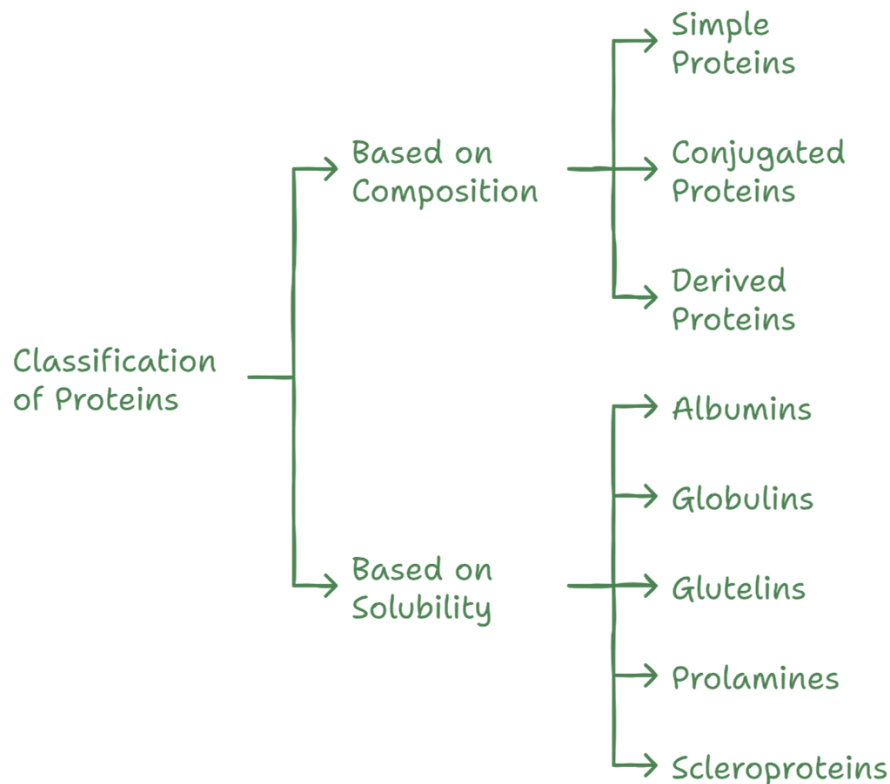


Proteins

Definition of Proteins

- Proteins are large, complex macromolecules composed of amino acid chains linked by peptide bonds.
- They perform various structural, enzymatic, transport, and regulatory functions in the body.
- Proteins contain carbon, hydrogen, oxygen, nitrogen, and sometimes sulfur or phosphorus.

Classification of Proteins



A. Based on Composition:

1. Simple Proteins

- Yield only amino acids upon hydrolysis.
- **Examples:** Albumin, Globulin, Keratin

2. Conjugated Proteins

- Contain a protein part and a non-protein group called a **prosthetic group**.
- Types include:
 - A. **Glycoproteins** (Carbohydrate + protein) – e.g., mucin
 - B. **Lipoproteins** (Lipid + protein) – e.g., HDL, LDL

- C. **Phosphoproteins** (Phosphate + protein) – e.g., casein in milk
- D. **Chromoproteins** (Pigment + protein) – e.g., hemoglobin
- E. **Nucleoproteins** (Nucleic acid + protein) – e.g., ribosomes

3. Derived Proteins

- Formed by partial hydrolysis or denaturation of simple or conjugated proteins.
- **Examples:** Peptones, Proteoses, Metaproteins

B. Based on Solubility

Type	Solubility	Examples
Albumins	Soluble in water and salt solutions	Serum albumin
Globulins	Insoluble in water, soluble in dilute salt	Serum globulin
Glutelins	Soluble in dilute acids/alkalis	Glutenin in wheat
Prolamines	Soluble in 70–80% alcohol	Zein in corn
Scleroproteins	Insoluble in most solvents	Collagen, Keratin

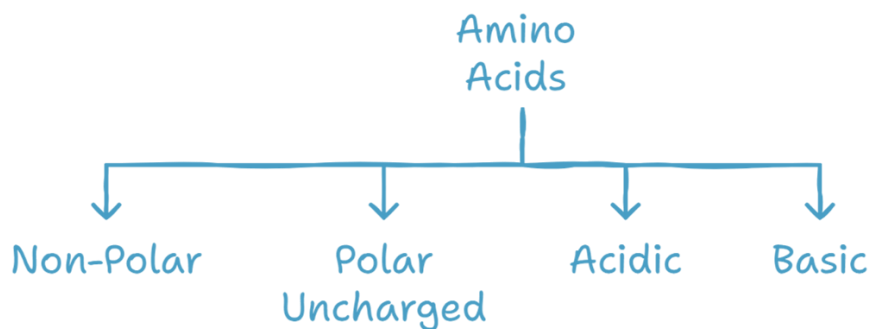
Amino Acids

Definition of Amino Acids:

- Amino acids are organic compounds that serve as the building blocks of proteins. Each amino acid contains:
 - An **amino group** ($-\text{NH}_2$),
 - A **carboxyl group** ($-\text{COOH}$),
 - A **hydrogen atom**,
 - A **variable side chain (R group)** attached to the **α -carbon**.
- There are 20 standard amino acids that are used in protein synthesis.

Classification of Amino Acids Based on Chemical Nature (Side Chain/R group):

- Amino acids can be classified according to the nature of their side chains (R groups), which influence their polarity, charge, and interaction with water.



1. Non-Polar (Hydrophobic) Amino Acids

Characteristics:

- R groups are hydrocarbons (alkyl or aromatic).
- Non-polar and hydrophobic.
- Tend to cluster in the interior of proteins.

Examples:

- Glycine (Gly)
- Alanine (Ala)
- Valine (Val)
- Leucine (Leu)
- Isoleucine (Ile)
- Methionine (Met)
- Proline (Pro)

2. Polar Uncharged Amino Acids

Characteristics:

- Side chains can form hydrogen bonds.
- Hydrophilic but not ionized at physiological pH.

Examples:

- Serine (Ser)
- Threonine (Thr)
- Asparagine (Asn)
- Glutamine (Gln)
- Cysteine (Cys)

3. Acidic Amino Acids (Negatively Charged)

Characteristics:

- R groups contain carboxyl (-COOH) groups.
- Ionized at physiological pH, carrying a negative charge.

Examples:

- Aspartic acid (Asp)
- Glutamic acid (Glu)

4. Basic Amino Acids (Positively Charged)

Characteristics:

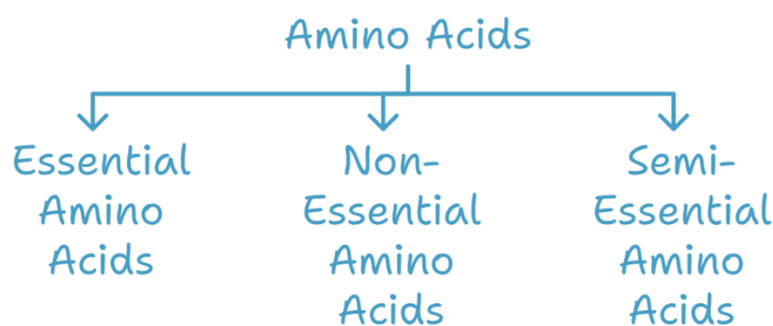
- R groups contain amino (-NH₂) groups.
- Positively charged at physiological pH.

Examples:

- Lysine (Lys)
- Arginine (Arg)
- Histidine (His)

Classification of Amino Acids Based on Nutritional Requirement:

- Amino acids are also classified based on whether they must be obtained from the diet or can be synthesized by the body.



1. Essential Amino Acids

- **Definition:** Cannot be synthesized by the human body; must be obtained from the diet.
- **Examples:**
 - A. Histidine (His) (*essential in infants and children*)
 - B. Isoleucine (Ile)
 - C. Leucine (Leu)

- D. Lysine (Lys)
- E. Methionine (Met)
- F. Phenylalanine (Phe)
- G. Threonine (Thr)
- H. Tryptophan (Trp)
- I. Valine (Val)

2. Non-Essential Amino Acids

- **Definition:** Can be synthesized by the body in sufficient amounts.
- **Examples:**
 - A. Alanine (Ala)
 - B. Asparagine (Asn)
 - C. Aspartic acid (Asp)
 - D. Glutamic acid (Glu)
 - E. Serine (Ser)
 - F. Cysteine (Cys)
 - G. Tyrosine (Tyr)
 - H. Proline (Pro)
 - I. Glycine (Gly)
 - J. Glutamine (Gln)

3. Semi-Essential (Conditionally Essential) Amino Acids

- **Definition:** Generally non-essential, but may become essential during periods of growth, illness, or metabolic stress.
- **Examples:**
 - A. Arginine (Arg)
 - B. Histidine (His)
 - C. Cysteine (Cys)
 - D. Tyrosine (Tyr)
 - E. Glutamine (Gln)

Structure of Proteins (Four Levels of Organization)

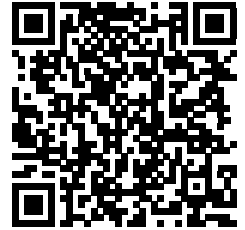


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