CHAPTER 1

The Living World

Distinctive characteristics exhibited by living organisms –

- Growth,
- Reproduction,
- Ability to sense environment and mount a suitable response,
- Metabolism,
- Ability to self-replicate,
- Self-organise,
- Interact and
- Emergence.

Growth –

Increase in mass and **increase in number of individuals** are twin characteristics of growth.
A multicellular organism grows by cell division.
In plants, this growth by cell division occurs continuously throughout their life span while in animals, this growth is seen only up to a certain age.
Unicellular organisms also grow by cell division.
Non-living objects also grow if we take increase in body mass as a criterion for growth. However, this kind of growth exhibited by non-living objects is by accumulation of material on the surface while in living organisms, growth is from inside.
Growth, therefore, cannot be taken as a defining property of living organisms.

Reproduction –

In multicellular organisms, reproduction refers to the production of progeny possessing features more or less similar to those of parents.
Organisms reproduce by sexual and asexual means.
Some methods of asexual reproduction –

Spores – Fungi.
Budding – yeast and hydra.
True regeneration – *Planaria* (flat worms).
Fragmentation – The fungi, the filamentous algae, the protonema of mosses.

In unicellular organisms, reproduction is synonymous with growth.
there are many organisms which do not reproduce (mules, sterile worker bees, infertile human couples, etc). Hence, reproduction also cannot be an all-inclusive defining characteristic of living organisms.

Metabolism –

The sum total of all the chemical reactions occurring in our body is metabolism.
All plants, animals, fungi and microbes exhibit metabolism.
Metabolic reactions can be demonstrated outside the body in cell-free systems. An isolated metabolic reaction(s) outside the body of an organism, performed in a test tube is neither living nor non-living.
Hence, while metabolism is a defining feature of all living organisms without exception, isolated metabolic reactions *in vitro* are not living things but surely living reactions.

Cellular organization –

Cellular organization of body is defining feature of all life forms as body of all living being consist of cell(s).
Cell is smallest independent possible unit of life which can sustain itself.

Ability to sense environment and mount a suitable response –

the most obvious and technically complicated feature of all living organisms is this ability to sense their surroundings or environment and respond to these environmental stimuli.
We sense our environment through our sense organs.
All organisms, from the prokaryotes to the most complex eukaryotes can sense and respond to environmental cues.
All organisms are aware of their surroundings.
Human being is the only organism who is aware of himself, i.e., has self-consciousness.
Consciousness therefore, is the defining property of living organisms.

All living phenomena are due to underlying interactions. Properties of tissues are not present in the constituent cells but arise as a result of interactions among the constituent cells. Similarly, properties of cellular organelles are not present in the molecular constituents of the organelle but arise as a result of interactions among the molecular components comprising the organelle.
These interactions result in emergent properties at a higher level of organisation. This phenomenon is true in the hierarchy of organizational complexity at all levels.
Therefore, we can say that **living organisms are self-replicating, evolving and self-regulating interactive systems capable of responding to external stimuli.**

Diversity In The Living World

Our earth has high bio-diversity as it has about 1.7-1.8 million species.
Different organisms are known by their local names in different areas so there is a need to standardise the naming of living organisms such that a particular organism is known by the same name all over the world. This process is called **nomenclature**.
Nomenclature or naming is only possible when the organism is described correctly and we know to what organism the name is attached to. This is **identification.**
For plants, scientific names are based on agreed principles and criteria, which are provided in **International Code for Botanical Nomenclature (ICBN).**
For animal there is **International Code of Zoological Nomenclature (ICZN).**
The scientific names ensure that each organism has only one name.

Universally accepted principles to provide scientific names –

- Each name has two components – the **Generic name** and the **specific epithet**. This system of providing a name with two components is called **Binomial nomenclature** - given by Carolus Linnaeus.
  e.g., mango – *Mangifera indica*. (*Mangifera* – genus name, *indica* – species epithet).
- Biological names are generally in Latin and written in italics.
- Both the words in a biological name, when handwritten, are separately underlined, or printed in italics to indicate their Latin origin.
- The first word denoting the genus starts with a capital letter while the specific epithet starts with a small letter.
- Name of the author appears after the specific epithet, i.e., at the end of the biological name and is written in an abbreviated form, e.g., *Mangifera indica* Linn.

Classification is the process by which anything is grouped into convenient categories based on some easily observable characters.
The scientific term for these categories is **taxa**.
All living organisms can be classified into different taxa. This process of classification is **taxonomy**.
External and internal structure, along with the structure of cell, development process and ecological information of organisms are essential and form the basis of modern taxonomic studies.
characterisation, identification, classification and nomenclature are the processes that are basic to taxonomy.
The branch of study of knowing more about different kinds of organisms, their diversities and the relationships among them is known as **systematics**.
Linnaeus used *Systema Naturae* as the title of his publication.

Taxonomic Categories

Classification involves hierarchy of steps in which each step represents a rank or category. Since the category is a part of overall taxonomic arrangement, it is called the **taxonomic category** and all categories together constitute the **taxonomic hierarchy**.

Each category, referred to as a unit of classification, represents a rank and is commonly termed as **taxon.**
Species → Genus → Family → Order → Class → Phylum or Division → Kingdom

Common Name	Biological Name	Genus	Family	Order	Class	Phylum/ Division
Man	*Homo sapiens*	*Homo*	Hominidae	Primata	Mammalia	Chordata
Housefly	*Musca domestica*	*Musca*	Muscidae	Diptera	Insecta	Arthropoda
Mango	*Mangifera indica*	*Mangifera*	Anacardiaceae	Sapindales	Dicotyledonae	Angiospermae
Wheat	*Triticum aestivum*	*Triticum*	Poaceae	Poales	Monocotyledonae	Angiospermae

TAXONOMICAL AIDS

Herbarium

Herbarium is a store house of collected plant specimens that are dried, pressed and preserved on sheets.
These specimens, along with their descriptions on herbarium sheets, become a store house or repository for future use.
The herbarium sheets also carry a label providing information about date and place of collection, English, local and botanical names, family, collector's name, etc.

Botanical Gardens

These specialised gardens have collections of living plants for reference.
Plant species in these gardens are grown for identification purposes and each plant is labelled indicating its botanical/scientific name and its family.
Some famous botanical gardens – Kew (England), Indian Botanical Garden, Howrah (India), National Botanical Research Institute, Lucknow (India).

Museum

Biological museums are generally set up in educational institutes such as schools and colleges.
Museums have collections of preserved plant and animal specimens for study and reference.

Zoological Parks

These are the places where wild animals are kept in protected environments under human care and which enable us to learn about their food habits and behaviour.

Key

Key is taxonomical aid used for identification of plants and animals based on the similarities and dissimilarities.
The keys are based on the contrasting characters generally in a pair called couplet.
It represents the choice made between two opposite options. This results in acceptance of only one and rejection of the other.
Each statement in the key is called a lead.
Separate taxonomic keys are required for each taxonomic category such as family, genus and species for identification purposes.
Keys are generally analytical in nature.

Flora, Manuals, Monographs, Catalogues

Flora contains the actual account of habitat and distribution of plants of a given area. These provide the index to the plant species found in a particular area.
Manuals are useful in providing information for identification of names of species found in an area.
Monographs contain information on any one taxon.
.