BIO ASSIGNMENT - 1

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SECTION: T2
COURSE: B-TECH CSE - IOT

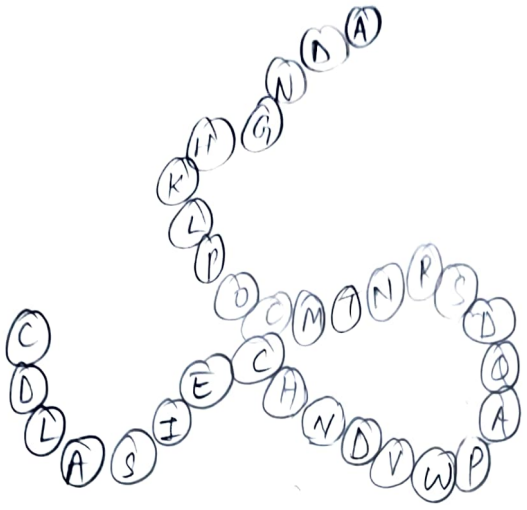
Q1. Write a detailed note on structure of protein with a neat labelled diagram and comment on its function and importance.

Ans = Proteins are an important class of biological macromolecules present in all biological organisms, made up of such elements are carbon, hydrogen, nitrogen, oxygen and sulphur. All proteins are polymers of amino acids. The polymers, also known as polypeptides consist of a sequence of 20 different L-α-amino acids, also referred to as residues. For chains under 40 residues the term peptide is frequently used instead of protein. To be able to perform their biological functions, proteins fold into one, or more, specific spatial conformations, driven by a number of non-covalent interaction such as hydrogen bonding, ionic interactions, Van der waals' forces and hydrophobic packing. In order to understand the functions of proteins. This is the topic of the scientific field of structural biology which employs techniques such as x-ray crystallography or NMR spectroscopy, to determine the structure of proteins.

STRUCTURE OF PROTEINS:

(1) Primary Structure:

The amino acid sequence of the peptide chains.
The sequence of the different amino acid is called the primary structure of the peptide or protein. The primary structure of a protein. A specific sequence of nucleotides in DNA is transcribed into MRNA, which is read by the ribosome in a process called translation. The sequence of a person is unique to that protein and defines the structure and functions of the protein.

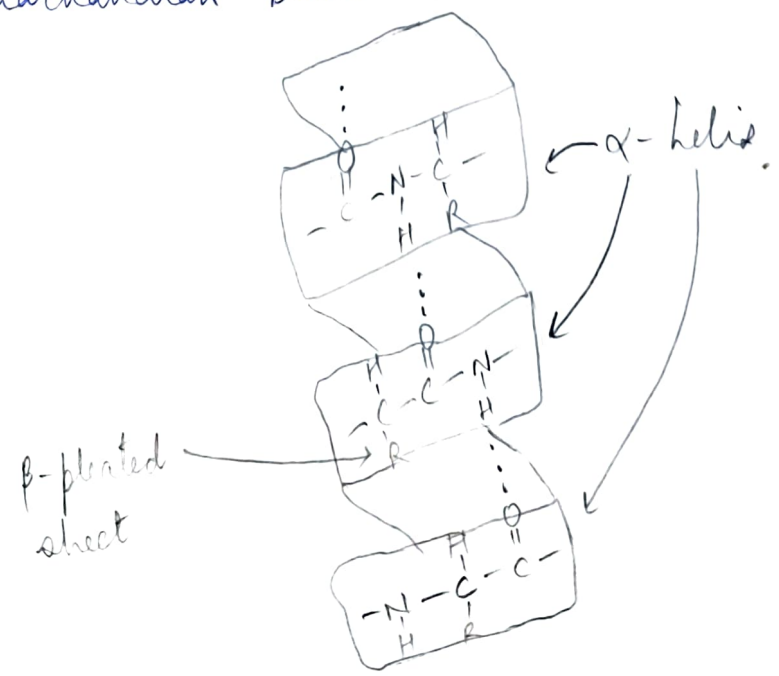


The primary structure of a protein is its amino acids sequence.

NOTE: Two cysteines form a disulphide bridge

(2) Secondary structure:

Highly regular self-structures (alpha helix and strands of beta sheet which are locally defined, meaning that there can be many different secondary motifs present in one single proteins that are the residues have in common, explaining why they occur frequently in most proteins. Each of these two secondary structure elements has a regular geometry, meaning they are constrained to specific varies of the dihedral angles Φ and Ψ. Thus, they can be formed in a specific region of the Ramachandran Plot.



(3) Tertiary Structure:

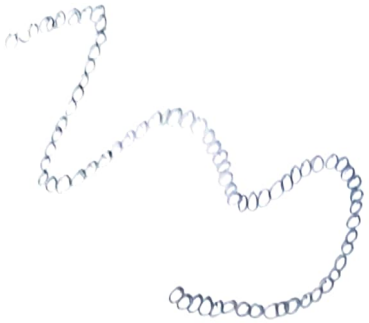
Three dimensional structure of a single protein molecule, a spatial arangement of the secondary structure. The elements of secondary structure are usually folded into a compact shape using a variety of loops and turns. The formation of tertiary structure is usually driven by the burial of hydrophobic residues.

(4) Quaternary Structure:

A complex of several protein molecules or polypeptide chains, usually called protein subunits in the context, which function as part of the larger assembly or protein complex. The quaternary structure is the interaction between several chains of peptide bonds.

Not all proteins have quaternary structure since they might ~~have~~ be functional as monomers. The quaternary structure is stabilized by the same range of interactions as the tertiary structure. Complexes of two or more polypeptide are called multimers.

PTO



Primary Protein Structure

α-helix

Secondary Protein structure.

Tertiary Protein Structure.

Quaternary Protein Structure.

FUNCTIONS AND IMPORTANCE:

Proteins are a class of macromolecules that perform a diverse range of functions for the cell. They help in metabolism by providing - structural support and by acting as enzyme, carriers or hormones. Protein shape is ~~of~~ critical to its functions & to permanent of functi and to permanent changes in the shape of the protein, leading to loss of function known as desaturation.

Several other functions include →

(a) Enzymes: In carrying out numerous chemical reactions and creating DNA molecules and carrying out complex processes).

(b) Hormones: Balancing components in Body.

(c) ~~Auto~~ Antibody: Used by the immune system to repair and heal body from foreign bacteria.

(d) Energy: Right amount of protein is needed to convert it into energy.

We need protein in one diet to help our body repair cells and make ~~our~~ new ones. It is also important for growth & development in children and pregnant women.

Q2. Elaborate the process and stages of cell division - mitosis and meiosis with a schematic representation.

Ans: MITOSIS (M phase)

Though brief in terms of the entire cell cycle is important because it is the stage where the newly replicated chromosomes are separated and two new daughter cells are formed from the original cell. Mitosis is divided into four stages:

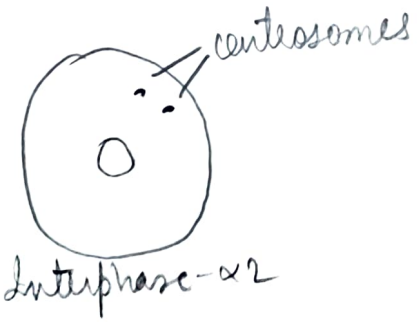
(a) Prophase
(b) Metaphase
(c) Anaphase
(d) Telophase.

Mitosis begins with the condensation of the chromosomal material, first appearing as slender threads and by the end of ~~the~~ prophase, each chromosome is visible as two identical

paired filaments (sister chromatids) held together at a construction called the centromere. Also, during prophase, the two centrosomes take positions at opposite poles of the cell and the nuclear fragments into vesicles.

At metaphase, the chromosomes move toward the equator of the cell and align themselves in the equatorial plane. During Anaphase, the two sister chromatids of each chromosomes, are seperated into independent chromosomes and move toward opposite pairs under the influence of the spindle fibres.

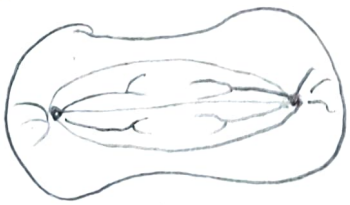
finally at Telophase, the nuclear membrane reforms around each group of chromosomes, the chromosomes decondense, the spindle fibris disappear and the cell divides (a process known as cytokinesis).

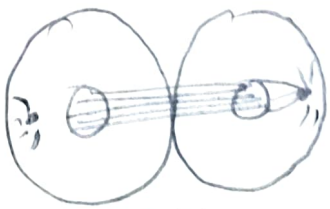


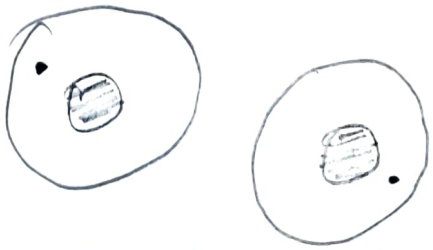
Interphase - $\alpha 2$

Prophase


Metaphase


Anaphase


Telophase


Interphase - αI

Mitosis is absolutely essential to life because it provides new cells for growth and for replacement of worn-out cells. Mitosis may the take minutes or hours, depending upon the kind of cells & species of organisms. It is influenced by time of day, temperature & chemicals. It is a process of asexual reproduction observed in unicellular organisms.

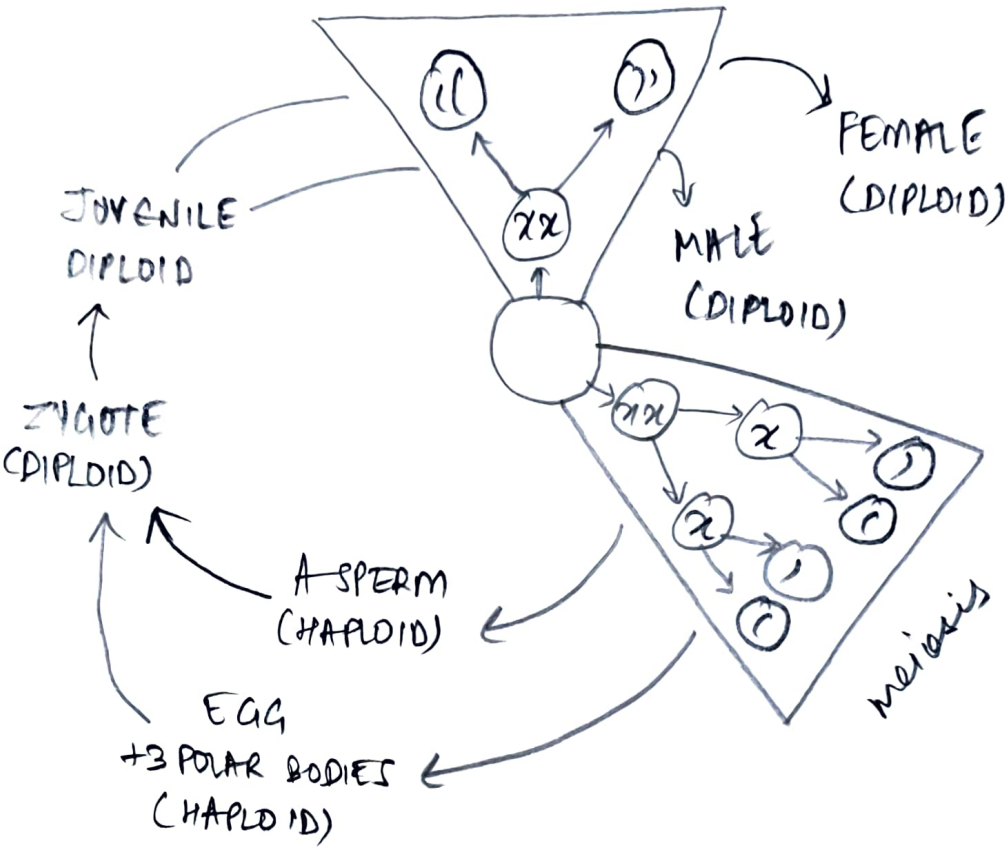
Importance of Mitosis:

(a) Genetic stability in the newly formed cells.
(b) Help in repairing the damaged cells or regrowth of cells in cuts or wounds.
(c) Help in increasing cell count.

MEIOSIS:

Meiosis is the production of genetics with a haploid (50% reduced) set of genetic material. The reduction of the genome happens during the first division of meiosis when the diploid genetic material is separated into two clusters around each of which forms a haploid daughter cell.
During the first meiotic division genetic recombination occurs, similar to gene enchoing in case of damage. Paired crossover, which means that each DNA strand breaks apart and reconnects to homologous strand.
The haploid cells generated by the first meiotic division divide again by normal cell division with the end result of four haploid cells, the genetics.

The second meiotic division is similar to mitosis.



As gametes, four sperm are created in the male sex, and one egg and three polar bodies are created in the female sex. One of the haploid gametes from each sex combines during fertilization to create a diploid zygote of a new individual, which is genetically different from the male or female parent. The diploid zygote then divides by mitosis to create further diploid cells of the growing organism. Hence, both meiosis and fertilization allow for the mixing of the gene pool and the generation of offspring that differ genetically from the parents. The development of new organisms that are not merely copies of the parent organisms allowed selective adaptation

to occur since there were always some descendents that could deal with changing environmental conditions that might have led otherwise to the extention of the species. In plant life cycles there is an independent gametophyte stage between the meiosis process & the production of gametes. But in all other cases, the meiotic cell division serves to reduce the chromosome number from diploid to haploid and fertilization initiates biological reproduction.