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Protein: Structure and Function

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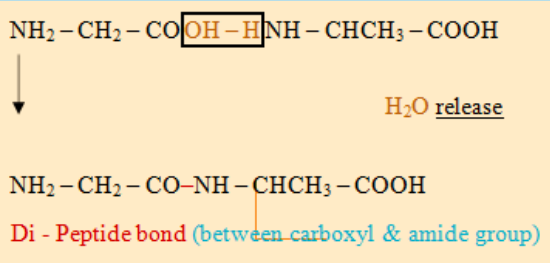
Introduction:

Muscle mass. It is commonly found in animal products, though Protein is a macro nutrient that is essential to building is also present in other sources, such as nuts & legumes.

Proteins are made up of hundreds or thousands of smaller units called Amino Acids, which are attached one to another in long chain.

There are 20 different types of Amino Acids that are combined to make a protein. These amino acids are attached to each other by the peptide bond, which forms between the carboxyl group of first amino acid and amide group of second amino acid as shown in structure:



HISTORY

Proteins were first described by the Dutch chemist **Mulder** and named by Swedish chemist **Berzelius** in 1838.

Proteins were recognized as a distinct class of biological molecules in the 18th century by **Antoine** and others, distinguished by the molecules ability to coagulate or flocculate under treatments with heat or acid.

At the time noted examples included Albumin from Egg whites, Blood serum albumin, Fibrin and Wheat gluten.

Mulder carried out elemental analysis of common proteins and found that nearly all protein had same empirical formula, **C400 H620N100O120P1S1**.

PROPERTIES OF PROTEINS

- Proteins may be either tasteless (tyrosine), sweet (glycine and alanine) or bitter (arginine).
- They have high melting point.
- They are soluble in polar solvents like Water and Ethanol but they are insoluble in nonpolar solvents such as Benzene and Ether.
- The solubility in water is dependent on pH and on salt concentration.
- The optical activity of proteins is due not

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only to asymmetry of amino acids but also to the chirality resulting from the arrangement of the peptide chain.

ROLES OF PROTEINS

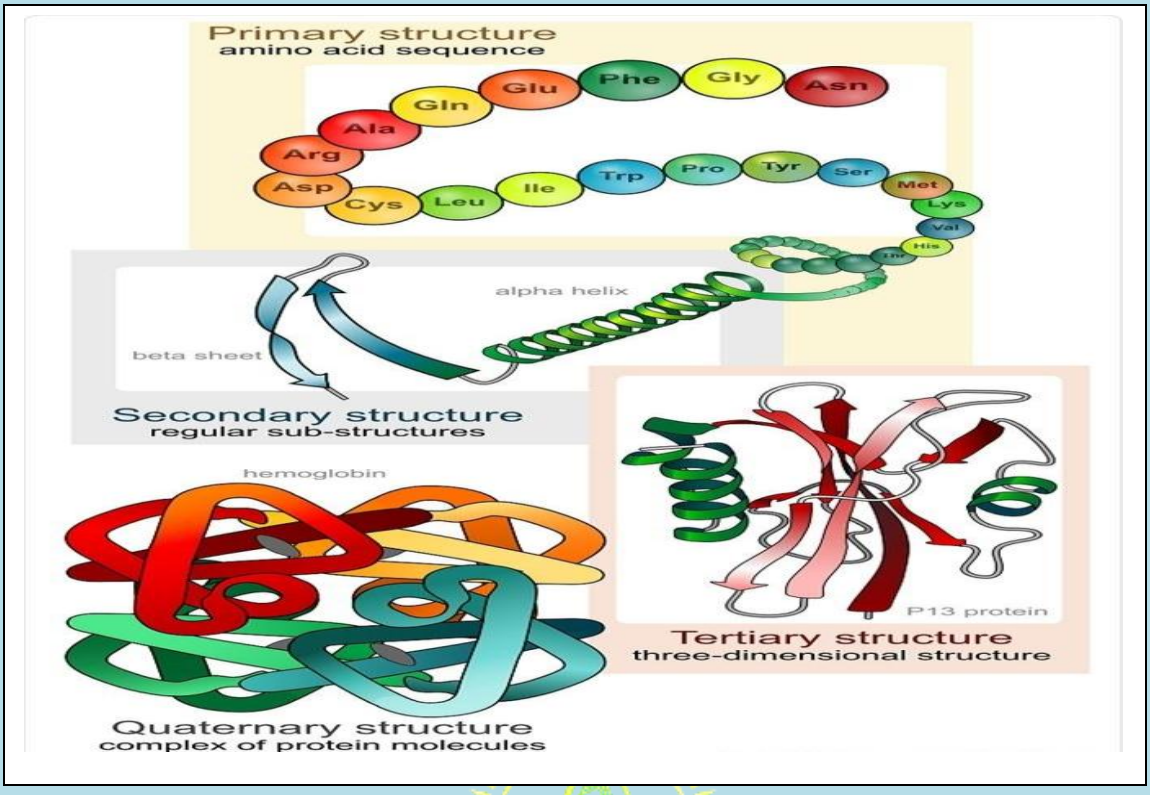
- Protein acts as enzymes and hormones i.e., Insulin, Glycogen.
- It provides nutrients transport and making antibodies i.e., Haemoglobin.
- It provides energy when carbohydrates and fat intake is inadequate.
- A class of protein known as fibrous proteins provide various part of our body with structure, strength and elasticity.
- Various protein hormones regulate the growth of plants and animals besides controlling many other physiological functions.
- The nucleoproteins serve as carrier of genetics characters and hence govern inheritance of traits.
- Proteins act as a buffer system, helping our body maintain proper pH values of blood and other bodily fluids.

TYPES OF PROTEINS

- On the basis of the shape of the molecules:
  - **Fibrous**-These proteins are long, thin and lie side by side to form fibres. These are insoluble in water.
    Example; collagen, keratein etc.
  - **Globular**-These proteins are folded into spherical 3-D shape. These are soluble in water.

Example; Insulin, Haemoglobin, Enzymes etc.

- On the basis of structure: *Each subsequent level being more complex than the previous.*
  - **Primary structure**-It describes the sequence of amino acids connected together to form the polypeptide. It may contain more than one chain. The two ends of polypeptide are as N-terminal & Cterminal.
  - **Secondary structure**- It describes the shape in which polypeptide chain can exists. Secondary structure arises due to folding of the backbone of the polypeptide chain by H-bond or intermolecular force of attraction.
  - **Tertiary structure**-It describes overall folding of a polypeptide chain that is further folding of the secondary structure. It folding occurs dueto sulphide linkage.
  - **Quaternary structure**- On joining multiple tertiary structures we get Quaternary structures. It describes different tertiary structures in a particular spatial arrangement.



SYNTHESIS OF PROTEINS

Protein synthesis is essential to cell function. The life cycle of a protein is starting with DNA transcription and moving to m-RNA translation, to protein maturation, to protein function, and finally to protein degradation.

PROTEIN SYNTHESIS IN ANIMALS

Protein synthesis is the process where an m-RNA is read by ribosomes to synthesize a polymer of amino acids known as protein. This process is known as translation.

The process of protein synthesis occurs in different organelles, such as Mitochondria, Cytoplasm, and also Rough Endoplasmic Reticulum in animal cells.

PROTEIN SYNTHESIS IN PLANTS

Although protein synthesis in plants has many similarities to protein synthesis in animals and other organisms. Protein synthesis occurs in three cellular compartments namely, Cytoplasm, Plastids, and Mitochondria. Each of them contains different protein synthetic machinery.

About 75% of the protein is synthesized in cytoplasm and 20% in the chloroplast, whereas only a few proteins are synthesized by distinct mechanisms.

Therefore, plant cells contain three types of ribosomes, three groups of t-RNAs, and three sets of factors for protein synthesis.

SOURCES OF PROTEINS

- ✓ Legumes and beans-All beans, lentils, chickpeas, split peas, tofu.
- ✓ Dairy products-Milk, yoghurt (especially Greek yoghurt), cheese (especially cottage cheese).
- ✓ Nut (including nut pastes) and seeds-Almonds, pine nuts, walnuts, hazelnuts, cashews, pumpkin seeds, sesame seeds, sunflower seeds.
- ✓ Fish and seafood-Fishes, prawns, crab, lobster, mussels, oysters, scallops, clams.
- ✓ Poultry- Chicken, duck, emu, goose, bush bird, turkey, eggs.
- ✓ Lean meats-Beef, lamb, veal, pork, kangaroo.
- ❖ Some grains and cereal-based products are also sources of protein in low quantity.

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