Protein Structure and Its Properties

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ABSTRACT

Protein structure prediction has now become a major entity for various research projects. Predicting protein structure has helped many researchers to design drugs, classify new proteins and have various applications in Genetic engineering, Pharmaceutical engineering, Industrial Biotechnology and so on. In this review structural level (1°, 2°, 3° and 4°) of protein structure is highlighted in detail that can help the researchers to utilize the knowledge for further analysis.

Keywords: Protein, drug designing, structural level, and, industrial biotechnology

INTRODUCTION

The name protein was suggested by a Swedish chemist Berzelius to the Dutch chemist Mulder in 1838 for the first time which means an organic nitrogenous of a complex compound found in the living cell. Protein is the most complex and abundant macromolecule found in the cell of the living organism. Over half of the dry weight of an organism is constituent of proteins. Protein are the structural and functional entity of a living cell. Protein is produced in our body from the process called gene expression i.e. DNA is transcribed to RNA and further RNA is translated to protein by ribosomes or rough endoplasmic reticulum. Proteins ha various functions in the body from providing structure, regulation of body process to the transportation of important materials from part to another part of the body. They are in various forms in our body like hair, a constituent of connective tissue, enzymes, hormones or oxygen carriers, some proteins act as a hereditary factor and some of them also help in muscle contraction. Therefore they are protein is essential to cell function and cell structure.

If you want to define protein more precisely in scientific terms you can say. Protein is a high molecular weight mixed polymer of amino acid joined together by peptide linkage (—CO-NH—). They are the polymers of amino acids. There are 100 thousand kinds of proteins in our body but these all proteins comprise only 20 types of amino acids. Each nitrogenous compound of an amino acid has both a carboxyl group (—COOH) and an amino group (—NH2) in it. Amino acid is constituent of carbon, nitrogen, hydrogen, oxygen, sulfur and sometimes phosphorus as well. If we hydrolyze a protein the product form is amino-acids.

PROTEIN CONFIGURATION

Protein has a very complicated structure, for convenience biochemists have recognized based on the complexity of the arrangement of amino acids into four structural levels of the organization. These levels were described by Linderstrom-Lang [1]. These levels are Primary, Secondary, tertiary and Quaternary. Mathematically these are also depicted into 1°, 2°, 3° and 4°. Out of these three of these structures (1°, 2°, 3°) can exist in the molecules composed of a single polypeptide chain, whereas the 4° involves the interaction of polypeptide within a multi-chained protein molecules. This 4 levels are described briefly.
(I) **Primary structure:** - In primal structure, the number of amino acids and the sequence bonded together by polypeptide chain, just like we described polypeptide linkage above i.e. the bond between alpha-carboxyl gatherings of one amino corrosive buildup to the alpha-amino gathering of the other. E.g.: Ala-Phe-Val-Leu

(II) **Secondary structure:** - Secondary structure of a protein is also known as the Helix formation or local folding. In this level the protein forms alpha helix or beta-sheet. Globular proteins demonstrate a few attributes properties, showing the nearness of standard curled structure in these atoms due to the presence of hydrogen bond folding of chain occur. A rigid and tubular structure called a helix is formed with neighboring amino-acids by folding and hydrogen bonding.

   a) **Alpha-helix:** - With X-beam diffraction Pauling and Corey found that a polypeptide chains with planar peptide bond would frame a privilege gave helical by straight forward contorts about the alpha-carbon-to-nitrogen and the alpha-carbon-to-carboxyl carbon bonds. And it was called a helical structure as alpha-helix [2].

   b) **Beta-pleated sheet:** - Pauling and Corey [2] distinguished the second sort of dull, least vitality or stable adaptation, which they named beta-pleated sheet. The development of beta-sheet relies on the intermolecular hydrogen holding albeit intramolecular hydrogen bonds are additionally present.

   c) **Random coil:** - Besides the alpha-helix and beta-sheet there are other secondary structures of protein which is a random coil. At the point when a polypeptide contains contiguous cumbersome buildup, for example, isoleucine or charged deposits, for example, glutamic acid and aspartic acid. Repugnance between these gatherings makes the polypeptide to expect an arbitrary loop design.

There are other secondary structures of proteins as well, which are called as Hairpin Bend and collagen triple helix. In hair pin bend there is a tight turn (~180º) involve in 4 amino acids. The substance of this turn is that the CO group of buildup n of a polypeptide chain is hydrogen-bonded to the amino group buildup n+3.

(III) **Tertiary Structure:** - This is also called the 3D shape of the protein. This structure has a single polypeptide backbone with more than one secondary protein structure. The tertiary structure thus involves the folding of the helices of globular proteins. It refers to the spatial arrangement of amino acids that are far apart in a linear sequence and to the pattern of disulfide bonds. The dividing line between secondary and tertiary structure is, hence a matter of taste. X-ray crystallography studies hate revealed the detailed 3-D structure of more than 300 proteins.

(IV) **Quaternary structure:** This is the fourth degree of complexity in protein structure. This degree of complexity is recently recognized to be of great value in many proteins. Some of the globular proteins consist of 2 or more interacting peptide chains. Each peptide chains in such proteins are called as a subunit. These chains may be identical or different in their primary structure. This specific association of a no. of subunits into complex large-sized molecules is referred to as the quaternary structure. In other words, the quaternary structure refers to the spatial arrangement of subunits and the nature of their contact.
Four different group of each amino acid is attached to an alpha-carbon atom which is C atom next to COOH. And other Four groups are: NH2 (amino group), COOH (carboxylic group), H (hydrogen) and a side chain(R). Amino acid group.-

1. Non-Polar  Characteristics 1. Hydrophobic
2. Polar  2. Hydrophilic
3. Acidic  3. Negatively charged
4. Basic  4. Positively charged

REFERENCES

