THE LIVING WORLD

Life can be defined as a unique aggregation of molecules. These molecules have the tendency to express themselves through various chemical reactions collectively called metabolic reactions. The basic purpose of these reactions is to transform or produce and utilize energy. The term used to define these reactions in a cumulative way is metabolism. Through metabolism, various biomolecules are synthesized resulting in growth, development, responsiveness, adaptations and reproduction. The forms that possess and express all these features are called living beings.

These living beings live in almost all possible habitats like forests, mountains, deserts, oceans, freshwater bodies, hot springs, polar regions etc.They are linked to one another by sharing the common genetic material.

All living beings share characteristics like organization, energy utilization, regulation or homeostasis, growth, development, reproduction and adaptation.

1.1 WHAT IS GROWING

Life has maintained certain fixed properties that life exhibits today and are very different from those that were present at its origin.

Characteristics of living organisms:

The most outstanding features that have arisen during life's history include

- Growth
- Reproduction
- Ability to sense environment
- Metabolism
- Cellular organization
- Consciousness.

1. GROWTH: It is the increase in number & mass of cells by cell division.

All living organisms have the capacity to grow.

Growth of an individual organism has two characteristics-

1. Increase in body mass

2. Increase in number.

In plants, growth occurs continuously throughout their lifespan. In animals, growth is only up to a certain age. However, cell division occurs to replace lost cells.

Unicellular organisms also grow by cell division.

Non-living objects grow by accumulation of material (increase in mass) on the surface.

For example: mountains, boulders, sand mounds etc. So growth cannot be taken as a defining property of living organisms alone. A dead organism does not grow.

2. REPRODUCTION:

In living organisms reproduction means the formation of new individuals from their parents.

Fungi multiply and spread easily by producing millions of asexual spores. Hydra and yeast multiply by budding. Planaria, a flat worm regenerates the lost part of its body and become a new one.

Filamentous algae, protonema of mosses and fungi also multiply by fragmentation.
In unicellular organisms reproduction is synonymous with growth, i.e., increase in number of cells. Therefore in unicellular organisms, there is no distinction in the usage of the terms growth and reproduction.
Many organisms do not reproduce - e.g. mules, worker bees, infertile human couples, etc. Hence, reproduction is not a perfect defining characteristic of living organisms.

3. METABOLISM:

A variety of biochemical changes are constantly occurring in a living organism leading to formation and interconversion of chemicals. All the chemical reactions taking place in our body come under metabolism. Non-living things do not metabolise. All living organisms show metabolism. However, metabolic reactions can be mimicked under *in vitro* conditions.

4. CELLULAR ORGANIZATION:

All living organisms are made up of cells. The cells perform all functions in the organism. Non-living things do not have a cellular organization. Therefore, it can be seen that a cellular organization gives rise to the functions of life-like metabolism, growth, reproduction, etc. Thus cellular organization is a defining characteristic of living organisms.

5. CONSCIOUSNESS:-

It is the awareness of one's environment, actions and intentions. It is present in living organisms. Human beings sense the environment through sense organs. Plants respond to external factors like light, temperature, water, pollutants, other organisms etc. In both plants and animals, photoperiod (duration of light) affects the reproduction in seasonal breeders.
Therefore, all organisms are 'aware' of their surroundings. So, it is the defining property of living organisms.
Human is the only organism having **self-consciousness i.e. aware of himself. Therefore consciousness is the defining property of living organisms.**
All living organisms are linked to one another by the sharing of common genetic material to varying degree.

1.2DIVERSITY IN THE IVING WORLD:

Earth provides the physical base for living beings. There are millions of varieties of living organisms in the world around us. There are also many organisms that we cannot see with our naked eye around us. They are found in varied habitats like mountains, oceans, forests, lakes, deserts and even hot water springs.
Number of species identified and studied is **1.7-1.8 million.**
All organisms which live on earth together make up the natural diversity of life in the world. This natural diversity of life on earth is generally called biological diversity or biodiversity.

Taxonomy: The systematic arrangement of organisms that includes characterization, identification, nomenclature, and classification of organisms is called taxonomy. Systematics is a branch of science that deals with identification, nomenclature, classification and evolutionary history of an organism. Thus systematics includes evolutionary history along with taxonomic characteristics of an organism. Systematics is as old as human civilization. **The term taxonomy was first introduced by A.P de Candolle in 1813.**

Systematics (Latin 'systema') means systematic arrangement of organisms.
Systema Naturae is the book written by Linnaeus.
Neosystematics is a concept of systematics that considers a species to be the product of evolution. This concept was developed by Julia Huxley in 1940.It takes into consideration all the known characteristics of organisms and all the known evidences from different fields of biology.

Identification: is to determine the exact place or position of an organism in the set plan of classification. It is carried out with the help of taxonomic keys.
Classification: It is the placing of an organism or a group of organisms in category according to a particular system and in conformity with a nomenclature system.
Characterization: The understanding of characters of organisms like external and internal structure (morphology and anatomy), the structure of the cell (cytology), developmental process (embryology) and ecological information (ecology) of organism.

Nomenclature (naming): The naming of living organisms is called nomenclature. The names are of two types-vernacular (common names) and scientific names.
Local names-Locally used names are called as local names. Local names are in local languages or common language. Local names are easy to use by local people, but these local names cannot be used by biologists due to the following draw backs.

- 1. A single local name is often used for many species.
- 2. The local names sometimes lead incorrect meaning about the organism.
- 3. Different local names are used to recognize an organism in different regions of country or world. These local names also vary with the language.

Scientific names: These are the names given to the organisms by biologists based on agreed principle and criteria. These are acceptable all over the world. To accomplish this, certain international codes have been established.
These codes are

- **ICBN-International Code of Botanical Nomenclature**
- **ICZN-International Code of Zoological Nomenclature**
- **ICVN-International Code of Viral Nomenclature**

ICBN/ICNB-International Code for Bacteriological Nomenclature or Nomenclature of Bacteria
BINOMIAL NOMENCLATURE:
Carolus Linnaeus used this nomenclature system for the first time and proposed scientific name of all the plants and animals. He is the founder of binomial system.
Linnaeus proposed scientific name of plants in his book" Species plantarum"
In binomial nomenclature, each scientific name has two components-generic name (genus) and specific name (species) E.g., *Mangifera indica* Linn. Mangifera is the genus name and indica is the species name. Linn indicates that this species was first described by Linnaeus
Who can give scientific names: Any one can study, describe, identify and give name to an organism provided certain universal rules are followed.
Rules:

1. A scientific name generally has two components (words) in Latin or derived from Latin irrespective of their origin.
2. First word of the biological name denotes the genus name where as the second one denotes for species.
3. Names are printed in italics or when hand written they are separately underlined to indicate their Latin origin.

4. Genus name starts with capital letter and specific name starts with small letter.
5. The name of the author is written in an abbreviated form after the species name and it is printed in Roman.
6. Each taxonomic group can have only one correct name.
7. The name should be short, precise and easy to pronounce.

Eg: *Mangifera indica*- Mangifera is the genus name and indica is the species name.

1.3 TAXONOMIC CATEGORIES:

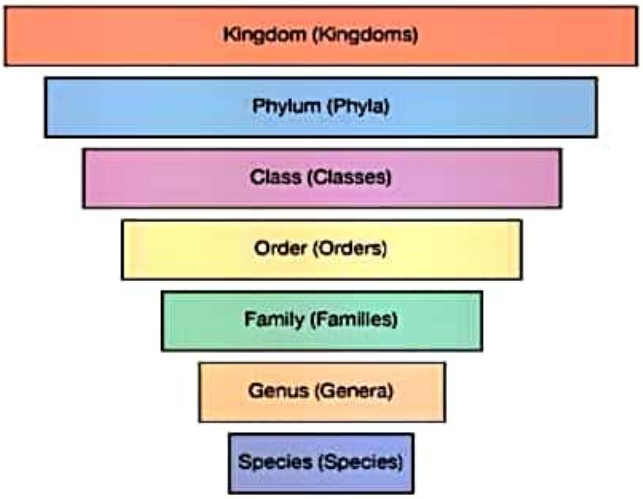
The term taxon was introduced for the first time by ICBN in 1956.**Mayr in 1964 defined Taxon as a taxonomic group of any rank that is sufficiently distinct to be worthy of being assigned a definite category.**

TAXONOMIC HIERARCHY:

The system of arranging organisms in a definite sequence of various taxonomic categories arranged in a proper descending order is called taxonomic hierarchy. It is also called Linnaean hierarchy as it was first proposed by **Carolus Linnaeus, the Father of Systematic Botany**. The hierarchy includes seven obligate categories.

They are as follows-

Kingdom - Animalia
↑
Phylum - Chordata
(Division in case of plants)
↑
Class - Mammalia
↑
Order - Primata
↑
Family - Hominidae
↑
Genus - Homo
↑
Species – sapiens



1.3.1 Species:

The lowest taxon or category in the biological classification is the species. So the basic unit of taxonomy is species. So the basic unit of taxonomy is species. **Species is a group of individuals resembling one another in all major vegetative and reproductive characteristics**. The individuals of a species resemble so closely

that they may be regarded as having been derived from the same parents. **In 1964, Ernst Mayr defined species as a group of potentially interbreeding populations that are reproductively isolated from other such groups.**
The term species was first introduced by **John Ray.**
Eg: sapiens

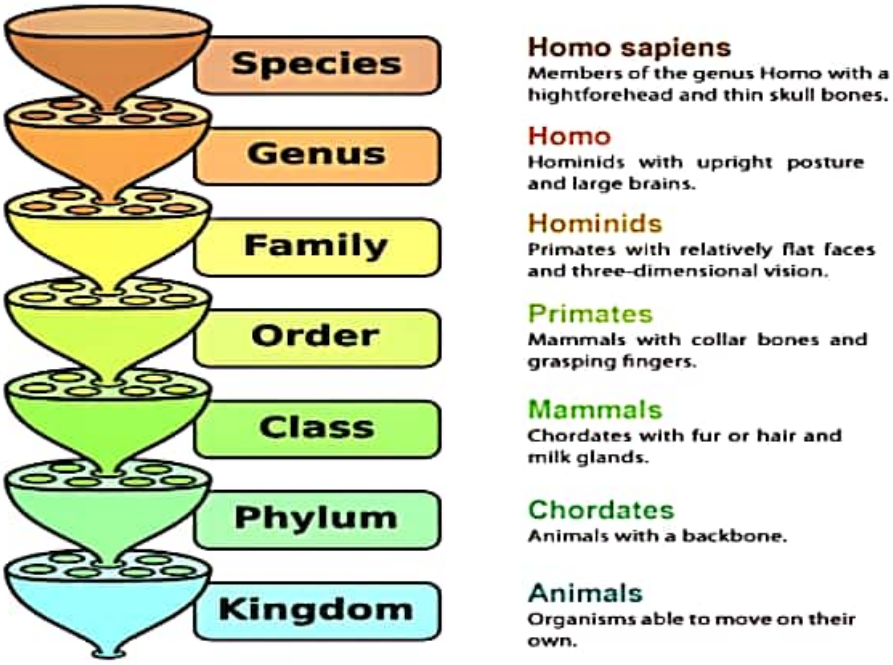
1.3.2Genus: A group of related species. All the species in a genus have many common characteristics and all have evolved from a common ancestor.
E.g.: Homo

1.3.3 Family: A family is an assemblage of related genera.
E.g.: Hominidae

1.3.4 Order or Cohort: An order is a group of related Families.
E.g.: Primata

1.3.5 Class: Several related orders having certain common characters form a higher category called the class.
E.g.: Mammalia
1.3.6 Phylum/Division:
Classes having same features in common constitute a Phylum. The term **phylum is used in the case of classification of animals and the term division is used in plant classification**.
E.g.: Chordata

1.3.7 Kingdom:
The highest taxon or category in biological classification is the Kingdom. It includes one or more related divisions or phyla. Plants are put in Kingdom Plantae and animals are put in the Kingdom Animalia.
E.g.: Plantae, Animalia.



Generic name	Specific epithet	Common name
Mangifera	*indica*	Mango