CLASSIFICATION OF PROTEINS
PART-A

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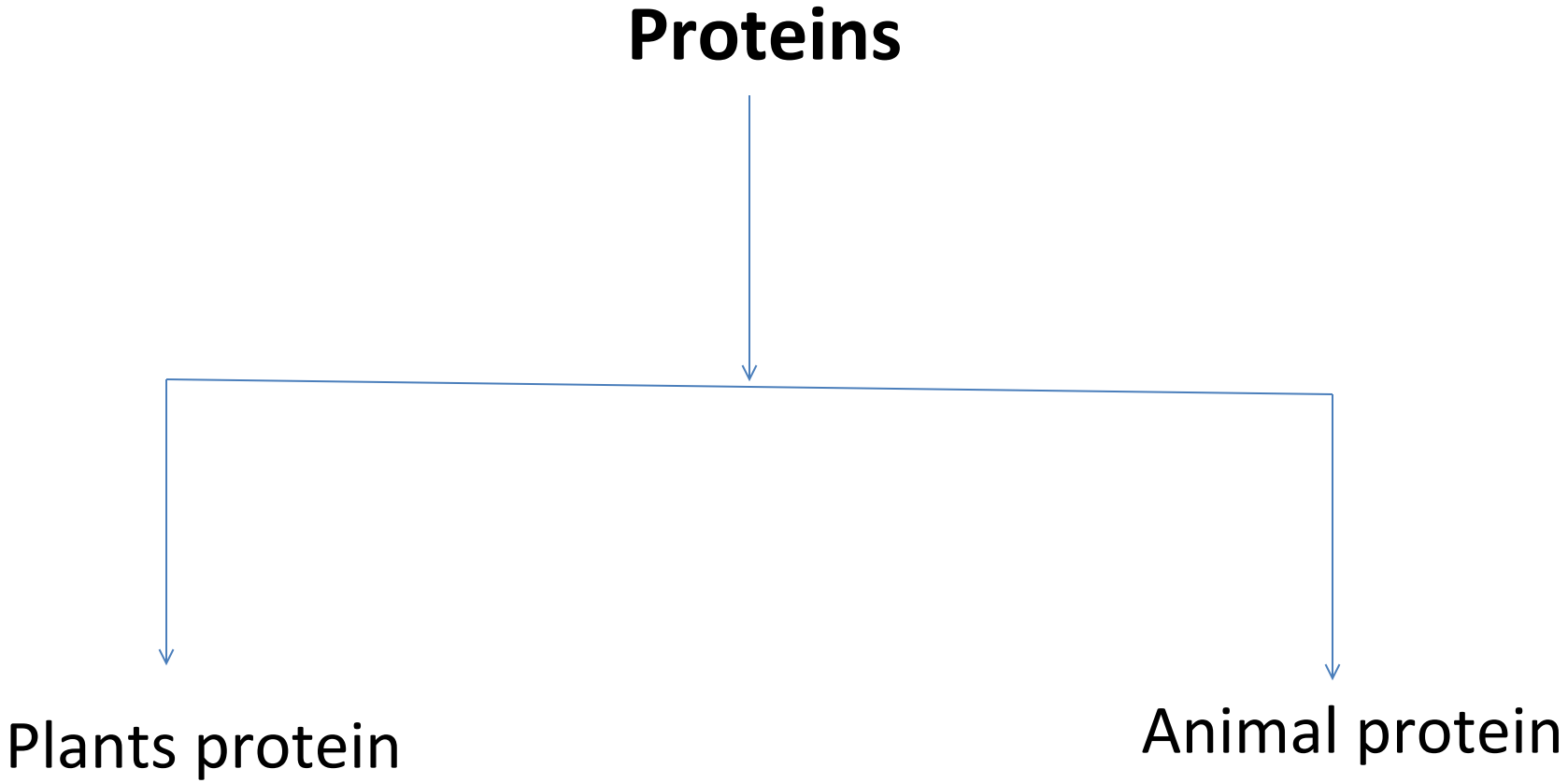
What is protein?

Proteins is a class of nitrogenous organic compounds which have large molecules composed of one or more long chains of different α-L amino acids and are an essential part of all living organisms, especially as structural components of body tissues such as muscle, hair, etc., and as enzymes and antibodies.
"a protein found in wheat"

Basis of proteins classification

- Source,
- chemical composition,
- structure,
- functions, and
- solubility in different solvents

Proteins on the basis of source



Protein classification based on chemical composition

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

- Simple protein
- Complex protein

Simple proteins

- Also known as homoproteins, they are made up of only amino acids. Examples are plasma albumin, collagen, and keratin.

Conjugated proteins

Sometimes also called heteroproteins, they contain in their structure a **non-protein portion**. Three examples are glycoproteins, chromoproteins, and phosphoproteins.

- **Glycoproteins**

They are protein that covalently bind one or
more carbohydrate units to the polypeptide backbone.

- **Chromoproteins**

They are proteins that contain colored prosthetic groups.
Typical examples are:
hemoglobin and myoglobin, which bind, respectively, one and four heme groups;
chlorophylls, which bind a porphyrin ring with a magnesium atom at its centre;
rhodopsins, which bind retinal.

- **Phosphoproteins**

They are proteins that bind phosphoric acid to serine and threonine residues.
Generally, they have a structural function, such as tooth dentin, or reserve function, such as milk caseins (alpha, beta, gamma and delta), and egg yolk phosvitin.

Protein classification based on structure

1. Primary Structure of Protein

- The Primary structure of proteins is the exact ordering of amino acids forming their chains.
- The exact sequence of the proteins is very important as it determines the final fold and therefore the function of the protein.
- The number of polypeptide chains together form proteins. These chains have amino acids arranged in a particular sequence which is characteristic of the specific protein. Any change in the sequence changes the entire protein.

2.Secondary Structure of Protein

- The proteins do not exist in just simple chains of polypeptides.
- These polypeptide chains usually fold due to the interaction between the amine and carboxyl group of the peptide link.
- The structure refers to the shape in which a long polypeptide chain can exist.
- They are found to exist in two different types of structures α – helix and β – pleated sheet structures.
- This structure arises due to the regular folding of the backbone of the polypeptide chain due to hydrogen bonding between -CO group and -NH groups of the peptide bond.
- However, segments of the protein chain may acquire their own local fold, which is much simpler and usually takes the shape of a spiral an extended shape or a loop. These local folds are termed secondary elements and form the proteins secondary structure.

α – Helix & β – pleated sheet

(a) α – Helix:

α – Helix is one of the most common ways in which a polypeptide chain forms all possible hydrogen bonds by twisting into a right-handed screw with the -NH group of each amino acid residue hydrogen-bonded to the -CO of the adjacent turn of the helix. The polypeptide chains twisted into a right-handed screw.

(b) β – pleated sheet:

In this arrangement, the polypeptide chains are stretched out beside one another and then bonded by intermolecular H-bonds. In this structure, all peptide chains are stretched out to nearly maximum extension and then laid side by side which is held together by intermolecular hydrogen bonds. The structure resembles the pleated folds of drapery and therefore is known as β – pleated sheet

3. Tertiary Structure of Protein

- This structure arises from further folding of the secondary structure of the protein.
- H-bonds, electrostatic forces, disulphide linkages, and Vander Waals forces stabilize this structure.
- The tertiary structure of proteins represents overall folding of the polypeptide chains, further folding of the secondary structure.
- It gives rise to two major molecular shapes called fibrous and globular.
- The main forces which stabilize the secondary and tertiary structures of proteins are hydrogen bonds, disulphide linkages, vander Waals and electrostatic forces of attraction.

4. Quaternary Structure of Protein

➢The spatial arrangement of various tertiary structures gives rise to the quaternary structure. Some of the proteins are composed of two or more polypeptide chains referred to as sub-units.

➢ The spatial arrangement of these subunits with respect to each other is known as quaternary structure.