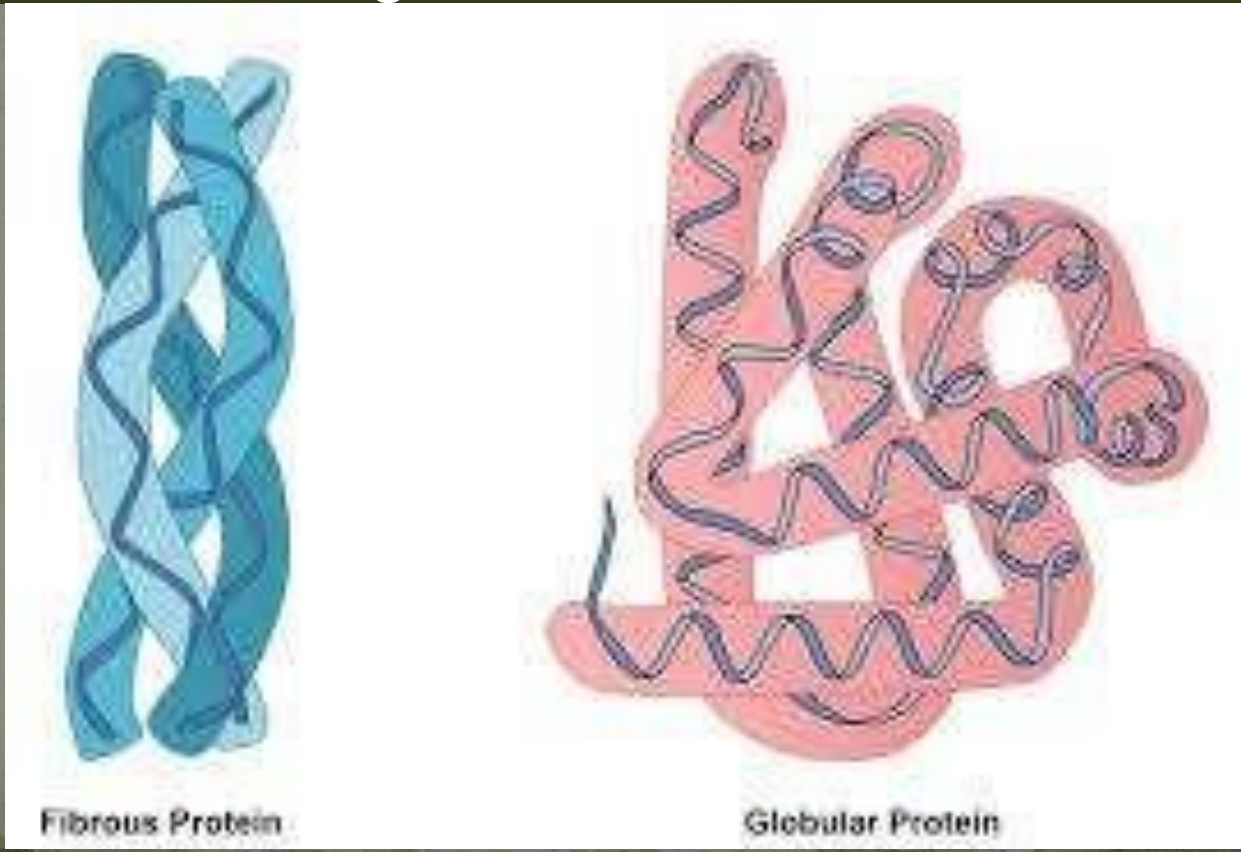
Protein classification based on shape

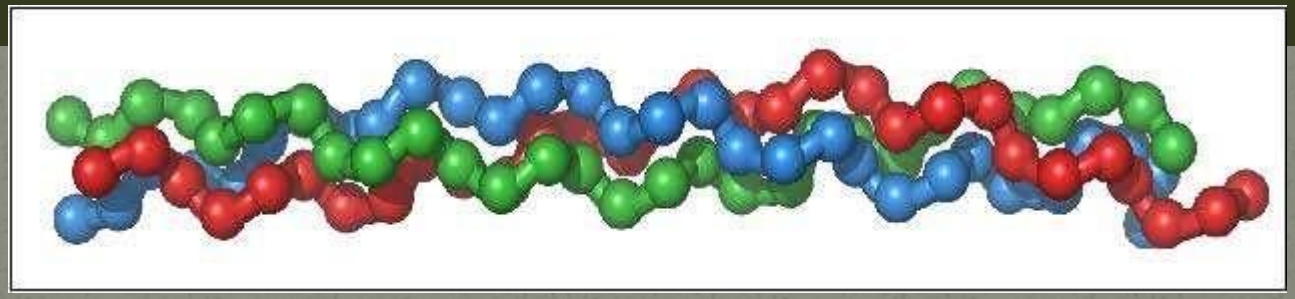
On the basis of their shape, proteins may be divided into two classes:

- **fibrous and**
- **globular**

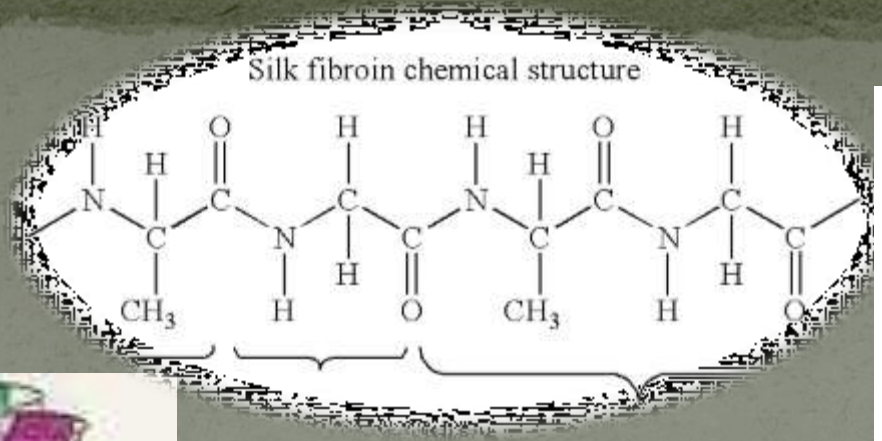


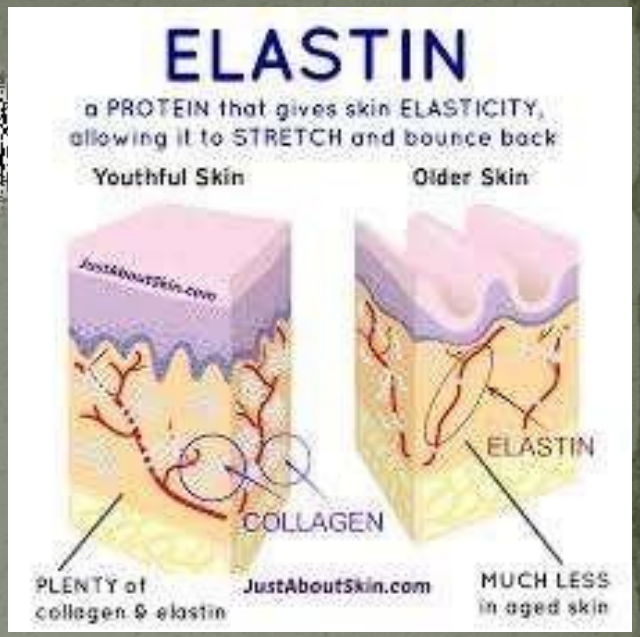
Fibrous proteins

- They have primarily **mechanical and structural functions**, providing **support to the cells as well as the whole organism.**
- These proteins are **insoluble in water** as they contain, both internally and on their surface, many **hydrophobic amino acids.**



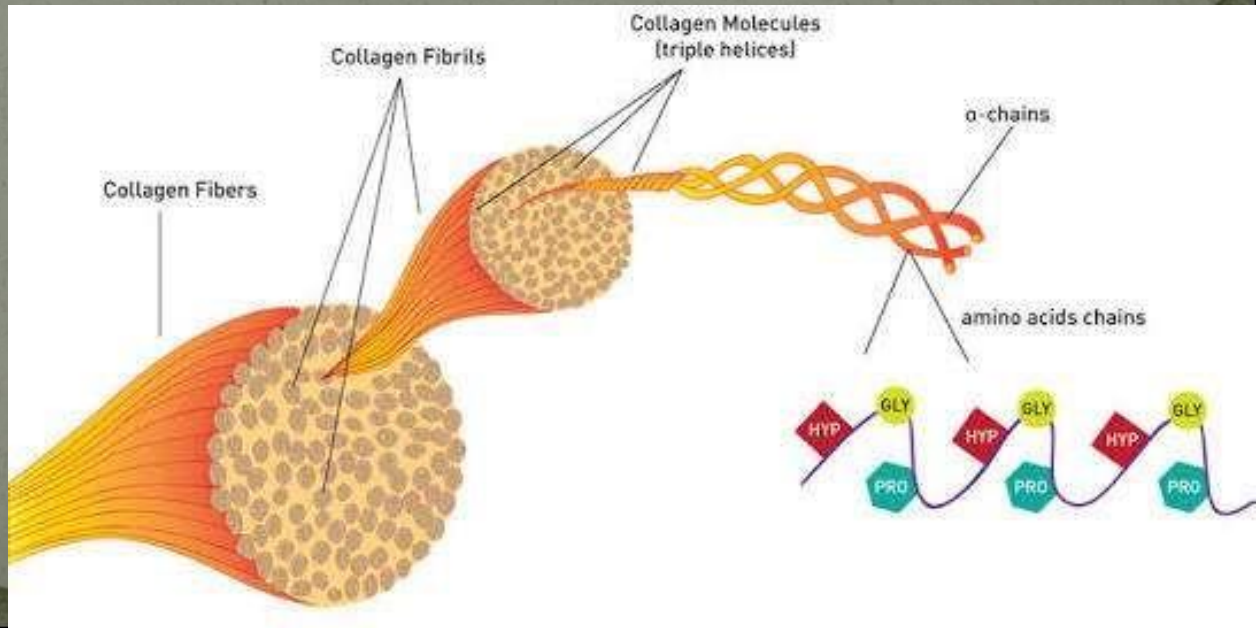
The presence on their surface of hydrophobic amino acids **facilitates their packaging into very complex supramolecular structures**





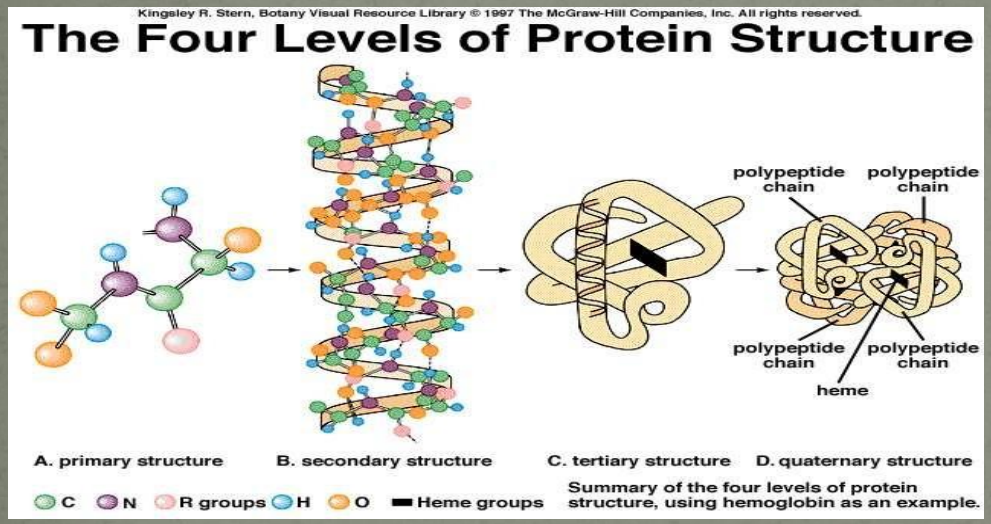
Examples

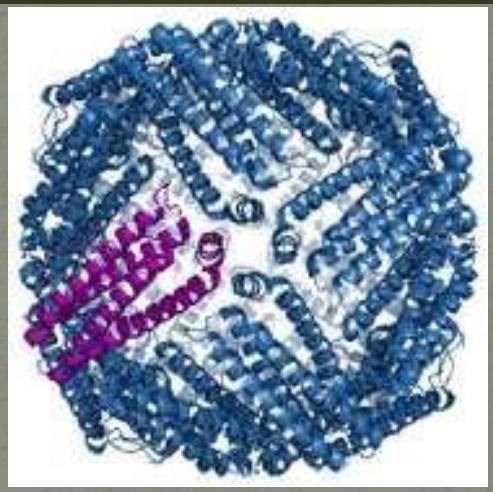
- ❑ **Fibroin**
- ❑ **Collagen**
- ❑ **α-Keratins**
- ❑ **Elastin**



Globular proteins

- Most of the proteins belong to this class.
- They have a **compact and more or less spherical structure**, more complex than fibrous proteins.
- In this regard, motifs, domains, tertiary and quaternary structures are found, in addition to the secondary structures.

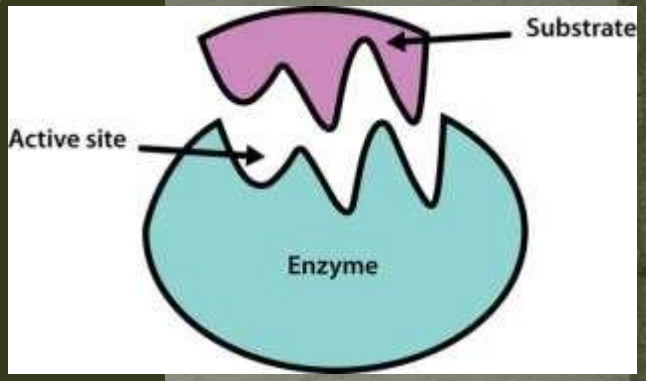


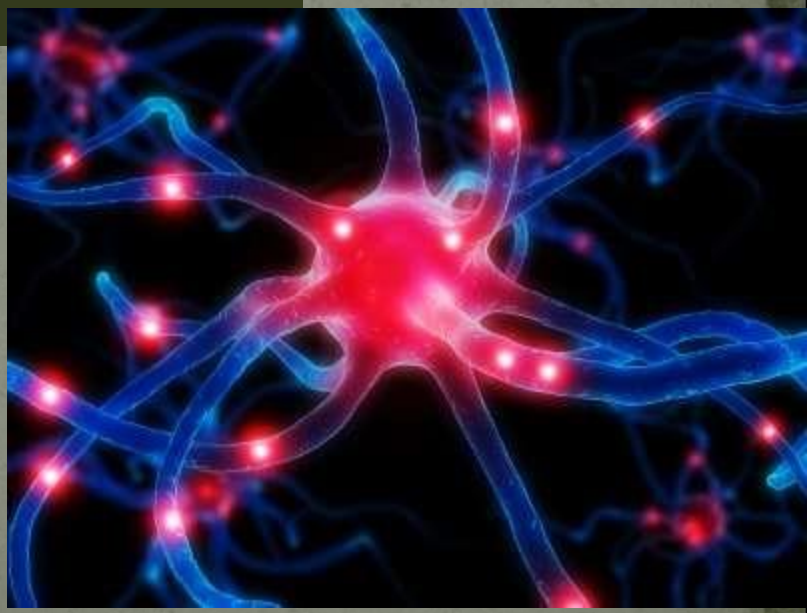


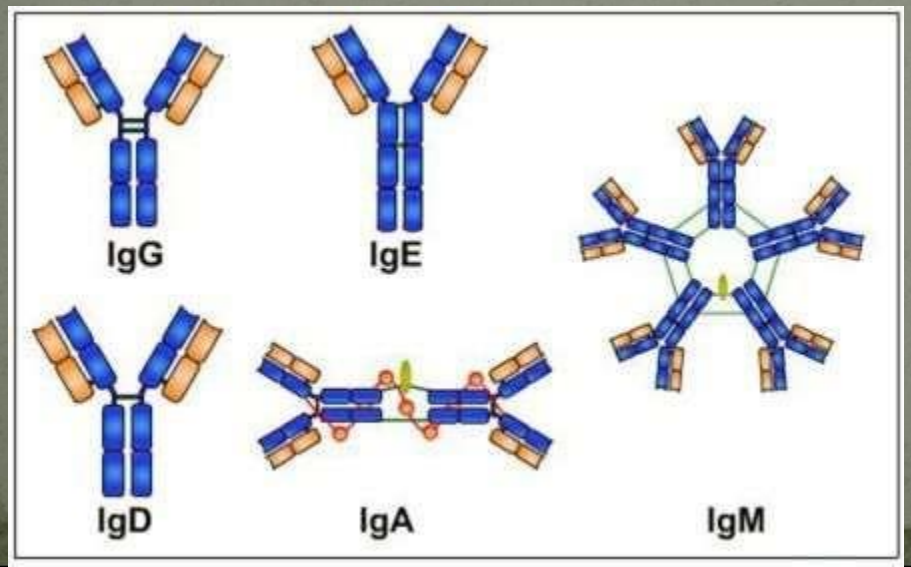
They **are generally soluble in water** but can also be found inserted into biological membranes (transmembrane proteins).

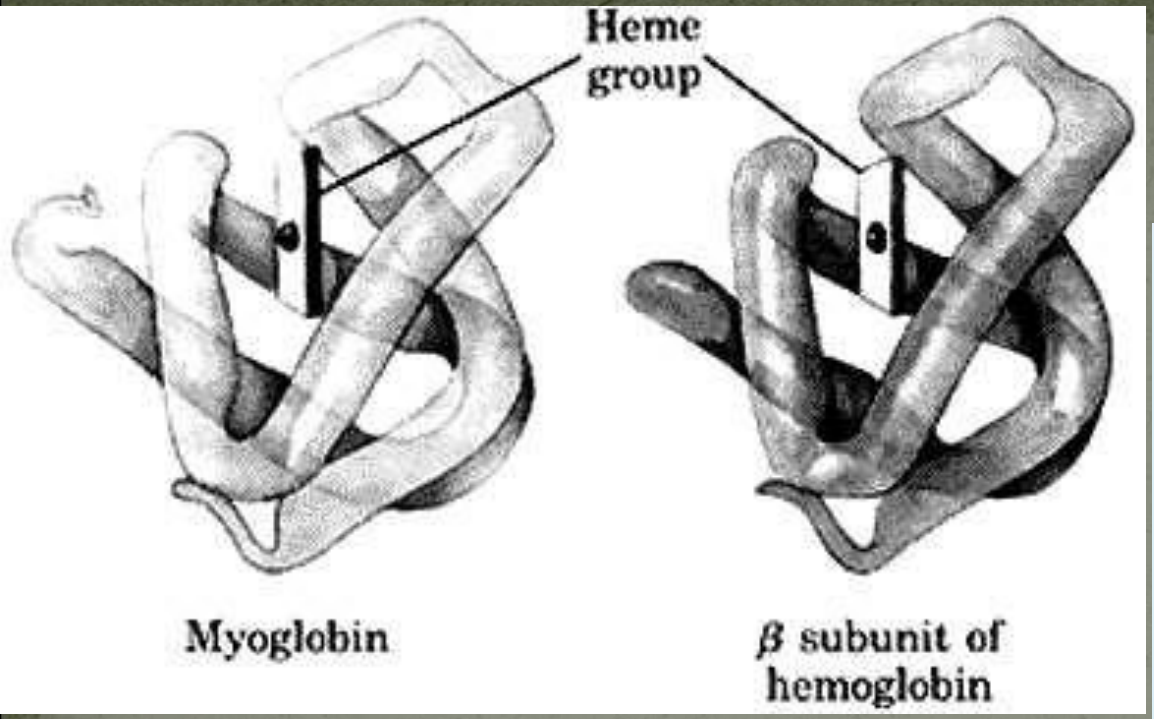
Unlike fibrous proteins, that have structural and mechanical functions, they act as:

- ❖enzymes;
- ❖hormones;
- ❖membrane transporters and receptors;
- ❖transporters of triglycerides, fatty acids and oxygen in the blood;
- ❖immunoglobulins or antibodies;
- ❖grain and legume storage proteins.



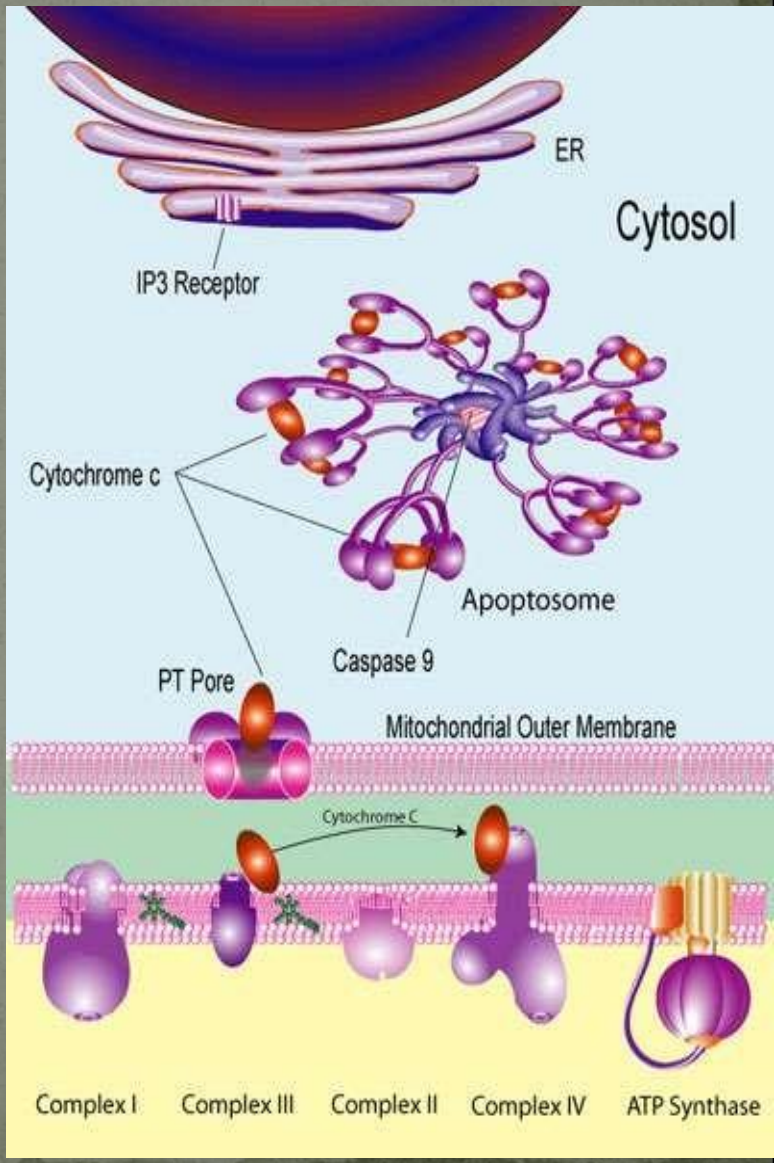






Examples of globular proteins are

- **myoglobin,**
- **hemoglobin, and**
- **cytochrome c**



Fibrous vs Globular Proteins

Fibrous

Little or no tertiary structure.

Long parallel polypeptide chains.

Cross linkages at intervals.

Long fibres and sheets formed.

Mostly insoluble.

Most have a structural role.

Keratin

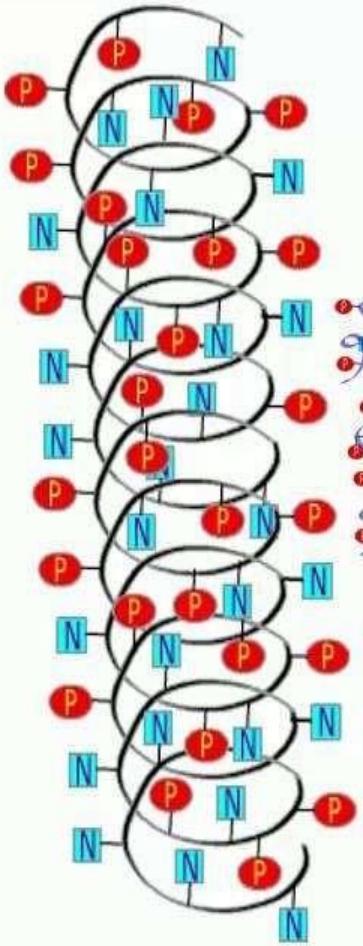
In hair and outer layer of skin.

Collagen

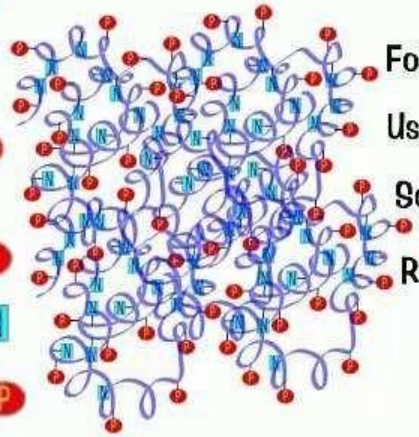
In connective tissue.

Bones, Teeth, Tendons & Walls of Blood Vessels

Silk



Globular



A complex tertiary structure.

Folded into a spherical/globular shape.

Usually soluble in water.

Some have a quarternary structure.

Roles in metabolic reactions.

Protein classification based on biological functions

From the **functional point** of view, they may be divided into several groups.

Enzymes (biochemical catalysts).

- In living organisms, almost all **reactions are catalyzed** by

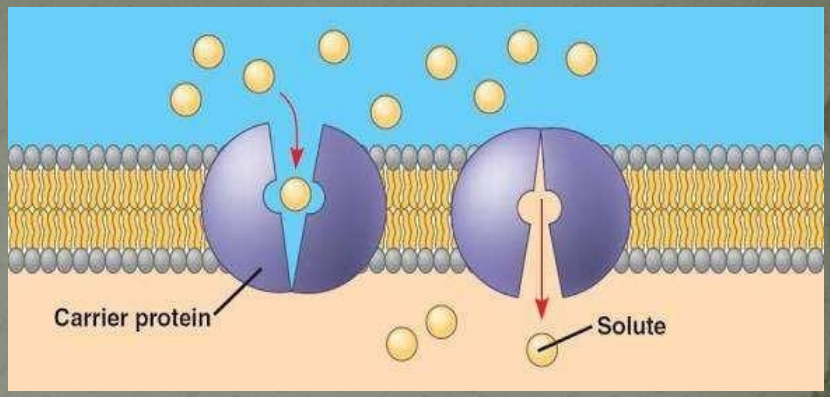
specific proteins called enzymes.

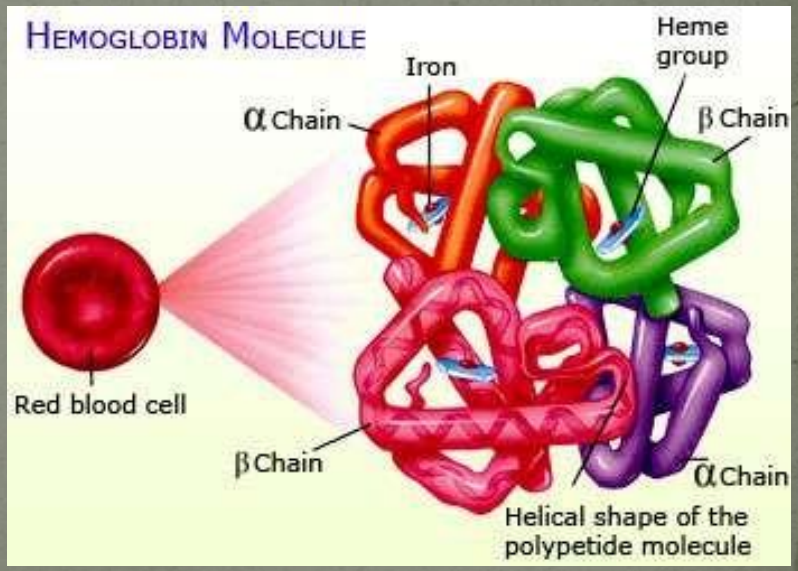
- They have a **high catalytic power**, increasing the rate of the reaction in which they are involved.
- Therefore, life as we know could not exist without their "**facilitating action**".

Transport proteins

Many **small molecules, organic and inorganic,** are transported in the bloodstream and extracellular fluids, across the cell membranes, and inside the cells from one compartment to another, by specific proteins.

Examples are:
hemoglobin, that carries oxygen from the alveolar blood vessels to tissue capillaries.

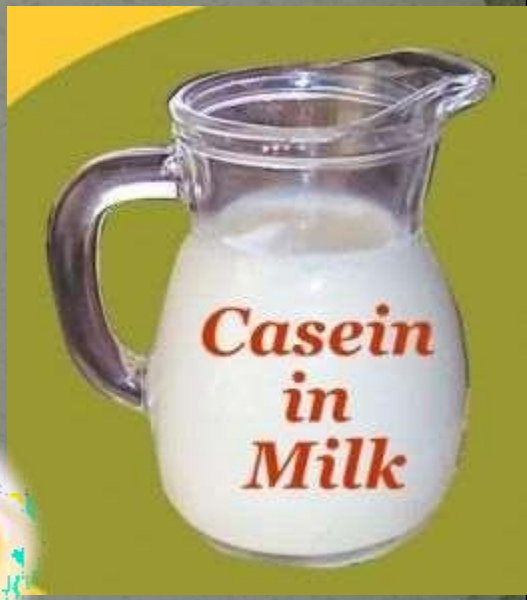




Storage proteins

Examples are:

- **ferritin**, that stores iron intracellularly in a non-toxic form;
- **milk caseins**, that act as a reserve of amino acids for the milk;
- **egg yolk phosvitin**, that contains high amounts of phosphorus;
- **prolamins and glutelins**, the storage proteins of cereals.



Protein functions

Class of protein	*Function*	*Examples*
Enzymic proteins	Biological catalysts	Urease, Amylase, Catalase, Cytochrome C, Alcohol dehydrogenase.
Structural proteins	Strengthening or protecting biological structures	Collagen, Elastin, Keratin, Fibroin
Transport or carrier proteins	Transport of ions or molecules in the body	Myoglobin, Hemoglobin, Ceruloplasmin, Lipoproteins
Nutrient and storage proteins	Provide nutrition to growing embryos and store ions	Ovalbumin, Casein, Ferritin
Contractile or motile proteins	Function in the contractile system	Actin, Myosin, Tubulin
Defense proteins	Defend against other organisms	Antibodies, Fibrinogen, Thrombin
Regulatory proteins	Regulate cellular or metabolic activities	Insulin, G proteins, Growth hormone
Toxic proteins	Hydrolyze (or degrade) enzymes	Snake venom, Ricin.