



### Hydrolysis of Proteins

Proteins can be hydrolysed and on the basis of hydrolysis they are of following types.

**(1) Simple Proteins :** On hydrolysis they give only a-amino acids

**Ex :** Albumins, globulins etc.

**(2) Conjugated Proteins :** These are having a Non-protein Prosthetic group and on it's bases they are of following types.

**(a) Nucleo protein :** Here Prosthetic group. is nucleic acid. e.g., Nuclein

**(b) Glycoprotein :** Here Prosthetic group is any carbohydrate. e.g., Mycin

**(c) Chromo protein :** Here Prosthetic group is any pigment having metals like Fe, Cu, etc.

**Ex :** Haemoglobin, Chlorophyll.

**(3) Derived Protein :** They are achieved by the partial hydrolysis of simple conjugated proteins.

**Ex :** Proteoses, Peptones.

### Structure of Proteins

Amino acids are joined together by an amide linkage called peptide bond. Proteins are long polymers of amino acids linked by peptide bonds (polypeptides)

#### (1) Primary Structure

- Frederic Sanger gave Primary structure of Insulin for the first time.
- Proteins may have one or more than one polypeptide chains.
- Amino acids of each polypeptide in a protein are joined to each other in a specific sequence and this sequence is termed as primary structure of that protein.

#### (2) Secondary Structure

- By intramolecular H-bonding between the carboxyl and amino groups there is regular folding of the backbone of the polypeptide chain which arises secondary structure.

### Previous Year's Questions



Which is the correct statement?

[AIPMT]

- (1) Starch is a polymer of a-glucose
- (2) Amylose is a component of cellulose
- (3) Proteins are composed of only one type of amino acid
- (4) In cyclic structure of fructose, there are four carbons and one oxygen atom.

### Rack your Brain



What is the disease caused by defective haemoglobin molecule in which one of the glutamic acid molecule is replaced by valine?

### Previous Year's Questions



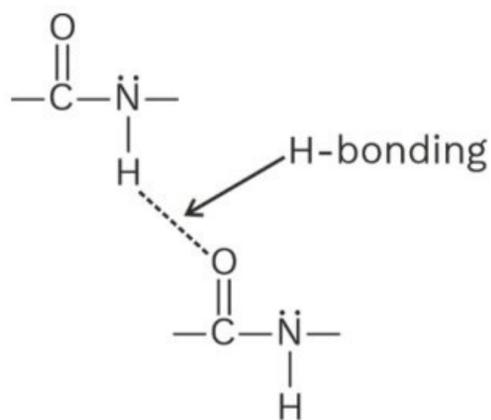
The helical structure of protein is stabilised by

[AIPMT]

- (1) Dipeptide bonds
- (2) Hydrogen bonds
- (3) Ether bonds
- (4) Peptide bonds



- Secondary structures are found to present in two different types of structures viz.  $\alpha$ -helix and  $\beta$ -pleated sheet structure.
- By intramolecular H-bonding between  $\text{—CO—}$  and  $\text{—NH—}$  groups of the peptide bond there is regular folding of the backbone of the polypeptide chain which arises  $\alpha$ -helix and  $\beta$ -pleated sheet structures.



#### (a) $\alpha$ -Helix Structure

- $\alpha$ -Helix is one of the most common ways in which a polypeptide chain forms all possible hydrogen bonds by twisting into a right handed screw (helix) with the  $\text{—NH}$  group of each amino acid residue hydrogen bonded to the  $\text{>C=O}$  of an adjacent turn of the helix.
- Stabilization of an  $\alpha$ -helical configuration by hydrogen bonding.

**Ex :**  $\alpha$ -keratin in skin, nails, myosin in muscles, fibroin in silk.  $\alpha$ -Helix is called 3.6 helix as each turn of helix has 3.6 amino acids and a 13-membered ring.

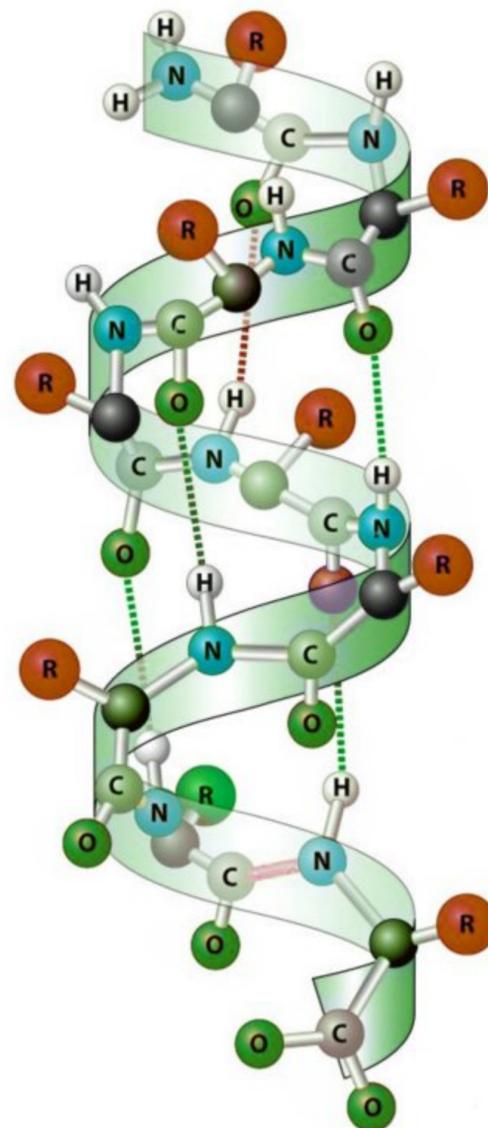
#### (b) $\beta$ -pleated sheet structure

- In  $\beta$ -pleated sheet structure all peptide chains are stretched out to nearly maximum extension and then laid side by side which are held together by intermolecular hydrogen bonds.

#### Rack your Brain



Which types of bonds are responsible for the stability of  $\alpha$ -helix?





- When the size of the groups (Alkyl Group) is moderate, the polypeptide chains contract a little to give a  $\beta$ -pleated sheet structure to protein molecule, as in silk protein fibroin.
- $\beta$ -pleated sheet structure are parallel and Anti parallel type.
- In parallel form all polypeptide chain run in the same direction while in Anti parallel form, the alternate Polypeptide chain run in same direction.

**Ex :** Parallel conformation — Keratin in hair  
Anti-Parallel Conformation — Silk Protein fibroin

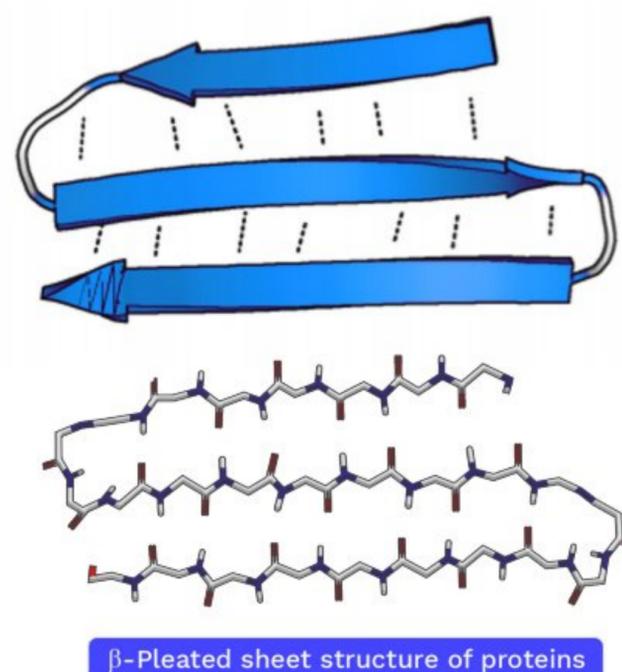
### (3) Tertiary Structure

- The tertiary structure of proteins represents the folding of the polypeptide chains or folding of the secondary structure of proteins.
- Tertiary and secondary structures of proteins are stabilise by the forces of H-bonds, disulphide linkages, van der Waals and electrostatic forces of attraction.
- It gives rise to 2 major molecular shapes that is fibrous and globular.

### (4) Quaternary Structure

- Some of the proteins are composed of more than one polypeptide chains referred to as sub-units.
- When these subunits have spatial arrangement with respect to each other then they are termed as quaternary structure.

**Ex:** Haemoglobin is an aggregate of four sub-units, two identical  $\alpha$ -chains (having 141 Amino acid residues and two identical  $\beta$ -chains (having 146 Amino acid residues).



### Concept Ladder



The tertiary structure is the three-dimensional structure of globular proteins. It arises due to the folding and superimposition of various secondary structural elements.

### Previous Year's Questions



Hemoglobin is

[AIPMT]

- (1) A vitamin
- (2) A carbohydrate
- (3) An Enzyme
- (4) A globular protein