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Topic: Proteins — classification.

Proteins are linear polymers of high molecular weight. All proteins contain C,H,O and N, the presence of N distinguishing them from carbohydrates and fats. On an average proteins contain 16% nitrogen. Some proteins also have S in addition, and in a few proteins P and other elements may be present. The molecular weight of proteins varies from about 12,000 Daltons to several million. Cell contain a very large number of proteins. The number may vary from 1000-2000 in the simplest bacteria to as many as 100,000 different proteins in human cells.

Levels of protein structure

1. Primary structure

Each type of protein is characterized by its own unique sequence of amino acids.

This describes the arrangement of amino acids in polypeptides of a certain protein.

This level determines the number, kind and arrangement of the amino acids forming a protein .

Amino acids, as their name indicates, contain both a basic amino group and an acidic carboxyl group. This di-functionality allows the individual amino acids to join together in long chains by forming peptide bonds: amide bonds between the -NH2 of one amino acid and the -COOH of another.

Sequences with fewer than 50 amino acids are generally referred to as peptides, while the terms protein or polypeptide are used for longer sequences.

A protein can be made up of one or more polypeptide molecules. The end of the peptide or protein sequence with a free carboxyl group is called the carboxy-terminus or C-terminus. The terms amino-terminus or N-terminus describe the end of the sequence with a free α-amino group.

Secondary Structure

This describes the way by which polypeptides are coiled. This structure is formed as a result of the hydrogen bonds between carboxyl and amine groups in close amino acid monomers.

The two main types of secondary structure are the α-helix and the ß-sheet.

Secondary structure depends on hydrogen bonds between –C=O and –NH group.

In α-helix, a single amino acid chain is coiled spirally by establishing hydrogen bonds between first and fourth amino acids.

Tertiary Structure

This describes the three-dimensional shape of proteins. This structure is formed as a result of the bonds between the side groups (R groups) of amino

acids, which bend the different polypeptide chains and give protein its unique shape.

The overall three-dimensional shape of an entire protein molecule is the tertiary structure. The protein molecule will bend and twist in such a way so to achieve maximum stability or the lowest energy state.

Although the three-dimensional shape of a protein may seem irregular and random, it is fashioned by many stabilizing forces due to bonding interactions between the side-chain groups of the amino acids.

Tertiary structure is due to a variety of bonds and interactions between amino acid side chains like disulphide bonds, electrostatic (ionic) bonds, hydrogen bonds, vander waals' interactions and hydrophobic effect.

Quaternary Structure

This describes proteins which consist of two or more chains of polypeptides. This structure is formed as a result of the linkage of polypeptide chains with each other.

Many proteins are made up of multiple polypeptide chains, often referred to as protein subunits. These subunits may be the same (as in a homodimer) or different (as in a heterodimer).

The quaternary structure refers to how these protein subunits interact with each other and arrange themselves to form a larger aggregate protein complex.

Biological functions of proteins with examples.

Functional class	Examples
Enzymes	Ribonuclease Amylase Trypsin Catalase
Regulatory proteins	Insulin Growth hormone Parathormone
Transport proteins	Haemoglobin Serum albumin Glucose transporter
Storage proteins	Ovalbumin Casein Ferritin Gluterlins Globulins
Contractile and motile	Actin Myosin Tubulin Kinesin
Structural proteins	Collagen Elastin Chondrin
Protective proteins	Immunoglobulin Thrombin Fibrinogen

Exotic proteins	Antifreezr proteins Monellin Resilin Glue proteins

Representative conjugated proteins

Class	Examples
Nucleoprotein	Ribosomes , TMV
Metaollproteins	Ferritin
Chromoproteins	Haemoglobin
Phosphoproteins	Casein
Lipoproteins	Blood plasma lipoproteins
Glycoproteins	Proteoglycan
Flavoproteins	Succinic dehydrogenase NADH dehydrogenase

Keratin is a fibrous protein. It contains large amount of sulphur.

Feathers are made of β - keratin.

The most abundant protein in the human body is collagen.

Enzymes are functional proteins. An enzyme is formed by chemically bonding together amino acids.