

The Living World

What is 'Living'?

- # When we consider something living, we use some criterias such as growth, reproduction, ability to sense, metabolism, ability to self-replicate, self organise, interaction and emergence.
- # But can we consider all these things as a defining ^{feature} of life form.

Defining feature → 100% present in Living
0% present in Non-Living

1. Growth

- # Increase in mass and increase in number of individuals are twin characteristics of growth.
 - # Unicellular organisms grow by cell division. So, growth and reproduction are mutually inclusive in case of unicellular org.
 - # In Multicellular organisms, growth and reproduction are exclusive events.
 - # Non-Living things also grow, if growth means increase in mass like mountains grow after snowfall.
 - In non-livings, growth is external like accumulation of material (accretion). In livings growth is internal (Intususception).
- ⇒ Therefore, growth cannot be considered as a defining feature.

2. Reproduction

- # Reproduction can be sexual or asexual.
- # Multicellular organisms reproduce through sexual mean.

Unicellular organisms reproduce by asexual means such as

- + Fungi → Spore formation
- + Yeast, hydra → Budding
- + Planaria (Flat worms) → True regeneration
- + Fungi, Filamentous Algae & the protonema of mosses → Fragmentation
- + Bacteria, Unicellular Algae or Amoeba → Cell division (Fission)

If we consider, reproduction as a defining feature, what about them who do not reproduce throughout life.

Ex- Mules, Sterile worker-bees, infertile human couples.

Therefore, reproduction cannot be a defining feature.

3. Metabolism

The sum total of all the chemical reactions occurring in our body is metabolism.

There are thousands of metabolic reaction occurring simultaneously inside all living organisms.

Metabolism is a defining feature of all living organisms without exception.

Isolated metabolic reaction *in vitro* are non-living things but surely living reactions.

Metabolism can be of two types:-

➤ Due to breakdown → In Animals → catabolism.

➤ For synthesis → In Plants → Anabolism.

4. Consciousness

- # It is the ability to sense the surroundings.
- # It is the most obvious and technically complicated feature of all living organisms and can be physical, chemical or biological.
- # All organisms from prokaryotes to eukaryotes can sense and respond to environmental cues.
- # Human beings are only organisms who have self consciousness.
- ⇒ The coma patient is also living because he responds to medicines.
- # Thus, consciousness is also a defining property.

Diversity in the Living World

- # There is immense diversity in this world among living organisms.
- # The number of species that are known and described range between 1.7 million - 1.8 million.
- # Nearly, 1500 species are discovered every year.
- # The diversity in number and types of organisms in the earth is known as **Biodiversity**.
- # The standardised naming of living organisms such that a particular organism is known by the same name all over the world is known as **Nomenclature**.
- # Scientific Names ensure that each organism has only one name.
 - International Code for Botanical Nomenclature (ICBN)
 - International code for Zoological Nomenclature (ICZN)
- # Biologists follow universally accepted principles to provide scientific names to known organisms.
- # Each name has two components — the Generic Name (Genus) and the Specific Epithet (Species).
- # This system of providing a name with two components is called **Binomial Nomenclature**.

This naming system was given by Carolus Linnaeus.

Universal Rules of Nomenclature

1. Biological names are generally in Latin (dead language) and written in italics. They are Latinised or derived from Latin irrespective of their origin.
2. The first word represents the genus, while other specific epithet.
3. Both words when handwritten, are separately underlined or printed in Italics.
4. The first word starts with a capital letter while other starts with a small letter.

Example :- Mangifera indica.
 ↓ ↓
 Genus Species

5. Name of author appears after the specific epithet.
 e.g. Mangifera indica Linn. These species was given by Linnaeus.

Rules for Taxonomy

1. Characterisation
2. Identification
3. Classification (Process by which anything is grouped into convenient categories based on some easily observable characters.)
4. Nomenclature

Based on characteristics, all living organisms can be classified into different taxa (Group, Rank). This process of classification is taxonomy.

External (morphology), Internal Structure (Anatomy), Structure of cell (Cytology), development process and ecological inf. of organisms are essential and forms the basis of modern taxonomic studies.

Systematics $\Rightarrow$ Study of diversity of organism and their comparative and evolutionary relationship.

Systematics = Taxonomy + Evolutionary Relationship
 (Systematic Arrangements)

Linnaeus used Systema Naturae as the title of his publication.

Taxonomic Categories

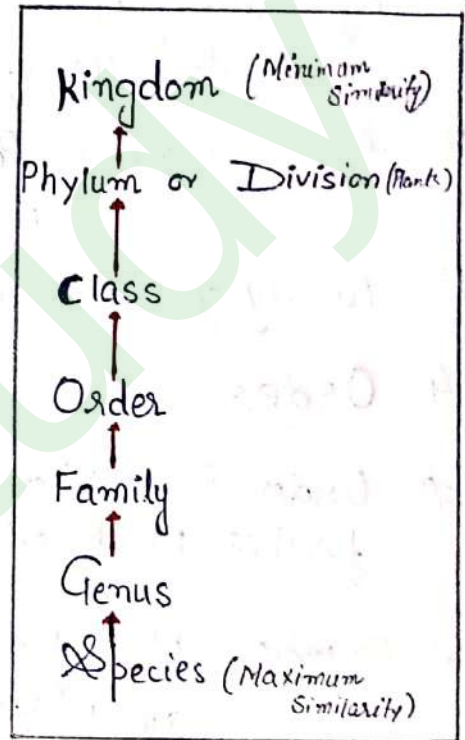
Category is a part of overall taxonomic arrangement, it is called taxonomic Category.

The hierarchical arrangement of this category is known as taxonomic hierarchy.

1. Species

Taxonomic studies consider a group of individual organisms with fundamental similarity as a species.

Example - Magnifera indica, Solanum tuberosum,
Panthera leo (lion).
 specific epithet



2. Genus

Genus represents another higher level of taxon.

Genus comprises a group of related species which has more characters in common in comparison to species of other genera.

Genus with one species $\rightarrow$ Monotypic e.g. Homo sapiens
 " two or more species $\rightarrow$ Polytypic e.g. Panthera.

Example :- Potato (Solanum tuberosum) and brinjal (Melongena) are two diff. species but both belongs to same genus $\rightarrow$ Solanum.

One genus is diff. from other
 e.g. Pathera differs from another genus Felis which includes cats.

3. Family

- # Has group of related genera with still less no. of similarities as compared to genus and species.
- # Families are characterised on the basis of both vegetative and reproductive features of plant species.
- # e.g. Among plants - *Solanum*, *Petunia* and *Datura* are placed in the family *Solanaceae*.
- # Among animals - *Panthera* is replaced with *Felis* (cat), in the family *Felidae*.
- # Family of dogs - *Canidae*.

4. Order

- # Order is another a higher category, is the assemblage of families which exhibit a few similar characters.
- # Example $\Rightarrow$ 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*.

5. Class

- # This category includes related order.
- # Example - Order *Primates* comprising monkey, gorilla, and gibbon is placed in class *Mammalia* along with order *Carnivora* that includes - tiger, cat and dog.

6. Phylum (Division for Plants)

- # Phylum is the second most higher category.
- # Classes comprising animals like fishes, amphibians, reptiles, birds along with mammals constitute phylum.
- # All these are based on common feature like presence of notochord and dorsal hollow neural system, are included in phylum Chordata.

7. Kingdom

- # Kingdom is the highest category with minimum similarity.
- # All animals are in → Kingdom Animalia
All plants are in → Kingdom Plantae

Common Name	Biological Name	Genus	Family	Order	Class	Phylum/Division
Man	Homo-sapiens	Homo	Hominidae	Primate	Mammalia	Chordata
Housefly	Musca Domestica	Musca	Muscidae	Diptera	Insecta	Arthropoda
Mango	Mangifera indica	Mangifera	Anacardiaceae	Sapindales	Dicotyledone	Angiospermae
Wheat	Triticum aestivum	Triticum	Poaceae	Poales	Monocotyledone	Angiospermae

Taxonomical Aids

1. Herbarium (Plant)

- # Herbarium is a store house of collected plant specimens that are dried, pressed and preserved on sheets.
- # These sheets are arranged according to a universally accepted system of classification.
- # Herbarium sheets include labels providing info. about date and place of collection, English, local, botanical names, family, collector's name, etc.
- * Herbaria is a quick referral system in taxonomical studies.

2. Botanical Gardens

- # These are specialised gardens have collections of living plants for reference.
- # Famous botanical gardens are at Kew (England), Indian Botanical garden, Howrah (India) and at National Botanical Research Institute, Lucknow.

3. Museum

- # Museums have collections of preserved plants and animal specimens for study and reference.
- # Specimens are preserved in containers or jars in preservative solⁿ.
- # Insects are preserved as in insect boxes after collecting, killing and pinning.
- # Plants and animals kept as ~~sp~~ dry specimens.
- # Larger animals are usually stuffed and preserved.

4. Zoological Parks

- # Here, wild animals are kept in protected environments under human care which enables us to learn about their food habits and behaviour.

5. Key

- # Key is used for identification of plants and animals based on the similarities and dissimilarities.
- # Keys are based on the contrasting characters generally in a pair called couplet.
- # Each statements in the Key is called a lead.
- # Keys are analytical in nature.
- # Flora, manuals, monographs and catalogues are some other means of recording description.
 - Account of habit and distribution of plants in given area.
 - Provide inf. for identification of names of species found in an area
 - Contain inf. of any taxon.