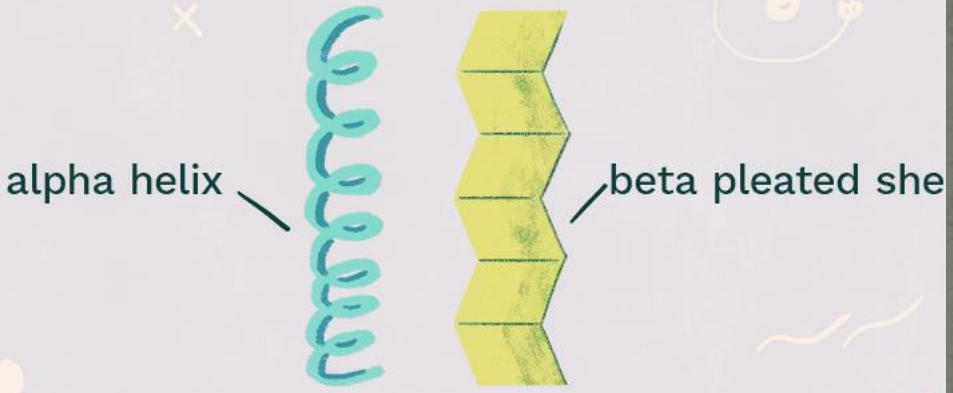
DR.JESY.E.J.

Types of Protein Structures

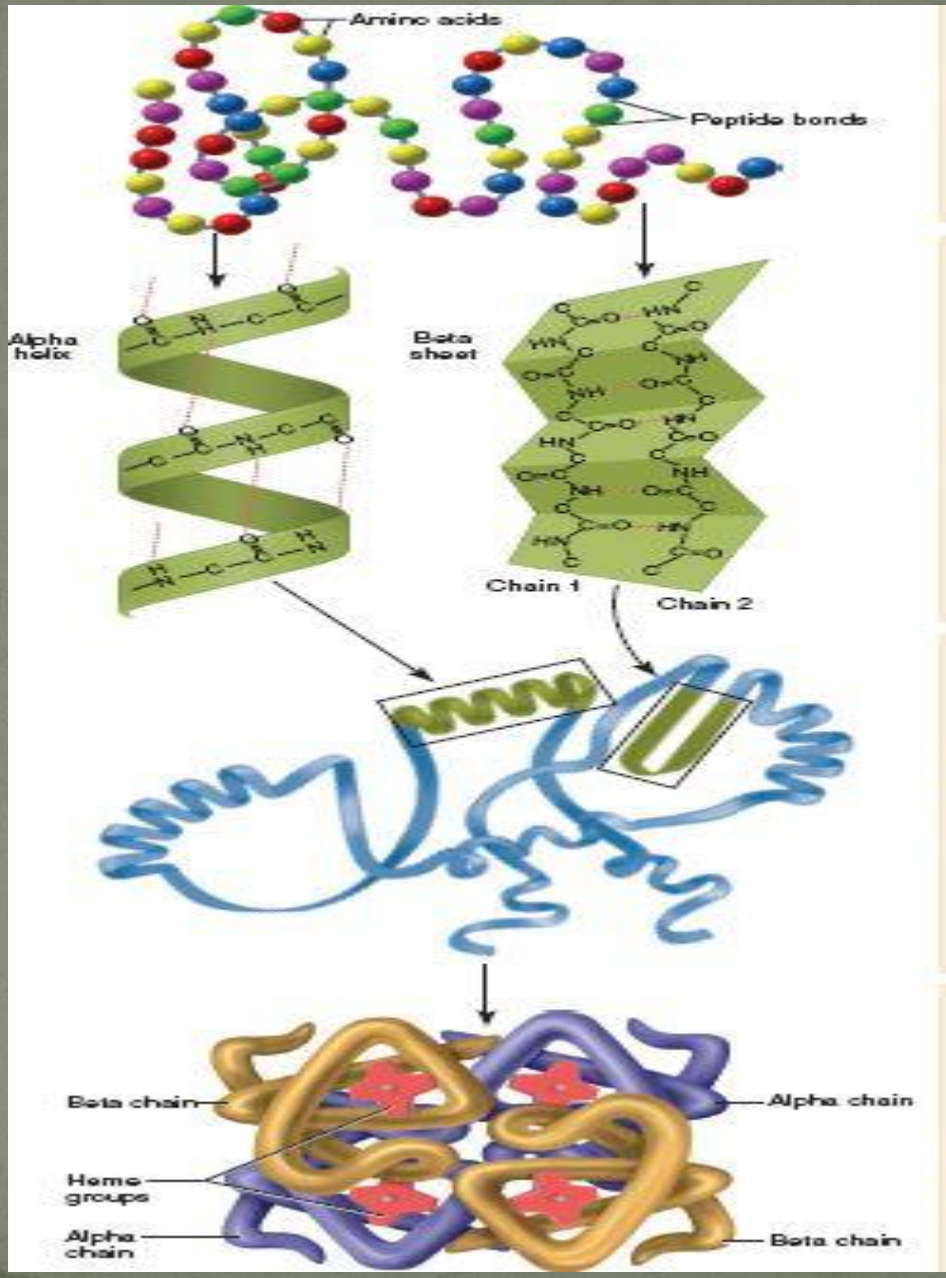
Primary Structure



Secondary Structure

Tertiary Structure

Quaternary Structure



Primary structure
Sequence of amino acids joined by peptide bonds

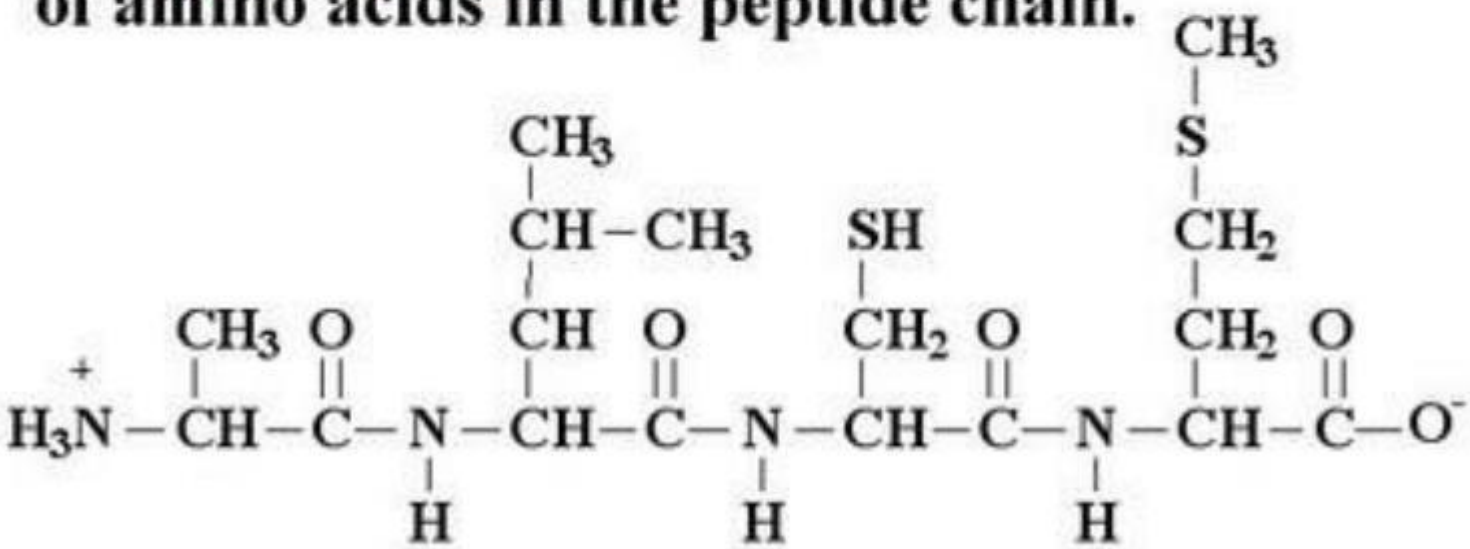
Secondary structure
Alpha helix or beta sheet formed by hydrogen bonding

Tertiary structure
Folding and coiling due to interactions among R groups and between R groups and surrounding water

Quaternary structure
Association of two or more polypeptide chains with each other

Primary Structure

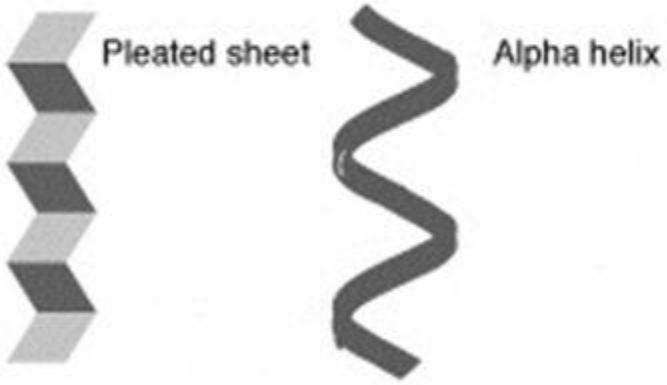
- A polypeptide containing 50 or more amino acids is called a protein.
- The primary structure of a protein is the sequence of amino acids in the peptide chain.



Ala-Leu-Cys-Met

Secondary Structure

- It is the ordered arrangement or conformation of amino acids in localized regions of a polypeptide or protein molecule;
- Hydrogen bonding plays an important role in stabilizing these folding patterns;
- The two main secondary structures are the ***alpha helix*** and ***beta-pleated sheet***



http://www.fiu.edu/~bch3033/Handouts/Lh4Ch04Prot.pdf

Secondary Structure: Alpha Helix

The secondary structures of proteins describes the type of structure that forms when amino acids form hydrogen bonds within a single polypeptide chain or between polypeptide chains

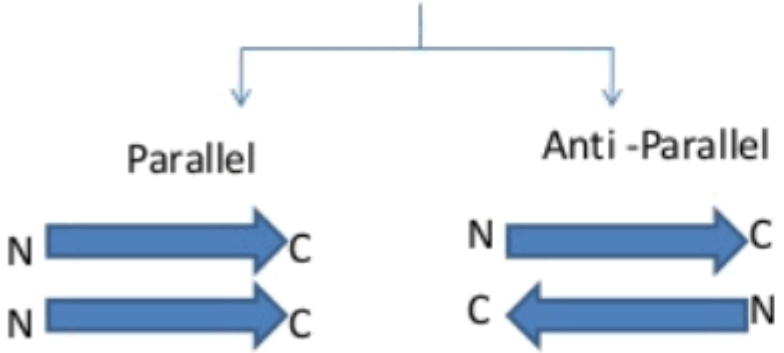
An **alpha helix (*α*-helix)** has

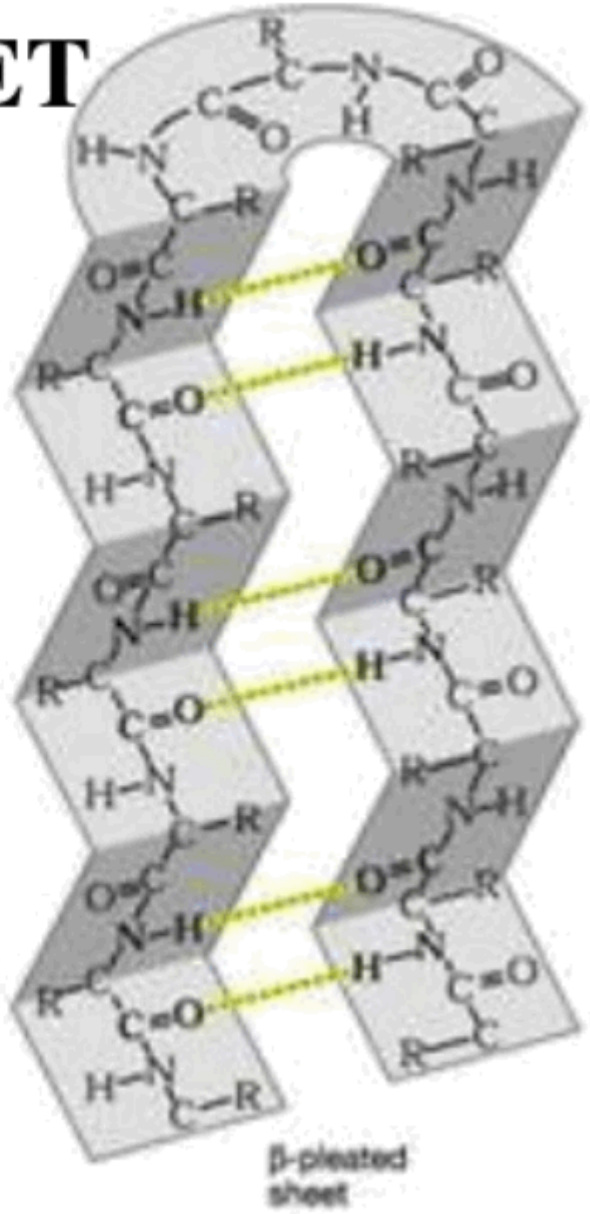
- a coiled shape held in place by hydrogen bonds between the amide groups and the carbonyl groups of the amino acids along the chain.
- hydrogen bonds between the H of an —NH group and the O of C═O of the fourth amino acid down the chain.

BETA PLEATED SHEET

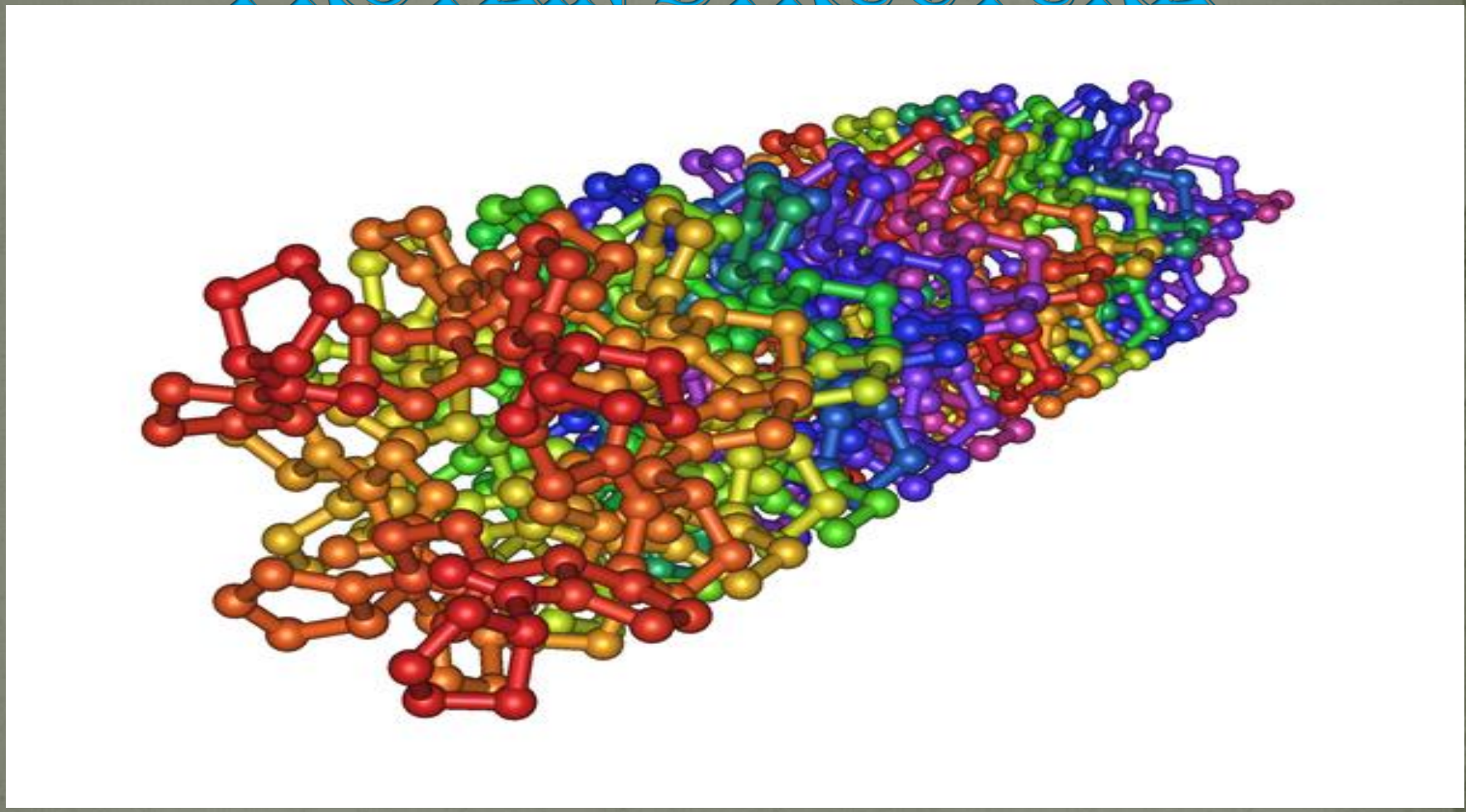
- Formed when 2 or more polypeptides line up side by side.
- Individual polypeptide - β strand
- Each β strand is fully extended.
- They are stabilized by H bond b/w N-H and carbonyl grps of adjacent chains.

2 types



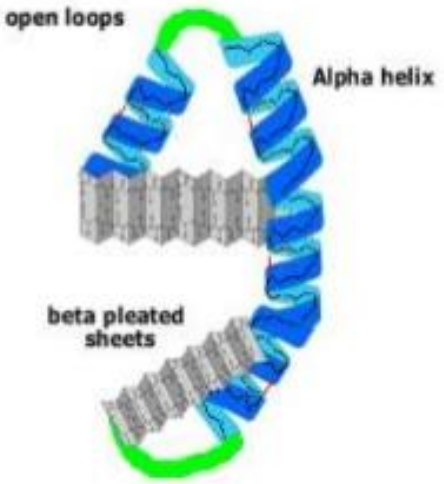


PROTEIN STRUCTURE



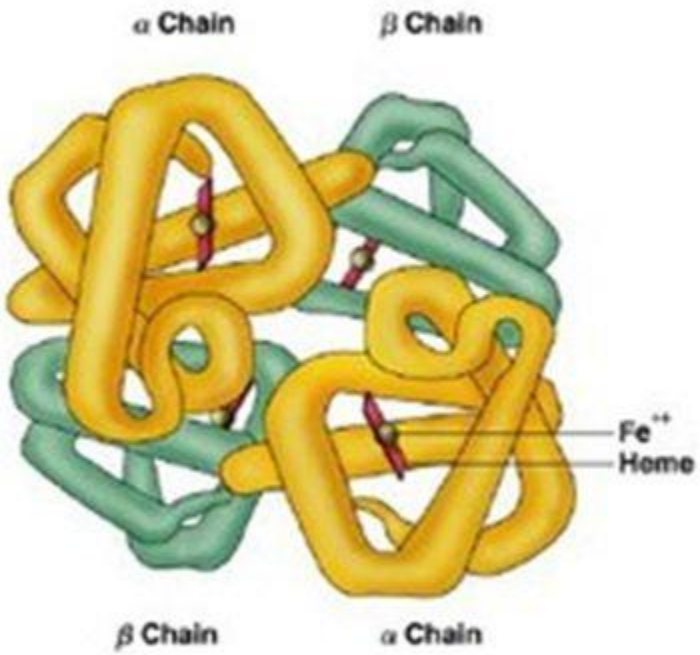
TERTIARY STRUCTURE

- Tertiary structure is the three-dimensional conformation of a polypeptide.
- The common features of protein tertiary structure reveal much about the biological functions of the proteins and their evolutionary origins.
- The function of a protein depends on its tertiary structure. If this is disrupted, it loses its activity.



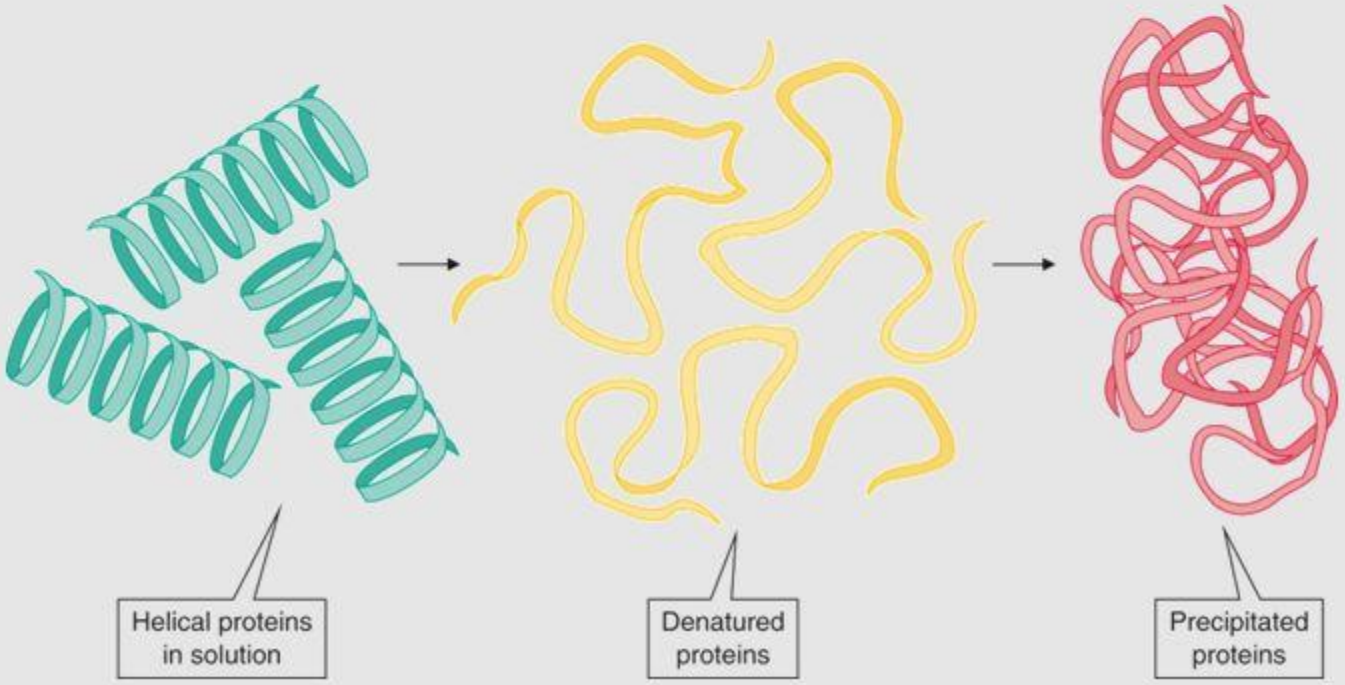
Quaternary Structure

- The quaternary structure contains two or more tertiary subunits.
- Hemoglobin contains two alpha chains and two beta chains.
- The heme group in each subunit picks up oxygen for transport in the blood to the tissues.



PROTEIN DENATURATION

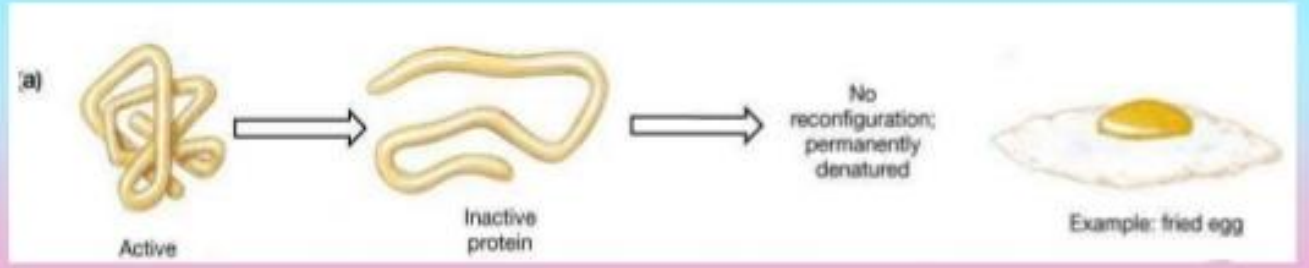
- **Protein denaturation:**
  - is the process by which a **protein** loses its **native state** (characteristic **quaternary, tertiary,** and **secondary structure**).
  - leads to a loss of biological activity (function).



Mechanism of protein denaturation:

- Unfolding of native proteins occurs at both the temperatures at higher temperature denaturation occurs means it is called heat denaturation or thermal denaturation and if denaturation occurs at lower temperature then it is called cold denaturation.

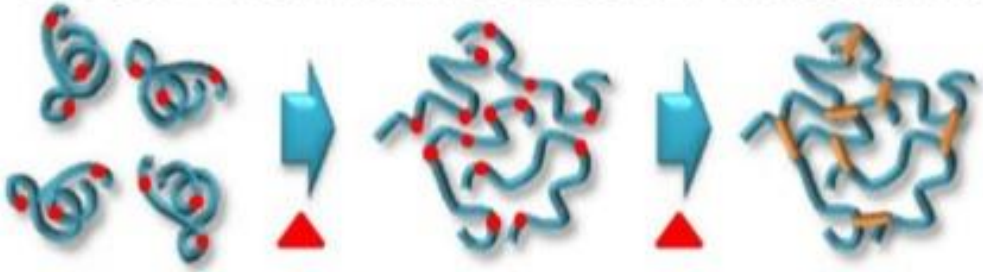
- In both the cases there is breakage of hydrogen bonds, disulfide bonds, hydrophobic interactions, vanderwalls forces but there is no breakage of peptide bonds during denaturation.



Denaturation of Protein

(a)

(b) Protein Thermal Irreversible Denaturation

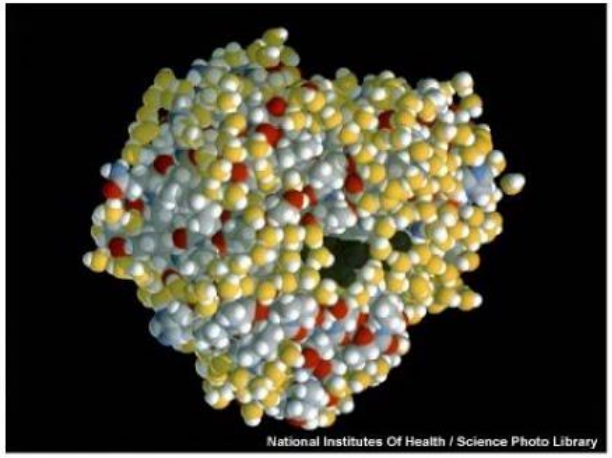


Globular proteins

Globular proteins usually have a spherical shape caused by tightly folded polypeptide chains.

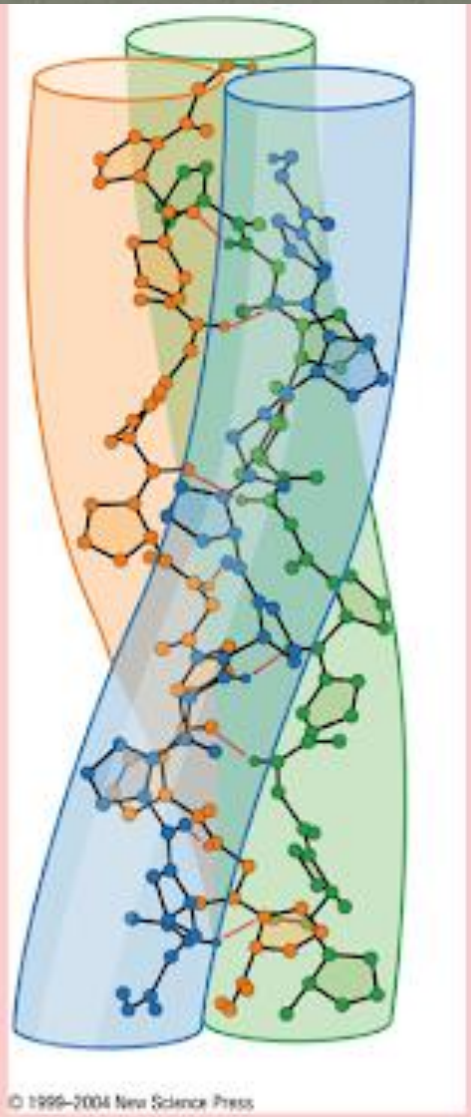
The chains are usually folded so that hydrophobic groups are on the inside, while the hydrophilic groups are on the outside. This makes many globular proteins soluble in water.

- **transport proteins** – such as haemoglobin, myoglobin and those embedded in membranes.



Fibrous proteins

- Several spiral-shaped polypeptide molecules
- Linked in parallel by **disulphide bridges**
- Protein has a rope-like structure



Fibrous protein	Globular protein
Consists of long, parallel polypeptide chains forming helical structures or pleated sheets	Consists of coiled and folded polypeptide chains forming spherical shape
Insoluble in water	Soluble in water
The structures is stable	The structures is unstable
Plays a major role in mechanical and structural functions	Takes part in metabolite and chemical processes
Example: Keratin and collagen	Example: Enzymes and haemoglobin