

10. BIOMOLECULES

STUDY NOTES

- The molecules that involve to build-up the living bodies are **Biomolecules**.
Ex: Carbohydrates, Proteins, Vitamins, Hormones, Nucleic acids.
- In this chapter we study the structure, function and applications of
 - Carbohydrates -Glucose, Fructose, Sucrose
 - Amino acids, Proteins
 - Enzymes
 - Vitamins
 - Nucleic acids - DNA,RNA
 - Hormones
- Carbohydrates (Saccharides):**Hydrates of carbon are called carbohydrates.
General formula: $C_n(H_2O)_m$.
Chemically, carbohydrates are optically active polyhydroxy aldehydes or ketones.
Ex: Sugars, Sucrose, Lactose
Uses of Carbohydrates: Source of energy, structural role (cellulose), Storage (starch, glycogen)
- Classification of carbohydrates:** Based on the number of saccharide units.
 - Monosaccharides (simple sugars)** **Ex:** Glucose, fructose, ribose.
 - Disaccharides** **Ex:** Maltose, Sucrose, Lactose
 - Oligo saccharides (short chains)** **Ex:** Raffinose
 - Polysaccharides (long chains)** **Ex:** Starch, Cellulose, Glycogen
 - Starch:** Wheat, maize, rice, potatoes, barley, sorghum etc., contain starch. Starch is a white amorphous powder, insoluble in cold water and sparingly soluble in hot water. It gives blue colour with I_2 and on hydrolysis it gives glucose. It is a polymer of glucose.
 - Cellulose:** Cellulose is a polymer of β -D-glucose joined by (1,4) glycosidic linkages. Wood has 40-50% cellulose and cotton has about 90% cellulose.
 - Glucose:** Glucose is a monosaccharide with chemical formula $C_6H_{12}O_6$. It exists in both open chain form and closed chain form. It contains an aldehyde group.**Preparation of Glucose:** From sucrose (hydrolysis), from starch (acid/enzyme hydrolysis)
- Classification based on functional group:**
 - Aldoses contain** aldehyde group ($-CHO$) **Ex:** Glucose
 - Ketoses contain** ketone group ($C = O$) **Ex:** Fructose
- Proteins:** Proteins are naturally occurring polypeptides that generally contain 100-300 amino acid units. **Ex:** Egg, Yolk, skin, hormones, connective tissues, most of the enzymes.
Plants and animals require proteins for their growth and maintainance.
- Enzymes:** Enzymes are bio catalysts which speed up reactions in biological reactions.
They are naturally occurring biomolecules. Most of them are simple or conjugated proteins.
The non-protein part of an enzyme is called prosthetic group.
The prosthetic group that is covalently bonded with the enzyme is called **cofactor**.
The prosthetic groups attached to the enzyme at the time of reaction are called **coenzymes**.

8. **Vitamins:** Vitamins are essential dietary factors and are naturally occurring organic compounds. Vitamin deficiency causes diseases. They are classified as fat soluble (A,D,E,K) and water soluble (B,C). Plants can synthesise all vitamins. Animals can synthesise few but not all vitamins. Human body can synthesise vitamin A from carotene.

9. **NUCLEIC ACIDS (DNA & RNA):** Nucleic acids are long chain biopolymers of nucleotides with a polyphosphate ester chain. They consist of a base (a pentose sugar) and phosphate group. Nucleic acids are responsible for the hereditary character from parents to offspring. The two main types of nucleic acids :

i) **DNA (Deoxyribo Nucleic Acid)** - Double helix strand.

DNA contains a five carbon sugar molecule called 2-deoxyribose

It contains Adenine, Guanine, Cytosine, Thymine, AGCT.

ii) **RNA (Ribo Nucleic Acid)** - Single helix structure.

RNA contains ribose. It contains Adenine, Guanine, Cytosine & uracil, AGCU

Both DNA and RNA contain adenine, guanine and cytosine.

- **Replication:** The synthesis of identical copies of DNA is called Replication.

- RNA is much shorter than DNA.

RNA is generally single stranded whereas a DNA is double stranded.

3 types of RNA:

(i) mRNA (messenger RNA) (ii) r RNA (ribosomal RNA) (iii) tRNA (transfer RNA)

- **Transcription:** This is the synthesis of mRNA from DNA blue print.

- **Translation:** This is the process of synthesis of proteins by using genetic information from mRNA.

10. **HORMONES:** Hormones carry biological information from one group of cells to distant tissues or organs. Animal hormones are produced by endocrine glands and are liberated directly into the blood stream. From there, they are carried to remote tissues or organs. They exert physiological effects and control metabolic activities. Plant hormones are growth hormones.

10.1 Male sex hormones (Androgens):

These are produced by testis. **Ex:** Testosterone.

They develop secondary male characteristics like deep voice, facial hair, sturdy body structure.

Synthetic testosterone helps in muscle growth.

10.2 Female sex hormones (Estrogens):

These are produced by ovary. **Ex:** Estradiol.

They develop secondary female characteristics like shrill voice, long hair, breast development.

They control menstrual cycle.