

9. BIOMOLECULES

IMPORTANT POINTS

1. What makes the difference between any two persons? The Physical structure, The Emotional reactions, Growth factors, Resistance capacities, Health..... All such kind of things in living beings are governed by a particular kind of molecules, called Biomolecules. The molecules that are involved to build-up the living bodies are Biomolecules.
Ex: Carbohydrates, Proteins, Vitamins, Hormones, Lipids, Nucleic acids.
2. In this chapter we study

 - i) Cell-Reactions
 - ii) Carbohydrates -Glucose, Fructose, Sucrose
 - iii) Amino acids, Proteins
 - iv) Enzymes
 - v) Vitamins
 - vi) Nucleic acids - DNA, RNA
 - vii) Lipids
 - viii) Hormones
3. **Cell and energy cycle:** Cell is the basic structural and functional unit of living organisms.
These cells require energy for their activities. Two types of reactions happen in a cell. They are exergonic and endergonic.
- 4.0. **Carbohydrates:** Hydrates of carbon are called carbohydrates. Their formula is of the form $C_n(H_2O)_m$. But there are exceptions like deoxyribose. Chemically, carbohydrates are polyhydroxy aldehydes or polyhydroxy ketones.
- 4.1. **Classification of carbohydrates:** Based on the **number of hydrolysis products**, carbohydrates are classified into 4 types.
Types of Carbohydrates:

 - i) **Monosaccharides:** Carbohydrates which do not cleave during hydrolysis are called monosaccharides.
Ex: Glucose, Fructose
 - ii) **Disaccharides:** Carbohydrates which give two monosaccharides on hydrolysis are called disaccharides.
Ex: Maltose, Sucrose, Lactose
 - iii) **Oligo saccharides:** Carbohydrates which give 2-10 monosaccharides on hydrolysis are called oligosaccharides.
Ex: Raffinose (which gives glucose, fructose and galactose on hydrolysis)
 - iv) **Polysaccharides:** Carbohydrates which give a large number of monosaccharides on hydrolysis are called polysaccharides.
Ex: Starch, Cellulose
 - **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.
- 4.2. **Based on the main functional group:**

 - i) **Aldose:** If the main functional group is $-CHO$, then the carbohydrate is called aldose. **Ex:** Glucose
 - ii) **Ketose:** If the main functional group is $>C=O$, then the carbohydrate is called a ketose. **Ex:** Fructose

5. **Proteins:** Plants and animals require proteins for their growth and maintenance. Proteins are naturally occurring polypeptides that generally contain 100-300 amino acid units.

Ex: Silk, hair, skin, hormones, connective tissues, most of the enzymes.

6. **Enzymes:** Enzymes are specific catalysts 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**.

7. **Vitamins:** Vitamins are essential dietary factors and are naturally occurring organic compounds. They are required in 'minute quantities' for the maintenance of normal health. Vitamin deficiency causes diseases. Vitamin deficiency is called avitaminosis. Plants can synthesise all vitamins. Animals can synthesise few but not all vitamins. Human body can synthesise vitamin A from carotene.

8. **NUCLEIC ACIDS:** Nucleic acids are long chain biopolymers of nucleotides with a polyphosphate ester chain.

The two main types of nucleic acids are

- i. RNA (Ribo Nucleic Acid)
 - ii. DNA (Deoxyribo Nucleic Acid)
- The purine bases in DNA are Adenine(A) and Guanine (G); and the pyrimidine bases in DNA are Thymine(T) and Cytosine (C)
 - RNA contains all the bases present in DNA except Thymine.

It contains Uracil (U) in the place of Thymine.

- **Structure of DNA** is double helix.
- **Structure of RNA** is single helix.
- **Replication:** The synthesis of identical copies of DNA is called Replication.
- RNA is much shorter than DNA and is generally single stranded.

There are 3 types of RNA.
mRNA messenger RNA
r RNA ribosomal RNA
tRNA transfer RNA

- **Transcription:** The synthesis of mRNA from DNA blue print.
- **Translation:** The process of synthesis of proteins by using genetic information from mRNA is known as Translation.

9. **LIPIDS:** Lipids are esters of long chain fatty acids and alcohols. They are naturally occurring oily and greasy organic compounds. They are insoluble in water but soluble in organic solvents like ether, benzene.

The common lipids are fats, oils, waxes, phospholipids, glycolipids, steroids and terpenes. Ghee, butter, curd, fish oils etc are animal sources of dietary lipids.

Ground nut oil, gingelly oil, mustard oils etc., are vegetable sources of dietary lipids.

10.1 **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.

Classification: Hormones are broadly classified into 2 types. 1. Steroid hormones
2. Non-steroid hormones

10.2 **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. They are misused by athletes and body builders.

10.3 **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.

BIOMOLECULES

CHEM BEATS!

- మన శరీరానికి 'జీవాన్ని' అనగా ఆకారాన్ని, ఆరోగ్యాన్ని, అందాన్ని, అమరతత్వాన్ని అందించేవే ఈ **Biomolecules**.
 - **Biomolecules** keep our Body Cells 'Alive'.
 - **Biomolecules** - Everybody's **Body Cell Molecules**.
- మన **Body** లో ఉండే **Body Cells** ను నిత్యం **Activate** చేసేవే **Biomolecules..**
- మన **Body Cells** లో ముఖ్యంగా ఉండే **4 Organic Compounds: O, C, H, N + S,P,....**
- **Core Four Organic Compounds [O, C, H, N]** మన **Body** లో 96% **Mass** ను కలిగి ఉంటాయి!
- **Body Cells** జీవానికి కారణం: **Body Cells** లో ఉండే **Organic Compounds** మధ్య జరిగే రసాయన చర్యలు.
 - **Biomolecules** are classified variously based on their **Functions** and **Sizes**.
 - **Proteins [Milk, Fish, Eggs]; Carbohydrates [Starch(Rice), Glucose, Fruits]**
 - **Lipids/ Fats [Triglycerides (Fats, Oils)], Sterols [Cholesterol]**
 - **Vitamins [A, D, E, K & C, B₁, B₂,...]**
 - **Nucleic Acids [RNA, DNA]**
 - **Enzymes [Lypage, Emylage]**
 - **Hormones [Testosterone, Estrogen...]**
 - **Minerals [Ca, P, K, Na, Cl, Mg, Fe, Zn, I.....]**