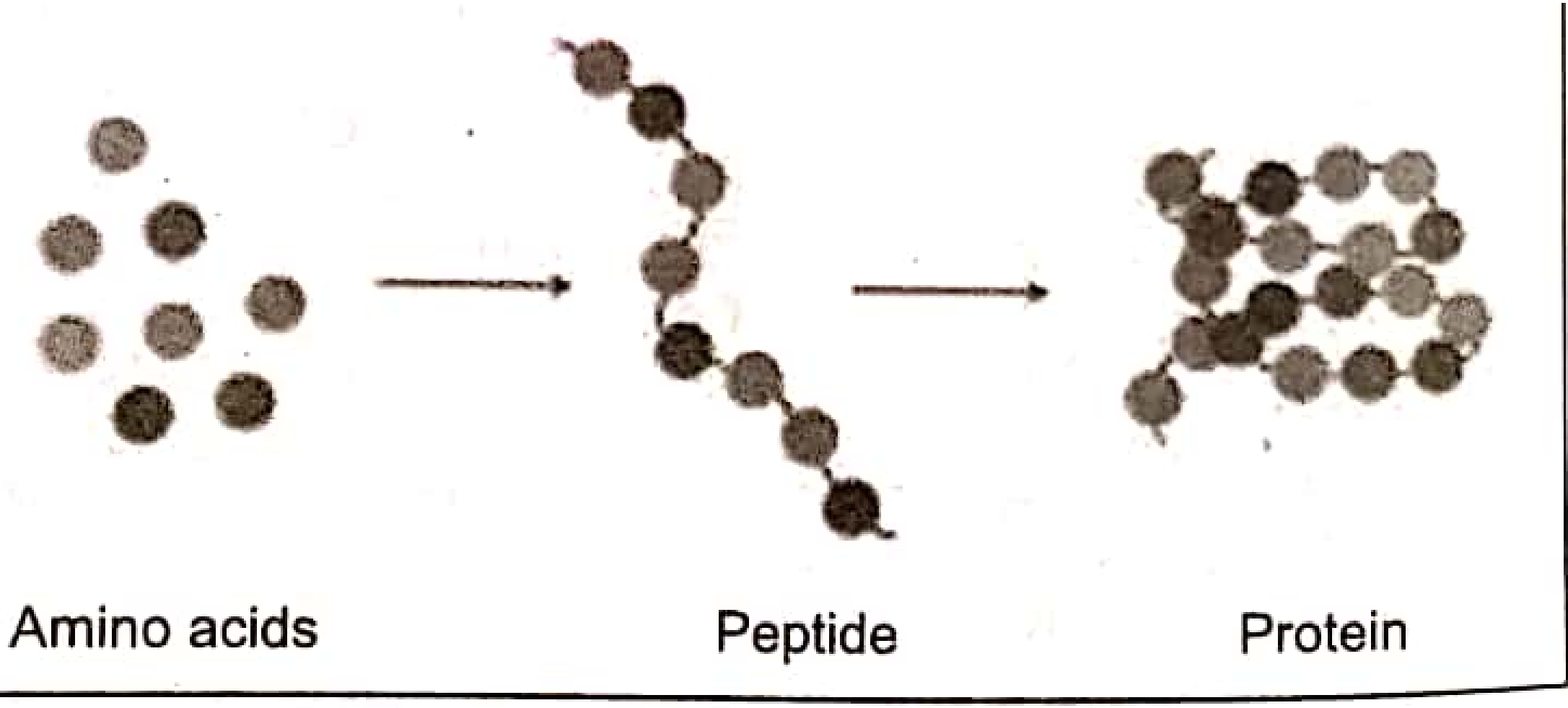
Peptides: Peptides are amides obtained by interaction between the amino acids and carboxylic groups of two or more amino acids molecules. Two molecules of glycine, for example, combine to form amide substance known as glycine.

glycyl

$$\overset{+}{N}H_3-CH_2-COO^- + \overset{+}{N}H_3-CH_2-COO^- \xrightarrow{-H_2O} H_3\overset{+}{N}CH_2CONHCH_2COO^-$$

Two molecules of glycine — Glycyl glycine

The amide group $-CO-NH-$ in the peptides is called peptide linkage.



Representation of amino acids, peptides and proteins

Proteins

Proteins are complex organic compounds essential for growth and maintenance of life. These are nitrogenous compounds obtained from α-amino acids. They are the constituents of all living

organisms and found in every part of plants and animals. They are present in muscles, skin, hair, nails, blood, tendons and arteries.

Proteins present in different plants and animals differ from one another in composition and biological action. Proteins perform diverse functions in life processes. Some proteins are responsible only for structural shapes of parts of the body *e.g.*, keratin in hair, some are responsible for regulating metabolic processes *e.g.*, insulin in blood sugar level whereas some act as catalysts for biological reactions *e.g.*, enzymes.

Plants synthesise proteins from carbon dioxide, water and other nitrogenous materials. Animals consume proteins from plants. Inside the animal body, proteins are hydrolysed to a mixture of amino acids from which a number of different or same proteins are resynthesised. Besides carbon, hydrogen, oxygen, nitrogen, sulphur is also present in some proteins. Phosphorus, iron and magnesium may be present in select proteins. Molecular weights of proteins are abnormally high as a protein molecule is constituted of several thousands of amino acid molecules. In all there are 26 different natural amino acids which are the building blocks of different proteins.

2.14 CLASSIFICATION OF PROTEINS

On the basis of structure

Proteins are classified into two types on the basis of structure:

(a) Fibrous proteins. These proteins consist of thin linear molecules which lie side by side to form fibres. Intramolecular hydrogen bonding holds the peptide chain together (Fig. 2.2). Fibrous proteins are insoluble in water.

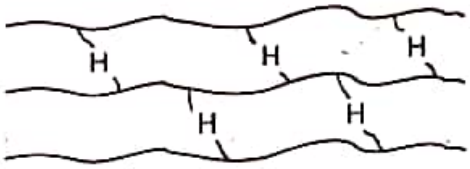


Fig. 2.2: *Structure of fibrous proteins.*

Fibrous proteins are the main structural materials of tissues. Examples of important fibrous proteins are *keratin* in skin and hair, *callagen* in tendon, *fibroin* in silk and *myosin* in muscles.

(*b*) Globular proteins. In these proteins, polypeptides are folded into compact spheroidal shapes. Intramolecular hydrogen bonding holds the peptide chain in shape in such proteins (Fig 2.3). These are soluble in water or aqueous solutions of acids and bases.

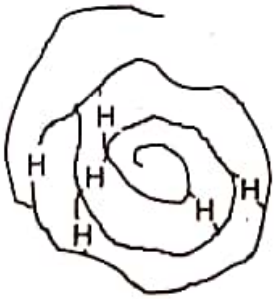


Fig. 2.3: *Structure of globular proteins.*

These proteins have the role to regulate and maintain life processes. Examples of this class of proteins are enzymes, hormones, haemoglobin and albumin.

On the basis of hydrolysis products

Proteins are classified according to hydrolysis products as follows:

(*a*) Simple proteins. Proteins which on hydrolysis yield only amino acids are called simple proteins. Examples of this class of proteins are albumins (such as egg albumin, serum albumin), globulins (such as tissue globulin) and glutelins (such as wheat gluteline).

(*b*) Conjugated proteins. Proteins which are a combination of two parts, a proteinous part and non-proteinous part, are called conjugate proteins. The non-proteinous part is called prosthetic group. Prosthetic group plays its part in biological function of the protein.

Conjugated proteins are further classified as nucleoproteins, glycoproteins and chromoproteins. The prosthetic groups in such proteins are nucleic acid, carbohydrate and haemoglobin (or chlorophyll) respectively.