

Unit

I

DIVERSITY IN LIVING WORLD

THE LIVING WORLD

Syllabus

What is living?; Biodiversity; Need for classification; Three domains of life; Taxonomy & Systematics; Concept of species and taxonomical hierarchy; Binomial nomenclature; Tools for study of Taxonomy – Museums, Zoos, Herbaria, Botanical gardens.

Five kingdom classification; salient features and classification of Monera; Protista and Fungi into major groups; Lichens; Viruses and Viroids.

Salient features and classification of plants into major groups - Algae, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms (three to five salient and distinguishing features and at least two examples of each category; Angiosperms-classification up to class, characteristic features and examples).

Salient features and classification of animals-non chordate up to phyla level and chordate up to classes level (three to five salient features and at least two examples).

In our Solar System, Earth is the only planet having a habitable nature for supporting life as it is situated at the correct, distance from the sun. The biodiversity of Earth is so vast from the perspective of both flora and fauna that so far, we have not completed the identification of all the life forms. According to an estimate made by **Robert May**, global species biodiversity is about 7 million. Of the total species discovered so far, 70% are animals and 22% are plants. Of the animals, 70% are insects. Three fourth of the planet is surrounded by water and one fourth by land due to which there are more diverse aquatic flora and fauna than terrestrial species. The aquatic biodiversity is very rich in the sense that many of them are still unscreened. Literature says only 15% of the bacteria known can be cultured in the laboratory indicating that we do not know the way of life of many of them. Nature displays countless relationships like cooperation, conflicts, nursing, predation, symbiosis, parasitism, amensalism and saprophytism among individuals at micro and macro levels and form a way for energy cycling/recycling through fixation or degradation process.

What is Life

We are trying to understand what is life and we could define life precisely as a complex organization of different molecules in a precise pattern to form its basic unit called 'cell'. The various chemical reactions which occur inside the cell which leads to the availability of energy, growth, development, responsiveness, metabolism and reproduction in living beings forms the basis for the power of organization to maintain and reproduce itself on earth.

Characteristics of Living Beings

Growth

- Growth is a fundamental characteristic of an organism.
- It can be clearly observed under a microscope in microbes when the cell enlarges in size and divides into two cells.
- In superior animals and plants it can be seen by the changes in their morphology, size etc.
- Cell division takes place to maintain the size and shape of the organisms and to replace the lost cells in tissues.
- Growth is irreversible and it implies both the increase in mass and number of cells within the organism.
- Growth occurs in non life forms - eg. piling up of ice bergs at poles and formation of sand dunes due to wind activity in deserts. It is a process of adding up of material externally (extrinsic) when compared to living beings where it is intrinsic i.e., takes place internally.
- Growth cannot be considered as a defining property of living organisms.

Reproduction

Reproduction is an exclusive characteristic of living organisms. It is defined as production of new individuals or offspring's from the existing organisms. There are two major types of reproduction.

1. Asexual Reproduction
2. Sexual Reproduction

Asexual Reproduction

- New individuals are formed from particular or any parts of the body of a single parent.
- There is no involvement of sex or fusion of gametes.
- Organisms like bacteria or amoeba undergo cell enlargement and divide to form new cells so that the number of cells increases and they form colonies. It is identical to growth.
- Yeast and Hydra show budding as a mode of asexual reproduction.
- Fragmentation is common in algae (in Cyanophyta a long filament is broken into small filaments by the formation of dead cells or hormogonia in between.).
- Bryophytes and Fungi (at protonemal stage), Planaria (flat worms) show ability to form or regenerate the original filament through this type of reproduction.

Sexual Reproduction

- Production of sexual gametes from opposite sexes, fusion and formation of a diploid zygote which again divides by mitosis and forms a new individual. (In Plants and Animals)
- Lifeless objects and infertile organisms cannot reproduce and form new progenies.

- Therefore reproduction can be regarded as a major and important characteristic feature of an organism but it is not their only defining characteristic.

Metabolism

Existing living organisms are made up of chemicals. They are small or large having various shape, size and functions. Chemicals are synthesized regularly and broken into some other forms in the body through various kinds of reactions. There are a range of processes like photosynthesis and respiration which helps them to keep their living state and the sum total of all reactions is called metabolism. There are two types of metabolism ;

- **Anabolism:** Involves synthesis of large compounds from smaller biomolecules eg. synthesis proteins from Amino acids.
- **Catabolism:** Involves split up of large molecules into smaller molecules eg. Sugars are broken down into molecules of water and carbon dioxide to liberate energy that is used to drive the synthesis of ATP.

As a result, metabolism can be regarded as a major characteristic feature of living organisms. Yet some of these reactions can be made to occur in vitro but these are living reactions that take place in life.

Consciousness

It is one of the known complicated features of all living organisms. Each and every living organism is able to detect the changes in their living environment. This is known as sensitivity.

- Any change in their living place detected by an organism is called consciousness and the response it gives towards it is called stimulus.
- The change may be physical (like intensity, duration,, direction of light, sound, change in temperature etc), chemical like acid and pollutants or biological by other organisms.
- Organisms from bacteria to plants and animals can sense this and react at various levels and devise responses to them.
- Plants like soybean, radish etc., or animals like sheep, goat, horse etc. breed or reproduce at specific seasons only. Therefore they are called seasonal breeders as their reproductive behavior changes with the length of the day (photoperiod).
- Microbes like Bacteria and Viruses are capable of this activity than any living being as they change their genomic sequences according to the antibiotic used and become resistant.
- Human being is the only life form who has self consciousness with awareness about surroundings. He can relate his mind to the environmental changes that occur in his surroundings.
- Interaction plays a crucial role which is responsible for the properties of tissues as it is not present in the individual cells but a interactive endeavor explains the properties of a tissue.
- Similarly properties of cellular organelles are not present in the molecular constituents of the organelle but come up as a result of interactions among the molecular components comprising the organelle. This holds good in the hierarchy of organizational complexity at all levels.

- Thus, the living organisms are said to be self-replicating, evolving and interactive systems capable of responding to external stimuli.
- The entire living organisms from Cyanobacteria to Dinosaur and up to mammals share the common genetic material, but in varying degrees.

BIODIVERSITY

Biodiversity is the number of different species that live within a particular ecosystem.

The survival of a wide variety of plant and animal species in their natural environments, which is the aim of conservationists concerned about the indiscriminate destruction of rainforests and other habitats.

Biodiversity, a short form of "biological diversity," generally refers to the variety and variability of life forms on Earth.

One of the most widely used definitions defines it in terms of

- the variability within species,
- between species and
- between ecosystems.

This is a measure of the diversity of organisms present in different ecosystems.

It can refer to

- genetic variation,
- ecosystem variation, or
- species variation (number of species) within an area, biome, or planet.

Terrestrial biodiversity tends to be greater near the equator, which seems to be the result of the warm climate and high primary productivity.

Biodiversity is not distributed evenly on Earth.

It is richest in the tropics.

Marine biodiversity tends to be highest along the coasts in the Western Pacific, where sea surface temperature is highest and in the mid-latitude band in all oceans.

There are latitudinal gradients in species diversity.

Biodiversity generally tends to crowd together in hotspots, and has been increasing through time, but will be likely to slow down in the future.

"Biodiversity" is most generally used to replace the more clearly defined and long established terms, species diversity and species richness. Biologists frequently define biodiversity as the "totality of genes, species and ecosystems of a region" An advantage of this definition is that it seems to describe most circumstances and presents a unified view of the traditional types of biological variety previously identified:

- taxonomic diversity (generally measured at the species diversity level)
- ecological diversity often viewed from the perspective of ecosystem diversity