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# Biomolecules

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**Abstract**

**Biomolecule**, also called **biological molecule,** is a loosely used term for molecules present in organisms that are essentially to one or more typically biological process such as cell division, morphogenesis or development. They have a wide range of sizes and structures and perform a vast array of functions. The four major types of biomolecules are carbohydrates, lipids, nucleic acids, and proteins.

Biology and its subfields of biochemistry and molecular biology study biomolecules and their reactions. Most biomolecules are organic compounds, and just four elements—oxygen, carbon, hydrogen, and nitrogen—make up 96% of the human body's mass.

**Keywords**: **Biomolecule,** cell division, morphogenesis, development, carbohydrates, lipids, nucleic acids, proteins.

**Introduction:**

All living organisms are made up of a fundamental unit called the cell. Each cell is made up of organic as well as inorganic compounds. The elemental analysis of the cell constituents shows that a cell comprises carbon, oxygen, hydrogen, nitrogen, phosphorus, etc. Biomolecules are the most essential organic molecules, which are involved in the maintenance and metabolic processes of living organisms. They range from small molecules such as primary and secondary metabolites and hormones to large macromolecules like proteins, nucleic acids, carbohydrates, lipids etc.

Biomolecules Definition-Biomolecules are molecules that occur naturally in living organisms.

Types of Biomolecules:

There are four major types of biomolecules:

i. Carbohydrates
ii. Lipids
iii. Proteins
iv. Nucleic acids

1. **Carbohydrates** –

   Carbohydrates are chemically defined as polyhydroxy aldehydes or ketones or compounds which produce them on hydrolysis.

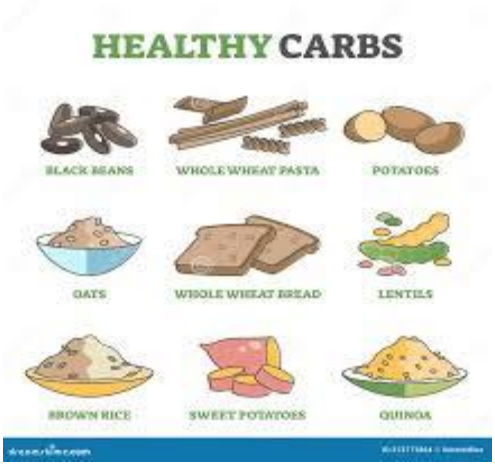
Depending on the number of constituting sugar units obtained upon hydrolysis, they are classified as monosaccharides, Disaccharides, oligosaccharides and polysaccharides Carbohydrates are good source of energy having long chains of sugars.

Monosaccharides are simple sugars that are composed of 3-7 carbon atoms. They have a free aldehyde or ketone group, which acts as reducing agents and are known as reducing sugars. Disaccharides are made of two monosaccharides. The bonds shared between two monosaccharides are the glycosidic bonds. Monosaccharides and disaccharides are sweet, crystalline and water soluble substances.

Polysaccharides are polymers of monosaccharides. They are un-sweet and complex carbohydrates. They are insoluble in water and are not in crystalline form.

Example: glucose, fructose, sucrose, maltose, starch, cellulose etc

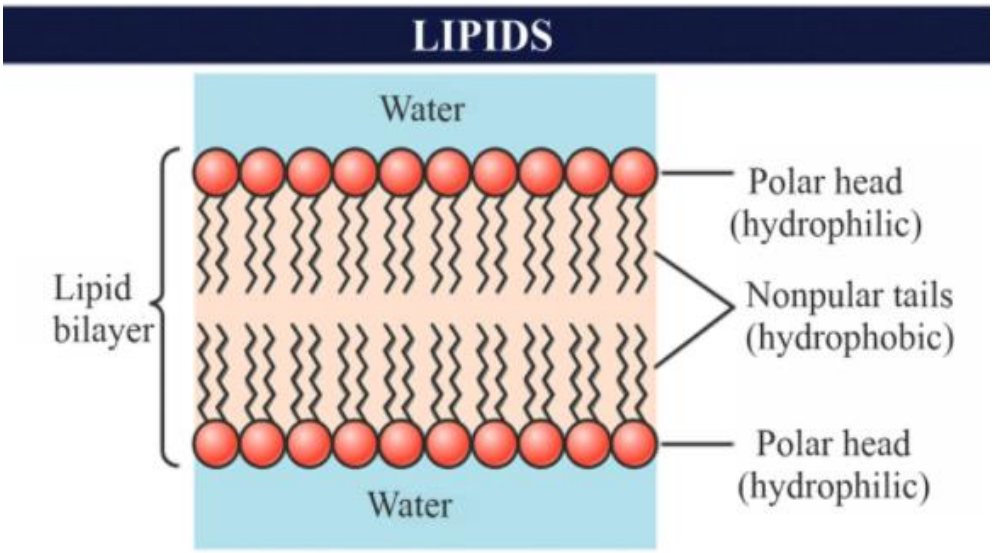
Carbohydrates are found in a wide array of both healthy and unhealthy foods—bread, beans, milk, popcorn, potatoes, cookies, spaghetti, soft drinks, corn, and cherry pie etc.




2. **Lipids – Lipids are organic compounds that contain hydrogen, carbon, and oxygen atoms, which form the framework for the structure and function of living cells.** Lipids are insoluble in water, soluble in organic solvents, are related to fatty acids and are utilized by the living cell.

   They include fats, waxes, sterols, fat-soluble vitamins, mono-, di- or triglycerides, phospholipids, etc.

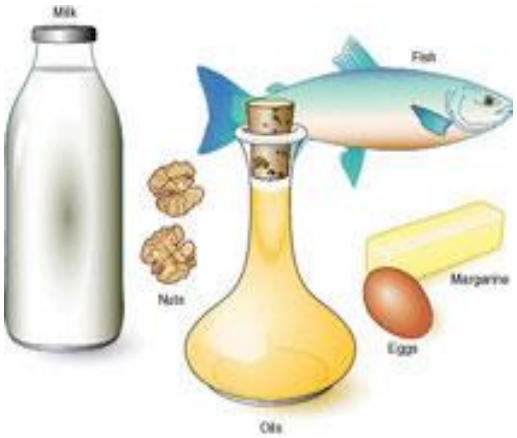
   Lipids are composed of long hydrocarbon chains. Lipid molecules hold a large amount of energy and are energy storage molecules. Lipids are generally esters of fatty acids and are building blocks of biological membranes. Most of the lipids have a polar head and non-polar tail.




Fatty acids can be unsaturated and saturated fatty acids. Lipids present in biological membranes are of three classes based on the type of hydrophilic head present.

Example: oils, fats, phospholipids, glycolipids, etc.

Dietary lipids are primarily oils (liquid) and fats (solid). Commonly consumed oils are canola, corn, olive, peanut, safflower, soy, and sunflower oil. Foods rich in oils include salad dressing, olives, avocados, peanut butter, nuts, seeds, and some fish.



3. **Nucleic Acids -** Nucleic acids refer to the genetic material found in the cell that carries all the hereditary information from parents to progeny. There are two types of nucleic acids namely, deoxyribonucleic acid (DNA) and ribonucleic acid (RNA).

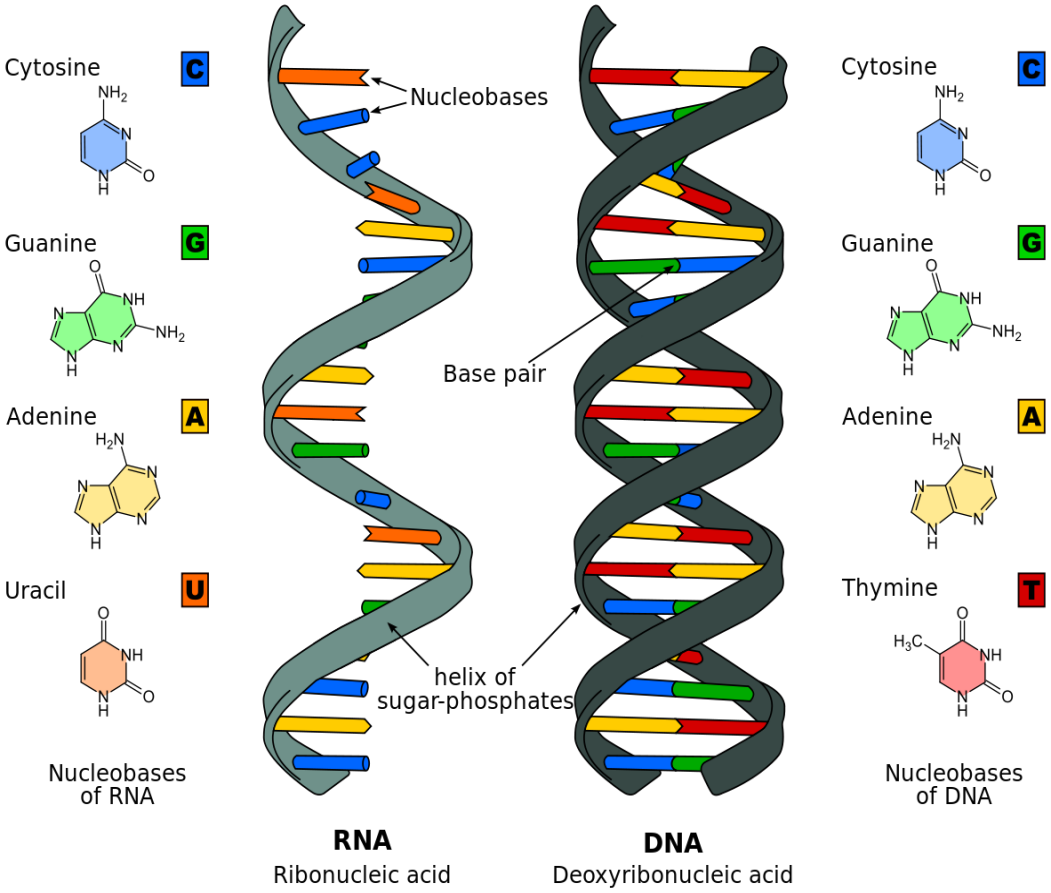
   The main function of nucleic acid is the transfer of genetic information and synthesis of proteins by processes known as translation and transcription.

   Nucleic acids are organic compounds with heterocyclic rings. Nucleic acids are made of polymer of nucleotides.

   Nucleotides consist of nitrogenous base, a pentose sugar and a phosphate group.

A nucleoside is made of nitrogenous base attached to a pentose sugar.

The nitrogenous bases are adenine, guanine, thyamine, cytosine and uracil.




4. **Proteins -** Proteins are large, complex molecules that play many critical roles in the body. They do most of the work in cells and are required for the structure, function, and regulation of the body's tissues and organs.

   Proteins are heteropolymers of stings of amino acids.

   Amino acids are joined together by the peptide bond which is formed in between the carboxyl group and amino group of successive amino acids. Proteins are formed from 20 different amino acids, depending on the number of amino acids and the sequence of amino acids.

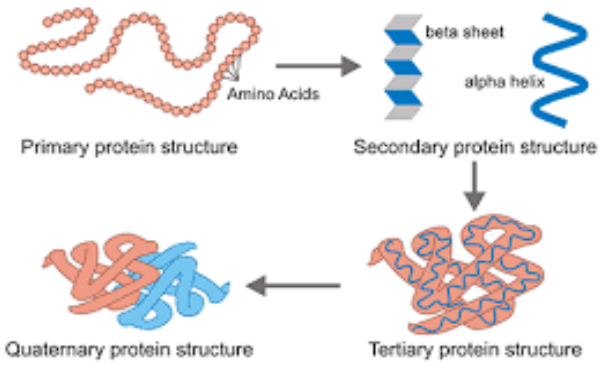
   There are four levels of protein structure:

   (i) Primary structure of Protein –In this structure protein exist as long chain of amino acids arranged in a particular sequence. They are non-functional proteins.

   (ii) Secondary structure of protein - The long chain of proteins are folded and arranged in a helix shape, where the amino acids interact by the formation of hydrogen bonds. This structure is called the pleated sheet. Example: silk fibres.

(iii) Tertiary structure of protein - Long polypeptide chains become more stabilizes by folding and coiling, by the formation of ionic or hydrophobic bonds or disulphide bridges, these results in the tertiary structure of protein.

(iv) Quaternary structure of protein - When a protein is an assembly of more than one polypeptide or subunits of its own, this is said to be the quaternary structure of protein.




Example: Haemoglobin, insulin.

**Functions of Biomolecules –**

1. Carbohydrates provide the body with source of fuel and energy, it aids in proper functioning of our brain, heart and nervous, digestive and immune system. Deficiency of carbohydrates in the diet causes fatigue, poor mental function. –
2. Each protein in the body has specific functions, some proteins provide structural support, help in body movement, and also defense against germs and infections. Proteins can be antibodies, hormonal, enzymes and contractile proteins. –
3. Lipids, the primary purpose of lipids in body are energy storage. Structural membranes are composed of lipids which form a barrier and controls flow of material in and out of the cell. Lipid hormones, like sterols, help in mediating communication between cells.
4. Nucleic Acids are the DNA and RNA; they carry genetic information in the cell. They also help in synthesis of proteins, through the process of translation and transcription.

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