D.PHARM • SECOND YEAR

Biochemistry & Clinical Pathology

CHAPTER 3

Proteins



ENGLISH CHAPTER NOTES

DIPLOMA IN PHARMACY

PROTEINS: DEFINITION & FUNCTIONS

DEFINITION

- Proteins are large biological macromolecules made of amino acids joined by peptide bonds.
- They contain carbon, hydrogen, oxygen and nitrogen; some also contain sulfur or phosphorus.

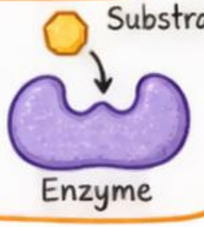
1. STRUCTURE

collagen supports skin and bone; keratin forms hair and nails.



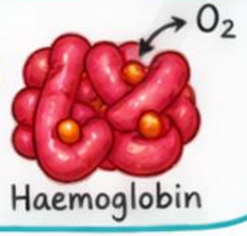
2. ENZYMES

amylase and other enzymes speed up biochemical reactions.



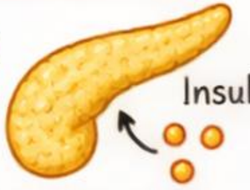
3. TRANSPORT

haemoglobin carries oxygen; albumin carries many substances.



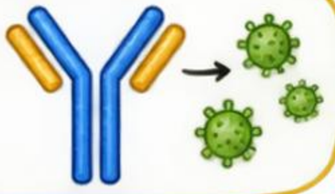
4. REGULATION

insulin and other protein hormones control body processes.



5. DEFENCE

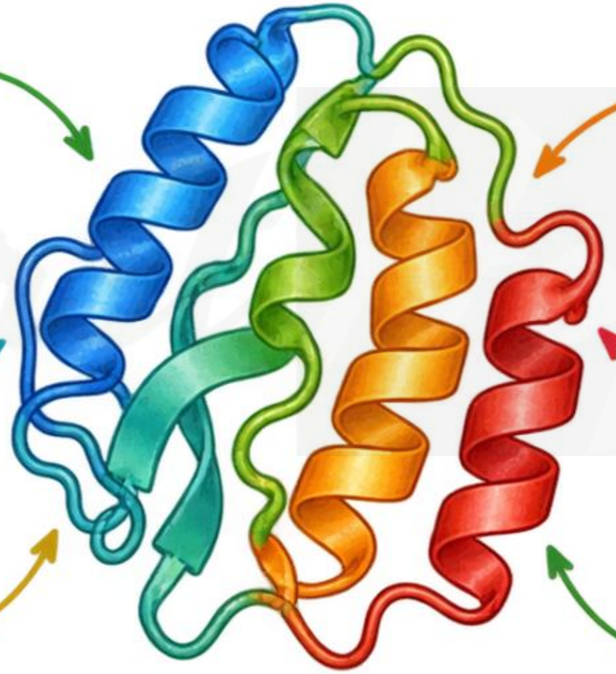
antibodies protect against foreign substances.



6. MOVEMENT

actin and myosin produce muscle contraction.





KEY IDEA

The amino-acid sequence decides protein folding, and folding decides function.

CLASSIFICATION BY COMPOSITION



Proteins are classified by what they yield or contain.

1. SIMPLE PROTEINS

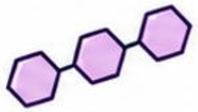
On complete hydrolysis, they yield only amino acids.

Examples: albumin, globulin, keratin.

2. CONJUGATED PROTEINS

Contain a protein part plus a non-protein prosthetic group.

Glycoprotein



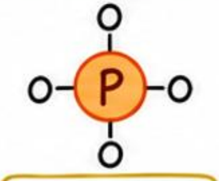
= carbohydrate + protein — mucin

Lipoprotein



= lipid + protein — HDL, LDL

Phosphoprotein



= phosphate + protein — casein

Chromoprotein



= pigment + protein — haemoglobin

Nucleoprotein



= nucleic acid + protein — ribosome

3. DERIVED PROTEINS

Form during partial hydrolysis or denaturation of simple or conjugated proteins.

Examples: proteoses, peptones, metaproteins.

CLASSIFICATION BY SOLUBILITY

Protein groups behave differently in solvents.

ALBUMINS

- Soluble in water and dilute salt solutions.
- Example: serum albumin.

GLOBULINS

- Insoluble in pure water, but soluble in dilute salt solutions.
- Example: serum globulins.

GLUTELINS

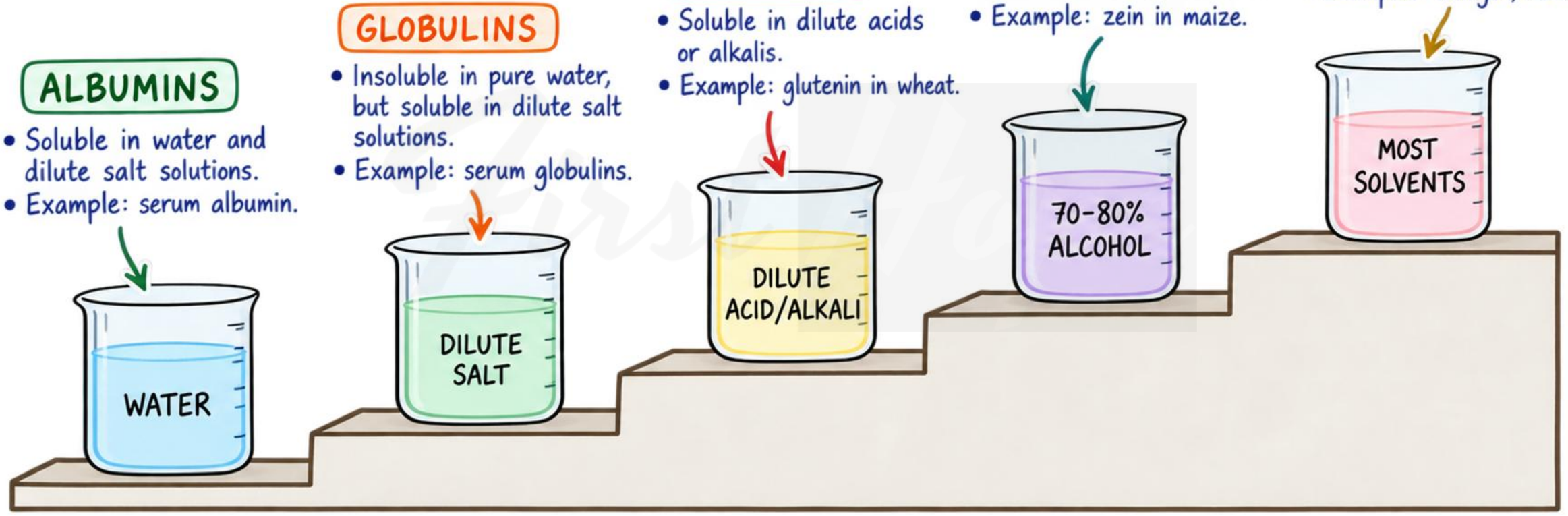
- Soluble in dilute acids or alkalis.
- Example: glutenin in wheat.

PROLAMINES

- Soluble in 70–80% alcohol.
- Example: zein in maize.

SCLEROPROTEINS

- Fibrous proteins; insoluble in most common solvents.
- Examples: collagen, keratin.



REMEMBER Solubility depends on amino-acid side chains, pH, ionic strength and protein folding.

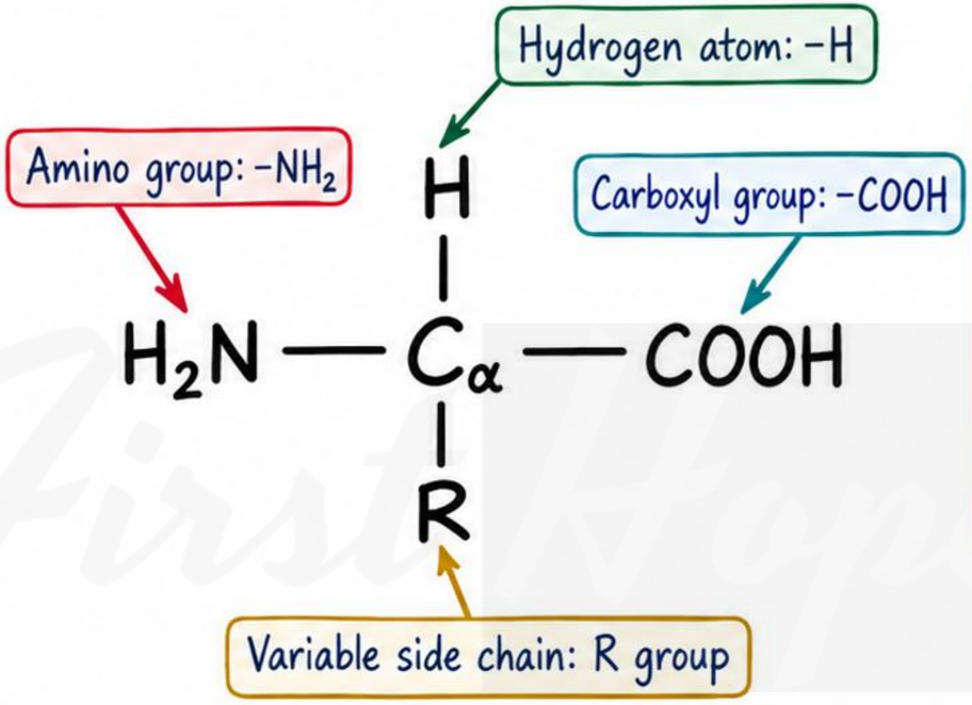
AMINO ACID: GENERAL STRUCTURE

DEFINITION

Amino acids are the building blocks of proteins. Twenty standard amino acids are commonly used in human protein synthesis.

R GROUP

The R group differs in each amino acid and controls its size, polarity, charge and chemical behaviour.



GENERAL α-AMINO ACID

PARTS ATTACHED TO α-CARBON

- Amino group: $-NH_2$
- Carboxyl group: $-COOH$
- Hydrogen atom: $-H$
- Variable side chain: R group

ZWITTERION AT PHYSIOLOGICAL pH

$$H_2N-CHR-COOH \xrightarrow{\text{pH 7.4}} {}^{+}H_3N-CHR-COO^{-}$$

It carries both positive and negative charges, but may have zero net charge.

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