BIOMOLECULES

STRUCTURE OF PROTEINS

Structure of proteins

1. **Primary configuration or structure :-** A straight chain of amino acids linked by peptide bonds form primary structure of proteins. This structure of proteins is most unstable. Newly formed proteins on ribosomes have primary structure.

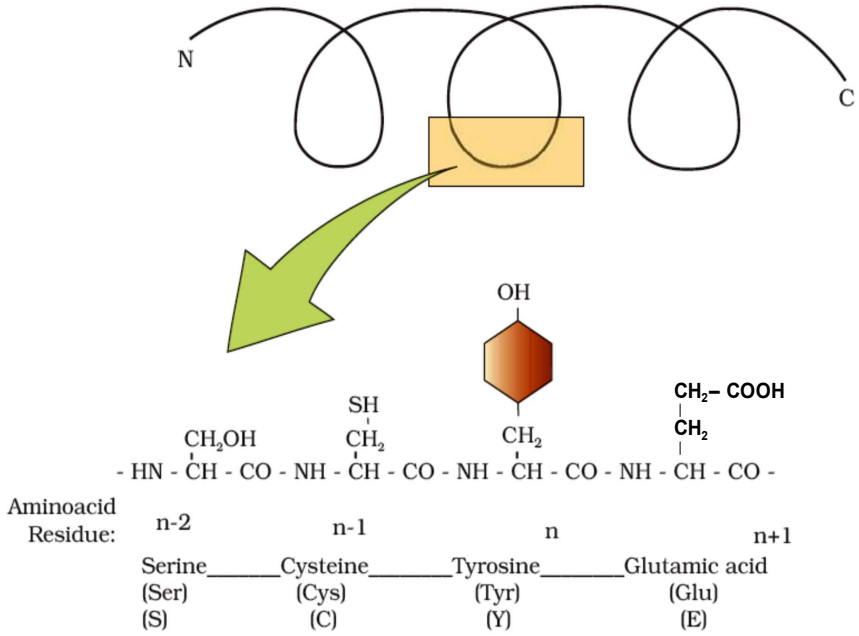
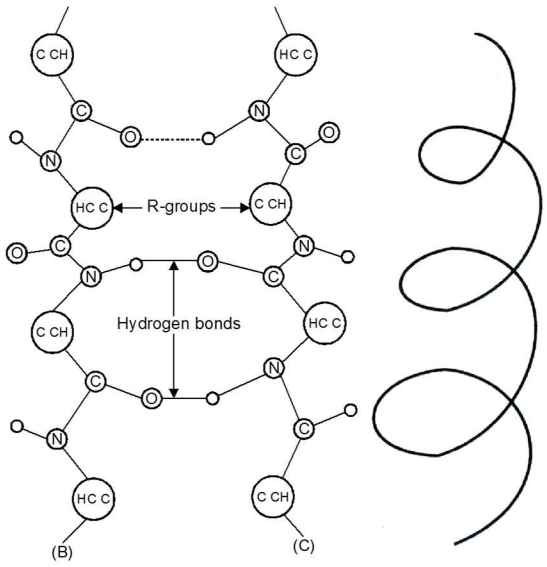


Fig. Primary structure of a portion of a hypothetical protein. N and C refer to the two terminal of every protein. Single letter codes and three letter abbreviations for amino acids are also indicated

2. **Secondary configuration :-** Protein molecules of sec~ structure are spirally coiled. In addition to peptide bond, amino acids are linked by hydrogen bonds between oxygen of one amide group and hydrogen of another amide group. This structure is of two types –



SECONDARY STRUCTURE OF PROTEIN

(i) **α–Helix :-** Right handed rotation of spirally coiled chain with approximately $3\frac{1}{2}$ amino acids in each tum. This structure has intramolecular hydrogen bonding i.e. between two amino acids of same chain e.g. Keratin ,Myosin, Tropomyosin.

(ii) **β-Helix or pleated sheath structure :-** Protein molecule has zig- zag structure. Two or more protein molecules are held together by intermolecular hydrogen bonding. e.g. Fibroin (silk).

- Proteins of sec. structure are insoluble in water and fibrous in appearance.
- Keratin is a fibrous, tough, resistant to digestion, sclera protein. Hardness of keratin is due to abundance of cysteine amino acid in its structure.

3. **Tertiary Structure :-** Proteins of tertianz structure are highly folded to give a globular appearance. They are soluble in water (colloid solution). This structure of protein has following bonds-

(i) Peptide bonds = strongest bond in proteins.

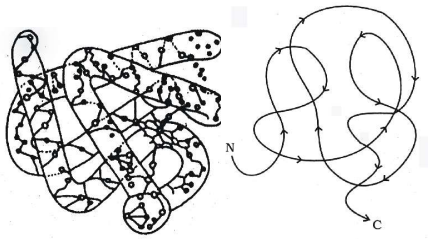
(ii) Hydrogen bonds

(iii) **Disulphide bond :-** These bonds are formed between- SH group of amino acid (Cysteine). These bonds are second strongest bond and stabilise tertiary structure of protein.

(iv) **Hydrophobic bond :** Between amino acids which have hydrophobic side chains for e.g. Aromatic amino acid

(v) **Ionic bond :** Formation of ionic bond occurs between two opposite ends of protein molecule due to electrostatic attraction.

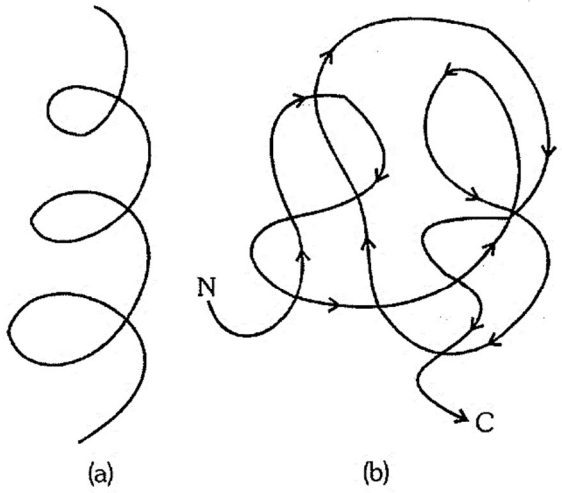
Majority of proteins and enzymes in protoplasm exhibit tertiary structure



TERTIARY STRUCTURE OF PROTEIN

4. **Quaternary Structure :-** Two or more polypeptide chains of tertiary structure unite by different types of bond to form quaternary structure of protein. Different polypeptide chains may be similar (lactic-dehydrogenase) or dissimilar types (Haemoglobin, insulin).

Quaternary structure is most stable structure of protein.



Cartoon showing : (a) A secondary structure and
(b) A tertiary structure of proteins

Properties of proteins

- Proteins are large sized molecules.
- Many proteins form colloidal solutions.
- A protein may bind as well as react with a variety of chemicals.
- Proteins cannot pass through cell membranes.
- The disruption of bonds of tertiary proteins structure is called denaturation.

Functions of Proteins

1. **Structural Proteins**

   Many proteins serve as building material of cells and tissues. Some proteins form supporting structures e.g., elastin of ligaments, collagen of tendons, cartilages, cartilage bone and connective tissue.

Some Proteins and their Functions	
Protein	**Functions**
Collagen	Intercellular ground substance
Trypsin	Enzyme
Insulin	Hormone
Antibody	Fights infectious agents
Receptor	Sensory reception (smell, taste, hormone, etc.)
GLUT – 4	Enables glucose transport into cells

2. **Protective Structure:** Fibrous protein keratin is the major constituent of external protective structure of animals like hair, feather, horny layer of skin, nails, claws, hoofs etc.
3. **Enzymes:** Many proteins function as enzymes to catalyse biochemical reactions.
4. **Carrier proteins:** Some proteins act as carriers which bind and transport specific molecules across a membrane or in a body fluid. Haemoglobin transports oxygen in the body, □-globulin of blood carries thyroxine, bilirubin and □-globulin transports vitamin A, D and K.

5. **Receptor proteins:** A number of proteins present on the external surface of cell membrane act as receptor molecules.
6. **Hormones:** Some hormones are proteinaceous e.g., insulin.
7. **Contractile proteins:** Myosin and actin make the muscle fibres contractile to bring about movements and locomotion.
8. **Defence:** Some proteins act as antibodies that participate in the defence mechanism of the body.
9. **Storage proteins:** These occur in milk, eggs and seeds to nourish the young ones. Iron storing protein commonly found in animal tissue is ferritin.
10. **Protein Buffers:** Proteins also help in maintaining a balance of acidity and alkalinity by combining with excess acids and bases.
11. **Visual pigments:** Rhodopsin and iodopsin are protein pigments.
12. **Toxins :** Many toxins of microbes, plants and animals are proteins.
13. **Blood clotting proteins :** The proteins fibrinogen and thrombin help in blood clotting to check bleeding from injuries.
14. **Sweetest substance:** Monellin, a protein derived from an African berry is 2000 times sweeter than sucrose.
15. **Repressor:** Most of the repressors that regulate genes (operon concept) are proteins in nature.