THE LIVING WORLD

Properties of Living Organisms:

1. Growth
   - Increase in mass and number of cells
   - In plants, growth by cell division occurs continuously throughout their life span.
   - In animals, growth is only up to certain age. However, cell division occurs in certain tissues to replace lost cells.
   - Non living objects grow by accumulation of material on the surface. In living organism, growth is from inside.

2. Reproduction
   - Production of progeny similar to those of parents
   - Organisms reproduce sexually or asexually
   - In unicellular organism, growth and reproduction are same.
   - Many organisms don't reproduce. Hence, reproduction is not a perfect defining characteristic of living organism.

3. Metabolism
   - Sum total of all biological reactions taking place inside a living system.
   - Isolated metabolic reactions in vitro are not living things but are living reactions

4. Cellular Organization
   - Unicellular- Single Celled Organism.
   - Multicellular- Multi Celled Organism.

5. Consciousness
   - Ability of organism to sense their environment and respond to the environment stimuli. E.g. Temperature, light, water etc.
   - Therefore, all organisms are aware of their surroundings.
   - Human is the only Organism Having Self- consciousness.

Levels of Oraganization

The living world can be organized into different levels. For example, many living organisms can be organzised into the following levels:

- Cell: Cell is the basic unit of all living things
- Tissues: tissues are group of cells of the same kind.
- Organ: organs are structure composed of one or more type of tissues.
- Organ System: Group of organs that work together to do a certain job
- Organism: Organism constitutes individual living things that may be made up of one or more systems.

The levels of organization above the individual organism are as follows:

- Population: Organisms of the same species that live in the same area make up a Population. E.g. All goldfish living in the same area make up a goldfish environment
- Community: All of the populations that live in the same are make up a community. The community that includes the goldfish population also includes other fish or coral populations.

Diversity in living world

- The Biodiversity of the earth is enormous

- Biodiveristy- The number of varities of plants and animals on earth. There is great diversity among living organism found on the planet earth. The differ in structure, habit, habitat, mode of nutrition and physiology.

- The number of species that are known and described ranges between 1.7-1.8 Million.

- Living organism shows lots of similarities and common features so that they can be arranged into many groups. In order to understand them and study them systematically, these living organisms, mainly the plants and animals are grouped under different categories.

Taxonomy and Systematics

- Taxonomy (Systematics)- The Branch of biology that deals with identification, Nomenclature of living organism and their classification on the basis of their similarities and differences.

- Augustin-Pyramus de Candolle (1778-1841)-Swiss French Botanist – Coined the word TAXONOMY, the science of naming and classifying organisms.

- Systematics – Systematic placing of organisms into a group or taxa on the basis of certain relationships between organisms OR Study of Principles and Procedures of Classification.

- Carolus Linnaeus Used the word first in his book named “Systema Naturae”.

- The Term “New Systematics” was proposed by Sir Julian Huxley in 1940.

Processes of Taxonomy

- Characterization- Understanding of Characters of organisms such as External and Internal Structure, structure of cell, development process, ecological information, etc.

- Identification- Correct Description of an Organism and its recognition in its scientific name.

- Classification- Grouping of organism in the convenient categories (taxa) based on characters.

Biology

- Nomenclature (Naming) – Providing Standardized names to the organism such that a particular organism is known by the same name all over the world.

- Binomial Nomenclature- System of naming with two components- proposed by Carolus Linnaeus.
  According to the binomial nomenclature, each scientific name has two components- Generic Name + Specific Epithet.

- Botanical Names are based on the rules provided in International Code For Botanical Nomenclature(ICBN).

- Zoological names are based on International Code For Zoological Nomenclature (ICZN).

Binomial Nomenclature

Nomenclature is the process of giving scientific names to plants and animals.
Carolus Linnaeus divised a binomial system of nomenclature in which an organism is given 2 names:

I. Generic Name- Name which shares with closely related organisms which has features similar enough to place them in the same group

II. Specific Name- Name which distinguished the organism from all other species. No Other organism can have te same combination of genus and species.

The scientific name derived by using the system of nomenclature is followed over the world as they are guided by a set of rules stated in the International Code of Nomenclature.

Universal Rules of Binomial Nomenclature

- Scientific Names are generally is **LATIN** and written in ***ITALICS.***
- The first word is genus name (Generic Name) and second word is the Specific Name(Specific Epithet).
- When Handwritten, the names are to be Underlined
- The names are printed in Italics.
- The first name (Genus) starts with capital letter and the second name (species) start with small letter. E.g. *Homo Sapiens.* Homo is the genus name and Sapiens is the species name.
- Name of the author appears after the specific epithet
  i.e. at the end of the biological name and is written in abbreviated from.
  E.g. *Mangifera Indica* Linn. It shows that the species was first discovered by Linnaeus.

Taxonomic Categories

- Classiification involves hierarchy of steps in which each step represents a Rank (Taxonomic Category or Taxon).
- All categories together consititute the Taxonomic Heirarchy
- Each taxon represents a unit of classification.

Kingdom. - Animalia

Phylum. - Chordata
(Division in case of plants)

Class. - Mammalia

Order. - Primata

Family. - Hominidae

Genus. - *Homo*

Species. - *Sapiens*

Species

- Species is the basis unit of classification. It is a group of individual organisms with fundamental similarities.

- It is defined as the group of individuals which resemble in their morphological and reproductive characters and interbreed among themselves and produce fertile offsprings.

- This is the biological concept of species proposed by Mayr.

Example-Crow

- We have two types of crows. One is the common house crow founds in plains around houses. The other is the hill or jungle crow.

- The two crows differ in intensity of black color on the neck and in size and shape of the beak.

- Both are crows but they cannot be interbreed. Thus , they are different species.

Genus

- It is the aggregates of closely related species.
- Its consists of a group of related species which has more characters in common in comparison to species of other genera.
- Example-
  Potato, tomato and brinjal are species of gen *Salonum.*
  Lion(*Panthera leo*), leopard (*P.Paradus*) and the tiger (*P.tigris*) are species of genus *Panthera.*
  This differs from another genus *Felis* which includes cats.

Family

- It is a group of related genera with less number of similarities as compared to genus and species.
- Examples:
  Family Solanaceae includes genus *Solanum ,*genus *Petunia* and genus *Datura.*
  Family Felidae includes genus *Panthera* and Genus *Felis.*

Order

- It is the assemblage of related families.
- Examples:
  Order Polymoniales includes Family Convolvulceae and the Family Solanaceae.
  Order Carnivora includes Family Felidae and Canidae (Dog).

Class

- It is the assemblage of related orders
- Examples:
  Order Primata, Carnivora etc is placed in class Mammalia.
  Order Polymonials and Order Sapindales etc. is placed is class Dicoyledonae.

Phylum (in animals) or Division (in plants)

- It is the assemblage of related classes.
- Examples:
  Classes Amphibia, Repitlia, Aves, Mammalia etc come under phylum Chordata.
  Class Dicotlydonae and Class Monocotlyedonae is placed under division angiospermae

Kingdom

- The assemblage of various Phyla
- It is the highest category.
- Example-
  Kingdom Plantae, Kingdom Animalia, etc

Phylogeny

- The evolutionary history of a particular taxon like species is called Phylogeny.
- The classification based on the basis of evolution is called as Phylogenetic Classification.
- Phylogenetic classification is not always possible since there are several gaps in the fossil records which form the basis of phylogenetic studies and also evolution is never unidirectional .
- Classic not explicitly based on evolutionary relationships is called as artificial, for example, organisms are grouped according to usefullness (economic plants), size(herbs and shrubs), colour (flowers), Ecological role (Ground Cover) and so forth.

Three Domains of Life

- All of life can be divided into three domains, which tell you the type of cell inside an organism
- The three domains are Archaea, Bacteria and Eukarya
- It is proposed by Carl Woese in 1990 who also proposed the six kingdom classification for living organisms. It

Taxonomical Aids

1. Herbarium

    - It is a store house of collected plant specimens that are dried, pressed and preserved on sheets and are arranged according to universally excepted classification .

    - The herbarium sheets are labelled with information about date and place of collection, English, local and botanical names, family, collector's name etc.

2. Botanical gardens

    - These are specialised gardens having collections of living plants for reference and identification purposes.

    - Each plant is labelled with its botanical name and family.

    - Famous botanical gardens are
      Royal botanical Garden, Kew England
      Indian botanical Garden, Howrah India
      National botanical research Institute, Lucknow India

3. Museum

    - Museum is a collection of preserved plants and animals for studying reference.

    - A museum contains specimens preserved in preservative solutions in containers or jars

    - Plant and animal specimens are preserved as dry specimens.

    - Insects are preserved in insect boxes after collecting, killing and pinning.

    - Stuffed larger animals like birds and mammals are also preserved.

    - It also has collections of animal skeletons.

4. Zoological parks (Zoos)

    - These are the places where live wild animals are kept in protected environment is under human care.

    - It enables to learn about their food habits and behaviour.

5. Key

    - It is the device used to identify each species in a group of organisms based on similarities and dissimilarities.

    - The keys are based on contrasting characters generally in a pair call **COUPLET**.

    - It represents the choice made between two opposite options. This results in acceptance of only one and rejection of other.

    - Each statement in the key is called **LEAD.**

Flora, Manuals, Monographs And Catalogues

- These are some other means of recording descriptions.

- They also Help in correct identification.

- **Flora** contains the actual account of habitat and distribution of plants species of a given area.

- **Manuals** help in providing information for identification of names of species found in an area. They also provide information about ease, description of family, germs and species.

- **Monographs** contain comprehensive information on any one taxon at a given time.

- **Catalogues** provide information about new addition and update the seconds. The catalogues are also the means for recording information for taxonomy.