DIVERSITY IN THE LIVING WORLD

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WHAT IS 'LIVING'?

When we try to define 'living', we conventionally look for distinctive characteristics exhibited by living organisms.

Growth, reproduction, ability to sense environment and mount a suitable response come to our mind immediately as unique features of living organisms.

Also few more features like metabolism, ability to self-replicate, self-organize, interact and emergence to this list.

Characteristics of Living Organisms

- All living organisms grow Reproduction

- Metabolism

- Cellular Organization of the body

- Consciousness
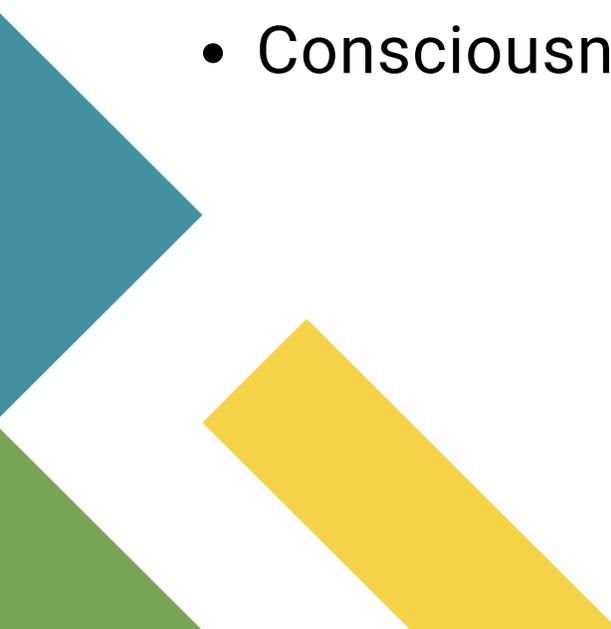
DIVERSITY IN THE LIVING WORLD

- If you look around you will see a large variety of living organisms, be it potted plants, insects, birds, your pets or other animals and plants. There are also several organisms that you cannot see with your naked eye but they are all around you.
- 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

- As stated earlier, there are millions of plants and animals in the world; we know the plants and animals in our own area by their local names. These local names would vary from place to place, even within a country. Probably you would recognize the confusion that would be created if we did not find ways and means to talk to each other, to refer to organisms we are talking about.
- Hence, there is a need to standardize 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. Obviously, 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.

- In order to facilitate the study, number of scientists have established procedures to assign a scientific name to each known organism. This is acceptable to biologists all over the world. For plants, scientific names are based on agreed principles and criteria, which are provided in International Code for Botanical Nomenclature (ICBN).
- Animal taxonomists have evolved International Code of Zoological Nomenclature (ICZN). The scientific names ensure that each organism has only one name.
- Description of any organism should enable the people (in any part of the world) to arrive at the same name. They also ensure that such a name has not been used for any other known organism.

- Biologists follow universally accepted principles to provide scientific names to known organisms. Each name has two components –the Generic nameand the specific epithet. This system of providing a name with two components is called Binomialnomenclature. This naming system given by CarolusLinnaeusis being practisedby biologists all over the world. This naming system using a two word format was found convenient.
- The scientific name of mango is written as Mangifera indica. Let us see how it is a binomial name. In this name Mangifera represents the genus while indica, is a particular species.

Universal Rules of Nomenclature

1. Biological names are generally in Latin and written in italics. They are Latinized 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. It can be illustrated with the example of Mangifera indica.

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. For example, we easily recognize groups such as plants or animals or dogs, cats or insects.

Likewise, in plants, if we try to talk of 'Wheat', the picture in each of our minds will be of wheat plants, not of rice or any other plant. Hence, all these -'Dogs', 'Cats', 'Mammals', 'Wheat', 'Rice', 'Plants', 'Animals', etc., are convenient categories we use to study organisms. The scientific term for these categories is taxa. Here you must recognize that taxa can indicate categories at very different levels. 'Plants' −also form a taxa. 'Wheat' is also a taxa. Similarly, 'animals', 'mammals', 'dogs' are all taxa −but you know that a dog is a mammal and mammals are animals. Therefore, 'animals', 'mammals' and 'dogs' represent taxa at different levels.

Hence, based on characteristics, all living organisms can be classified into different taxa. This process of classification is taxonomy.

Human beings were, since long, not only interested in knowing more about different kinds of organisms and their diversities, but also the relationships among them. This branch of study was referred to as 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. The scope of systematics was later enlarged to include identification, nomenclature and classification. Systematics takes into account evolutionary relationships between organisms

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.

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

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. Let us consider Mangifera indica, Solanum tuberosum (potato) and Panthera leo (lion). All the three names, indica, tuberosum and leo, represent the specific epithets, while the first words Mangifera, Solanum and Panthera are genera and represents another higher level of taxon or category. Each genus may have one or more than one specific epithets representing different organisms, but having morphological similarities. For example, Panthera has another specific epithet called tigris and Solanum includes species like nigrum and melongena. Human beings belong to the species sapiens which is grouped in the genus Homo. The scientific name thus, for human being, is written as Homo sapiens.

GENUS

Genus comprises a group of related species which has more characters in common in comparison to species of other genera. We can say that genera are aggregates of closely related species. 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.

FAMILY

The next category, Family, has a group of related genera with still less number of similarities as compared to genus and species. Families are characterised 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

You have seen earlier that categories like species, genus and families are based on a number of similar characters. Generally, 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.
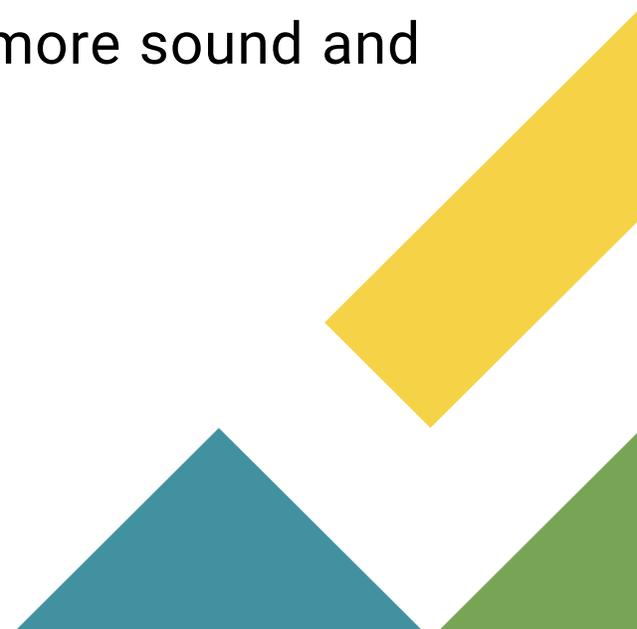
PHYLUM

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, on the other hand, is distinct, and comprises all plants from various divisions. Henceforth, we will refer to these two groups as animal and plant kingdoms. The taxonomic categories from species to kingdom have been shown in ascending order starting with species. These are broad categories. However, taxonomists have also developed sub-categories in this hierarchy to facilitate more sound and scientific placement of various taxa.

Organisms with their Taxonomic Categories

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

Taxonomists have developed a variety of taxonomic aids to facilitate identification, naming and classification of organisms. These studies are carried out from the actual specimens which are collected from the field and preserved as referrals in the form of herbaria, museums and in botanical gardens and zoological parks. It requires special techniques for collection and preservation of specimens in herbaria and museums. Live specimens, on the other hand, of plants and animals, are found in botanical gardens or in zoological parks. Taxonomists also prepare and disseminate information through manuals and monographs for further taxonomic studies. Taxonomic keys are tools that help in identification based on characteristics

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).

MUSEUMS

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.
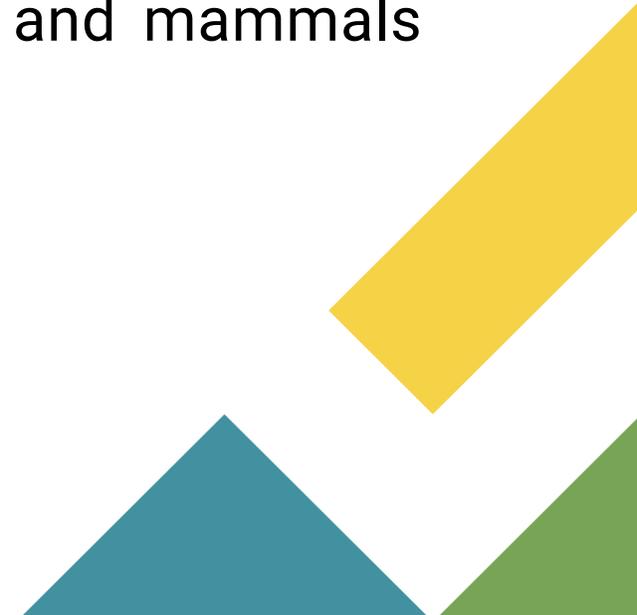
ZOOLOGICAL PARKS

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. Children love visiting these parks, commonly called Zoos
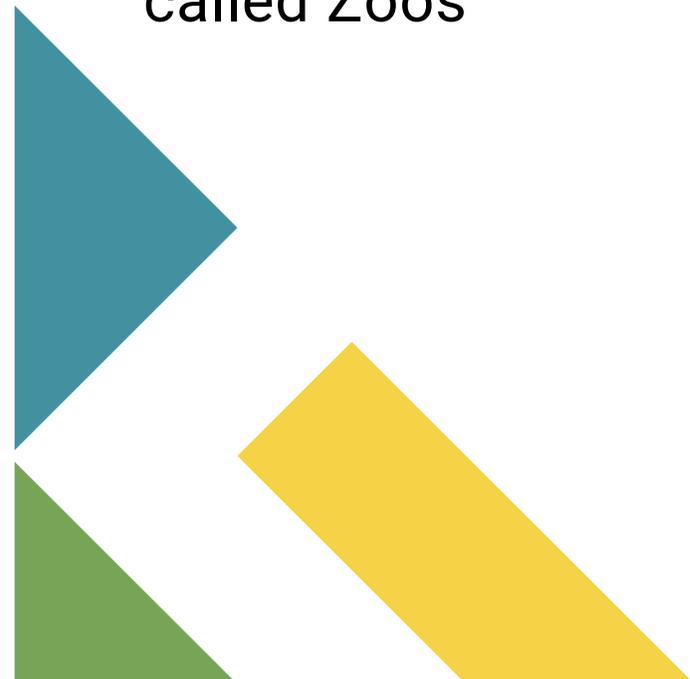
KEYS

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

Thank you

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