
Revision Notes

Class - 11 Biology

Chapter 1 - The Living World

Life is a unique process that is made from the aggregation of molecules. These molecules undergo various chemical reactions to perform their specific functions which are called metabolism. This results in the production and utilization of energy. The metabolism will result in the growth, development, reproduction, adaptations, etc of the living organisms through the production of various biomolecules.

All the living organisms that live in various habitats are found to share a somewhat similar genetic material that may be either terrestrial, aquatic, in mountains, deserts, oceans, forests, etc.

Living organisms contain certain important characteristics that include growth and development, body organization, homeostasis, reproduction, adaptation, and energy utilization.

1.1 What is Growth

To differentiate whether an organism is living or not, various characteristics need to be checked in the case of living organisms.

Characteristics of living organisms:

The characteristic of living organisms is given below –

1) Growth: All living organisms can undergo the process of growth and development that results in an increase in the mass and number of cells. Multicellular organisms grow by cell division. The growth of plants and animals takes place with the help of cell division. In the case of plants, the cell division occurs throughout their life while in the case of animals the cell division occurs up to a certain age, and then the cells lose their capability to divide.

It results in an increase in body mass and increases in the number of cells.

Examples: Mountains, boulders, sand mounds, etc grow by the accumulation of the materials although they are non-living. So, growth cannot be taken as the factor which categorizes the organism as living.

2) Metabolism: As the body and organs are the constituents of different chemicals, they perform various metabolic functions that result in the conversion of chemicals into other biomolecules. All plants, animals, and microbes exhibit metabolism. It is absent in the case of non-living organisms but may be introduced through the in-vitro method.

3) Sensitivity: The living organisms whether prokaryotes or eukaryotes respond according to their surroundings and the stimuli present around them, it may be physical, chemical, or biological. The living organisms are sensitive about their surroundings and are responsible in accordance with their stimuli. The stimuli can either be biological, physical, or chemical.

4) Reproduction: The ability to produce young ones is the process of reproduction which is observed only in the case of the living organisms. In the case of fungi, reproduction occurs through asexual spores, while in the case of hydra budding occurs and in planaria regeneration occurs which are all the asexual methods of reproduction.

Reproduction is the increase in the number of cells while in the case of mules, infertile human couples, etc reproduction is absent. So, reproduction is simply synonymous with growth which is not appropriate to distinguish the living organisms.

5) Cellular Organization: It is the defining characteristic of living organisms since all living organisms are made up of cells that help in performing various cellular functions resulting in the growth and development, reproduction, metabolism, etc in the body. Since non-living organisms are not made up of cells so they do not have cellular organization.

6) Movement: The living organisms show movement and locomotion and more specifically plants move according to the movement of the sun.

Example: The flame of a candle and a crystal do not show movement while if we take mango trees then we can see they undergo movement, growth, and development along with reproduction and results in the production of more trees through their seeds. Thus mango trees are said to be alive as they show movement while candles flame and crystal are not alive.

Also, the organisms that are aware and are conscious of their surroundings will be the living organisms.

1.2 Diversity in the Living World:

The Earth is the main area where the living organisms live. The world consists of millions of living organisms that sometimes we cannot even see with our naked eyes. These organisms are found to be living in various habitats that include forests, oceans, deserts, lakes, mountains, and even hot water springs.

There are different types of plants, animals, insects in the world. This is very important and their variability is necessary for survival. The number of species identified and studied is 1.7-1.8 million. They all together make a natural diversity of life in the world which is generally called biological diversity or biodiversity.

Taxonomy: Taxonomy is the study of the classification, characterization, nomenclature, and identification of organisms and it is a branch of science. Systematics is another branch of science that includes the study of the classification, nomenclature, identification, and evolutionary history of an organism. Thus, the taxonomic characteristics of an organism along with its evolutionary history come under the systematics. In 1813, A.P de Candolle was the first to introduce the term taxonomy while systematics was introduced as the time of human civilization.

The term Systematics is derived from the Latin word 'systema' which means the systematic arrangement of organisms. Linnaeus published his book Systema Naturae where the classification of plants, animals was based on taxonomy.

Neo-systematics is the branch of systematics that deals with the species to be the product of evolution. In 1940, Julia Huxley was the one who developed this concept. It involves the known characteristics of an organism and also the known evidence from different fields of biology.

Identification: It is the method of placing the organisms in their exact place based on their classification. The identification of organisms can be done with the help of taxonomic keys.

Classification: The classification is the process of grouping various living organisms based on the common features that they share. A single group consists of those organisms that have similar common features. To make classification easier various groups are formed in which different organisms are placed depending upon their characteristics.

Characterization: The studying and understanding of characters of organisms and categorizing them like external and internal structure (morphology and anatomy), the structure of the cell (cytology), developmental process (embryology), and ecological information (ecology) of the organism.

Nomenclature (naming): The naming of living organisms is called nomenclature. There are two types of names, one is vernacular (common names) and the other is the scientific name. Local names are used in local languages or common language and are easy for the local peoples but these names are not used by biologists because:

1. For many species a single local name is often used.
2. The local names sometimes lead to incorrect meanings about the organism.
3. In different regions of the country or world, the different local names are used for one organism. Scientific names: The names are given according to certain rules and are followed by the biologist all over the world. To make it common around the world various international codes have been established.

These codes are:

- ICBN-International Code of Botanical Nomenclature
- ICZN-International Code of Zoological Nomenclature
- ICVN-International Code of Viral Nomenclature

ICBN/ICNB-International Code for Bacteriological Nomenclature or Nomenclature of Bacteria.

Binomial Nomenclature:

Carl Linnaeus is the one credited for the introduction of the binomial nomenclature of the plants and animals with his work in the book *Species Plantarum* in 1753.

Binomial nomenclature is the biological system of naming the organisms in which the name is composed of two terms, where, the first term indicates the genus, and the second term indicates the species of the organism. E.g., *Mangifera indica* Linn. *Mangifera* is the genus name and *indica* is the species name. Linn indicates that this species was first described by Linnaeus. Who can give scientific names: Identification, nomenclature, and classification of organisms are all involved in this branch of biology.

Rules:

1. A scientific name generally has two components (words) in Latin or is derived from Latin irrespective of their origin.
2. The First word of the biological name denotes the genus name whereas the second one denotes species.
3. When applying the binomial nomenclature system, the name of the species is written in italics or underlined separately when handwritten.
4. The generic name must start with a capital letter while a specific name should start with a small letter.
5. The name of the author is printed in Roman or an abbreviated form at the end after the species name.
6. Only one correct name must be assigned to each taxonomic group.
7. The scientific name selected should be such that it would be easy to pronounce, and short.

Eg: *Mangifera indica*- *Mangifera* is the genus name and *indica* is the species name.

1.3 Taxonomic Categories:

In 1956 the term Taxon was introduced and in 1964, Mayr defined taxon to be the various categories based on different characters of the organisms that consist of a taxonomic group of any rank.

Taxonomic Hierarchy:

Various organisms in different categories depend upon their common characters to make classification easier. These groups together are called taxonomic hierarchies. The taxonomic hierarchy includes. Kingdom, division of the kingdom, phylum, class, order, family, genus, and species. Species are the lowest while the kingdom is the highest rank within the hierarchy. It is also called the Linnaean hierarchy as it was first proposed by Carolus Linnaeus, the Father of Systematic Botany. The hierarchy includes seven obligate categories.

They are as follows-

Kingdom - Animalia

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Phylum - Chordata

(Division in case of plants)

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Class - Mammalia

↑

Order - Primata

↑

Family - Hominidae

↑

Genus - Homo

↑

Species – sapiens

Species: It is the lowest category of the taxonomic hierarchy. There are around 8.7 million species observed on earth till now while their rest are left undiscovered. It refers to a group of organisms that are similar in shape, form, generative options. Species may be more divided into subspecies. It was first defined by Ernst Mayr in 1964 that the species are the interbreeding populations that are reproductively isolated from other such groups. The term species was first introduced by the biologist John Ray.

E.g.: sapiens.

Genus: A category that is placed above species as they consist of a group of related species. Genus are of various types based on the number of species present like monotypic (one genus present), and polytypic (several species present). For e.g., the genus Panthera constitutes both lion and tiger.

Family: This taxonomic category consists of related genera having similar

characteristics. For e.g., the families Canidae, Felidae, Ursidae, etc come under one order Carnivora.

Order or Cohort: This taxonomic category is more specific than the class as it consists of one or more similar families. The class Mammalia consists of around twenty-six orders that include primates, Carnivora, etc.

Class: It was the most general taxonomic category before the introduction of phyla. In the animal kingdom, there are around 108 classes that include Pisces, reptilia, aves, etc. The categories used in classification now are different from those of the Linnaeus taxonomy.

Phylum: This category is more specific than the kingdom. In the animal kingdom, there are around thirty-five phyla that include phylum Arthropoda, Chordata, etc.

Kingdom: The highest level of classification is the kingdom which is further divided into various subgroups. The total kingdoms of the living organisms are five in number that includes Monera, Protista, Fungi, Plantae, and Animalia.

Species - *Homo sapiens*

Genus - Homo

Family - Hominids

Order - Primates

Class - Mammals

Phylum - Chordates

Kingdom - Animals

Generic name	Specific epithet	Common name
Mangifera	indica	Mango
Solanum	tuberosum	Potato
Solanum	nigrum	Nightshade
Panthera	leo	Lion
Panthera	tigris	Tiger
Homo	Sapiens	Man

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

1.4 Taxonomical Aids:

The taxonomical aids help us in the study of knowing our bioresources and are also useful in agriculture, forestry, and industry. It can be used both in the field as well as in the laboratory. There are various taxonomical aids that are used by the taxonomists that help them in the identification, nomenclature, and classification of organisms.

The important taxonomic area includes herbaria, botanical gardens, museums, zoological parks, and keys.

1.4.1 Herbarium:

A herbarium is a collection of preserved plant specimens that are dried and labeled. The plant species that are collected are first dried, pressed, mounted, and then labeled on the herbarium sheets.

The steps involved in the herbarium technique are as follows:

- Collecting various specimens from different areas.
- Drying the particular specimen by placing them in between the various folds of newspapers or by iron drying them.
- By dipping the specimens in mercuric chloride poisoning is done.
- With the help of a cello tape or glue, mounting the dried specimens on the herbarium sheets.
- Certain specimen parts that are difficult to attach to the sheet, like stems, are stitched so that they stick to their position on the sheet.
- To keep them for a longer time, preserves must be sprayed.
- The labeling for identification of all the specimens must be done at the left side of the bottom corner. The name, date of collection, area of collection, habit, etc must be written.
- Lastly, these herbarium sheets are deposited under the herbarium covers where the rest of the herbarium sheets are covered and packed.
- These herbarium sheets are stored in the cupboards named under their category.

To avoid any confusion each herbarium sheet is to be labeled properly on the right-hand corner at the bottom of the herbarium sheet which includes the scientific name along with author's name, local name, name of family, locality, date of collection, name of the collector, etc.

The book flora consists of information about the collected specimens, this book gives the information regarding the number of plant species present in the various regions along with their brief description. is published in the form of a book called flora.

Some important floras of India are Flora of British India, Flora of Delhi, Flora of Madras, Flora of Travancore, etc.

In England, the Royal Botanical Garden at Kew is the largest Herbarium in the world.

Central National Herbarium is the largest Herbarium in India located in the Indian Botanical Garden at Kolkata established in 1787.

1.4.2 Botanical gardens: They are those gardens that are responsible for the cultivation and preservation of a wide range of plants. These plants are reserved along with their botanical names that are tagged as a label. It is a collection of many species of plants such as succulent plants, garden herbs, and many more exotic plants. Visitors include educational displays, art exhibitions, and open-air theatre musical performances with tours and other entertainments. They are under the control of the universities or the scientific research organizations that relate both the herbaria and the research programs together in the botanical sciences. There are more than 600 botanical gardens present all around the world.

The ancient Botanical Garden in the world is the Hanging Gardens of Babylon and comes under the Wonders of the world.

The Royal botanical garden at Kew in England is the largest Botanical Garden in the world and is known as the botanical capital of the world. It was discovered by Bentham and Hooker.

In India Indian Botanical Garden at Kolkata is the largest botanical garden while Tropical Botanical Garden at Thiruvananthapuram in Kerala is the largest tropical botanical garden in Asia.

1.4.3 Museum:

The museum is the place where the artistic and educational plants or animals are preserved, stored, and exhibited to the public. Museums are of various types that include the natural science museum, Science Museum and Zoological Museum.

The Botany and Zoology Departments of all the college's museums are maintained. Animals can also be preserved as they are placed in the jars or containers having chemical solutions which help them to preserve for a longer time. The specimens are then identified and labeled and are then stored after their catalog is prepared.

The plants and animal specimens are also preserved as dry specimens. Like insects after collecting, killing, and pinning are then preserved in insect boxes while in the case of the birds and mammals they are first stuffed and then preserved. The skeletons of the animal are preserved in the museums.

1.4.4 Zoological parks: They are animal parks within enclosures that display to the public and replicate their natural habitats for behavioral patterns which benefit the animals and visitors. Special climatic conditions are created for the animals and the walkthrough exhibits are there for visitors for non-aggressive species. Visitors are how to avoid eating foods that animals might snatch or to keep their paths away.

The zoological park of Kruger in South Africa is the largest zoo in the world.

The Zoo of Kolkata in India is the largest zoo.

1.4.5 Keys: A key is a taxonomic aid with the help of it the species can be identified among the group of organisms. It helps biologists in the identification of the species and is prepared by a taxonomist. Taxonomic keys consist of a series of prepared statements which are known as couplets and describe the features of some organisms. A key starts with the couplet called the first couplet and then selects the statement which fits the particular specimen. The first couplet then leads to the introduction of another couplet that will result in providing the identity of the specimen.

There are two types of keys called Dichotomous keys, they are indented keys and bracketed keys. The indented keys consist of the couplets having choices that are equidistant from the left margin and follow the lead that was selected. In a key, each statement is called a lead.

The bracketed keys provide choices side by side of the couplet that is numbered or lettered. It is helpful if the previous couplet is provided; alternate couplets are indented in some bracketed keys.

Other Taxonomic Aids: Various other taxonomic aids include flora, manuals, monographs, and catalogs also serve as taxonomic aids for correct identification.

Flora: The number of plant species present in a particular region comes under flora. The index of the plants that occur in a particular area can be maintained. The first complete flora of India was compiled by Hooker.

Monograph: The handbooks that consist of the details and information regarding one taxon (family or genus).

Manuals: They consist of information regarding the various species found in a particular area and help in their correct identification.

Catalog: It consists of the list of publications that include the books, periodicals, and dictionaries containing new information for taxonomic studies.

Fast Track Revision:

1. The organisms exhibiting metabolism, cellular organization, homeostasis, growth, reproduction, development, responsiveness, and other characteristics of life are designed as living things.
2. Growth is an irreversible increase in the mass of an individual.
3. Systematics deals with the identification, nomenclature, classification, and evolutionary history of an organism.
4. To determine the exact place and position of organisms is called identification that helps in the set plan of classification.
5. Classification is performed on the basis of the similarities and it helps in the arrangement of organisms into groups.
6. The Nomenclature is based on the international code of nomenclature that helps in determining the scientific name of organisms.
7. Binomial nomenclature: It was introduced by Carolus Linnaeus and it includes the system of the naming of an organism having two components or epithets – generic and specific epithet.
8. The arrangement of taxonomic categories in a sequence is called the taxonomic hierarchy while each level in the hierarchy is called taxon.
9. The taxonomic hierarchy of a number of species includes the arrangement of the sequence of taxonomic categories in descending order.
Kingdom → Phylum/Division → Class → Order → Family → Genus → Species
10. Taxonomical aids: They are the techniques and procedures that help in the storage of information of the specimens that help in the identification and classification of organisms.
11. Herbarium is the library that is made up of dried, pressed, and preserved plant specimens.
12. The preserved plant and animal specimens are collected and stored in the museum.
13. The Botanical Garden has a collection of living plants.
14. The place where the wild animals are kept in a protected area that are taken care of by the humans are called Zoological parks.
15. The identification of plants and animals that is based upon their similarities and differences is called Key.

16. The book that deals with the plants of a particular region or habitat is called Flora.

17. In biological studies, the comprehensive information of a taxon is called a Monograph.

18. The name of species that are found in a particular area helps in providing the information for identification is called manual.

