

CLASS 11
BIOLOGY

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UNIT-1
DIVERSITY IN THE WORLD

CHAPTER-1
THE LIVING WORLD

WHAT DEFINES A LIVING?

- **GROWTH**- increase in biomass.

Non living organisms like mountains, sand mounds, etc are also known to increase in their biomass via depositing more material on surface.

- **REPRODUCTION**- production of progeny.

Unfertile/sterile, mules (a hybrid) can not reproduce.

- **METABOLISM** – defined as sum of all chemical reactions occurring in an organism so as to synthesize one biomolecule from another.
- Similar chemical reactions can be performed in vitro too, although the reactions are similar but are outside the living system i.e; CELLULAR ORGANISATION. Hence, cellular organization becomes defining feature of living beings.
- **SELF CONSCIOUSNESS**- ability to sense their surrounding and response to stimuli.

When it comes to human beings, it is all the more difficult to define the living state. We observe patients lying in coma in hospitals virtually supported by machines which replace heart and lungs. The patient is otherwise brain-dead. The patient has no self-consciousness. Are such patients who never come back to normal life, living or non-living?

WHAT DEFINES A LIVING?

Living organisms are self-replicating, evolving and self-regulating interactive systems capable of responding to external stimuli.

The number of species that are known and described range between 1.7-1.8 million. This refers to biodiversity or the number and types of organisms present on earth.

NOMENCLATURE-

- Standardizes the name of the organism, that will be known same in the whole world.
- For naming a organism it is to be described and known correctly i.e; identification.
- However studying such wide range of organisms is a never ending task so a convenient way is to categorize on the basis of observable characters i.e; classification.

TAXONOMY-

- Taxonomy : Taxis = arrangement, nomos = law

Taxonomy includes study of following points-

(1) Identification : A process by which an organism is recognised from the other already known organisms and is assigned to a particular taxonomic group is called identification.

(2) Nomenclature : Naming of organisms according to international scientific rules is called nomenclature.

(3) Classification : A process by which any organism is grouped into convenient categories on the basis of some easily observable characters.

SYSTEMATICS-

- The word systematics is derived from the Latin word 'systema' which means systematic arrangement of organisms. Linnaeus used *Systema Naturae* as the title of his publication.
- Systematics include identification, nomenclature and classification and evolutionary relationships between organisms.

- For naming plants, scientific names are based on agreed principles and criteria which are provided in International Code for Botanical Nomenclature (ICBN).
- In a similar way, Animal taxonomists have evolved International Code of Zoological Nomenclature (ICZN).
- Biologists follow universally accepted principles to provide scientific names to known organisms. 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. This naming system given by Carolus Linnaeus is being practised by biologists all over the world.

BINOMIAL NOMENCLATURE-

Universal rules of nomenclature are as follows :-

1. Biological names are generally in Latin and written in italics. They are Latinised or derived from Latin irrespective of their origin.
2. The first word in a biological name represents the **genus** while the second component denotes the **specific epithet**.
3. Both the words in a biological name, **when handwritten**, are **separately underlined**, or **printed in italics** to indicate their Latin origin.
4. The first word denoting **the genus starts with a capital letter** while the **specific epithet starts with a small letter**.

Printed- *Mangifera indica*

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. It indicates that this species was first described by Linnaeus.

- Since it is nearly impossible to study all the living organisms, it is necessary to devise some means to make this possible. This process is classification.
- 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.

- A taxa can indicate categories at very different levels.
- ‘Plants’ – also form a taxa, ‘Wheat’ is also a taxa but they represent taxa at different levels.
- Based on characteristics, 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.

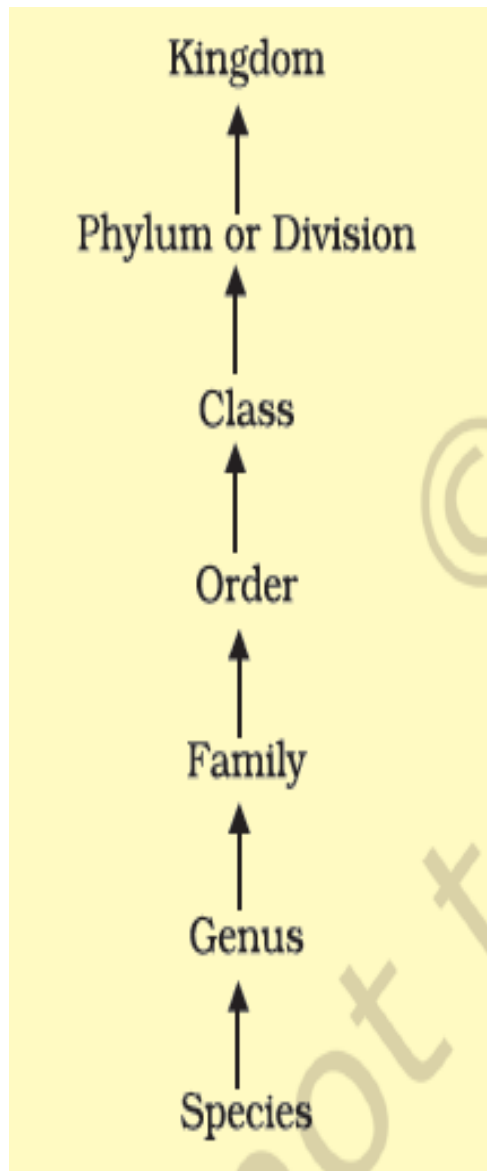
Point to remember- characterisation, identification, classification and nomenclature are the processes that are basic to taxonomy.

TAXONOMIC CATEGORIES-

- Classification is not a single step process but 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, in fact, represents a rank and is commonly termed as taxon (pl.: taxa).
- These taxonomic groups/ categories are distinct biological entities and not merely morphological aggregates.
- Taxonomical studies of all known organisms have led to the development of common categories such as kingdom, phylum or division (for plants), class, order, family, genus and species.

POINT TO REMEMBER - All organisms, including those in the plant and animal kingdoms have species as the lowest category.

Taxonomic categories and hierarchy can be illustrated by an example.



Classification of Mango :-

Taxonomic Categories	Kingdom	—	Plantae	Taxa (Sing. Taxon)
	Division	—	Angiospermae	
	Class	—	Dicotyledonae	
	Order	—	Sapindales	
	Family	—	Anacardiaceae	
	Genus	—	<i>Mangifera</i>	
	Species	—	<i>Mangifera indica</i>	

UNDERSTANDING DIFFERENT TAXONOMICAL CATEGORIES-

Species-

- Taxonomic studies consider a group of individual organisms with fundamental similarities as a species.
- One should be able to distinguish one species from the other closely related species based on the distinct morphological differences.

Genus-

- Genera are aggregates of closely related species.
- Genus comprises a group of related species which has more characters in common in comparison to species of other genera.
- For example, potato and brinjal are two different species but both belong to the genus *Solanum*.
- Lion (*Panthera leo*), leopard (*P. pardus*) and tiger (*P. tigris*) with several common features, are all species of the genus *Panthera*. **This genus differs from another genus *Felis* which includes cats.**
- Each genus may have one or more than one specific epithets representing different organisms, but having morphological similarities.

Family-

- Family has a group of related genera with still less number of similarities as compared to genus and species.
- Families are characterized on the basis of both vegetative and reproductive features of plant species.
- Among plants for example, three different genera *Solanum*, *Petunia* and *Datura* are placed in the family Solanaceae.
- Among animals for example, genus *Panthera*, comprising lion, tiger, leopard is put along with genus, *Felis* (cats) in the family Felidae.
- Similarly, if you observe the features of a cat and a dog, you will find some similarities and some differences as well. They are separated into two different families – Felidae and Canidae, respectively.

Order-

- Order and other higher taxonomic categories are identified based on the aggregates of characters. Order being a higher category, is the assemblage of families which exhibit a few similar characters.
- The similar characters are less in number as compared to different genera included in a family.
- Plant families like Convolvulaceae, Solanaceae are included in the order Polymoniales mainly based on the floral characters.
- The animal order, Carnivora, includes families like Felidae and Canidae.

Class-

- This category includes related orders. For example, order Primata comprising monkey, gorilla and gibbon is placed in class Mammalia along with order Carnivora that includes animals like tiger, cat and dog. Class Mammalia has other orders also.

Phylum-

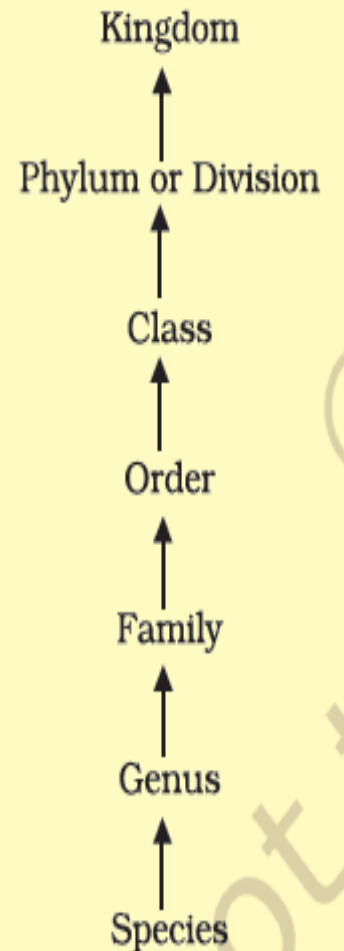
- Classes comprising animals like fishes, amphibians, reptiles, birds along with mammals constitute the next higher category called Phylum.
- All these, based on the common features like presence of notochord and dorsal hollow neural system, are included in phylum Chordata.
- In case of plants, classes with a few similar characters are assigned to a higher category called Division.

Kingdom-

- All animals belonging to various phyla are assigned to the highest category called Kingdom. Animalia in the classification system of animals. The Kingdom Plantae, all plants from various divisions.

The taxonomic categories from species to kingdom have been shown in ascending order starting with species in Figure

- These are broad categories. However, taxonomists have also developed sub-categories in this hierarchy to facilitate more sound and scientific placement of various taxa.



TAXONOMICAL AIDS-

Biologists have established certain procedures and techniques to store and preserve the information as well as the specimens. Some of these are explained to help you understand the usage of these aids.

Herbarium-

- Herbarium is a store house of collected plant specimens that **are dried, pressed and preserved on sheets.**
- Further, these sheets are arranged according to a universally accepted system of classification.
- 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.**
- Herbaria also serve as quick referral systems in taxonomical studies.

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.
- The famous botanical gardens are at Kew (England), Indian Botanical Garden, Howrah (India) and at 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**. Specimens are preserved in the containers or jars in preservative solutions.
- Plant and animal specimens may also be preserved as **dry specimens**.
- Insects are preserved in insect boxes after collecting, killing and pinning.
- Larger animals like birds and mammals are **usually stuffed and preserved**.
- Museums often have collections of skeletons of animals too.

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 behavior**.
- All animals in a zoo are provided, as far as possible, the **conditions similar to their natural habitats**.

Key-

- Key is another 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 and catalogues are some other means of recording descriptions. They also help in correct identification.

- **Flora contains the actual account of habitat and distribution of plants of a given area, 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.**

Use the dichotomous key to determine what each leaf is.

Dichotomous Key For Leaves

- | | |
|---|-----------|
| 1. a. Needle leaves | go to 2 |
| b. Non-needle leaves | go to 3 |
| 2. a. Needles are clustered | Pine |
| b. Needles are in singlets | Spruce |
| 3. a. Simple leaves (single leaf) | go to 4 |
| b. Compound leaves (made of "leaflets") | go to 7 |
| 4. a. Smooth edged | go to 5 |
| b. Jagged edge | go to 6 |
| 5. a. Leaf edge is smooth | Magnolia |
| b. Leaf edge is lobed | White Oak |
| 6. a. Leaf edge is small and tooth-like | Elm |
| b. Leaf edge is large and thorny | Holly |
| 7. a. Leaflets attached at one single point | Chestnut |
| b. Leaflets attached at multiple points | Walnut |

A. Magnolia

B. Walnut

C. Elm

D. Spruce

E. Pine

White

F. Oak

G. Chestnut

H. Holly

USES OF TAXANOMICAL AIDS-

- Taxonomic studies of various species of plants, animals and other organisms are useful in agriculture, forestry, industry and in general in knowing our bio-resources and their diversity.
- These studies would require correct classification and identification of organisms. Identification of organisms requires intensive laboratory and field studies.
- The collection of actual specimens of plant and animal species is essential and is the prime source of taxonomic studies.
- **These are also fundamental to studies and essential for training in systematics.**
- It is used for classification of an organism, and the information gathered is also stored along with the specimens.
- In some cases the specimen is preserved for future studies.

THANK YOU
FOR YOUR KIND ATTENTION