BIOMOLECULES

BIOMACROMOLECULES

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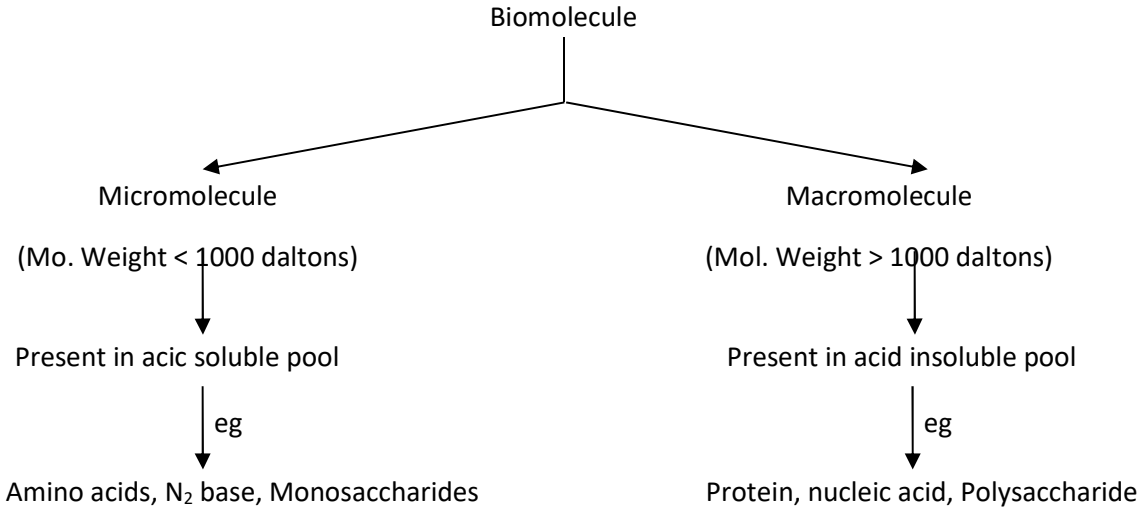
- Macromolecules are larger in size.
- Complex in structure with high molecular weight.
- Low solubility.
- These are formed by polymerization of micromolecules.
- Found mostly in colloidal form
- Organic in nature
- Can-not pass through the membrane, therefore, every cell has to produce its own macromolecules, e.g., Proteins, Nucleic acids and Polysaccharides (formed by condensation of amino acids, nucleotides and monosaccharide's respectively).

HOW TO ANALYSE CHEMICAL COMPOSITION

- Various biomolecules present in a living tissue (like a vegetable or a piece of liver) can be studied by their chemical analysis.
- Take a living tissue and grind it in trichloroacetic acid (Cl_3CCOOH) using a mortar and pestle. We obtain a thick slurry.
- When we strain this slurry through cheese cloth or cotton, it gives two fractions.
- One is called filtrate or acid soluble pool having thousands of organic compounds.
- Other fraction is called retentate or acid insoluble pool containing proteins, nucleic acid, polysaccharides etc.
- The acid soluble pool contains chemicals with small molecular mass of 18-800 daltons approximately. They are called macromolecules or biomicromolecules. They include amino acids, sugars, nucleotides etc.
- The acid-insoluble fraction contains organic compounds that have molecular weights in the range of ten thousand Daltons and above. They are known as macromolecules or biomacromolecules. They include polysaccharides, proteins, nucleic acids .

- Lipids are not strictly macromolecules, their molecular weight do not exceed 800 Da, but they come under the macromolecular fraction because when we grind a tissue, cell membrane and other membranes are broken into pieces and form vesicles which are not water soluble (lipids are also present in structures like cell membrane and other membranes).
- The acid-soluble fraction represents roughly the cytoplasm composition (without organelles), while the acid insoluble fraction represents the macromolecules of the cytoplasm and cell organelles. The two fractions together represent the entire chemical composition of living tissues or organisms.
- Biomolecule → All the carbon compound that present in living tissue.



Special note: Lipids are micro molecules but obtained under, macromolecular fraction due to their insoluble nature in aqueous medium of a cell.

TABLE : AVERAGE COMPOSITION OF CELLS

Component	% of the total cellular mass
Water	70-90
Proteins	10-15
Carbohydrates	3
Lipids	2

Nucleic acids	5-7
Ions	1

All carbon compounds that we get from living tissue can be called - Biomolecules.

- Inorganic elements and compounds are also present in the living organisms which can be known with the help of 'ash' analysis technique.
- A small amount of a living tissue (e.g. Leaf or liver and this is called wet weight) is weighed and dried. All the water evaporates.
- When the tissue is fully burnt, the carbon compounds are oxidised to gaseous form like CO_2, water vapour are removed and the remnant is called 'ash'. This ash contains many inorganic elements like calcium, magnesium etc.
- In the acid-soluble fraction - inorganic compounds like sulphates, phosphates etc are also present.
- Elemental analysis gives composition of living tissue in the form of O. C. H, N etc.
- Analysis of compounds gives an idea of the kind of organic and inorganic constituents as maintained in the table.

Table : A list of representative inorganic constituents of living tissues.

Component	Formula
Sodium	Na^+
Potassium	K^+
Calcium	Ca^{++}
Magnesium	Mg^{++}
Water	H_2O
Compounds	NaCl, $CaCO_3$, PO_4^{3-}, SO_4^{2-}

- From a biological point of view we can classify the bio molecules into micromolecules and macromolecules.
- Water is the most abundant chemical in living organisms.