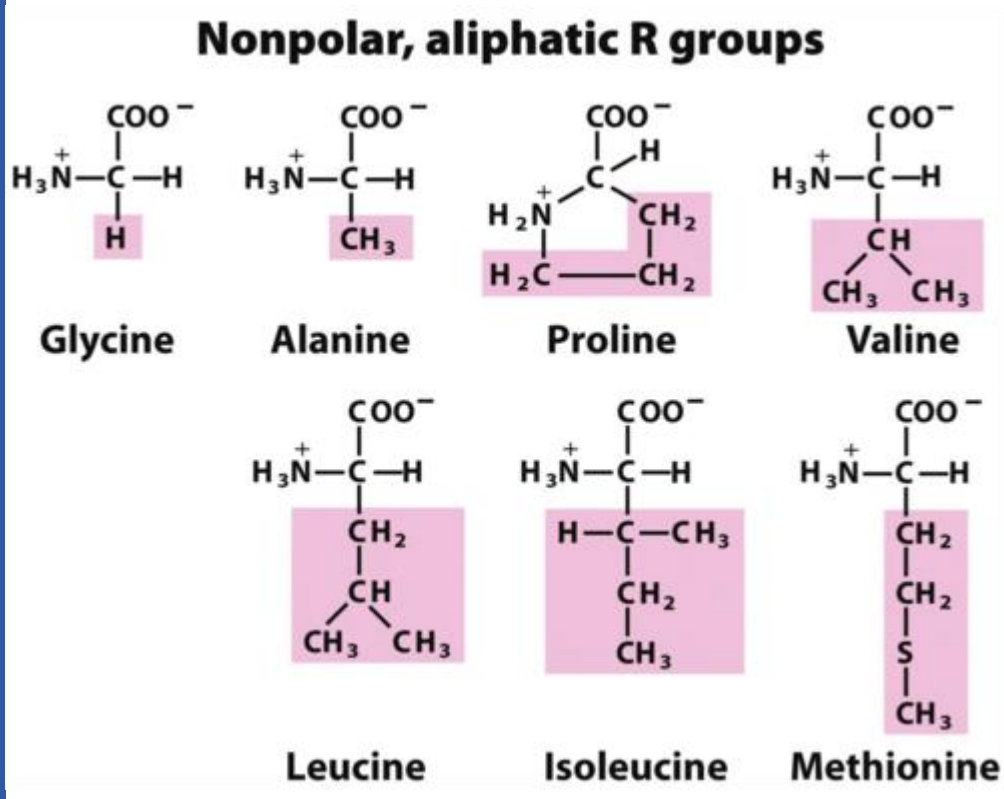
Based on R Group (side chain)

Based on Nutritional value

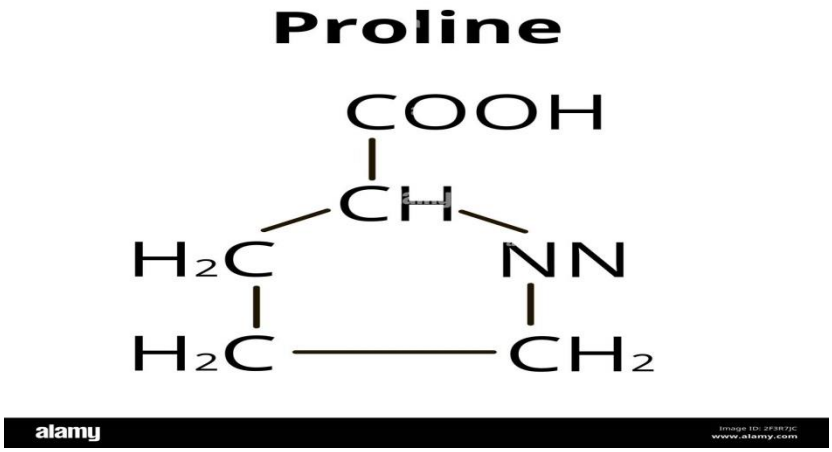
Based on metabolic fate

1- Classification of amino acids based on R-group

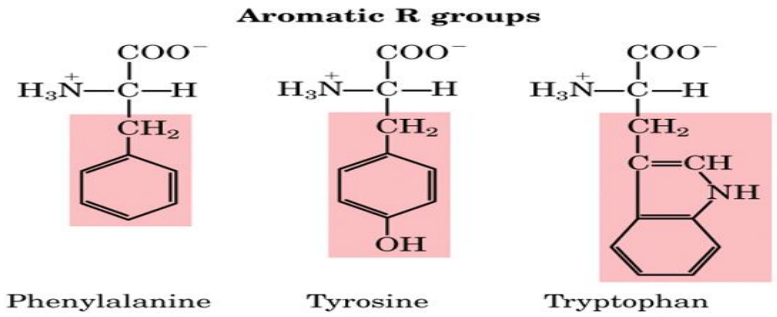
1. **Aliphatic amino acids (Nonpolar)**: Contains mostly open hydrocarbon side chain The R groups in this class of amino acids are nonpolar and hydrophobic. Glycine, Alanine, Valine, leucine, Isoleucine, Methionine, Proline.



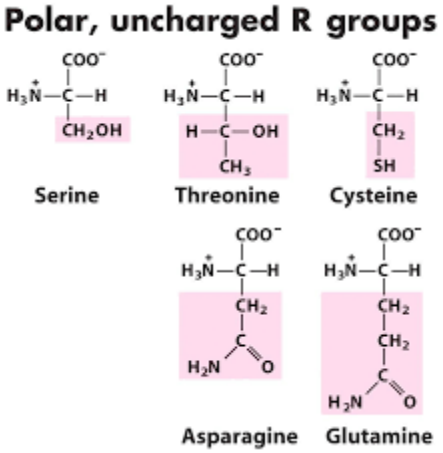
Proline is an imino acid not amino acid which Contains secondary amino group in the molecule



2. **Aromatic amino acids:** Contains closed ring hydrocarbon Phenyl ring as side chain e.g Phenylalanine, tyrosine, and tryptophan, with their aromatic side chains, are relatively nonpolar (hydrophobic). All can participate in hydrophobic interactions.

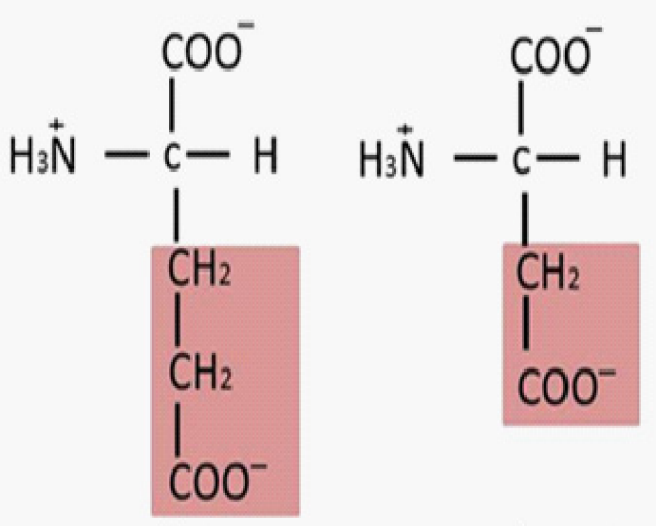


3. **Polar, Uncharged amino acids:** The R groups of these amino acids are more soluble in water, or more hydrophilic, than those of the nonpolar amino acids, because they contain functional groups that form hydrogen bonds with water. This class of amino acids includes serine, threonine, cysteine, asparagine, and glutamine.

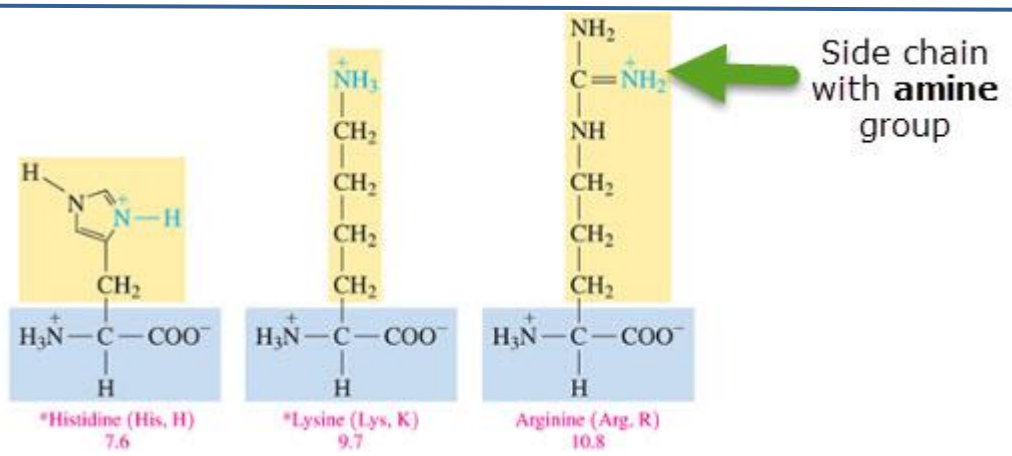


Cysteine is Sulfur containing amino acids Contains sulfur atom in their side chain

4. **Acidic amino acids: Contains COOH group OR their amides in their side chain---** Amino acids in which R-group is acidic are negatively charged. E.g Glutamic acid and Aspartic acid. (A G A G)



5. **Basic amino acids:** Contains more than 1 NH2 groups in side chain ---Amino acids in which R-group are positively charged. E.g Lysine, Arginine, Histidine (H A L)



2- Classification of amino acids based on nutritional value

1- Essential amino acids (Nine)

Nine amino acids cannot be synthesized in the body and, therefore, must be present in the diet in order for protein synthesis to occur.

These essential amino acids are histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine.

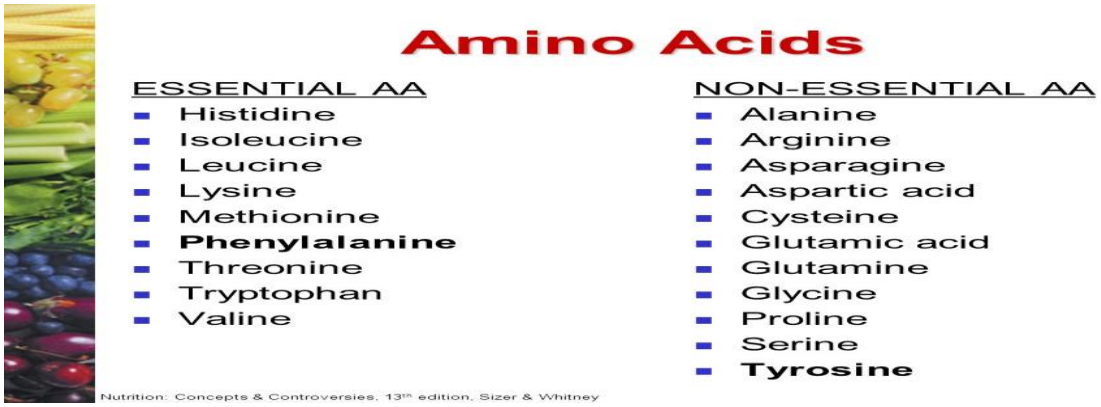
2- Non-essential amino acids (Eleven)

These amino acids can be synthesized in the body itself and hence do not necessarily need to be acquired through diet.

These non-essential amino acids are Arginine, glutamine, tyrosine, cysteine, glycine, proline, serine, ornithine, alanine, asparagine, and aspartate.

3- Semi essential amino acids

Small quantity synthesized in body Not sufficient to the metabolic need Partly supplied through diet Ex Histidine Arginine



3- Classification of amino acids based on the metabolic fate

1. **Glucogenic amino acids**: These amino acids serve as precursors of gluconeogenesis for glucose formation. Glycine, alanine, serine, aspartic acid, asparagine, glutamic acid, glutamine, proline, valine, methionine, cysteine, histidine, and arginine.
2. **Ketogenic amino acids:** These amino acids break down to form ketone bodies. Leucine and Lysine.
3. **Both glucogenic and ketogenic amino acids:** These amino acids break down to form precursors for both ketone bodies and glucose. Isoleucine, Phenylalanine, Tryptophan, and tyrosine.

Glucogenic amino acids	Glucogenic and ketogenic	Ketogenic amino acids
Alanine, Arginine, Asparagine, Aspartate Asparagine, Cysteine, Methionine Glutamate, Glutamine, Glycine, Histidine Proline, Serine, Threonine,Valine	Tyrosine Isoleucine Phenylalanine Tryptophan	Leucine Lysine