Characteristics of Living Things

We often say that plants, animals, and microorganisms are living things. **How can we say whether a thing is living or non-living? Which characteristics of living things classify them as living?** Let us explore.

The various characteristics of living things are:

- **All living things are made up of cells.** Cell is the basic unit of life. Living organisms that are made up of only one cell are called **unicellular** such as *Amoeba, Chlamydomonas*, bacteria, etc. Those made up of many cells are called multicellular. A complex **multicellular** organism is made up of trillions of cells such as humans, dogs, pine tree, lizard, birds etc.

- **All living things require food** for growth and development. It also gives them energy for sustaining life processes. For example, plants manufacture their own food by the process of photosynthesis. Such organisms are called **autotrophs**. Animals, on the other hand, depend on plants and other animals for their food. They are called **heterotrophs**.

- **All living things grow**. Growth can be easily observed in all plants and animals. Living things either produce new cells or their pre-existing cells increase in size and hence they grow. In animals, growth stops as they reach their adult stage while the plants keep on growing throughout their life.

- **All living things respire**. Respiration is a process that includes breathing. The movement of air in and out of the body and vice-versa is known as breathing. For example, animals such as earthworms breathe through their skin; fish use gills for breathing; and plants exchange gases through tiny pores called stomata, which are present mainly on the surface of leaves. Respiration is a two stage process. It has two stages:

- External respiration − This is the process of breathing i.e., taking in oxygen and giving out carbon dioxide.

- Internal respiration − In this stage, oxygen taken in is utilised to produce energy.

- **All living organisms respond to stimuli**.

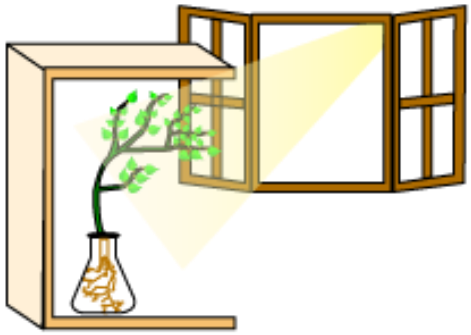
Do you know what stimulus is?

Stimuli are certain changes in the surroundings that cause an organism to respond to them. For example, animals such as cockroaches hide as soon as the light is switched on.

Plants such as *Mimosa pudica* (touch-me-not) close their leaves when touched.

Let us now perform the following activity to understand how plants respond to stimuli.

Take a potted plant and keep it in a room at a slight distance from the window. Sunlight must enter through the window during the day time. Water this plant regularly for a few days.



You will observe that the stem of the plant bends towards the sunlight.

This proves that living organisms react to stimuli.

- **All living organisms excrete.**

  What is excretion?

  A part of the food we eat is utilised by the body while the rest is removed from the body.

  The process of getting rid of waste materials from the body is known as excretion. This process occurs in both plants and animals. In animals, waste products such as urea are excreted in urine; and carbon dioxide, which is also a waste product, is excreted by lungs. In plants, the wastes are converted into harmless substances such as gum, resins, etc.

- **All living organisms reproduce**. Some animals produce eggs while others give birth to young ones. Plants, on the other hand, reproduce by producing spores or seeds.

Do you know?

Mammals such as humans, cats, dogs etc., which give birth to young ones, are called **viviparous animals.**
Animals such as hens, crocodiles, insects, etc., which produce eggs, are called **oviparous animals.**

- **All living organisms can move.** It should be noted that all living organisms can move. While animals can move from one place to another with the help of special locomotory organs such as limbs, plants show movement in the form of movement of root towards earth, bending of flowers in sunflower plant towards light, etc. The energy for movement comes from within the organism.

- **All living organisms have a definite life span.** All organisms have a definite life span. Organisms are born; they grow, and finally die. Some organisms have a short life span such as bacteria that live for only 20 to 25 minutes while some organisms have a longer life span such as tortoise that live up to 150 years.

We can now distinguish between living and non-living things.

Living things	Non-living things
They are made up of cells.	They are not made up of cells.
They show movement, but the energy for movement comes from within the organism.	They show movement by taking external force or energy.
They require food.	They do not require food.
Growth in them is irreversible.	Growth is reversible.
Respiration occurs in which food is oxidised to release energy.	They do not require respiration.
Reproduction occurs in living things.	Non-living things do not reproduce.

Differences between plants and animals

Plants	Animals

They can make their own food by the process of photosynthesis. They are autotrophs.	They cannot make their own food. They are heterotrophs.
They show movement, but cannot show locomotion i.e., they cannot change their position from one place to another.	They show movement as well as locomotion.
They show response to stimuli, but lack sense organs.	They also show response to stimuli and have well-developed sense organs.
They grow throughout their life.	They stop growing once they reach their adult form.

Taxonomical Categories and Rules of Nomenclature

- **Diversity in the Living World**

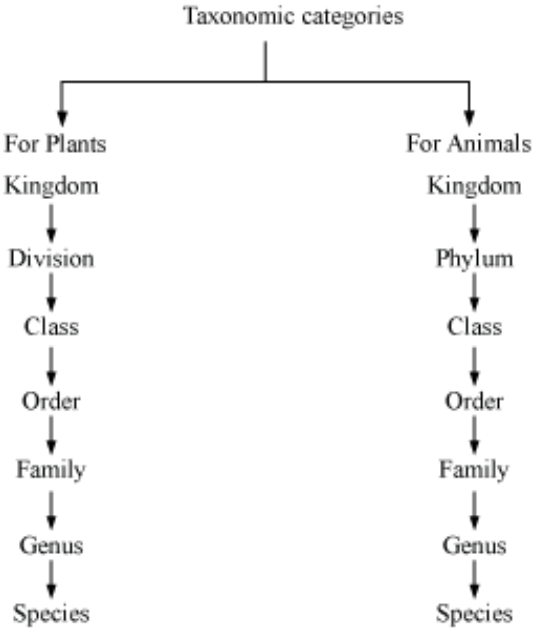
  Biodiversity − Total number and types of organisms present on earth

  Number of known species − 1.7 − 1.8 million

  Classification

- Not a single step process
- Involves hierarchy or multiple steps
- Each step represents a rank or a category
- All categories together constitute taxonomic hierarchy.
- Rank is commonly termed as taxon (pl. – taxa).

  Taxonomic Categories



- Different taxonomic categories arranged in descending order

Aid to memory - You can learn this hierarchy using the following mnemonic: **K**ids **P**refer **C**heese **O**ver **F**ried **G**reen **S**pinach

Compilation of Taxonomic Hierarchy Species

- Individual organisms with fundamental similarities

For example:

Mangifera indica	*Solanum tuberosum*	*Homo sapiens*
(Mango)	(Potato)	(Human being)

indica, *tuberosum*, *sapiens* – represent specific epithets

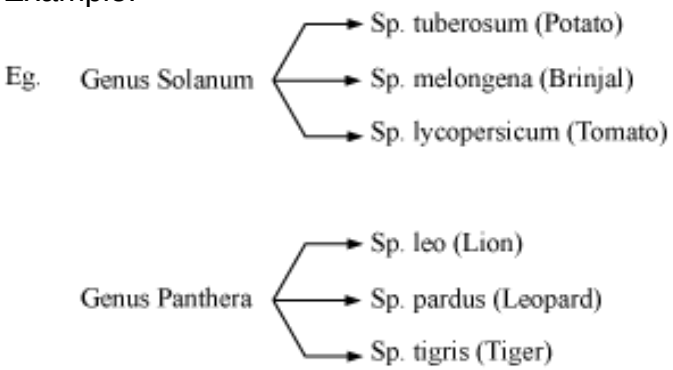
Mangifera, *Solanum*, *Homo*

- Represent genera (sing. – genus)
- Each genus may have one or more than one specific epithets.

Genus

- Includes closely related species
- Species of one genus have more characters in common as compared to species of other genera.

Example:



Family

- Contains groups of related genera
- Less number of similarities compared to genus and species
- Characterized on the basis of vegetative and reproductive features
- For example:
- Family Solanaceae contains
- *Solanum*
- *Petunia*
- *Datura*
- Family Felidae contains
- *Panthera* (comprises of lion, tiger, leopard)
- *Felis* (Cats)

Order

- Considered a higher taxonomic category
- Identified on the basis of aggregates of characters
- Assemblage of families with few similar characters
- Similar characters are less in number as compared to different genera in a family
- For example:
- Families – Convolvulaceae, Solanaceae – based on floral characters included in order Polymonials
- Order – Carnivora includes families like
- Felidae (Cats)
- Cancidae (Dogs)

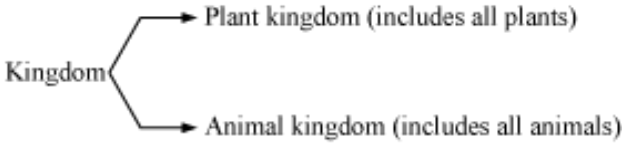
Class

- Includes related orders
- For example:
- Class Mammalia includes Order Carnivora and Order Primata.

Phylum or Division

- Based on common features among different classes

- In case of plants – Division, in case of animals – Phylum
- For example – Division - Angiospermae (based on presence of flowers)
- Phylum - Chordata (Based on presence of notochord, dorsal hollow neural system)
- Major two kingdoms are



Nomenclature − Naming of the living organisms so that a particular organism is known to all over the world by a standard name.

Scientific Names

- Provided by the International Code for Botanical Nomenclature (ICBN) to plants and the International Code of Zoological Nomenclature (ICZN) to animals
- Follow the concept of binomial nomenclature

- Given by Carolus Linnaeus

Rules of Binomial Nomenclature

- **Biological Names**

- Generally in Latin, Latinised or derived from Latin
- The first word represents genus while second component represents specific epithet.
- Both words when hand written − separately underlined
  when printed − in italics
- The first word of generic name starts with a capital letter and specific epithet starts with a small letter.
  Example
  Mangifera indica [Biological name of Mango]
  Genus Specific epithet
- The name of author appears after specific epithet.

- Written in abbreviated form
  For example: *Mangifera indica* Linn − this species was first described by Linnaeus

Systematic Position

The systematic position is the description of various taxonomical ranks in which an organism is placed.

Systematic position of human

The scientific name of human is "*Homo Sapiens*". *Homo* means human and *sapiens* means wise.

Level	Human	Characteristic feature
Kingdom	Animalia	Heterotrophic mode of nutrition, bodily movements
Phylum	Chordate	Presence of notochord
Class	Mammalia	Presence of mammary glands
Order	Primates	Having erect position with binocular vision
Family	Hominidae	Having forelimbs shorter than hind limbs
Genus	*Homo*	Human having large cranium and tool making ability
Species	*Sapiens*	Having highly developed brain capable of thinking and speaking.

Systematic position of mango

The scientific name of mango is *"Mangifera indica*". *Mangifera* means sweet fruit and *indica* indicates its origin in India.

Level	Mango	Characteristic feature
Kingdom	Plantae	Autotrophic mode of nutrition, no bodily movements
Division	Magnoliophyta	Flowering plants
Class	Magnoliopsida	Dicotyledons
Order	Sapindales	Mostly woody plants, with compound or lobed leaves.
Family	Anacardiaceae	Bear fruits that are drupes
Genus	*Mangifera*	Having sweet fruit

Species	*indica*	Originated from India.

Classification

- Process of grouping into convenient categories
- Based on some easily observable characters
- Helps in revealing the relationship between various organisms and making their study easy and organized

Taxa

- Scientific term for categories

Taxonomy

- Process of classification of living organisms into different taxa

Systematics

- Study of systematic classification
- Word derived from Latin
- '*Systema*' means systematic arrangement of organisms.
- Linnaeus used *Systema Naturae* as the title of his publication.
- Includes evolutionary relationships between organisms

Taxonomical Aids

Taxonomical Studies

- Study of various species of plants and animals and is useful in agriculture, forestry, industry, etc.
- Useful in knowing about our bio-resources and their diversity
- Require correct classification and identification of organisms
- Identification requires intensive laboratory and field studies.
- Prime requisite - collection of plant and animal specimens
- Used for classification
- Information gathered is stored along with specimens.

- Biologists have established certain procedures and techniques (called taxonomical aids) to store and preserve information as well as specimens.

Taxonomical Aids

Herbarium

- Storehouse of plant specimens
- Specimens dried, pressed, and preserved on sheets
- These sheets are arranged according to the accepted system of classification.
- Herbarium sheet contains information about date and place of collection, collector's name, local and botanical names.
- Also provides quick referral systems in taxonomical studies

Botanical Gardens

- Specialised gardens for collecting living plants
- Grown for identification purposes
- Each plant labelled, indicating scientific name and family it belongs to
  Example − Botanical garden at Kew (England), Indian Botanical garden at Howrah (India), National Botanical Research Institute at Lucknow (India)

Museums

- Collection of preserved plant and animal specimens
- Useful for study and reference
- Specimens are preserved in containers or jars in preservative solutions. Specimens can also be preserved dry.
- Insects are preserved in insect boxes after collecting, killing, and pinning.
  Large animals − stuffed and preserved
- Also have collection of skeletons of animals

Zoological parks

- Protected environments for wild animals

- Provide condition similar to natural habitat
- Enable us to learn about their food habits and behaviour

Key

- Keys are analytical in nature; hence used in identification of plants and animals based on contrasting characters in a pair called couplet.
- Out of two proposed characters, only one which is relevant is accepted while the other is rejected.
- Each statement in a key is called a lead.
- Unique for each category such as family, genus, order, etc.

Other Taxonomical Aids

- Flora, manuals, monographs, and catalogues are other taxonomical aids.
- Help in correct identification
- Contain actual account of habitat and distribution
- Provide index to plant species found in a particular area
- Monographs contain information on any one taxon.