

Proteins: Classification and Types-

Classification of Proteins:-

Proteins have been classified from time to time utilizing different criteria.

A. Proteins classified on the basis of function:

i. Enzyme Proteins :

This includes the proteins that catalyze chemical reactions. Almost all enzymes (except ribozymes and DNA enzymes) are proteins and form a diverse group in itself.

ii. Structural Proteins :

This group of proteins are responsible for maintaining the structure of the cells and tissues. The proteins of extracellular matrix (collagen, elastin, reelin etc), proteins of the exoskeleton (keratin, fibroin and sclerotin), the histones, the ribosomal proteins and cell membrane proteins are also included in this group. Extracellular matrix proteins, the peptidoglycans of the bacterial cell wall and virus coat proteins are also included in this group.

iii. Storage Proteins :

Although all forms of proteins can be digested and used as a source of energy and as a building material by different organisms, there are certain forms which are meant for storage only and they are not used for other purposes. This includes the proteins legumins (legumes), zein (maize), hordein (oat), glutenin (wheat) and animal protein likes egg protein (ovalbumin) and milk protein (casein). All these proteins are meant for specific purposes- the milk protein to feed the young ones and the seed and egg proteins to support the development and growth of embryo.

iv. Hormones :

Some smaller proteins functions as hormones and are popularly known as peptide hormones. The most peptide hormones are insulin, glucagon, the hormones of hypophysis and gastrointestinal tract.

v. Immunoglobulins :

These are highly specialized proteins which recognize foreign proteins in the body and inactivate it. Thus they provide protection against a foreign invasion (infection). They are also known as antibodies.

vi. Transport Proteins :

These proteins are responsible for transporting small molecules or ions such as cytochrome transporting electron during biochemical reactions, haemoglobin transporting oxygen and a number of transmembrane proteins which are also known as carriers (function as symport, antiport) transport across the membrane.

vii. Motor Proteins :

This includes all these proteins which are involved in movement and can convert chemical energy into mechanical energy. The more common proteins are actine, myosin, dynein and kinesin.

A number of structural proteins especially those forming the cytoskeleton and extracellular matrix are also associated in movements.

viii. Receptor Proteins :

These proteins are present on cell membranes, cytoplasm or nucleus and bind to specific molecules (a ligand). These are able to sense the presence of ligands like insulin (insulin receptor), calcium (calcium sensing receptor) or light (rhodopsin) or other environmental stimulus receiving proteins.

ix. Signal Proteins :

Cell use a number of molecules such as amino acids, polypeptides, steroids to communicate with one another. The proteins (polypeptides) serving this purpose are known as signal molecules. These signals are received by specific receptors.

x. Toxic Proteins :

These proteins are produced by the organisms for self-defence or to provide competitive advantage. The bacterial proteins (Clostridium botulinum) the snake venom and the plant proteins canatoxin (Canavalia ensiformis), arbin (Abrus precatorious) and ricin (Ricinus communis) belong to this category.

B. Proteins classified on the basis of location in the living cells:

i. Membrane proteins:

This includes a number of membrane associated proteins (membrane/transmembrane) and perform variety of important functions, porins, a number of membrane bound enzymes, ion channels and proton pump etc.

ii. Intracellular proteins:

These proteins are present inside the cell, such as the ribosome proteins, histones and a large number of cytosolic enzymes.

iii. Extracellular proteins:

The proteins which are secreted outside the cells for specific functions are included in this category. Almost all the enzymes of the digestive tract are including in this type.

iv. Virus proteins:

This includes the virus coat proteins which are not covered in any of the above type.

C. Proteins classified on the basis of Post translation modification:

i. Native proteins:

This includes only those forms of proteins which have the same primary structure which is produced after translation (without modification) through the secondary and tertiary structures may change.

ii. Conjugated Proteins:

This includes a number of proteins which are modified after translation by covalent linkage with oligosaccharides, lipids, metals etc. and are respectively named as glycoprotein's (elastase), lipoproteins (chylomicron) and metalloproteins (ferritin, Mo-protein etc.)

iii. Protein complexes:

Sometimes a functional protein is formed by association of several protein units (native or modified) forming a multimeric organization. It may involve all identical units (homomeric) or different (heteromeric) (lac-repressor proteins, immunoglobulins).

iv. Cleaved proteins:

Many proteins are cleaved and trimmed after synthesis. The important examples are the digestive enzymes. Which are synthesized as zymogens and then become active only after cleavage of bonds.

Chymotrypsinogen in the native form with 245 amino acid chain. It becomes active (α -chymotrypsin) by removal of two dipeptides (amino acid-14-15, and amino acid -147-148) and cleaving the long chain 245 amino acid chain into three fragments (1-13, 16-146 and 149-245) which then get joined by disulfide cross linkage.

v. Misfolded proteins or prions:

These are the native proteins which change their configuration (misfold) and fail to perform the function of the native protein.

D. Proteins classified on the basis of structure:

The structure of a protein can be viewed in several ways, shape (globular, fibrillar) molecular organization (primary, secondary, tertiary and quaternary) or on composition such as simple (having only amino acid) and conjugated (amino acid chains linked with other groups, carbohydrates, lipids etc.).
