FACULITY OF TECHNOLOGY UNIVERSITY OF COLOMBO

DEPARTMENT OF INFORMATION AND COMMUNICATION TECHNOLOGY

IC 3207 - Bioinformatics (21/22)

Assignment 01

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1.Describe the four levels of protein structure-primary, secondary, tertiary, and quaternary-in your own words. Explain how each level contributes to the final 3D organization and function of a protein.

Primary Structure –

- Primary structure: unique linear sequence of amino acids joined through peptide bonds in a protein chain

- Contribution to 3D structure and function: Just a change of even one amino acid in this sequence can result in a completely different shape and function of the final protein, showing how important primary structure is with respect to the starting point for folding.

Secondary structure-

- The secondary level involves the folding of segments of the amino acid chain into repetitive shapes, such as spirals (alpha helices) or zig-zag sheets (beta sheets). Hydrogen bonds forming between the backbone atoms within the chain stabilize these patterns.

- Contribution to 3D structure & function: This level helps the protein achieve its basic structure and provides regions with added strength and stability, thus allowing for correct further folding later on

Tertiary Structure

• This is basically the complete 3D shape that any polypeptide makes after it has folded further. The structure occurs due to different interactions taking place between the side chains of amino acids, the R groups.

• Contribution to 3D structure and function: This level of structure is what actually gives the protein its proper shape and function. For instance, things like enzyme active sites or binding pockets only appear once the protein is completely folded into this stable 3D form.

Quaternary structure –

• Usually, many proteins are made by a single polypeptide chain that has a tertiary structure . but some proteins are made with more polypeptide chains that single polypeptide chain is called subunits.when the more subunits are interacted together it shows a Quarternary structure. Ex – hemoglobin.

• Contribution to 3D structure & function –when more subunits are together , it can perform more functionality , complex functions.

2.List five major forces that stabilize protein structure. Briefly describe the role of each.

- **Hydrogen bonds:** These help to keep the repeated patterns in the secondary structure and also the overall fold in the tertiary and quaternary levels, giving support all around.
- **Ionic bonds:** Formed between positive and negative side chains because they attract each other. These gives extra stability to proteins, specially on the surface.
- **Van der Waals forces:** Very weak forces that happen when atoms come really close together, helping the protein to keep its shape tight.
- **Disulfide bonds:** Strong covalent links between the sulfur atoms of cysteine residues, making the folded protein a lot more tougher.
- **Hydrophobic interactions:** Non-polar side chains try to avoid water and gather inside the protein, which acts as one of the main driving forces for folding into the proper 3D shape.

3. Compare and contrast eukaryotic and prokaryotic cells.

Eukaryotic Cells	**Prokaryotic Cells**
Usually larger in size	Usually, smaller
DNA kept inside a nucleus	DNA floats in the cytoplasm
True nucleus present	Lacks a true nucleus
Have large ribosomes	Have smaller ribosomes
Grow at a slower rate	Can grow faster
Contain various organelles (like mitochondria, Golgi)	Lack membrane-bound organelles
Both have plasma membrane and cytoplasm	Both have plasma membrane and cytoplasm