**2 c Protein Structure**

Proteins differ from one another in the number, type and sequence of their constituent amino acids. Each protein has a precise chemical composition and amino acid sequence, which leads to it having a unique 3D-shape.

The role of a protein in an organism depends on the proteins shape.

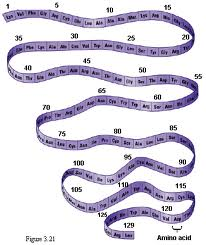
All proteins are regarded as being made up of a primary, secondary and tertiary structure while some also display a quaternary structure.

**Primary Structure**

**Primary Structure** describes the unique order in which amino acids are linked together by covalent bonding to form a protein.

Using three letter abbreviations, a bit of protein chain might be represented by, for example:

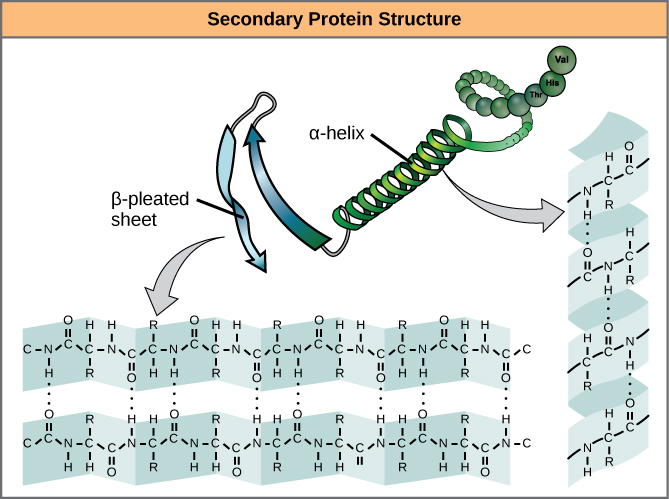
https://www.chemguide.co.uk/organicprops/aminoacids/protprim2.gif



**Secondary Structure**

**Secondary Structure**refers to the coiling or folding of a polypeptide chain that gives the protein its 3-D shape. There are two types of secondary structures observed in proteins. One type is the **alpha (α) helix** structure. This structure resembles a coiled spring and is secured by hydrogen bonding in the polypeptide chain. The second type of secondary structure in proteins is the **beta (β) pleated sheet**. This structure appears to be folded or pleated and is held together by hydrogen bonding between polypeptide units of the folded chain that lie adjacent to one another.

* Secondary structure is created by the formation of hydrogen bonds **between the oxygen from the carboxyl group** of one amino acid **and the hydrogen** from the amino group of another.
* Secondary structure does not involve the side chains, R groups.



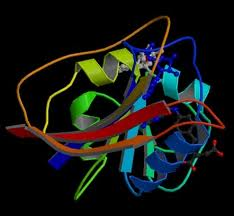
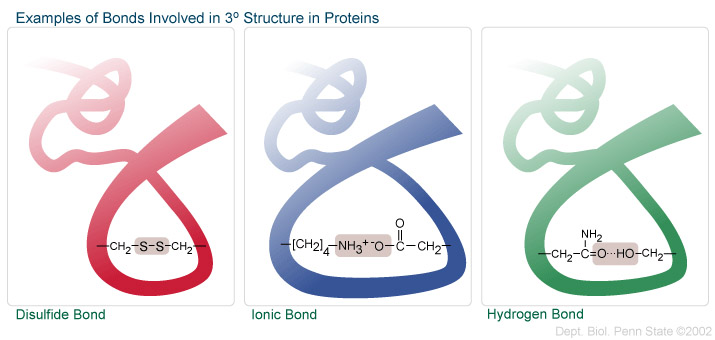
**Tertiary structure**

The term tertiary refers to the overall three- dimensional shape of a polypeptide.

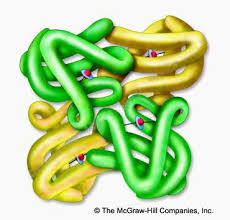
The polypeptide chain (containing the alpha helix and beta pleated sheets) bend and fold over itself because of interactions among R-groupsand the peptide backbone.

Interactions that cause tertiary organisation include:

* + **Covalent bonds** between sulphur atoms to create disulphide bonds (bridges)
  + **Hydrogen bonds** between polar side chains
  + **Ionic bonds** between positively and negatively charged side chains.

**Quaternary structure:**

Quaternary structure only applies to proteins made from **more than one** polypeptide chain. Proteins made from a single polypeptide will not have a quaternary structure. In proteins with more than one polypeptide chain (often referred to as a polypeptide subunit), weak interactions between the subunits help to stabilize the overall structure.