Padasalai's Telegram Groups!

(தலைப்பிற்கு கீழே உள்ள லிங்கை கிளிக் செய்து குழுவில் இணையவும்!)

- Padasalai's NEWS - Group
https://t.me/joinchat/NIfCqVRBNj9hhV4wu6_NqA

- Padasalai's Channel - Group
https://t.me/padasalaichannel

- Lesson Plan - Group
https://t.me/joinchat/NIfCqVWwo5iL-21gpzrXLw

- 12th Standard - Group
https://t.me/Padasalai_12th

- 11th Standard - Group
https://t.me/Padasalai_11th

- 10th Standard - Group
https://t.me/Padasalai_10th

- 9th Standard - Group
https://t.me/Padasalai_9th

- 6th to 8th Standard - Group
https://t.me/Padasalai_6to8

- 1st to 5th Standard - Group
https://t.me/Padasalai_1to5

- TET - Group
https://t.me/Padasalai_TET

- PGTRB - Group
https://t.me/Padasalai_PGTRB

- TNPSC - Group
https://t.me/Padasalai_TNPSC

Bio- Botany, Chapter – 8

Biomolecules

Water

Properties of water:

- Adhesion (ability to bind with other molecules), Cohesion (Ability to bind with watermolecule themselves)
- Latent heat of vapourisation
- High melting and boiling point
- Universal solvent
- Specific heat capacity

Metabolites

Metabolites are products of metabolism (chemical reactions in our body) Eg: Amino acids, Enzymes, Proteins, Vitamins, Pigments, Hormones Etc. Metabolites that involves directly in living organisms and have major effects in daily working of its body are known as **primary metabolites**. Those metabolites which do not involve directly and regularly in body functioning but have some effects in the functioning of body is termed as **secondary metabolites**.

Organic molecules

1. **Carbohydrates**: Chemical compounds which have carbon, hydrogen and oxygen in a ratio of 1:2:1. (Every molecule which have carbon hydrogen and oxygen in a ratio of 1:2:1 are not carbohydrates). Commonly termed as sugar. Number of carbon in the simple carbohydrates varies from 3 to7. Functional group attached to sugar molecule also varies. If the functional group attached to the sugar is aldehyde, then it is termed as **Aldose Sugar.** If the functional group attached to the sugar is ketone group then the sugar is termed as **Ketose sugar**.

Monosaccharides				
If the number of carbon in carbohydrate is	**No**	**Common Name of sugar**	**Examples**	
			Aldehyde form	**Ketose form**
	3	Trioses	Glyceraldehyde	Dihydroxyacetone
	4	Tetroses	Erythrose	Erythrulose
	5	Pentoses	Ribose	Ribulose
	6	Hexose	Glucose	Fructose

Mostly, Hexose sugar (Either glucose or fructose) act as the monomer unit of other sugars. These monomer unit of larger sugar molecules are known as **saccharides**.

Oligosacharides			
If the number of Saccharides in carbohydrate is	**No**	**Common Name of sugar**	**Examples**
	1	Monosacharide	Glucose, Fructose ($C_6H_{12}O_6$)
	2	Disaccharides	Maltose, Lactose, Sucrose ($C_{12}H_{24}O_{12}$)
	3	Trisaccharides	Raffinose ($C_{18}H_{32}O_{16}$)
	4	Tetrasaccharides	Stachyose
	5	Pentasaccharides	Verbascose

If the number of saccharides are more than 10 the sugar molecules are termed as **polysaccharides**. Two kinds of polysaccharides are there. If the monomer unit/saccharides are of same type in the entire polysaccharide structure, those are termed as **Homopolysaccharides**. Examples: Peptidoglycan, Hyaluronic acid, Agar agar. If the monomer units are different types in a polysaccharide then that type of polysaccharides are termed as **Heteropolysaccharides**. Example: Starch, Glycogen, Cellulose, Chitin Etc. Each monomeric unit of polysaccharides are connected with **glycosidic bond**. On the basis of function, polysaccharides are divided into two groups. **Storage polysaccharides** (Starch and Glycogen) and **Functional polysaccharides** (Cellulose and Chitin)**.**

Starch: Plant storage carbohydrate. Made by repeated units of amylose (linear glucose chain) and amylopectin (branched glucose molecules). Iodine test to find out the presence of starch.

Glycogen: Animal storage carbohydrate. Made up of glucose molecule.

Cellulose: Made up of glucose molecule. Cellulose fibres are straight and uncoiled. Industrial uses like cotton fibres, nitrocellulose for explosives.

Chitin: Structural polysaccharides which having carbohydrates and amino acids. Also called **Mucopolysaccharide**. Monomer unit is N- Acetyl glucosamine.

2. **Lipids:** Main groups are Triglycerides, Phospholipids, Steroids and Waxes.
   Triglycerides: Single Glycerol molecule and three fatty acids attached to that.
   Phospholipids/Membrane lipids: Major components of plasma membrane of cells. Contain 2 fatty acid chains and a glycerol.
   Steroids: Commonly found in animal hormones and cell membrane
   Waxes: Long chain alcohols and saturated fatty acids linked by an ester bond
3. **Proteins:** Amino acids combined together to form protein. Polymer chains of amino acids are called protein. 20 Naturally occurring amino acids are there in living system. And 2 synthetic amino acids. Amino acids are connected together by peptide bonds. If two amino acids are connected with a peptide bond, that molecule/Protein is called **dipeptide**. If 3 amino acids are connected linearly by peptide bonds then that molecule or protein is called a **tripeptide** Most of the protein contains more number of amino acids, so proteins commonly called as **polypeptides.** Sequence of protein means the amino acids which linearly arranged to make the protein.

   Structure of protein:

   - Primary structure: Linear arrangement of amino acids
   - Secondary structure: Linearly arranged amino acids chain folded or coiled to form secondary structure. If amino acid chain folded into plate like structure it is called **β pleated sheets**. If the amino acid chains are coiled, then that secondary structure is called **α helix.**
   - Tertiary structure: Any type of secondary protein (α helix/ β pleated sheets) folded into globular structure to form tertiary protein
   - Quaternary structure: Two or more protein molecules attached together to form quaternary structure of protein.

   Enzymes: Enzymes are globular protein, which act as catalysts in biological reaction (Metabolism). Enzymes can be of 2 types; 1) **Extra cellular enzymes** are enzymes which produced inside a cell and travels out of the cell and act in a region out of the cell. Eg: Digestive enzymes. 2) **Intra cellular enzymes** are enzymes which produces and act inside the same cell only. Eg: Insulin. In every reaction, Reactants must reach a particular level of energy called activation energy. Enzymes lower the activation energy for the reactants, thus the reactants made capable of attaining the activation energy fast and take place the reaction.

Properties of Enzymes

- All are globular proteins (Tertiary structure of protein)
- Enzymes takes place in chemical reactions without changing the product and without changing the shape of the enzyme
- Each enzyme is specific for their own chemical reaction. Ie, The enzyme which is active in a chemical reaction may not be active in another reaction. (Like a lock and its key)
- Enzymes have a particular pocket like region in its body called **active site** where the reactants can attach and take place the reaction.

Factors effecting the rate of Enzyme Reactions

- **Temperature:** Reaction rate increase up to an extent if temperature increases. But after a limit, Reaction Rate decreases if temperature increases.
- **pH:** As same as temperature, pH also influence the reaction rate positively up to an extent. And after a limit if the pH changes, it will adversely affect the reaction rate.
- **Substrate concentration:** Rate of an enzyme reaction increases with increase in substrate concentration
- **Enzyme concentration:** Rate of reaction increases with increased concentration of enzymes.

Enzyme inhibitors

- **Competitive inhibitors:** Some molecules will have similarity with the structure of reactant and they will occupy the active site of enzymes which will make the enzyme inactive for reactant. These type of molecules are called Competitive inhibitors. (Reactant have to compete with the inhibitor for active sites) Eg: RUBISCO have an active site suitable for both CO_2 and Oxygen
- **Non-competitive Inhibitor:** These type of molecules will not be similar to reactants so that they cannot bind to active site of enzyme. But they attach with any other part of enzyme which changes the shape of the active site. (here, inhibitor is not a competitor for the reactant to attach to active site) Eg: Cyanide ions blocks cytochrome oxidase in cellular respiration process.
- **Allosteric inhibitor:** Sometime, products of reaction itself inhibits the reaction. If the product is formed sufficient in number, the product itself produce a signal to its enzyme to stop reaction like a feedback mechanism. This type of inhibition of enzymes is known as allosteric inhibition.
- **End product inhibition:** In a series of reaction, many enzymes and reactants are involved. After all the series of reactions, one end product will be formed. This end product sometimes inhibits any of the enzymes act in between that series of reactions.

Most of the enzyme name ends with **–ase**. (Lactase, kinase, oxidase etc).

4. **Nucleic acids: DNA** and **RNA** are the two kinds of genetic materials. Both of these materials are made using the basic structure called nucleic acids. The single unit of both DNA and RNA is called nucleotides.

Nitrogen Base + Pentose sugar = Nucleoside

Nucleoside + Phosphate = Nucleotide

Nitrogen bases are cyclic/ ring structured molecules having nitrogen. These are of two kinds. **Purins** (with two ring structure) and **Pyramidines**(one ring structure)

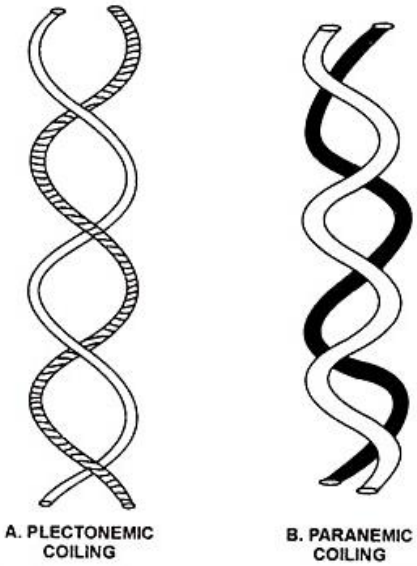
Purins are Adenine(A) and Guanine(G) and pyramidins are Cytosine(C), Thymine(T), and Uracil(U). DNA contains nitrogen bases such as Adenine, Guanine, Cytosine and Thymine, where the RNA contains nitrogen bases such as Adenine, Guanine, Cytosine, and Uracil

Nucleotide+ Nucleotide = Dinucleotide
(Dinucleotide) *n = Polynucleotide

Most widely accepted Helical structure of DNA was proposed by **James Watson and Francis Crick in 1962**. Erwin Chargaff in 1949 proved that Adenine will always pair with Thymine by double bond and Guanine will always pair with Cytosine by triple bond.

Features of DNA

- Two stranded helical structure, One strand will be in 5' to 3' direction, next strand will be in 3' to 5'. As the strands are said to be in opposite direction, both are said to be antiparellal.
- The angle that makes by two sugar molecules on adjacent strands with the imaginary helical axis of DNA will be $120^{0,}$ which is called as **minor groove.** The angle made by two sugar molecules on distant strands with imaginary helical axis of DNA is 240^{0}, and it is called as **major groove**.
- Each base is 0.34 nm apart and a complete turn of the helix comprises 3.4 nm or 10 base pairs per turn in the common form of DNA (B DAN is the common form)
- DNA helical structure has a diameter of 20 A^{0} (2nm) and a pitch of about 34 A^{0} (3.4nm). (Pitch means the length of a single helical turn)



- Two strands of DNA are in **plectonemic coiling**, not in **paranemic coiling**. So that each strand cannot move independently and makes it strong in bonding.
- Based on the Helix and distance between each turn, DNA have 3 forms, **A- DNA, B- DNA and Z-DNA.**

RNA (Ribonucleic Acid)

Single stranded and unstable polymers of nucleic acids. Mainly 3 types

mRNA: (messenger RNA) Carries message which having the instruction from DNA for building of protein with amino acids. Consists of 5 % of total RNA

tRNA: Message carried from DNA(mRNA) is read by tRNA and transfer the amino acids whichever is needed to build up the protein. Also called **soluble RNA.** Consists of 15 % of total RNA

rRNA: helps to make up the two subunits of ribosomes. Building of protein is by the help of ribosomes and tRNA. Consists of 80 % of total RNA

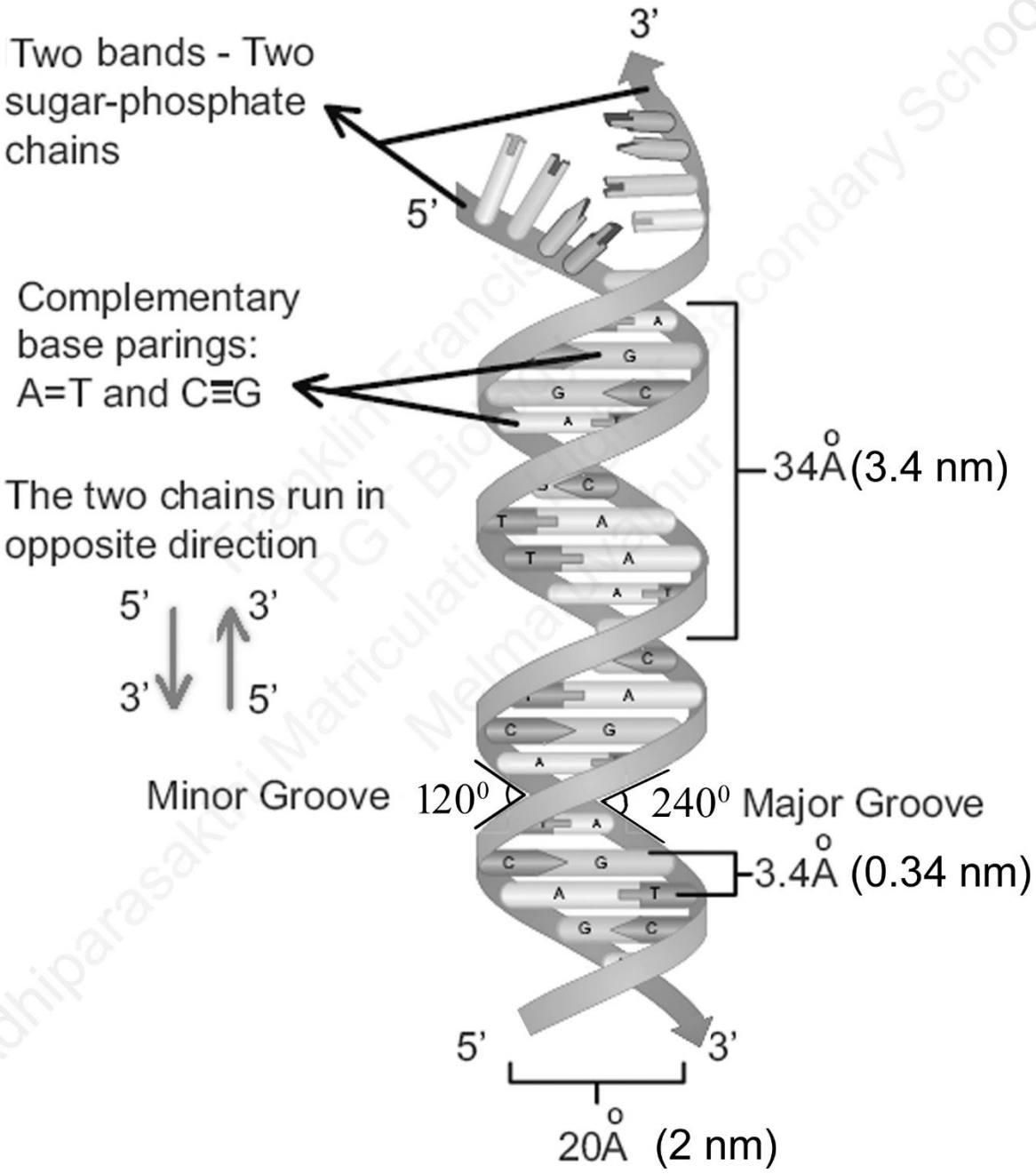


Figure 8.43: Structure of DNA