**Classification of Proteins**

**I. Classification of protein on the basis of Structure and composition**:

**1. Fibrous protein:**

They are elongated or fiber like protein. Axial ratio (length: breadth ratio) is more than 10. They are static in nature with simple structure. They have less biological functions. They are mostly present in animals

Fibrous proteins are further classified as- simple and conjugated

i. Simple fibrous protein:

Examples; Scleroprotein (Keratine, elastin, collagen, fibroin etc), Scleroprotein or Albuminoids: they make animal skeleton and they are water insoluble.

ii. Conjugated fibrous proteins:

Examples; pigments present in chicken feather.

**2. Globular protein:**

They are spherical or globular in shape. Axial ratio is always less than 10. They are dynamic in nature (can flow or move) with higher degree of complexity in structure. They have variety of biological functions. Examples; enzymes, hormones etc

Globular protein is further classified on the basis of composition or solubility.

i. Simple or homo globular protein: They are composed of amino acids only.

Some examples are;

a. Protamine: They are positively charged (basic) proteins mostly present in animals and fishes (sperm). Protamines binds with DNA in embryonic stage and later replaced by histone. It is soluble in water and ammonium hydroxide solution. It is not coagulated by heat. It precipitate out in aqueous solution of alcohol. Protamine are rich in arginine and lysine whereas devoid of sulfur containing and aromatic amino acids.

b. histone: They are basic protein but weak base in comparison to protamine. Histone is low molecular weight protein and are water soluble. It is not coagulated by heat. Histone is present in nucleic acids as nucleohistone binding with DNA.

c. Albumin: It is the most abundant protein in nature. It is most commonly found in seeds in plants and in blood and muscles in animals. Molecular weight of albumin is 65000 KD. It is water soluble and can be coagulated by heat. Plant albumins; Leucosine, Legumelins etc, Animal albumins; serum albumin, myosin, lactalbumin, ova-albumin etc

d. Globulin: Pseudoglobulin (water soluble) and Euglobulin (water insoluble)

e. Glutelins: Water insoluble. Eg. Glttenin (wheat), glutelin (corn), oryzenin (rice)

f. Prolamine: They are storage protein found in seeds.. They are water insoluble. But soluble in dilute acid or detergents and 60-80% alcohol. They are coagulated by heat. Examples; Gliadin (wheat), zein (corn), Hordein (barley), Avenin (oats)

ii. Complex or conjugate or hetero globular protein:

These proteins in which protein are always linked by non-protein moiety to become functional. So, they are composed of both protein and non- protein components. The non-protein component is known as prosthetic group.

On the basis of prosthetic group, they are classified as follows;

a. Metalloprotein: They have metal prosthetic group. Some metals such as Hg, Ag, CU, Zn etc, strongly binds with proteins such as collagen, albumin, casein by –SH group of side chain of amino acids.. Eg. Ceruloplasmin; contains copper as prosthetic group

Some other metals such as Calcium weakly binds with protein. Eg. Calsequestrin, calmodulin. Some metals such as Na, K etc do not binds with protein but associate with nucleic acids protein.

b. Chromoprotein: They have colored prosthetic group. Some examples are;

Haemoprotein: Haemoglobin, myoglobin, chlorophyll, cytochrome, peroxidase, haemocyanin

Flavoprotein: Riboflavin (Vit B2) give yellow/orange color to FAD requiring enzymes

c. Glycoprotein/Mucoprotein: They have carbohydrate as prosthetic group. Eg. Antibody, complement proteins, Heparin, Hyaluronic acid

d. Phosphoprotein: They have phosphate group as prosthetic group. Eg. Caesein (milk protein binds with calcium ion to form calcium salt of caseinate). Eg.. Ovovitellin; present in egg yolk

e. Lipoprotein: They have lipid as prosthetic group. Eg. Lipovitelline, chylomicrons

**3. Derived protein:**

These protein are the derivatives of either simple or complex protein resulting from the action of heat, enzymes and chemicals. Some artificially produced protein are included in this group.

They are classified as primary derived protein and secondary derived protein.

i. Primary derived protein: The derived protein in which the size of protein molecules are not altered materially but only the arrangement is changed. Some examples are;

a. Proteans: Obtained as a first product after the action of acid or enzymes or water on protein. They are insoluble in water. Eg. Edestan, myosin

b. Metaprotein: They are produced by further action of acid or alkali on protein at 30-60°C. They are water insoluble but soluble in dil acid or alkali. Eg. Curd

c. Coagulated protein: They are produced by the action of heat or alcohol on protein. They are insoluble in water. Eg. Coagulated egg

ii. Secondary derived protein:

The derived protein in which size of original protein are altered.

Hydrolysis has occurred due to which size of protein molecule are smaller than original one.

Examples;

a) Proteoses: They are produced by the action of dilute acid or digestive enzymes when the hydrolysis proceeds beyond the level of metaprotein. They are soluble in water .They are not coagulated by heat. • Eg. Albumose, Globulose etc.

I**I. Classification of protein on the basis of biological functions:**

1. Catalytic protein: They catalyze biochemical reaction in cells. Eg. Enzymes and co-enzymes

2. Structural protein; They make various structural component of living beings. Eg. Collagen make bone, Elastin make ligamnets and keratin make hair and nails

3. Nutrient protein: They have nutritional value and provide nutrition when consumed. Eg. Casein in milk

4. Regulatory protein: They regulate metabolic and cellular activities in cell and tissue. Eg. Hormones

5. Defense protein: They provide defensive mechanism against pathogens. Eg. Antibodies, complement proteins

6. Transport protein: They transport nutrients and other molecules from one organ to other. Eg. Haemoglobin

7. Storage protein: They stores various molecules and ions in cells. Eg. Ferritin store Iron

8. Contractile or mobile protein: They help in movement and locomotion of various body parts. Eg. Actin, myosin, tubulin etc

9. Toxic protein: They are toxic and can damage tissues. Eg. Snake venom, bacterial exotoxins etc

**Functions of Proteins**

1. Proteins are vital for the growth and repair, and their functions are endless. They also have enormous diversity of biological function and are the most important final products of the information pathways.

2. Proteins, which are composed of amino acids, serve in many roles in the body (e.g., as enzymes, structural components, hormones, and antibodies).

3. They act as structural components such as keratin of hair and nail, collagen of bone etc.

4. Proteins are the molecular instruments through which genetic information is expressed.

5. They execute their activities in the trans­port of oxygen and carbon dioxide by hemoglobin and special enzymes in the red cells.

6. They function in the homostatic control of the volume of the circulating blood and that of the interstitial fluids through the plasma proteins.

7. They are involved in blood clotting through thrombin, fibrinogen and other protein factors.

8. They act as the defence against infections by means of protein antibodies.

9. They perform hereditary transmission by nucleoproteins of the cell nucleus.

10. Ovalbumine, glutelin etc. are storage proteins.

11. Actin, myosin act as contractile protein important for muscle contraction.