SNS COLLEGE OF ALLIED HEALTH SCIENCE

Affiliated to The Tamil Nadu Dr M.G.R Medical University, Chennai

DEPARTMENT OF PHYSICIAN ASSISTANT

COURSE NAME: BIOCHEMISTRY

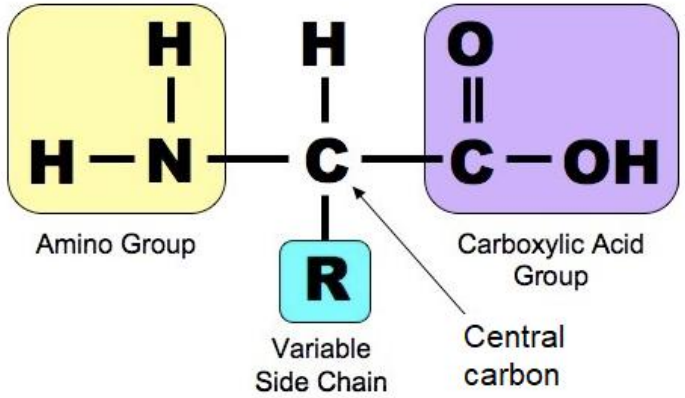
UNIT : 1

TOPIC : PROTEIN - CLASSIFICATION

FACULTY NAME: MITHRA V

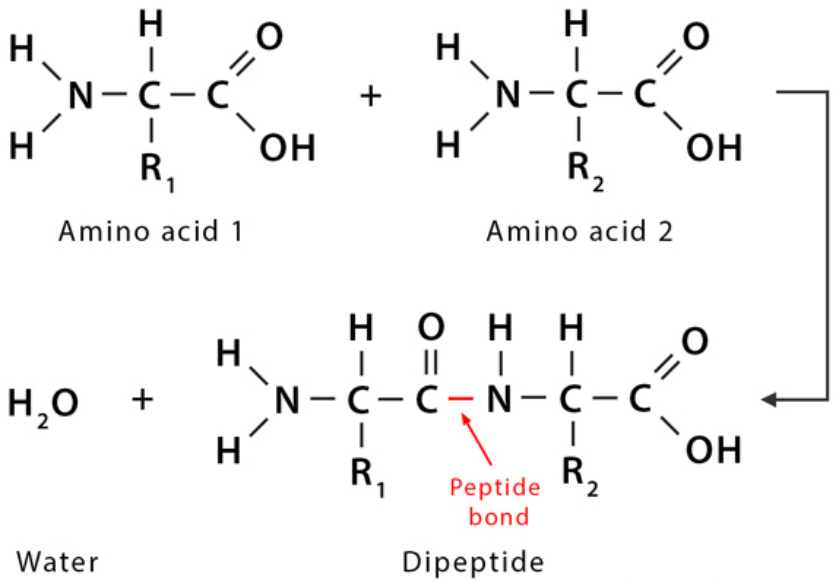
PROTEINS (DEFINE)

- Complex, large macromolecules essential for life
- Polymers made up of smaller units called **amino acids**
- **Bond Type**: Amino acids linked via **peptide bonds**
- **Bond Formation Mechanism**:
- Carboxyl group (–COOH) of one amino acid
- Reacts with amino group ($–NH_2$) of another
- **Role in Body**:
- Metabolism regulation
- Cell signaling & communication
- Structural support & movement



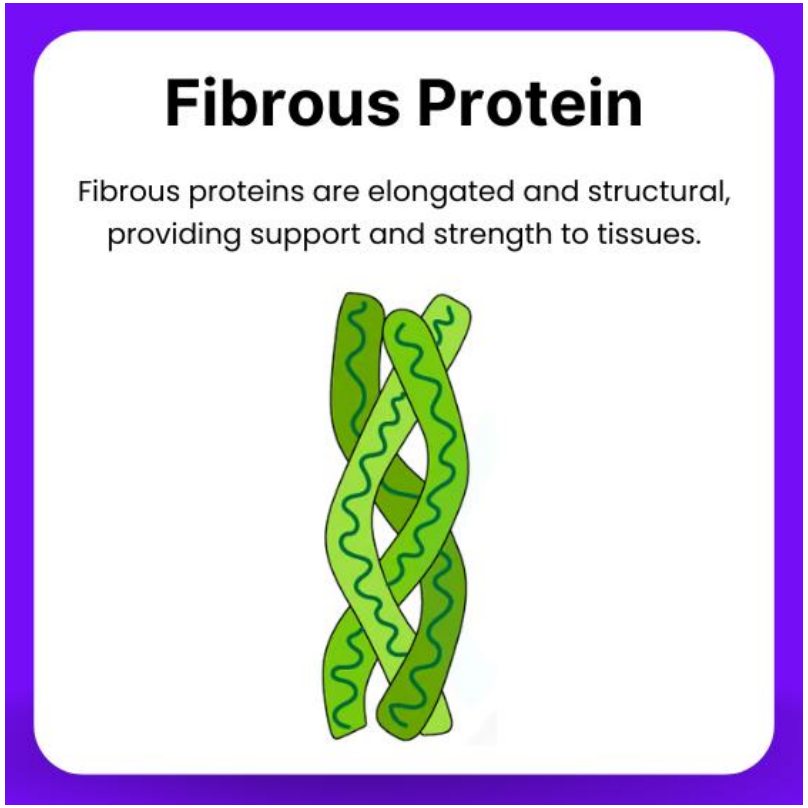
PEPTIDE VS POLYPEPTIDE

- **Dipeptide**:
  - 2 amino acids joined by **1 peptide bond**
- **Tripeptide**:
  - 3 amino acids joined by **2 peptide bonds**
- **Polypeptide**:
  - Chain of **>10 amino acids** linked by multiple peptide bonds
- **Peptide Bond Characteristics**:
  - **Covalent bond**
  - **Planar, rigid, partial double bond character**



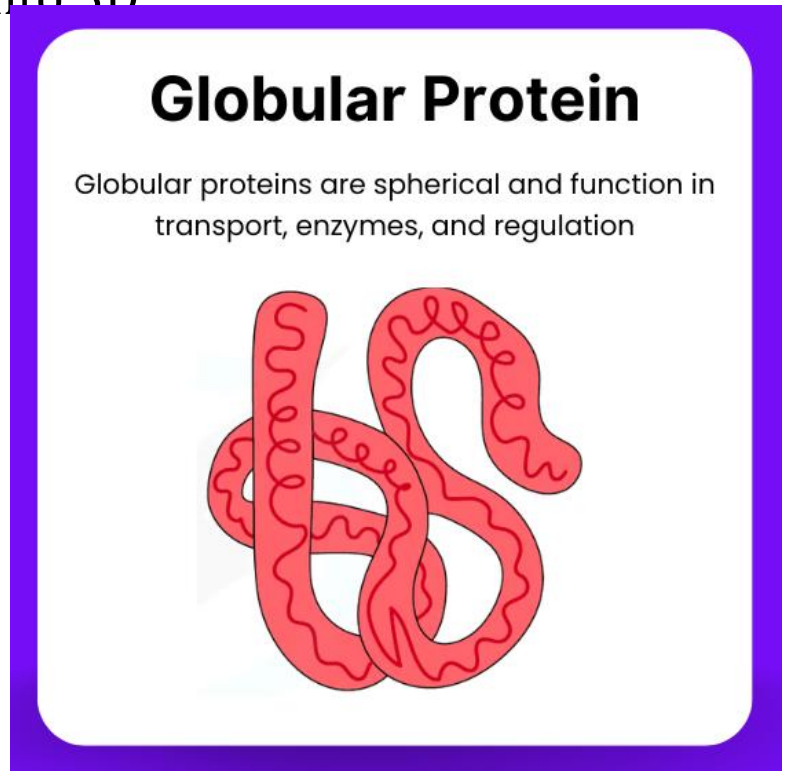
Classification – Based on Shape

- **Fibrous Proteins (Scleroproteins)**:
  - **Structure**: Long, elongated, thread-like, coiled
  - **Solubility**: **Insoluble in water** & dilute salts
  - **Function**: Provide **structural support, strength, protection**
  - **Location**: Connective tissues, skin, hair, muscles
- **Examples**:
  - **Collagen**: Abundant protein in animals (tendons, ligaments, skin)
  - **Keratin**: Hair, nails, horns, feathers
  - **Actin & Myosin**: Muscle contraction



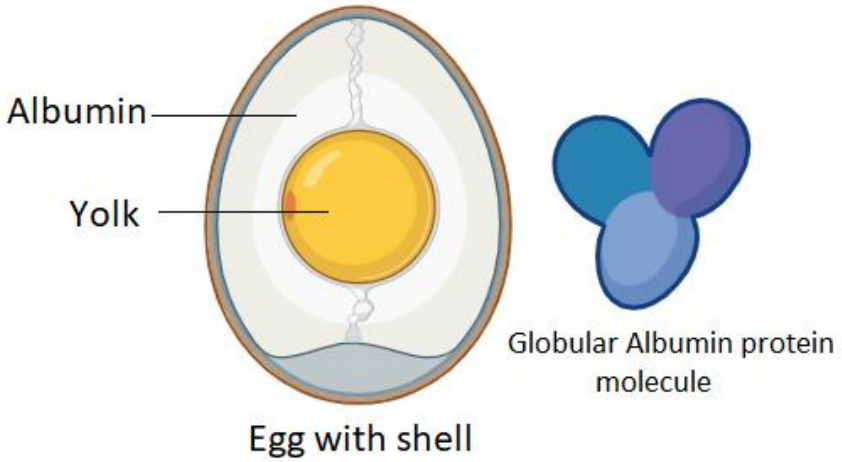
Classification – Based on Shape

- **Globular Proteins**:
  - **Structure**: Compact, folded into **spherical or oval** shape, coiled into 3D
  - **Solubility**: **Soluble in water** & aqueous solutions
  - **Function**: Dynamic roles – transport, catalysis, regulation
  - **Location**: Blood, cytoplasm, hormones
- **Examples**:
  - **Albumin**: Maintains osmotic pressure in blood
  - **Insulin**: Regulates blood glucose
  - **Hemoglobin**: Oxygen transport



Classification – Based on Constitution

- **Simple Proteins**:
  - **Composition**: Contain **only amino acids** (no non-protein part)
  - **Solubility-based Subgroups**:
    - **Albumins**: Soluble in water, coagulated by heat (e.g., egg white)
    - **Globulins**: Soluble in salt, insoluble in water (e.g., immunoglobulins)
    - **Prolamins**: Soluble in 70–80% alcohol (e.g., gliadin in wheat)
    - **Glutelins**: Soluble in dilute acid/alkali (e.g., glutenin in wheat)
    - **Histones**: Basic, DNA-binding (in nucleus)
    - **Protamine**: Small, basic, sperm cells



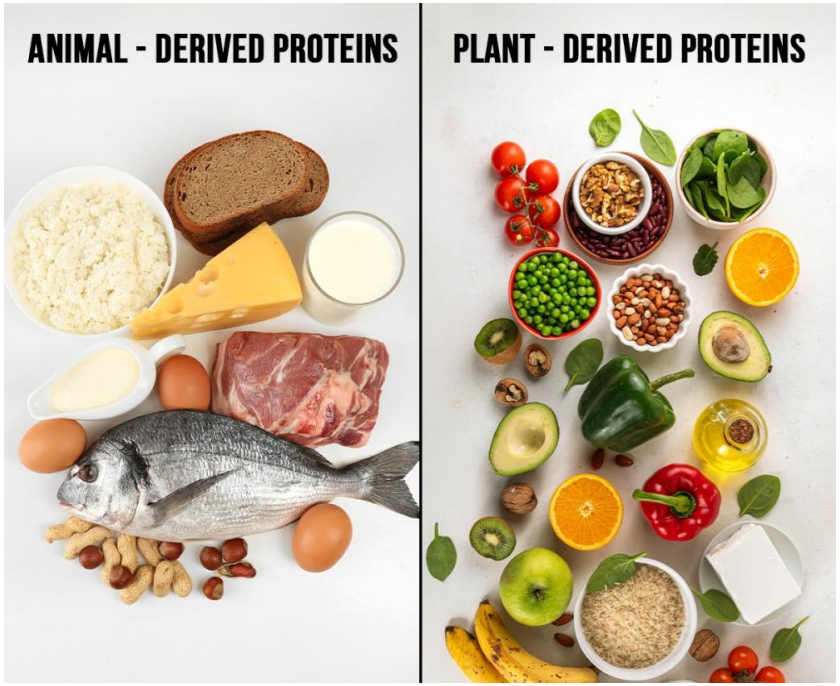
Classification – Based on Constitution

- **Conjugated Proteins**:
  - **Composition**: Protein + **Non-protein prosthetic group**
  - **Function**: Transport, protection, catalysis, storage

Type	Prosthetic Group	Example
Nucleoproteins	Nucleic acid (DNA/RNA)	Ribosomes, Chromatin
Glycoproteins	Carbohydrates (<4%)	Immunoglobulins, Mucins
Mucoproteins	Carbohydrates (>4%)	Mucin (saliva, gastric mucus)
Lipoproteins	Lipids	LDL, HDL, Chylomicrons
Chromoproteins	Colored pigment	Hemoglobin (heme), Rhodopsin
Metalloproteins	Metal ions	Ferritin (Fe), Ceruloplasmin (Cu)
Phosphoproteins	Phosphate group	Casein (milk), Pepsin

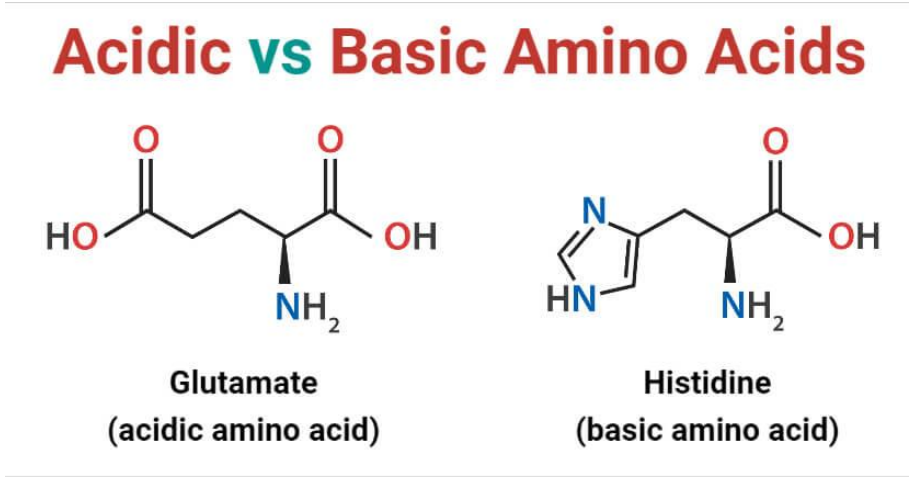
Classification – Based on Constitution

- **Derived Proteins**:
  - **Origin**: Not naturally occurring; formed by **partial or complete breakdown** of native proteins
  - **Proteoses**: Soluble in water, not coagulated by heat.
  - **Peptones**: Smaller, diffuse through membranes
  - **Peptides**: Short chains (di-, tri-, polypeptides)
- **Clinical Relevance**:
  - Detected in urine during **proteinuria**
  - Used in **protein hydrolysates** for nutrition

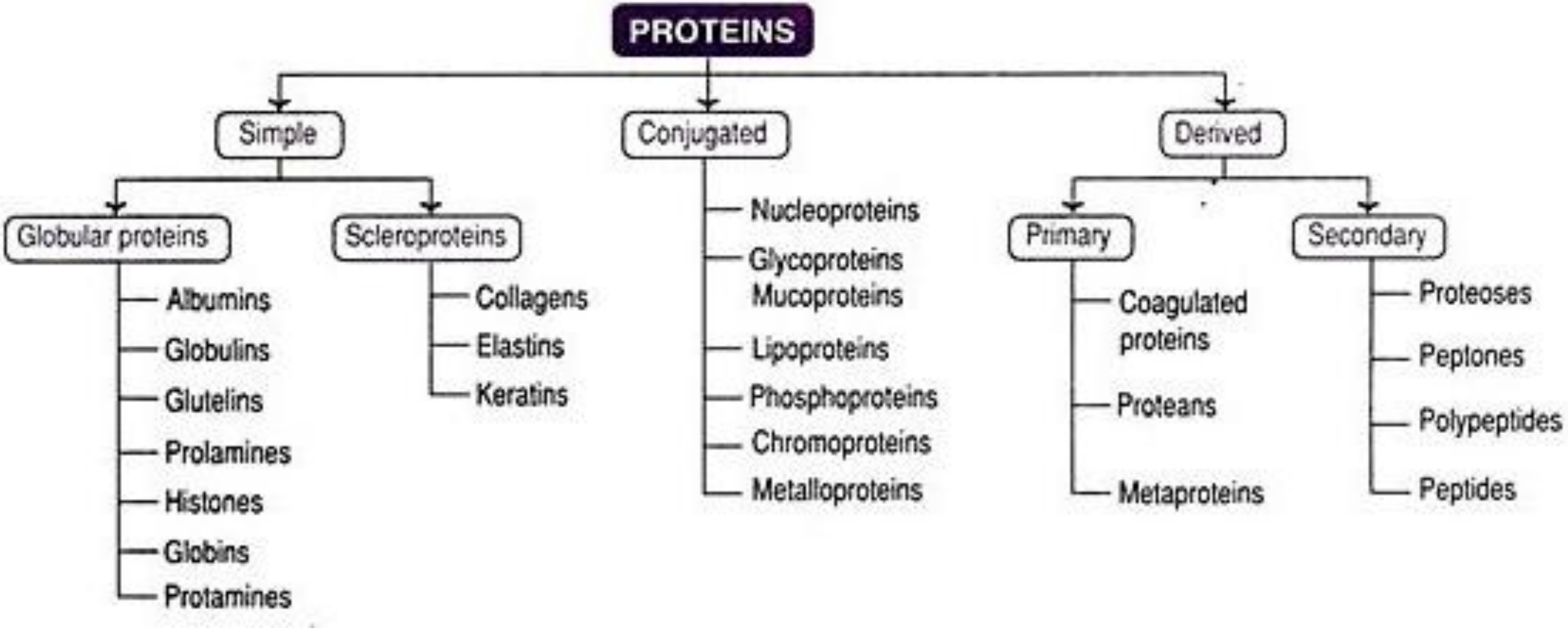


Classification – Based on Nature of Molecules

- **Acidic Proteins**:
  - **Negatively charged** at physiological pH (exist as **anions**)
  - High content of **acidic amino acids** (Aspartic acid, Glutamic acid)
  - **Examples**: Blood group antigens and Casein (milk)
- **Basic Proteins**:
  - **Positively charged** at physiological pH (exist as **cations**)
  - Rich in **basic amino acids** (Lysine, Arginine, Histidine)
  - **Examples**: **Histones** (DNA packaging in nucleus), **Ribosomal proteins** and **Protamine** (sperm)



SUMMARY


PROTEINS
Simple
Conjugated
Derived
Globular proteins
Scleroproteins
Albumins
Globulins
Glutelins
Prolamines
Histones
Globins
Protamines
Collagens
Elastins
Keratins
Nucleoproteins
Glycoproteins
Mucoproteins
Lipoproteins
Phosphoproteins
Chromoproteins
Metalloproteins
Primary
Secondary
Coagulated proteins
Proteans
Metaproteins
Proteoses
Peptones
Polypeptides
Peptides

REFERENCES

- **Lehninger Principles of Biochemistry** – *David L. Nelson, Michael M. Cox*
- **Harper's Illustrated Biochemistry** – *Victor W. Rodwell, David A. Bender, et al.*
- **Textbook of Medical Biochemistry** – *M.N. Chatterjea, Rana Shinde*
- **NCBI Bookshelf** – *Biochemistry: Proteins* 🔗 https://www.ncbi.nlm.nih.gov/books/NBK557845/
- **Protein Data Bank (PDB)** – *RCSB PDB* 🔗 https://www.rcsb.org
- **Journal**: *Journal of Biological Chemistry (JBC)* – ASBMB 🔗 https://www.jbc.org

THANK YOU