BIOMOLECULES

Biomolecules are the chemical compound found in living organism, involved in the maintenance and metabolic process of living organism.

Cells are basic structural and functional units of living organisms, are highly organized and constant source of energy, required to maintain the life.

Biochemical organization of Cell: Atoms are organized into molecules, molecules into organelles, organelles into cells, cell organized to form tissue, tissue organized to form organ, organ to organ system and organ system organized to form organism.

Biomolecules are defined as any organic molecule present in a living cell. Biomolecules are mainly composed of major six elements, **carbon, hydrogen, oxygen and nitrogen, sulphur and phosphorus**. The next major elements are sodium, chlorine, potassium, calcium and magnesium. These make up to 3-5 % of living thing. Trace elements present at low level (1%) of living cell includes iron, iodine, manganese, molybdenum, selenium, silicon, tin, vanadium, boron, chromium, cobalt, copper and fluorine.

Each Biomolecules is essential for body functions. They have wide range of size, structure and perform various types of function.

The four major types of Biomolecules are:

1. **CARBOHYDRATES**
2. **LIPIDS**
3. **PROTEIN**
4. **NUCLEIC ACID**

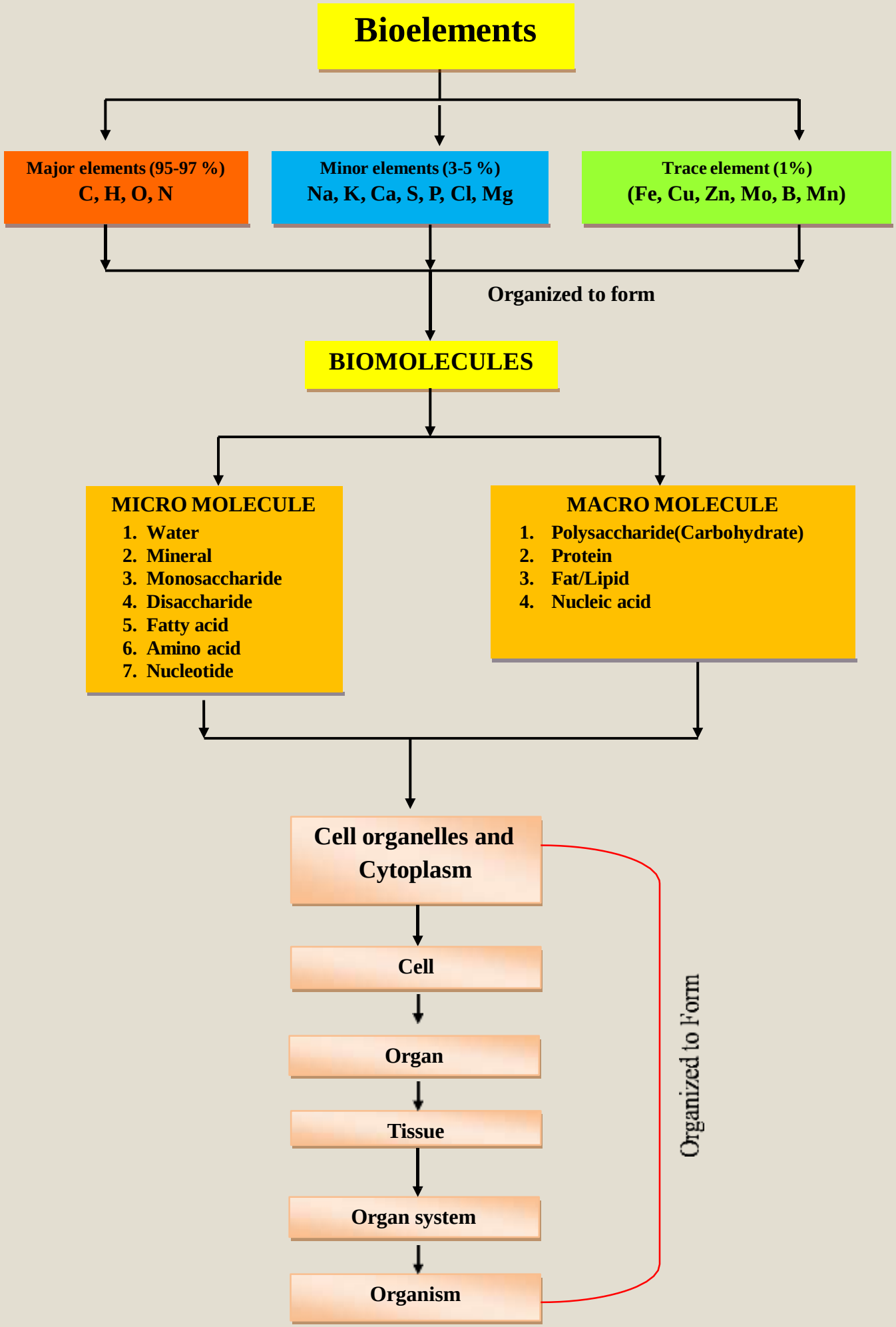

Figure1: Biochemical organization of cell

NUCLEIC ACID

Nucleic acid is a complex organic substance present in living cells, especially DNA or RNA, whose molecules consist of many nucleotides linked in a long chain.

Nucleic acids are the Biomolecules that allow organisms to transfer genetic information from one generation to the next. Nucleic acids are long-chain polymeric molecules, the monomer of nucleotides. Nucleic acids are also referred to as polynucleotides.

Nucleotides contain three parts

a. A Nitrogenous Base
b. A Five-Carbon Sugar
c. A Phosphate Group

Nucleotide = Nitrogenous base + Sugar (5C) + PO_4 group

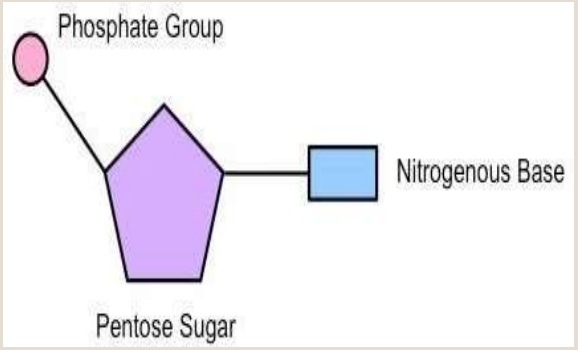

Figure 1: Nucleotide

Nucleotides are linked together to form polynucleotide chains. Nucleotides are joined to one another by covalent bonds between the phosphate of one and the sugar of another. These linkages are called phosphodiester linkages.

Nucleic acid base are of two types

1. Purine: Adenine and Guanine
2. Pyrimidine: Cytosine and Thymine (in DNA)/ Uracil (in RNA)

TWO MAJOR TYPES OF NUCLEIC ACID:

1. **Deoxyribonucleic acid (DNA)**: DNA is a more stable double stranded form that stores the genetic blueprint for cell.
2. **Ribonucleic acid (RNA):** RNA is a more versatile single stranded form that transfers the genetic information for decoding

DNA and RNA are responsible for the inheritance and transmission of specific characteristics from one generation to the other. Phosphodiester linkages form the sugar-phosphate backbone of both DNA and RNA.

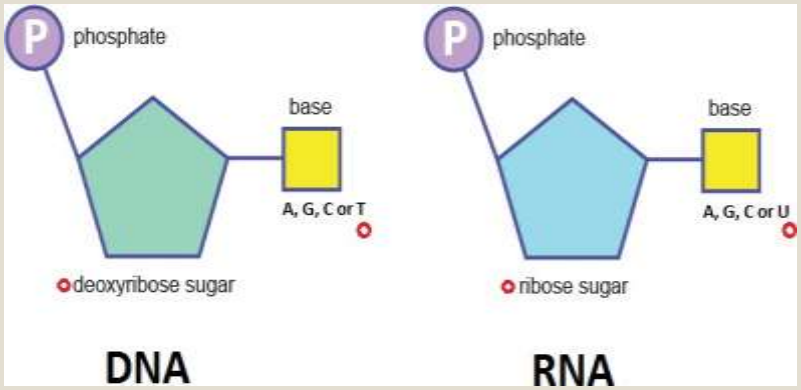

Figure 2: DNA and RNA

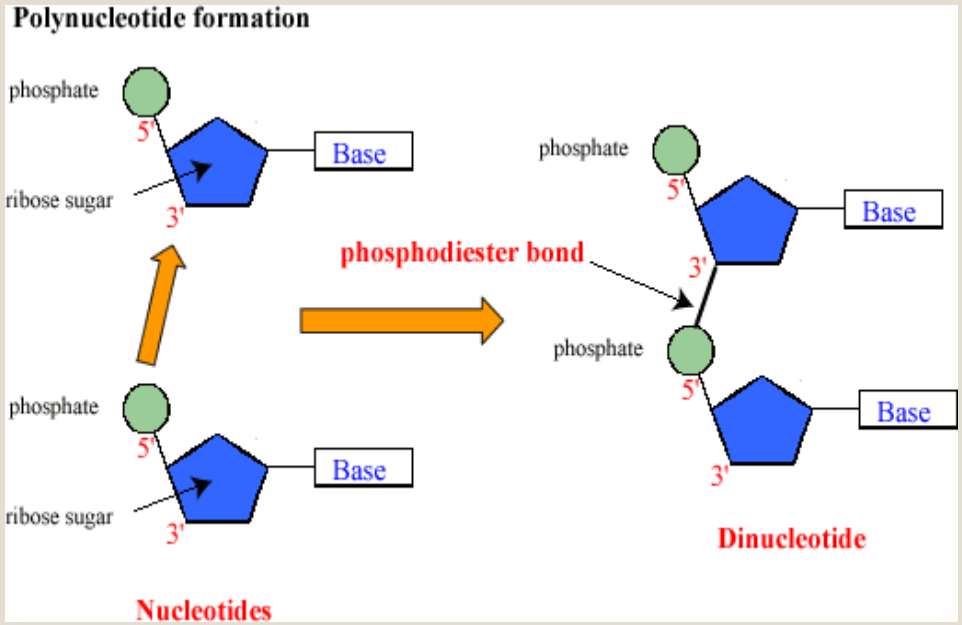

Figure 3: Formation of polynucleotide

Deoxyribonucleic Acid (DNA)

DNA is composed of a phosphate-deoxyribose sugar backbone and the nitrogenous bases adenine (A), guanine (G), cytosine (C) and thymine (T). DNA is composed of a pentose sugar, phosphoric acid and some cyclic bases containing nitrogen.

Nitrogenous Bases: Adenine, Guanine, Cytosine, and Thymine

Five-Carbon Sugar: β-D-2-deoxyribose.

These bases and their arrangement in the molecules of DNA play an important role in the storage of information from one generation to the next one. DNA has a double strand helical structure in which the strands are complementary to each other. In double stranded DNA, adenine pairs with thymine (A-T) and guanine pairs with cytosine (G-C).

Ribonucleic Acid (RNA)

RNA is composed of a phosphate-ribose sugar backbone and the nitrogenous bases adenine (A), guanine (G), cytosine (C) and uracil (U). RNA most commonly exists as a single stranded molecule. In RNA the fourth base is different from that of a DNA.

Nitrogenous Bases: Adenine, Guanine, Cytosine, and Uracil

Five-Carbon Sugar: β-D-ribose

There are three types of RNA molecules, each having a specific function:

1. Messenger RNA (m-RNA)
2. Ribosomal RNA (r-RNA)
3. Transfer RNA (t-RNA)

1. Messenger RNA (mRNA): Encodes amino acid sequence of a polypeptide. Messenger RNA is translated to form proteins.
2. Transfer RNA (tRNA): Brings amino acids to ribosomes during translation of mRNA in protein synthesis.
3. Ribosomal RNA (rRNA) is a component of ribosomes and is also involved in protein synthesis.

BIOLOGICAL ROLE OF NUCLEIC ACID

1. Nucleic acids are responsible for the transmission of inherent characters from parent to the offspring.

2. DNA is organized into chromosomes and found within the nucleus of our cells. It contains the "programmatic instructions" for cellular activities. When organisms produce offspring, these instructions in are passed down through DNA. DNA commonly exists as a double stranded molecule with a twisted double helix shape.

3. It has also played a major role in studies regarding biological evolution and genetics. DNA is the cellular molecule that contains instructions for the performance of all cell functions.

4. DNA fingerprinting is a method used by forensic experts to determine paternity. It is also used for identification of criminals.

5. RNA is essential for the synthesis of proteins. Information contained within the genetic code is typically passed from DNA to RNA to the resulting proteins. There are several different types of RNA.

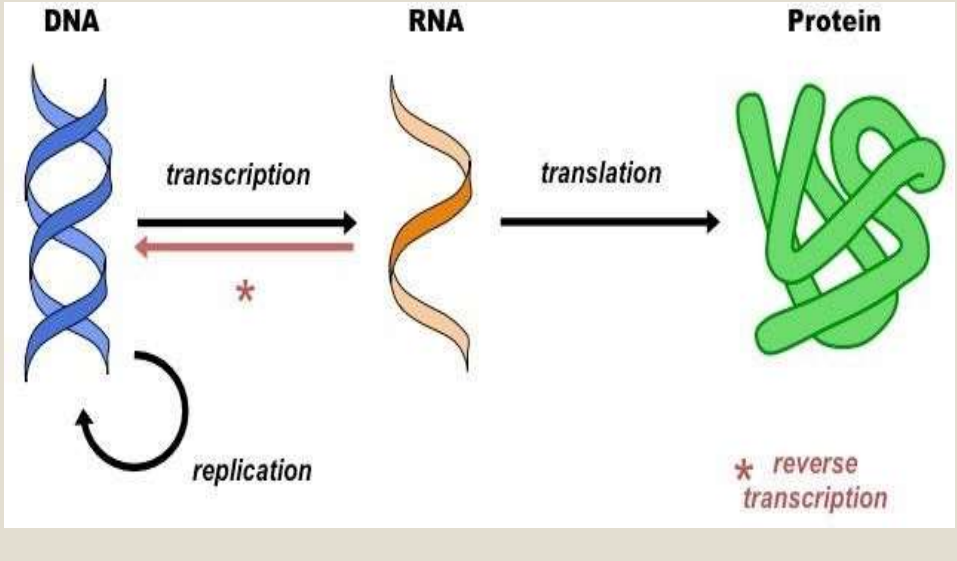

Figure 4 : Central Dogma of life