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

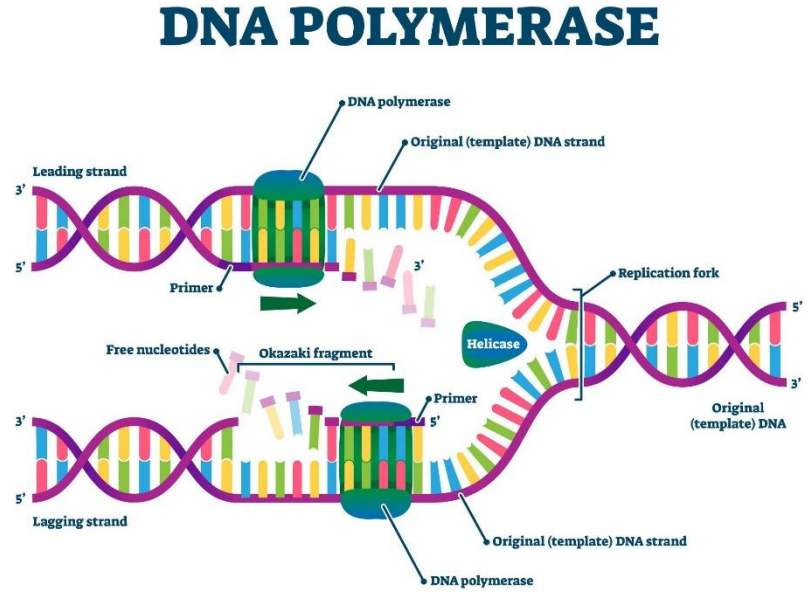
TOPIC : PROTEINS – FUNCTIONS AND PROPERTIES

FACULTY NAME: MITHRA V

FUNCTIONS OF PROTEINS

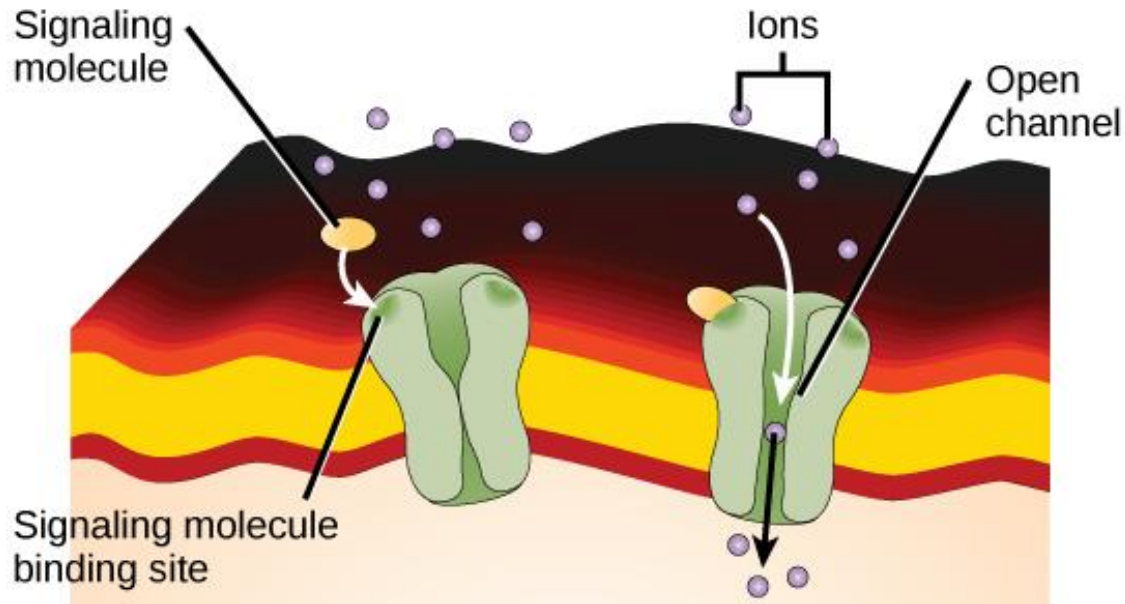
- **Hormonal Proteins**
- Secreted by endocrine glands as hormones.
- Regulate body functions (e.g., insulin controls blood sugar)

- **Enzymatic Proteins**
- Act as catalysts for chemical reactions.
- Speed up metabolism
- Help in DNA replication
- **Amylase:** breakdown starches into sugars.
- **Pepsin:** breaks down proteins into smaller polypeptides.
- **DNA polymerase:** Synthesizes DNA



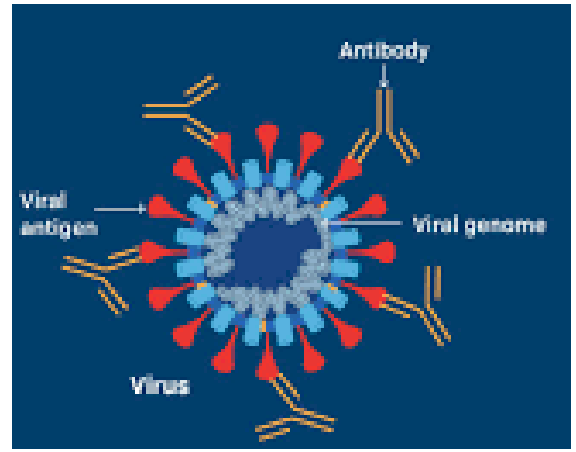
FUNCTIONS OF PROTEINS

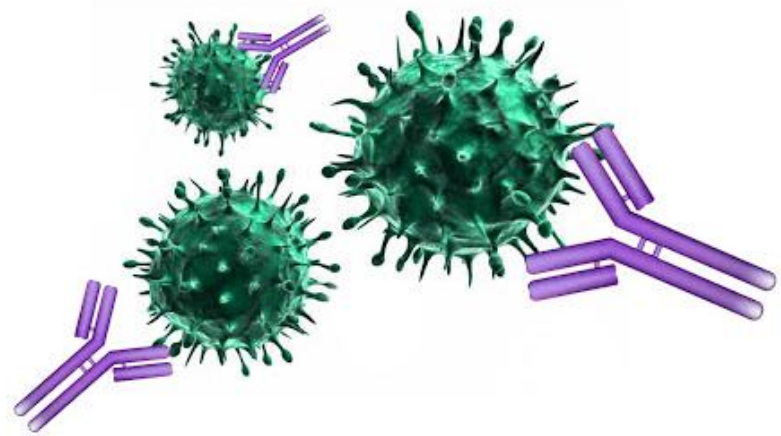
- **Structural Proteins**
- Fibrous proteins - provide strength and shape.
- Components of muscles, bones, skin, hair, cartilage.
- Excess protein can be converted to fat for storage.
- **Receptor Proteins**
- Present on cell surfaces; control what substances enter or leave the cell.
- Enable cells to detect and respond to signals (hormones, neurotransmitters, etc.).



FUNCTIONS OF PROTEINS

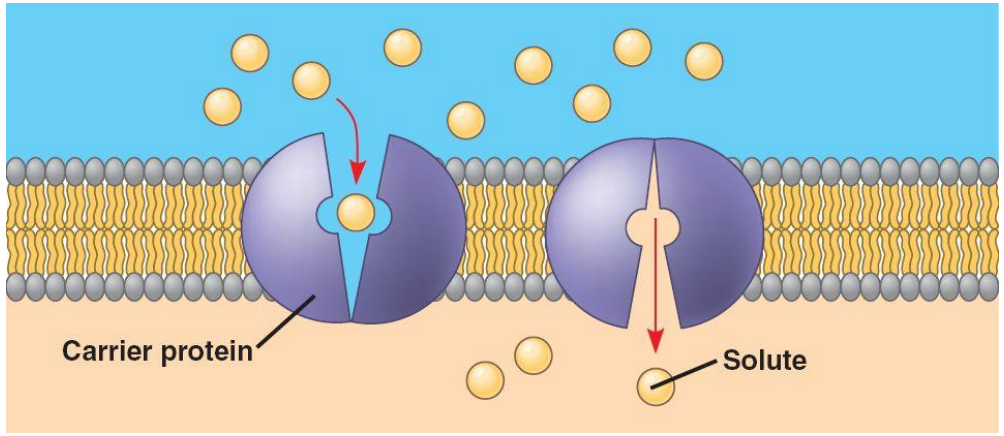
- **Defensive Proteins (Antibodies/Immunoglobulins)**
- Produced by white blood cells to fight pathogens.
- Identify, neutralize, destroy antigens.
- Part of immune system for healing and protection.
- **Storage Proteins**
- Store minerals and nutrients (e.g., casein in milk, ovalbumin in egg whites).
- Provide amino acids or ions (like iron in ferritin, potassium, etc.) when needed.



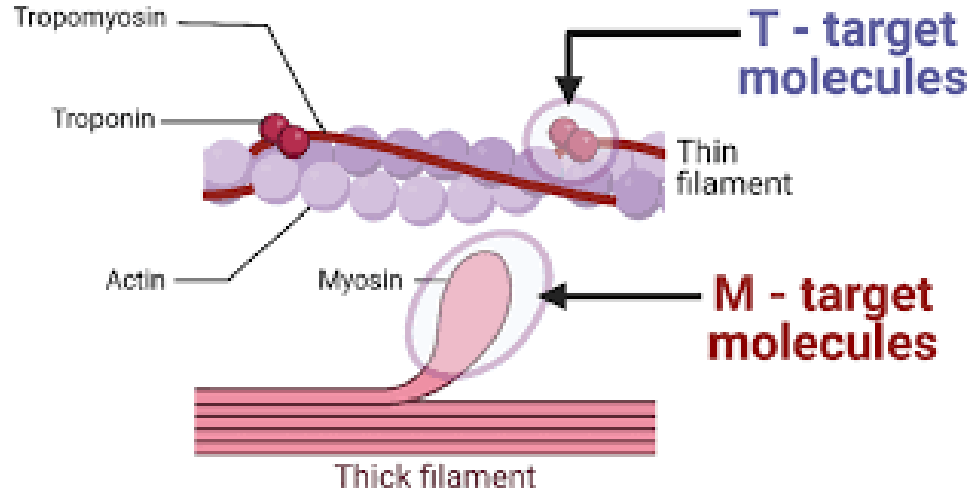


FUNCTIONS OF PROTEINS

- **Transport Proteins**
- Carry vital substances throughout the body (e.g., hemoglobin carries O2)
- Move molecules across cell membranes or in blood.



- **Contractile Proteins**
- Responsible for movement (e.g., actin and myosin in muscles).
- Regulate force and speed of muscle and heart contractions.

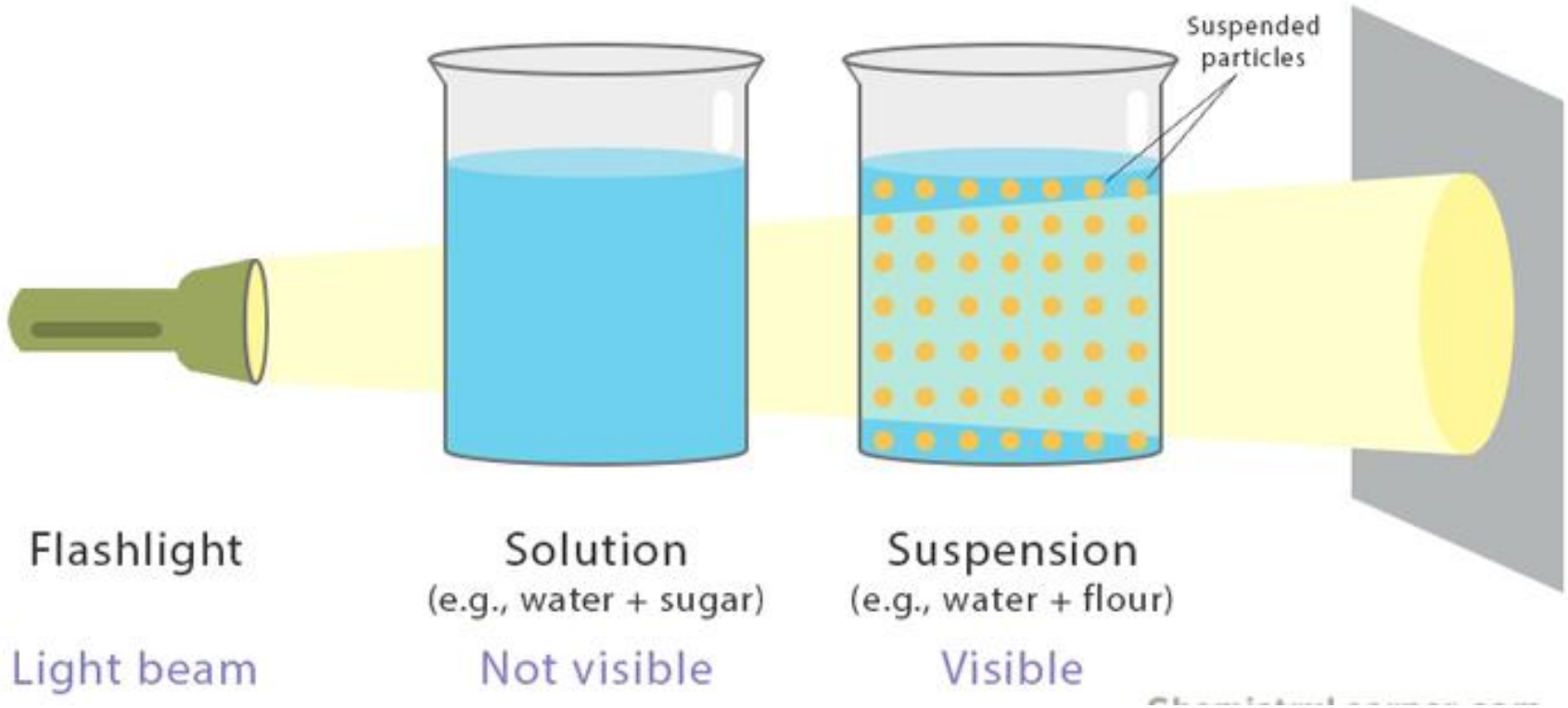


PHYSICAL PROPERTIES

Property	Description	Example
MOLECULAR WEIGHT	Ranges from ~5 kDa (insulin) to million Da	Hemoglobin: ~64.5 kDa (tetramer)
SHAPE/CONFORMATION	Globular (spherical), fibrous (elongated, thread like)	Globular: Myoglobin Fibrous: Collagen and Keratin
SOLUBILITY	Depends on surface hydrophilicity/hydrophobicity	Albumin and Myosin
COLLOIDAL NATURE	Form colloids in solution → high viscosity, light scattering (Tyndall effect)	Egg white (albumin solution) becomes viscous when beaten
OPTICAL ACTIVITY	Rotate plane-polarized light	All natural proteins are laevorotatory (L-amino acids)

Tyndall Effect

Scattering of light by particles in a medium



CHEMICAL PROPERTIES

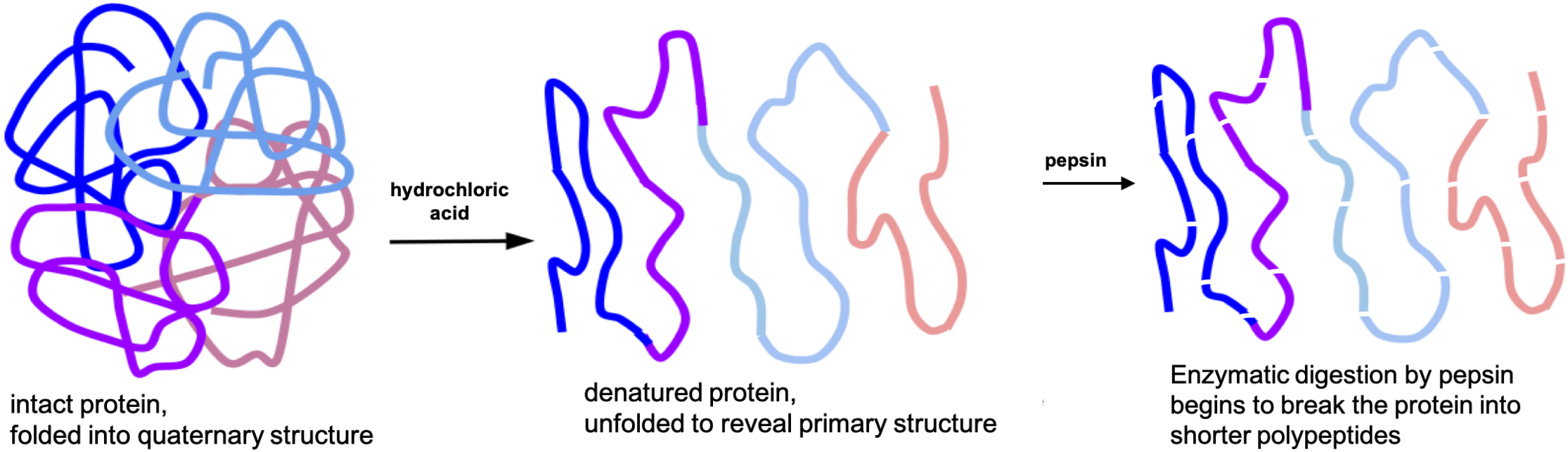
Property	Description	Example
ZWITTERION	Proteins contain both acidic (–COOH) and basic (–NH_2, side chains) Hybrid molecule, +vely & -vely charged *ionic groups*.	At physiological pH ~7.4, most proteins are negatively charged Glycine at pH = 6.0 is zwitterionic
ISOELECTRIC PH (PI)	Isoelectric point (pI) – The pH at which an amino acid or protein has zero net charge, so it doesn't move in an electric field to anode or cathode.	• Pepsin (highly acidic): pI ≈ 1.0 • Lysozyme (basic): pI ≈ 11 • Serum albumin: pI ≈ 4.7 →
PEPTIDE BONDS	–CO–NH– linkage; partial double-bond character → planar, rigid	Gives proteins their secondary structure backbone

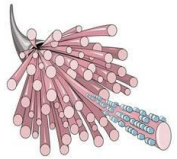
BIOLOGICAL PROPERTIES

Denaturation of Proteins

Agent/Type	Mechanism	Example
HEAT	Breaks H-bonds, hydrophobic interactions	Boiling egg → egg white albumin coagulates (solid)
STRONG ACID/BASE	Disrupts ionic bonds and H-bonds	Curdling of milk by lactic acid
ORGANIC SOLVENTS	Disrupts hydrophobic core	Alcohol disinfection → denatures microbial proteins
MECHANICAL AGITATION	Shearing forces break weak interactions	Whipping egg white → temporary foam

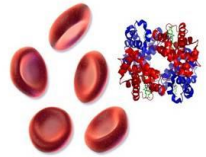
- Hydrochloric acid (HCL) in the stomach - pH of 1.5-3.5.
- **Acidity of the stomach causes food proteins to denature, unfolding their three-dimensional structure** to reveal just the polypeptide chain.

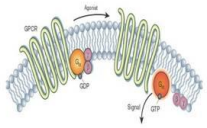




Structural Proteins

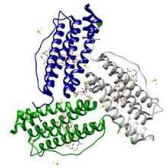
Transport Proteins

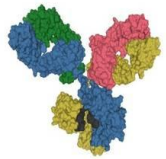




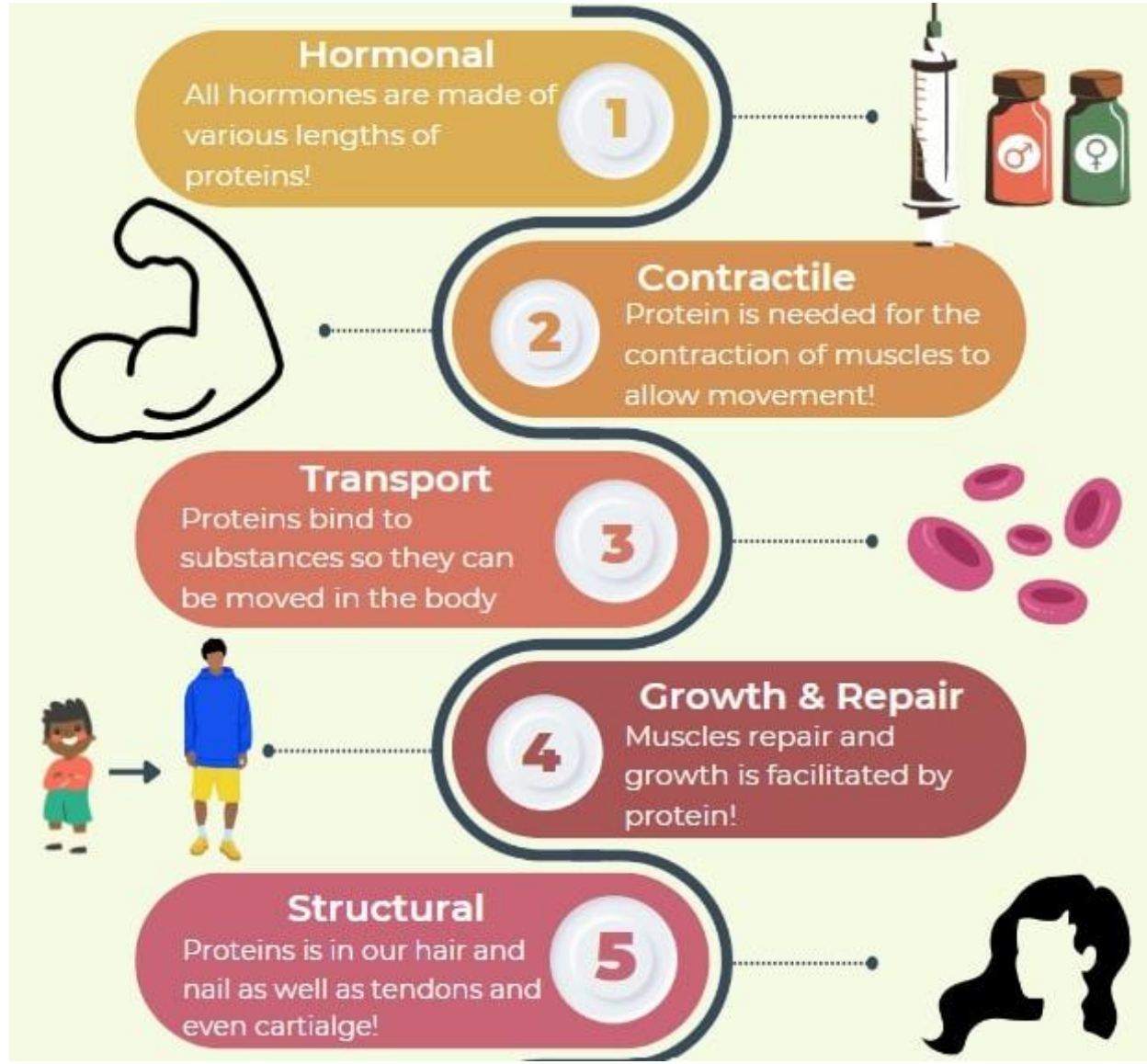
Regulatory Proteins

Storage Proteins





Defensive Proteins



REFERENCES

- Voet, D., Voet, J. G., & Pratt, C. W. (2016). Fundamentals of Biochemistry: Life at the Molecular Level (5th ed.).
- Nelson, D. L., Cox, M. M., & Hoskins, A. A. (2021). Lehninger Principles of Biochemistry (8th ed.).
- https://www.khanacademy.org/science/biology/macromolecules/proteins-and-amino-acids
- NCBI Bookshelf → Biochemistry (free textbook by Berg et al.): https://www.ncbi.nlm.nih.gov/books/NBK22567/

THANK YOU