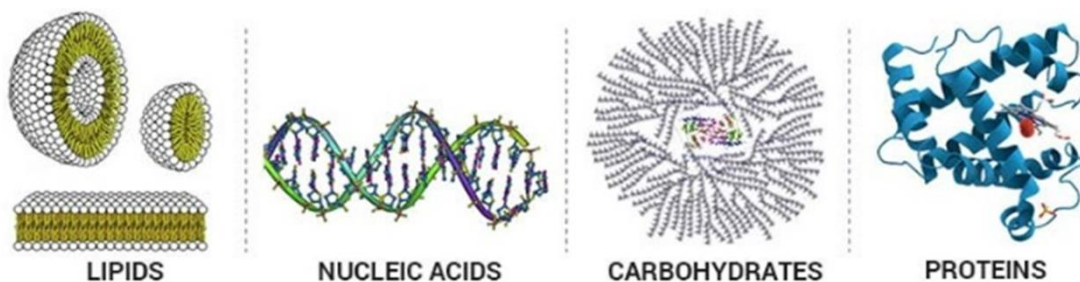


## Bio-molecules:

A biochemical substance is a chemical substance found within a living organism. The four major groups of biomolecules include polysaccharides, proteins, nucleic acids (DNA and RNA), and lipids. They are found in and produced by living organisms. Thus, many of the biomolecules are polymers.

However It also includes small molecules like primary and secondary metabolites and natural products.

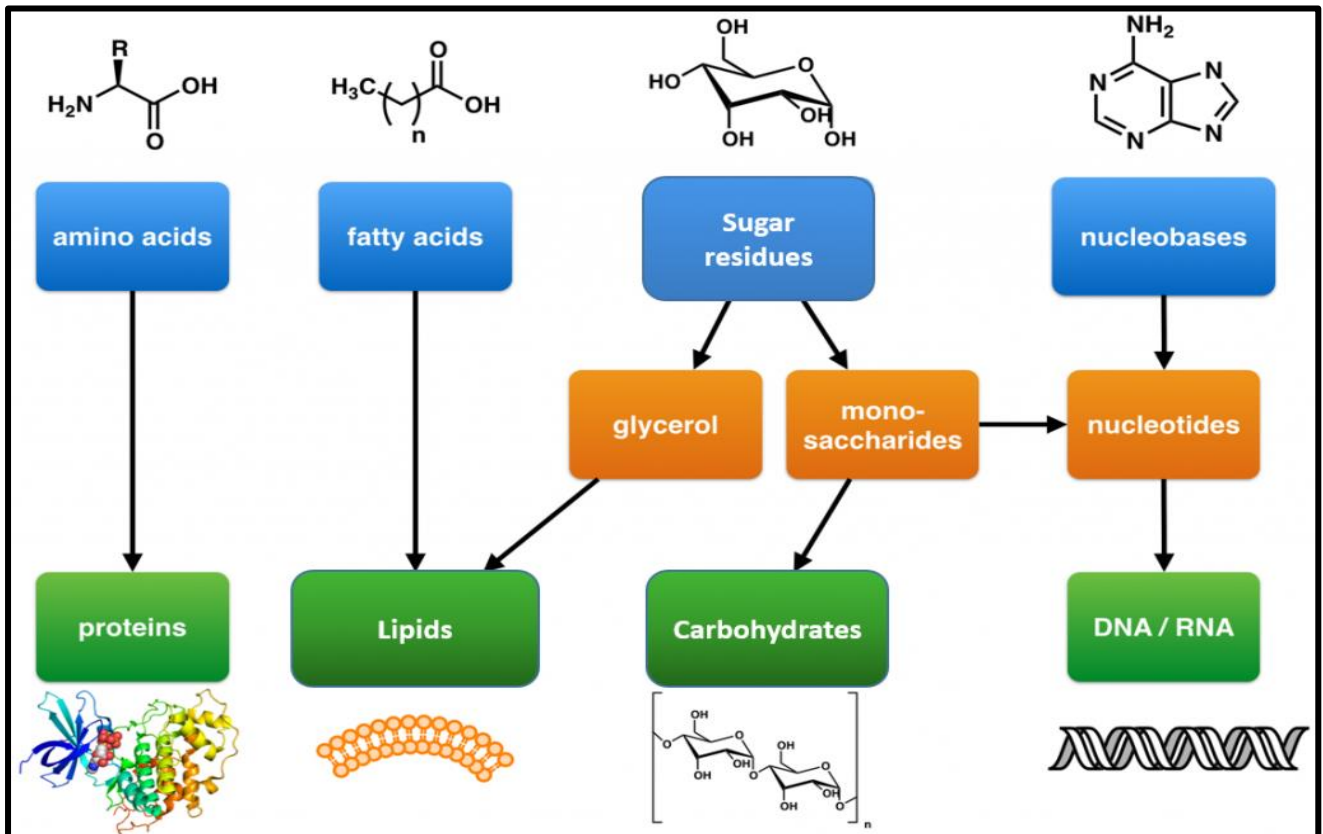
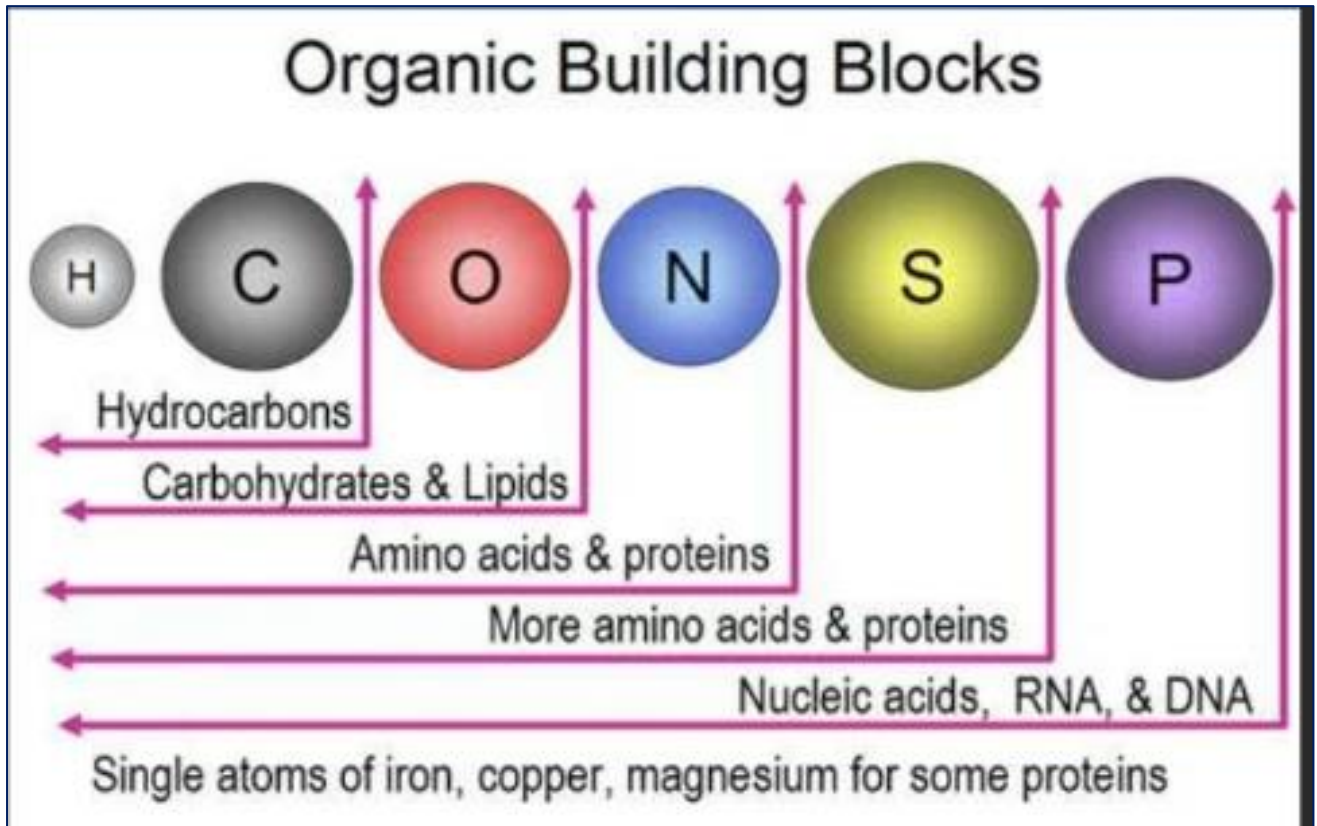


## What are Biomolecules?

- ✓ Biomolecules atoms consists mainly of carbon and hydrogen with nitrogen, oxygen, sulphur, and phosphorus that are covalently bound together.
- ✓ The chemical composition and metabolic reactions of the organisms appear to similar.
- ✓ The composition of living tissues and non-living matter are appear to be similar in qualitative analysis.
- ✓ Closer analysis reveals that the relative abundance of carbon, hydrogen and oxygen is higher in living system.
- ✓ All forms of life are mainly composed of biomolecules only.
- ✓ All living forms like bacteria, algae, plant and animals are made of similar macromolecules that are responsible for life.

Living organism → Organs → Tissue → cells → Organelles → Biomolecules

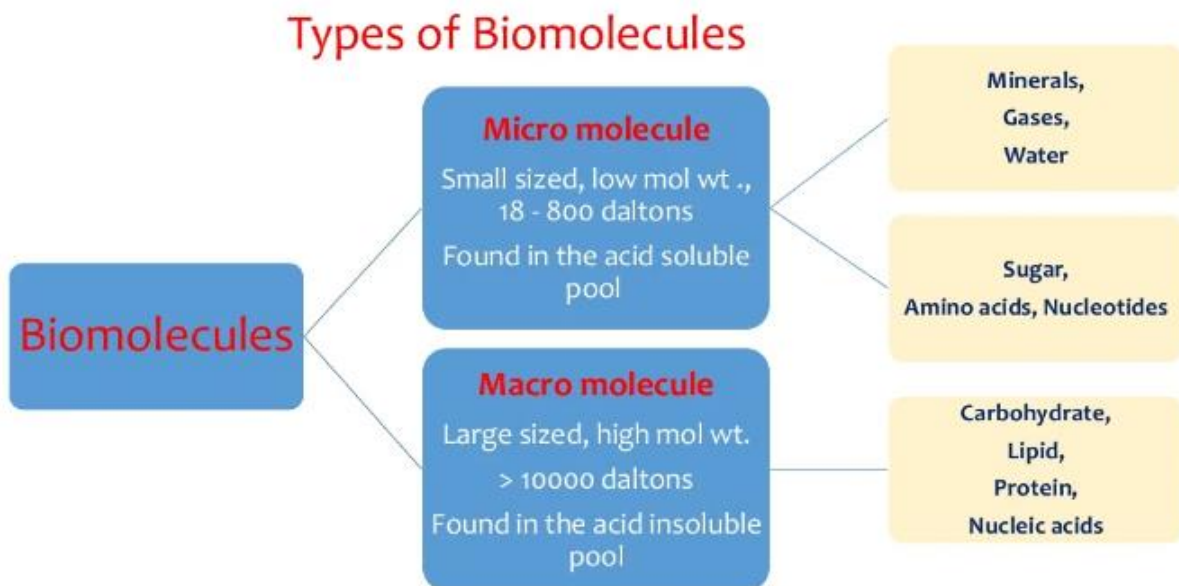
# The Molecular building blocks of life are made from organic compounds:



## Types of Biomolecules:

Based on the functions and structures of biomolecules, they are classified as the following major types:

1. Carbohydrates
2. Proteins
3. Nucleic Acids
4. Lipids.

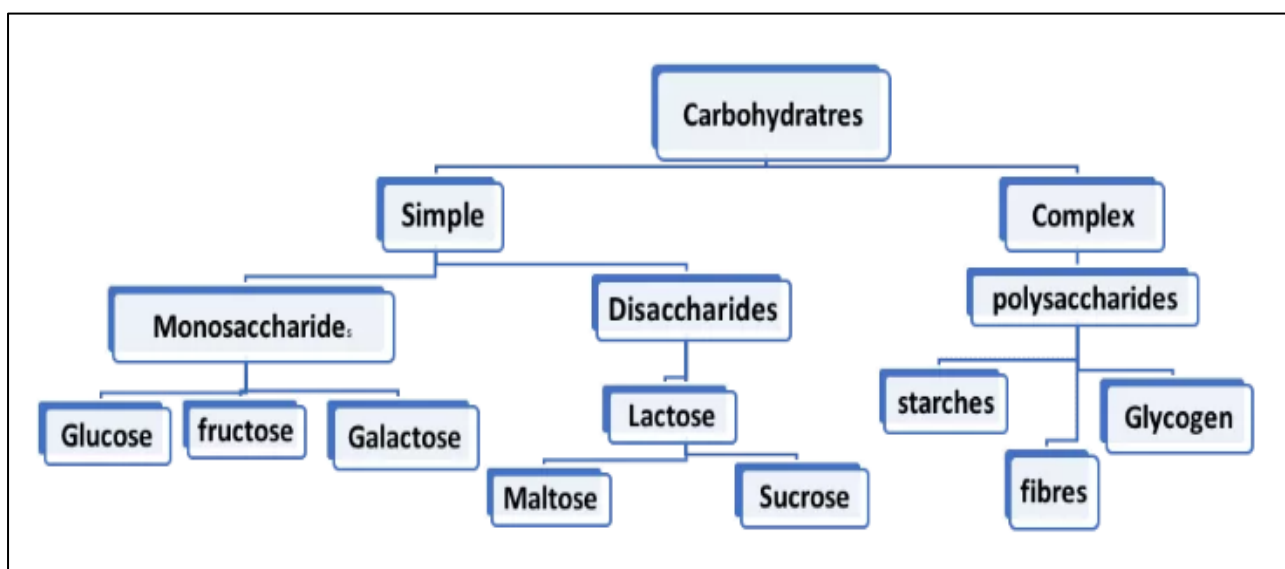


## Carbohydrates:

**General formula:  $(CH_2O)_x$**

**Linkage: Glycosidic bond**

- ✓ Carbohydrates are chemically defined as polyhydroxy aldehydes or ketones or compounds which produce them on hydrolysis.
- ✓ In layman's terms, we acknowledge carbohydrates as sugars or substances that taste sweet.
- ✓ Depending on the number of constituting sugar units obtained upon hydrolysis, they are classified as monosaccharides (1 unit), oligosaccharides (2-10 units) and polysaccharides (more than 10 units).
- ✓ They have multiple functions' viz. they're the most abundant dietary source of energy; they are structurally very important for many living organisms as they form a major structural component, e.g. cellulose is an important structural fiber for plants.



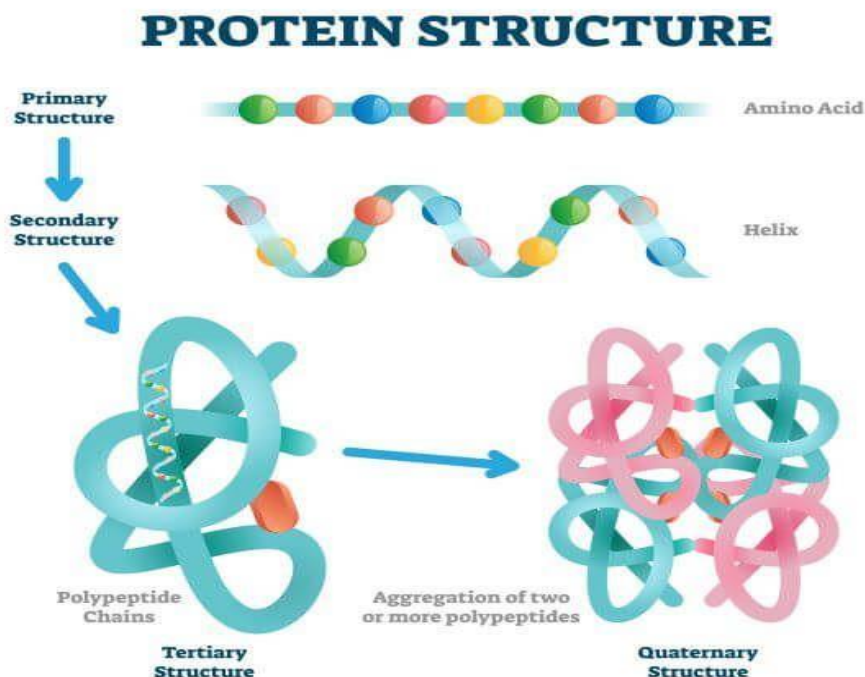
**Classification of Carbohydrates (Types of Carbohydrates)**

# Proteins:

**Linkage:** Peptide bonds, Disulfide linkages, and Hydrogen bonding.

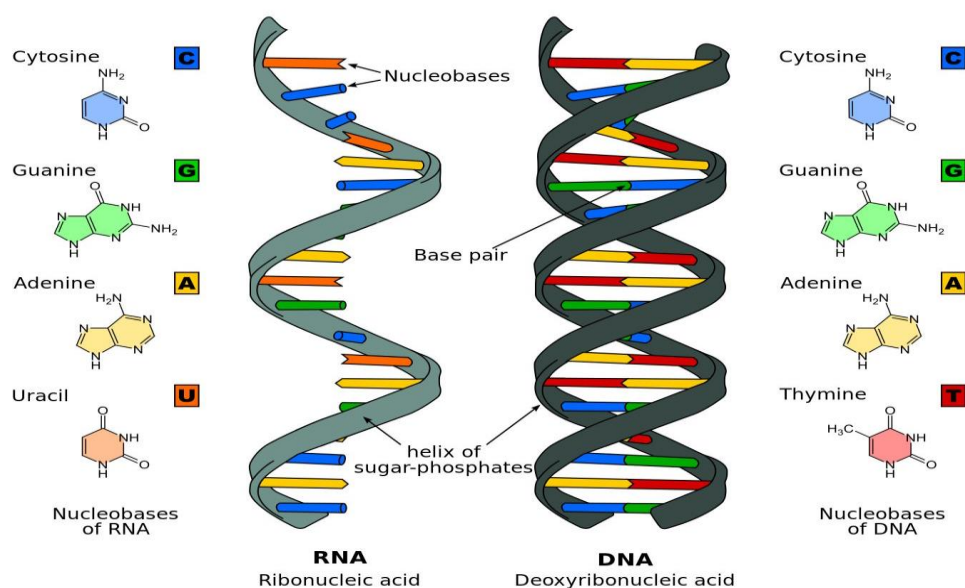
**Functional group:** amines, ammonias, carboxyl's and 20 remainder groups.

- ✓ Proteins are another class of indispensable biomolecules, which make up around 50 per cent of the cellular dry weight.
- ✓ Proteins are polymers of amino acids arranged in the form of polypeptide chains.
- ✓ The structure of proteins is classified as primary, secondary, tertiary and quaternary in some cases.
- ✓ These structures are based on the level of complexity of the folding of a polypeptide chain.
- ✓ Proteins play both structural and dynamic roles. Myosin is the protein that allows movement by contraction of muscles.
- ✓ Most enzymes are protein in nature.



## 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.
- ✓ The monomeric unit of nucleic acids is known as nucleotide and is composed of a nitrogenous base, pentose sugar, and phosphate.
- ✓ The nucleotides are linked by a 3' and 5' phosphodiester bond.
- ✓ The nitrogen base attached to the pentose sugar makes the nucleotide distinct.
- ✓ There are 4 major nitrogenous bases found in DNA: adenine, guanine, cytosine, and thymine. In RNA, thymine is replaced by uracil.
- ✓ The DNA structure is described as a double-helix or double-helical structure which is formed by hydrogen bonding between the bases of two antiparallel polynucleotide chains.
- ✓ Overall, the DNA structure looks similar to a twisted ladder.

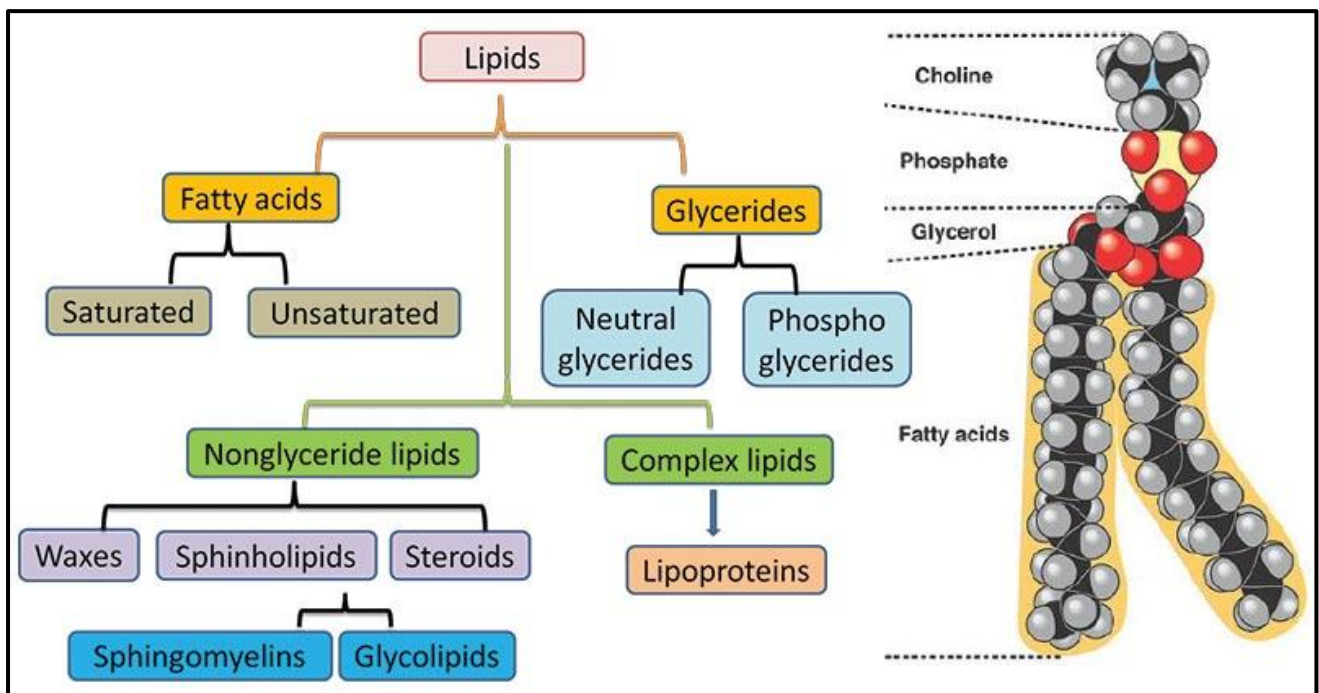


# Lipids:

**Linkages: Ester linkages**

**Functional group: esters, carboxyls, hydroxol, and hydrocarbons**

- ✓ Lipids are organic substances that 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.
- ✓ Unlike carbohydrates, proteins, and nucleic acids, lipids are not polymeric molecules.
- ✓ Lipids play a great role in the cellular structure and are the chief source of energy.



## Classification and Types of lipids



## Other biomolecules are metabolites & natural products.

**A metabolite** refers to any substance produced by metabolism or by a metabolic process. Examples of metabolites are alcohols, amino acids, antioxidants, nucleotides, organic acids, vitamins, polys, alkaloids, terpenoids, etc.

**Natural products** include biologically-derived materials, bio-based materials, and bodily fluids.

