Proteins:

Proteins are important molecules in cells. Proteins are the major component of the dry weight of cells. The name protein is derived from a Greek word Proteios which means pre-eminent or first. This name was fist suggested in 1838 by a Swedish chemist Berzelius. He suggested it to a Dutch chemist Mulder and he referred it to the complex organic substances found in the cells of living beings.

Proteins are the most abundant intracellular macro-molecules. Proteins are connected intimately with all chemical and physical activity, which constitutes the life of the cell. Proteins are present in and vital to all living cells. They provide structure, protection to the body of multicellular organism in the form of skin, hair, callus, cartilage, ligaments, muscles, tendons. Proteins regulate and catalyze the body chemistry in the form of hormones, enzymes, immunoglobulins etc.

What are Proteins?

Proteins are known as building blocks of life. Proteins are biomolecules, usually large in size that consists of one or more chains of amino acids. Proteins perform variety of functions like catalyzing metabolic reactions, replication of DNA, response to stimuli, and transporting molecules. Proteins differ from each other mainly in the sequences of amino acids.

Characteristics of Proteins:

- ✓ General Characteristics of Proteins are as follows:
- ✓ Proteins are organic substances; they are made up of nitrogen and also, oxygen, carbon and hydrogen.
- ✓ Proteins are the most important biomolecules, they are the fundamental constituent of the cytoplasm of the cell.
- ✓ Proteins are the structural elements of body tissues.
- ✓ Proteins are made up of amino acids.
- ✓ Proteins give heat and energy to the body and also aid in building and repair.
- ✓ Only small amounts of proteins are stored in the body as they can be used up quickly on demand.
- ✓ Proteins are considered as the bricks, they make up bones, muscles, hair and other parts of the body.
- ✓ Proteins like enzymes are functional elements that take part in metabolic reactions.
- ✓ Antibodies, blood haemoglobin are also made of proteins.
- ✓ Proteins have a molecular weight of 5 to 300 kilo-daltons.

Properties of Proteins:

The general properties of proteins are similar to those of the amino acids:

Physical Properties of Proteins:

- ✓ Proteins are colourless and tasteless.
- ✓ They are homogeneous and crystalline.
- ✓ Proteins vary in shape; they may be simple crystalloid structure to long fibrilar structures.
- ✓ Protein structures are of two distinct patterns - Globular proteins and fibrilar proteins.
- ✓ Globular proteins are spherical in shape and occur in plants. Fibrilar proteins are thread-like, they occur generally in animals.
- ✓ In general proteins have large molecular weights ranging between 5 X 10^3 and 1 X 10^6.
- ✓ Due to the huge size, proteins exhibit many colloidal properties.
- ✓ The diffusion rate of proteins is extremely slow.
- ✓ Proteins exhibit Tyndall effect.
- ✓ Proteins tend to change their properties like denaturation. Many a times the process of denaturation is followed by coagulation.
- ✓ Denaturation may be a result of either physical or chemical agents. The physical agents include, shaking, freezing, heating etc. Chemical agents are like X-rays, radioactive and ultrasonic radiations.
- ✓ Proteins like the amino acids exhibit amphoteric property i.e., they can act as acids and alkalies.
- ✓ As the proteins are amphoteric in nature, they can form salts with both cations and anions based on the net charge.
- ✓ The solubility of proteins depends upon the pH. Lowest solubility is seen at isoelectric point, the solubility increases with increase in acidity or alkalinity.
- ✓ All the proteins show the plane of polarized light to the left, i.e., laevorotatory.

Chemical Properties of Proteins:

- ✓ Proteins when hydrolyzed by acidic agents, like conc.HCl yield amino acids in the form of their hydrochlorides.
- ✓ Proteins when are hydrolyzed with alkaline agents leads to hydrolysis of certain amino acids like arginie, cysteine, serine, etc., also the optical activity of the amino acids is lost.

- ✓ Proteins with reaction with alcohols give its corresponding esters. This process is known as esterification.
- ✓ Amino acids react with amines to form amides.
- ✓ When free amino acids or proteins are said to react with mineral acids like HCl, the acid salts are formed.
- ✓ When amino acids in alkaline medium react with many acid chlorides, acylation reaction takes place.
- ✓ Sanger's reaction - Proteins react with FDNB reagent to produce yellow colored derivative, DNB amino acid.
- ✓ Xanthoproteic test - On boiling proteins with conc. HNO_3, yellow color develops due to presence of benzene ring.
- ✓ Folin's test - This is a specific test for tyrosine amino acid, where blue color develops with phosphomolybdo tungstic acid in alkaline solution due to presence of phenol group.

Function of Proteins:

Below is the list of proteins functions.

- ✓ Proteins are seen in muscles, hair, skin and other tissues, they constitute the bulk of body's non-skeletal structure. Example: The protein keratin is present in nails and hair.
- ✓ Some proteins are hormones and regulate many body functions. Example: Insulin hormone is a protein and it regulated the blood sugar level.
- ✓ Some proteins act enzymes, they catalyze or help in biochemical reactions. Example: Pepsin and Tripsin.
- ✓ Some proteins act as antibodies; they protect the body from the effect of invading species or substances.
- ✓ Proteins transport different substances in blood of different tissues. Example: Haemoglobin is a oxygen transport protein.
- ✓ Contractile proteins help in contraction of muscle and cells of our body. Example: Myosin is contractile protein.
- ✓ Fibrinogen a glycoprotein helps in healing of wounds. It prevents blood loss and inhibits passage of germs.