Unit 1
Diversity in the living world

Chapter 1

THE LIVING WORLD

Characteristics of living organism

- **Growth**

- **Reproduction**

- **Metabolism**

- **Cellular Organization**

- **Consciousness**

Growth

- Increase in mass & number
- Cell division
- Plants- division occurs continuously & Animals- certain age
- Division also enables to replace lost cells
- Unicellular- division to increase in number
- Growth- increase in body mass
- Non- living- grow with accumulation of material on surface, Eg- Mountains, Boulders, Sand mounds
- Growth cannot be defining property- living organism
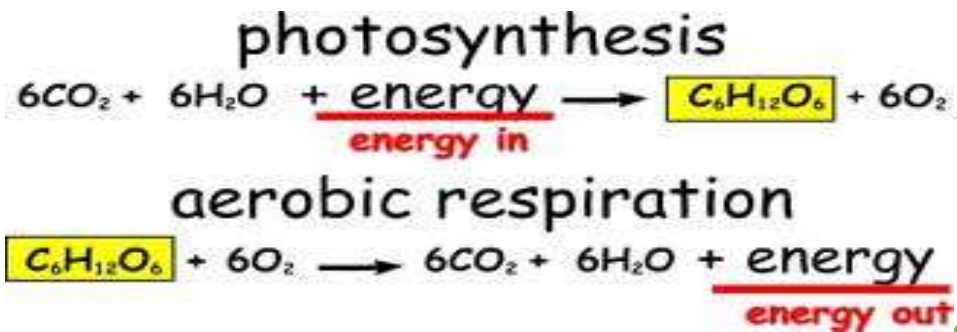- Conditions when it is observed in living organism when explained- characteristics of living

Reproduction

▶ Organism reproduce to progeny similar to them

▶ Asexual & Sexual Reproduction

▶ Unicellular organism like Amoeba, Bacteria, Chlamydomonas- multiply & increase in number- defined as Growth

▶ So it is unclear with the usage of two terms- growth & reproduction- Unicellular

▶ Many organism do not reproduce- mules, sterile worker bee, infertile human couples

▶ Hence reproduction- defining characteristic of living organism

▶ Non living- do not reproduce
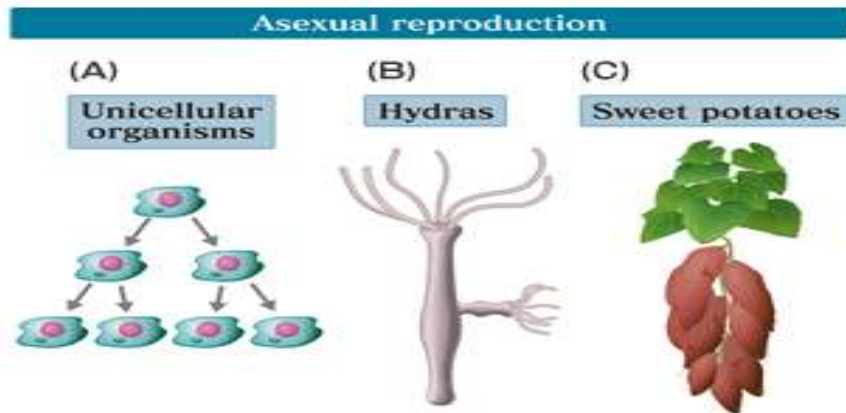
Metabolism

▶ All organism are made of chemicals- small & big

▶ Chemicals- Biomolecules, which are made & changed to other molecules

▶ Conversion reactions of these molecules- **Metabolic reactions**

▶ Sum total of all chemical reactions- **Metabolism**

▶ Non- living- no metabolism

▶ Metabolic reactions- demonstrated outside the body in cell free system (test tube/ *in vitro*) is neither living nor non living

▶ Metabolism- defining feature of living things & hence **Cellular organization of the body is the defining feature of life form**

▶ Ex- Photosynthesis (Anabolism), Cellular respiration (Catabolism)

photosynthesis

$$6CO_2 + 6H_2O + \underline{energy} \longrightarrow \boxed{C_6H_{12}O_6} + 6O_2$$

energy in

aerobic respiration

$$\boxed{C_6H_{12}O_6} + 6O_2 \longrightarrow 6CO_2 + 6H_2O + \underline{energy}$$

energy out

- Living organism- sense their surroundings or environment stimuli (physical, chemical or biological)

- Organism sense through sense organs

- Plants- light, water, temperature, organism, pollutants

- Photoperiod influence reproduction- seasonal breeders (plants & animals)

- Human- aware of himself, i.e., self- consciousness

- **Consciousness- defining property of living organism**

Diversity of living world

- **Biodiversity :** Term used to refer to the number of varieties of plant and animals in region on earth.

- Number of species known- 1.7- 1.8 million

- **Need for classification :** living organisms are classified into categories so that they could be named, remembered, studied and understood.

- Need to standardize naming organism, so organism named same in all over world- **Nomenclature**

- Nomenclature- scientific name to all known organism

- Plants- based on principles & criteria of ICBN (International Code for Botanical Nomenclature)

- Animals- ICZN (International Code of Zoological Nomenclature)

- Scientific names ensure that each organism has only one name

► Binomial nomenclature was first introduced by Carolus Linnaeus. He published the book 'Systema Naturae'.

► The scientific naming of an organism using two words- Binomial nomenclature.

► Each name two components- **Generic name & Specific epithet/ Species name.**

► *Rules for Nomenclature* :

1. Biological Names are generally Latin & written in italics

2. First word represents **genus** & second word denotes **specific epithet**

3. Both word of biological name should be underlined separately when hand written & italics if printed

4. First word denoting genus start with capital letter & specific epithet or species name should start with small letter.

Taxonomy

- Process of classification based on characteristics of living organism

- External & internal structure, cell structure, development, ecological information- basis of modern taxonomy

- Human being is interested to know different organism & diversity along with their relationship with others- **Systematics**

- **Systematics :** It deals with classification of organisms based on their diversities and relationships among them.

- **Taxonomic Hierarchy :** It is the arrangement of various **taxa** of classification

- Taxonomical study of all known organism will led to development of categories such as kingdom, phylum or division, class, order, family, genus and species

- Species → Genus → Family → Order → Class → Phylum (for animals)/ Division (for plants) →Kingdom

species

- Group of individuals having fundamental similarities and successful reproduction takes place among themselves

- Distinct morphological difference is there between two closely related species

- **Eg: *Panthera tigris, Panthera leo, Solanum tuberosum, Solanum nigrum.***

- *tigris, leo, tuberosam, nigrum*- Specific epithet/ species name

- *Panthera & Solanum*- generic name, next higher level taxon

- Genus may have more than one specific epithet- represent different organism

genus

▶ **Genera are aggregates of closely related species.**

▶ Group of related species with more characters in common than species of other genera

▶ *E.g: Panthera leo ,P. pardus (leopard) ,P tigris*

▶ Animals which comes under genus *Panthera* shares several common features & differs from genus *Felis*

▶ Potato (*Solanum tuberosam*) & Brinjal (*S. melongena*)

family

- It has a group of related genera with less number of similarities
- Characterized on the basis of vegetative & reproductive feature
- E.g:family Solanaceae includes genera *Solanum*, *Petunia* & *Datura*.
- Family Felidae includes genera *Panthera* (lion, tiger ,leopard) & *Felis* (cat)

Order

- Assemblage of families which exhibit few similar characters
- Similar characters will be less in number
- Plants family Convolvulaceae, Solanaceae- order **Polymoniales**
- Animals family Felidae & Canidae- order **Carnivora**

class

▶ It includes all related orders having few similar characters. .

▶ E.g: class **Mammalia** includes order Primata (monkey, gorilla, gibbon) & Carnivora.

▶ Class Dicotyledonae includes order polymoniales & sapindales(mango)

Phylum/ division

▶ It include classes with very few similarities

▶ Phylum **Chordata** includes classes fish, amphibia, reptilia, aves & mammalia due to common feature- presence of notochord & dorsal hollow neural system

▶ Division **Angiospermae** includes class dicotyledonae & monocotyledonae.

kingdom

- ▶ Highest category of taxonomy
- ▶ Animals- Kingdom Animalia
- ▶ Plants- Kingdom Plantae

Taxonomic aids

- Taxonomic studies of various species of plants, animals and other organisms- know bio- resources & diversity

- Studies require correct classification & identification-collection of actual specimen of plants & animals

- Fundamental to studies & essential for training in systematics

- Specimens are gathered, stored/ preserved with information for future studies

Taxonomical aids are,

- Herbarium

- Botanical Garden

- Museum

- Zoological Park

HERBARIUM

- Herbarium is a store house of collected plant specimens that are dried, pressed and preserved on sheets.

- Specimens- description on herbarium sheet, label of date & place of collection, English, local & botanical name, family & collector name

- Quick referral system for taxonomic studies

BOTANICAL GARDEN

- Specialized garden having collection of living specimen

- Plants grown for identification purpose

- Plant is labelled with botanical/scientific name & family

MUSEUM

- Museums have collections of preserved plant and animal specimens- study & reference

- Set up in educational institutes

- Specimen preserved in containers & jars in preservative solutions

- Plants & animals- dry specimens, insects- insect boxes after collecting, killing & pinning, Large animals- stuffed & preserved

- Skeletons of animals

ZOOLOGICAL PARK

- Zoological Parks are the places where wild animals are kept in protected under human care.

- Learn food habits & behavior

- Conditions are provided as animals natural habitat

KEY

- Key is another taxonomical aid used for identification of plants and animals based on the similarities and dissimilarities.

- Based on contrasting character, generally in pair- couplet

- Represent choice between two opposite options- accepting one & rejecting another

- Each statement- lead

- Separate taxonomic keys- each taxonomic category like family, genus & species- identification purpose

- Analytical in nature

Taxonomic key

A taxonomic key is a device that biologists use to figure out what unknown organisms actually are. The key is made up so that you answer a series of questions about the characteristics and an answer is narrowed down