The Living World

Building blocks of life and their functions:

Living organism is formed of many types of inorganic as well as organic biomolecules. Inorganic compounds include water, minerals etc. and are always micro-biomolecules (small sized, low molecular weight, readily soluble in water and diffusible) while organic molecules may be micro (e.g. monosugars, amino acids etc.) or macro biomolecules (large sized, high molecular weight, insoluble or slightly soluble and non-diffusible e.g., proteins, fats, nucleic acids, etc.). These both types of biomolecules play important roles in metabolism:

- **Role of Water:** Water forms 70-90% of the cellular pool. It forms 65% of human body. It is formed of H and O in the ratio of 2:1. 95% of water is found in free state and 5% in combined form in the cell.
- **Role of Oxygen:** Oxygen is mainly utilized in aerobic cell respiration of the nutrients inside the mitochondria to produce energy-rich ATP molecules so is essential for life. In the absence of oxygen, only 5% of energy available is released.
- **Role of Sodium chloride (common salt):** Sodium chloride plays an important role in metabolic functions of body especially when in ionic form.
- **Role of Carbohydrates:** Carbohydrates are organic compounds formed of C, H and O generally in the ratio of 1:2:1. These are commonly called saccharides (Gk. saccharon = sugar). Most organisms use carbohydrates as an important fuel, breaking these bonds and releasing energy to sustain life.
- **Role of Proteins:** Proteins are polymeric compounds formed by interlinking of amino acids (monomers) by peptide bonds. Out of about 100 types of amino acids, only 20 types of amino acids are of biological importance. Proteins play a vital role in the formation of structures in living organisms. Like carbohydrate and fat protein can be broken down with the release of energy.
- **Role of lipids:** Lipids comprise a major group of insoluble hydrocarbons having many functions. These are polymers of alcohols (e.g. glycerol) and fatty acids interlinked by ester bonds. Complex lipids such as true fats are important organic molecules that are used to provide energy.

- **Role of Nucleic Acid:** These are polymers of nucleotides interlinked by phosphodiester bonds, so called polynucleotides. Each nucleotide is formed of 3 components: a pentose sugar (e.g. ribose in RNA and deoxyribose in DNA), a phosphate group and an inorganic nitrogen-base (a purine or a pyrimidine).

DNA acts as genetic material in most organisms and controls the synthesis of structural and. functional proteins. RNA also act as genetic material in all plant viruses e.g. TMV and helps in protein synthesis.

Systematics

1. The term 'Systematics' was proposed by Linnaeus in 1735.
2. It includes description of external morphological characters of plants or living organisms. E.g., morphological characters of root, stem, leave, flowers.
3. New systematics or Neo systematics or Biosystematics is a new branch. Its name was given by Julian Huxley (1940).
4. The term taxonomy was coined by A. P. de Candolle.
5. Carolus Linnaeus is called the father of taxonomy.
6. H. Santapau is called the father of Indian taxonomy. **Alpha taxonomy**- Only morphological characters are used for identification and classification of plants. Beta taxonomy- Involves genetical, anatomical, cytological, palynological, physiological and other characters. Omega taxonomy- Analysis and synthesis of all information and types of data to develop classification system based on phylogenetic relationship.
7. **Cytotaxonomy** – The use of cytological characters of plants in classification or in solving taxonomic problems is called cytotaxonomy.
8. **Chemotexonomy** – The use of chemical compounds present in plants for classification or in solving taxonomic problems is called chemotaxonomy or chemical taxonomy. The basic chemical compounds used in chemotaxonomy are alkaloids, carotenoids, tannins, etc.
9. **Karyotaxonomy** – It is based on the characters of nucleus and chromosomes. Pattern of chromosomal bands is most specific character for classification of organisms.

Nomenclature

1. Nomenclature is giving distinct scientific names to various structures including living organisms for their identification.

2. The names are of two types – vernacular (common name) and scientific names.

3. Types of Nomenclature - Polynomials nomenclature Binomial nomenclature Trinomial nomenclature

4. Carolus Linnaeus is the founder of binomial system.

5. Linnaeus proposed scientific names in his book "Species planatarum".

6. In binomial nomenclature, each scientific name has 2 components – generic name (genus) and specific name(species). Eg. Solanum tuberosum (potato).

ICBN-"International Code of Botanical Nomenclature"

1. Collection of rules regarding scientific nomenclature of plants.

2. ICBN was first proposed by Sprague, Hitchcock, Green (1930).

3. ICBN was first accepted in 1961.

Main rules of ICBN

- Name of any species consists of two names – Generic name and Specific name.
- In plant nomenclature, tautonyms are not valid i.e. generic name and specific name cannot be the same e.g., Magnifera indica. But tautonyms are valid for animal nomenclature e.g., Naja naja (Indian cobra).
- Length of genus or species should not be less than 3 letters and not more than 12 letters e.g., Magnifera indica. Exception: Riccia pathankotensis
- First letter of genus should be in capital letters and first letter of specific name should be in small letter.
- Name of scientist (who proposed nomenclature) should be written in roman in short after the specific name e.g., Magnifera indica Lin.
- If any scientist has proposed wrong name then his name should be written in bracket and the scientist who corrected the name should be written after the bracket e.g., Tsuga canadensis (Lin.) Salisbury.

Type specimen (herbarium sheet) are of different types- Holotype: Herbarium sheet on which the first description of plant is based.

Isotype: Isotype is any duplicate specimen of the holotype.

Lectotype: In case holotype is lost, second herbarium sheet prepared from the original plant is called lectotype.

Isolectotype: Isolectotype is any duplicate specimen of the lectotype.

Syntype: In case holotype and original plant is lost then many herbarium sheet prepared from many plants of same species is called syntype.

Isosyntype: It is a duplicate specimen of a syntype.

Neotype: In case holotype and original plant is lost then herbarium sheet prepared from other plants of same species is called neotype.

Isoneotype: any duplicate specimen of the neotype.

Paratype: Additional description sheet used in the first description of plant is called paratype. It is prepared from some other plant of same species having some variations.

Taxonomic categories

a. Species b. Genus c. Family d. Order e. Class

f. Phylum g. Kingdom