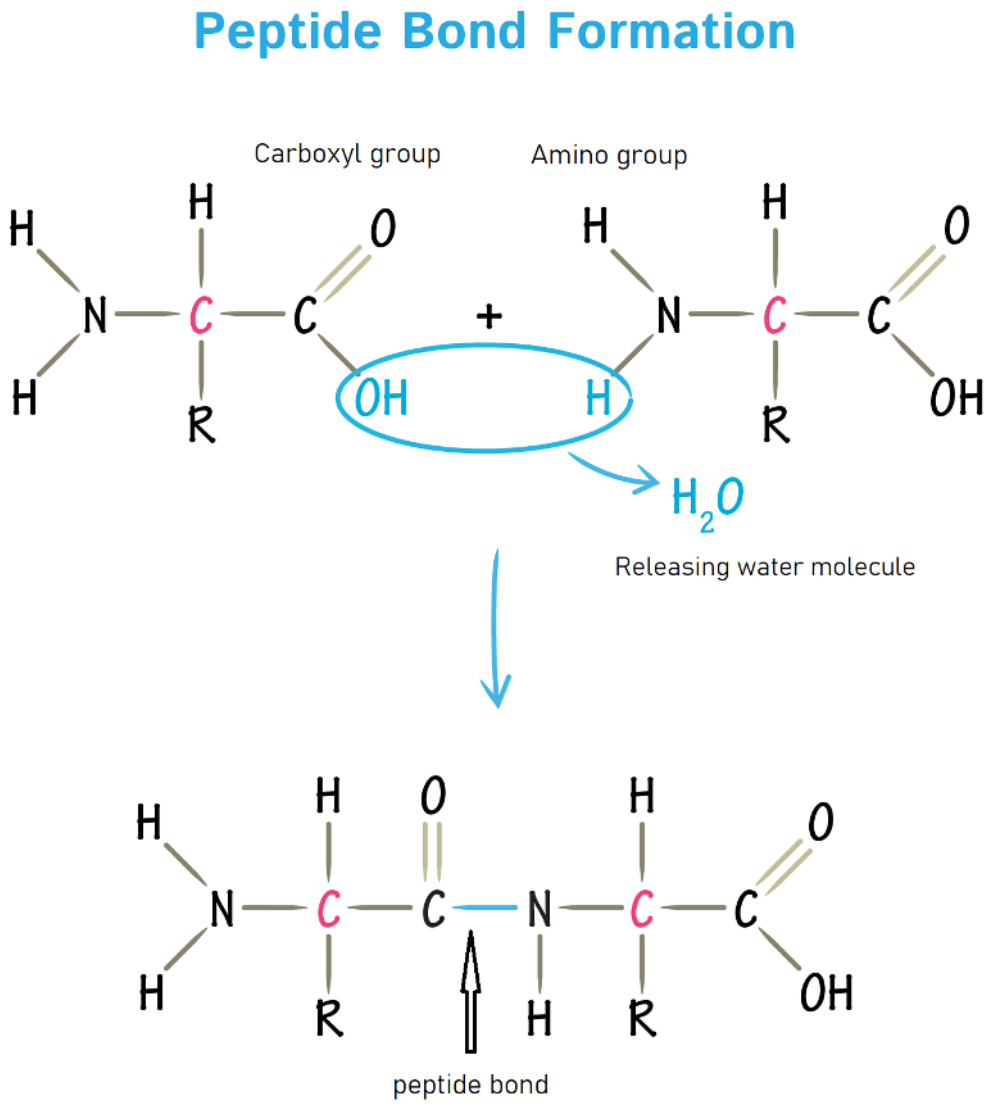
Proteins

Proteins :- Highly complex macromolecule that is present in all living organisms. consist of one or more long chains of L-α-amino acids joining by peptide bond.

peptide bond :- is a chemical bond between two α-amino acids by linking carboxyl group(-COOH) of the one amino acid to the amino group ($-NH_2$)of of another amino acid with release the water molecule. The resulting bond is called a peptide bond, and the resulting molecule is an amide (CO-NH). protein is generally used for a polypeptide containing more than 50 amino acids.



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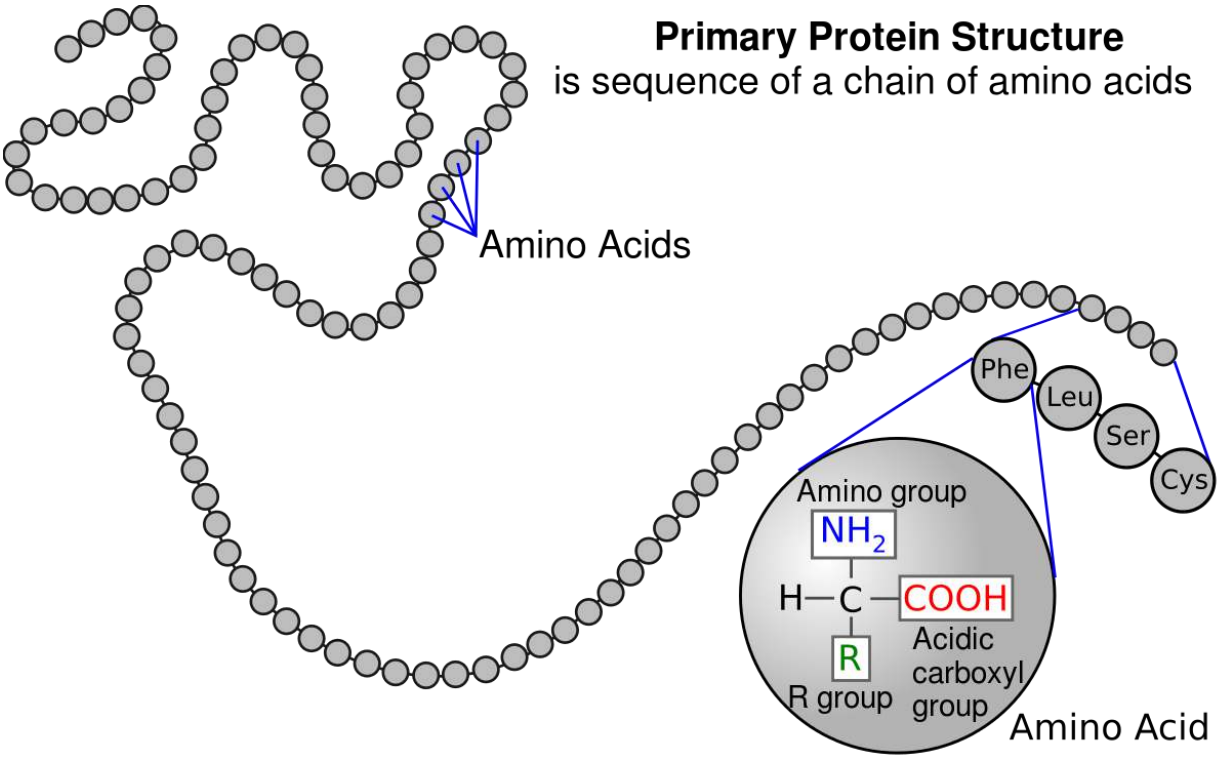
Structure of Proteins:- Proteins have different levels of structures types as below.

1- Primary structure:- The linear sequence of amino acids form the backbone of proteins (polypeptides). Each protein has a unique sequence of amino acid which is determined by the genes contained in DNA. The primary structure is maintained by the covalent bond of the peptide linkages. and consider the simplest level of protein structure. For example, insulin is composed of 51 amino acids in 2 chains. One chain has 31 amino acids, and the other has 20 amino acids.



2- Secondary structure:- The secondary structure is refers to local folded structures that form within a polypeptide due to interactions between atoms of the backbone. (The backbone just refers to the polypeptide chain apart from the R groups – so all we mean here is that secondary structure does not involve R group atoms.) The most common types of secondary structures are the α helix and the β pleated sheet. Both structures are held in shape by hydrogen bonds, which form between the carbonyl(O) of one amino acid and the amino (H) of another.

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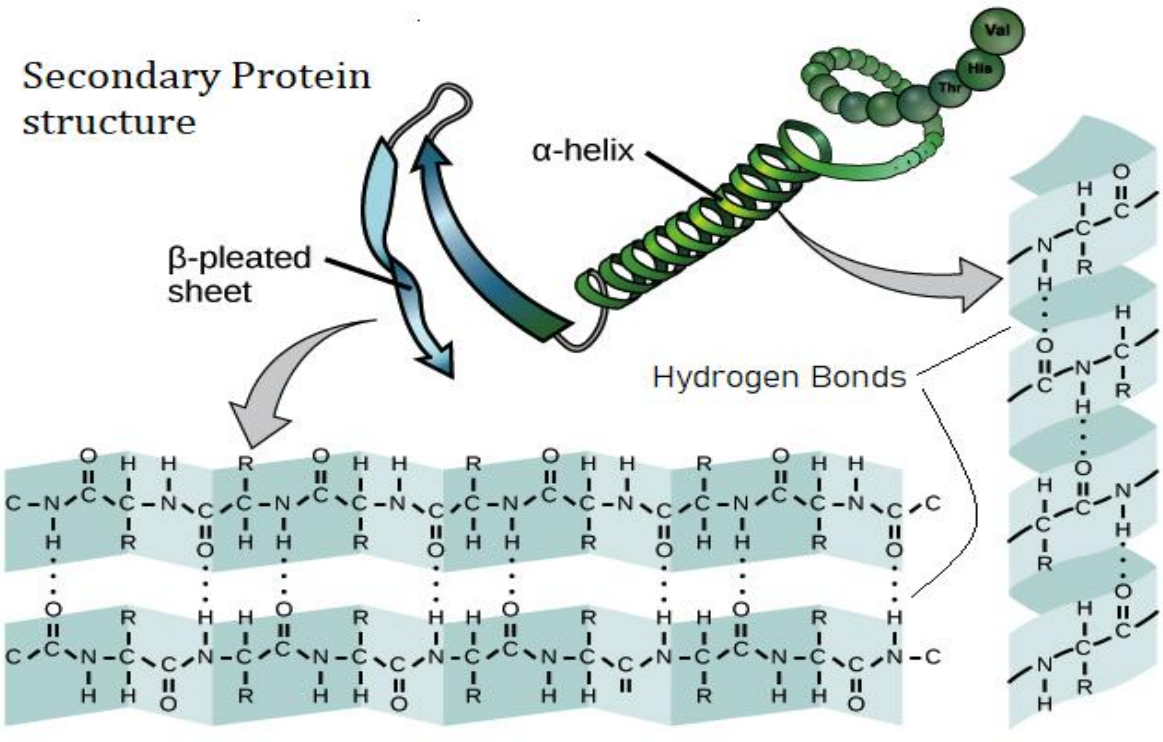
- (ALPHA) α helix:- this is most common type of secondary structure .its spiral structure of protein .the carbonyl (C=O) of one amino acid is hydrogen bonded to the amino H (N-H) of an amino acid that is four down the chain. (E.g., the carbonyl of amino acid 1 would form a hydrogen bond to the N-H of amino acid 5.) This pattern of bonding pulls the polypeptide chain into a helical structure that resembles a curled ribbon, with each turn of the helix containing 3.6 amino acids. The R groups of the amino acids stick outward from the α helix, where they are free to interact.
- (BETA) β pleated sheet:- two or more segments of a polypeptide chain line up next to each other, forming a sheet-like structure held together by hydrogen bonds. The hydrogen bonds form between carbonyl and amino groups of backbone, while the R groups extend above and below the plane of the sheet. The strands of a β pleated sheet may be parallel, pointing in the same direction (meaning that their N- and C-termini match up), or anti-parallel, pointing in opposite directions (meaning that the N-terminus of one strand is positioned next to the C-terminus of the other).



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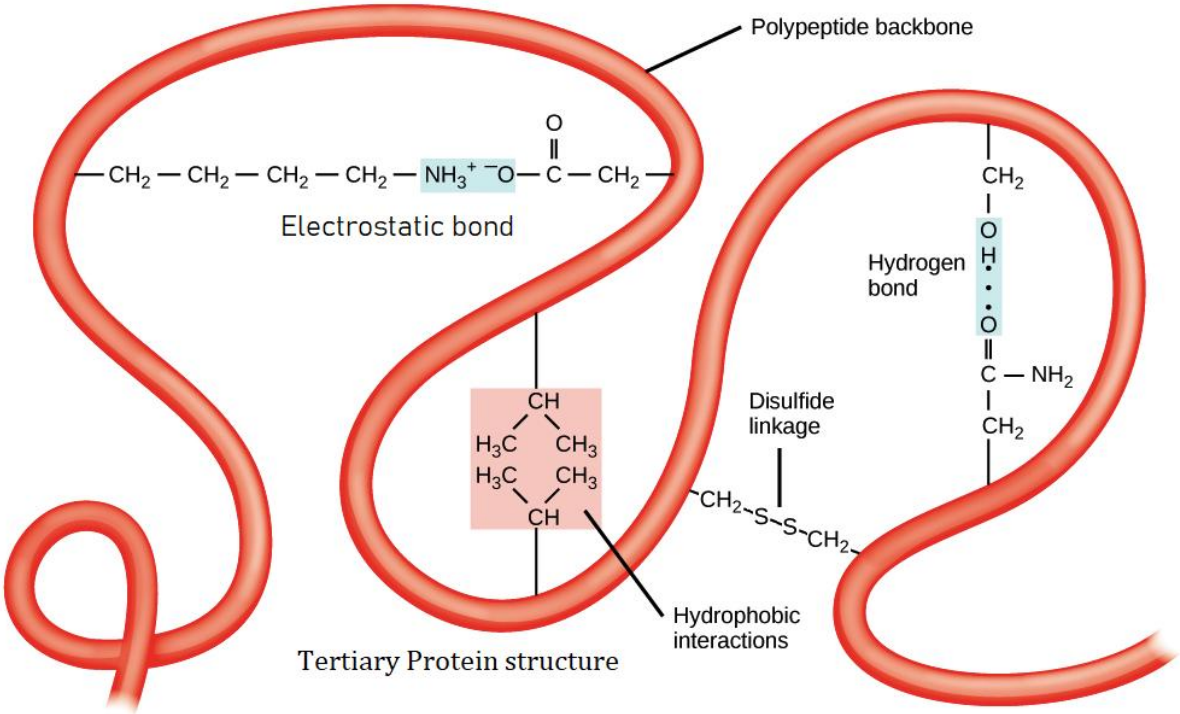
3- Tertiary structure:- The three-dimensional arrangement of protein structure is called as tertiary structure. The tertiary structure is primarily due to interactions between the R groups of the amino acids that make up the protein. R group interactions that contribute to tertiary structure include hydrogen bonds, hydrophobic bonds, electrostatic bonds, and van der waals forces – basically, these are non-covalent bonds. Finally, also there's one special type of covalent bond that can contribute to tertiary structure. this type known as the disulfide bonds.



4- Quaternary structure:- proteins are made up of multiple polypeptide chains, the individual polypeptide chains are known as subunits. When these subunits come together by non-convalent bonds, they give the protein its quaternary structure.

for example of a protein with quaternary structure: hemoglobin. Hemoglobin carries oxygen in the blood and is made up of four subunits.

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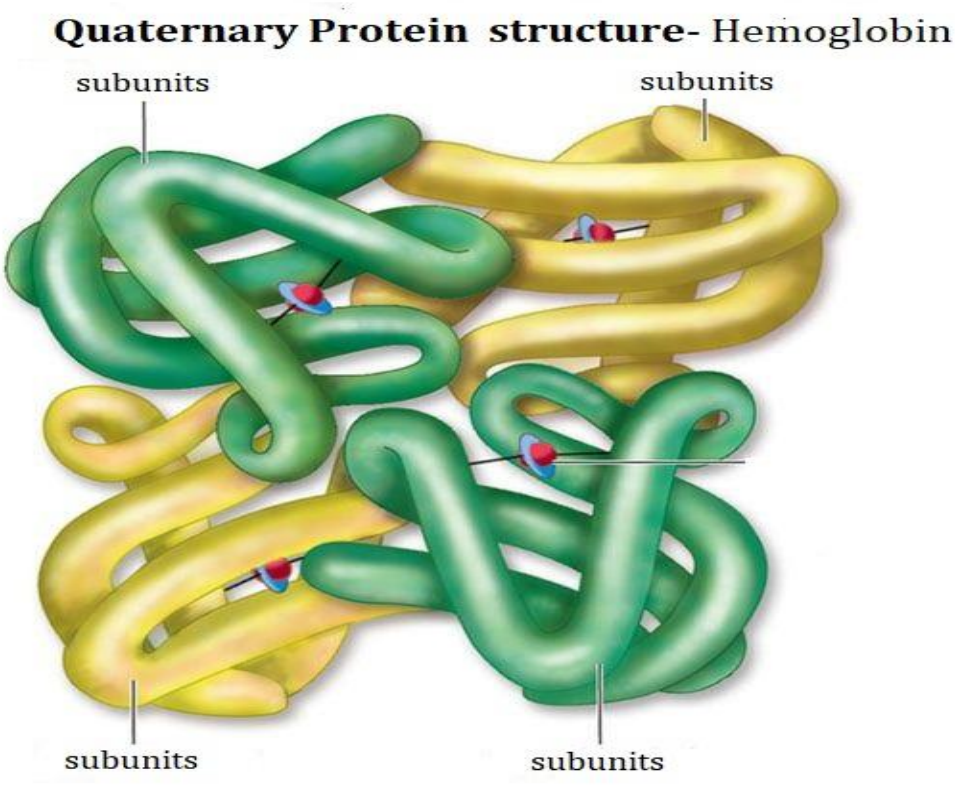
Quaternary Protein structure- Hemoglobin
subunits
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