• Classification and evolution

- **Primitive organism** or lower organism has a simple body structure and ancient body design
- **Advanced organism** or higher organism has a complex body structure and organization
- **Evolution** The process of gradual and continuous change in primitive or simple organisms to give rise to advanced organisms
- **Biodiversity** The variety of life forms present in various ecosystems
- Hierarchy of classification
- The hierarchical arrangement of various taxonomical categories in descending order is: Kingdom → Phylum (for animals)/ Division (for plants) → Class → Order → Family → Genus → Species.
- Mnemonic to learn this hierarchy: Kids Prefer Cheese Over Fried Green Spinach
- **Species** is the basic unit of classification
- **Carolus Linnaeus** developed the hierarchy of classification. He also brought out the famous book *Systema Naturae*
- o Linnaeus also developed the concept of binomial nomenclature
- Binomial nomenclature refers to the naming of species. In this system, the name of a species is made up of two words: the genus name and the species name. E.g. *Rosa indica*
- **Diversity**: It refers to the variety and variability among living organisms from all sources including land, water, and other ecosystems.
- Classification
- It refers to the identification, naming, and grouping of organisms into a formal system based on similarities in internal and external structures or evolutionary history
- It helps in organising the diversity of life forms in detail.
- \circ $\;$ Characteristic A feature that helps identify or describe a person or a thing

- There are certain characteristics that are considered more fundamental than others. These fundamental characteristics make broad divisions in living organisms.
- Principles of classification
- **Nature of cell (Fundamental characteristic):** On the basis of the nature of cell, living organisms are classified as: **prokaryotes and eukaryotes**
- **Cellularity:** On the basis of cellularity, organisms are classified as: **unicellular and multicellular**
- **Mode of nutrition**: On the basis of mode of nutrition, organisms are classified as: **Autotrophs and heterotrophs**
- R.H. Whittaker (in 1969) proposed a five-kingdom classification of living organisms
- The five kingdoms proposed by Whittaker are: Monera, Protista, Fungi, Plantae, and Animalia



Kingdom Monera: It includes mainly bacteria, blue-green algae, or cyanobacteria

• Important features of Monera:

- Absence of well-defined nucleus or membrane-bound organelles- prokaryotic organisms.
- All of them are unicellular
- Can be autotrophic or heterotrophic

Kingdom Protista: It Includes protozoans such as, *Amoeba, Paramecium*, diatoms etc **Important features of protista**:

• Unicellular, eukaryotic organism

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• Can be autotrophic or heterotrophic

Kingdom Fungi: Commonly known fungi are Yeast, mushroom, Penicillium, Aspergillus, etc.

- Important features of fungi:
- Multicellular eukaryotic organisms
- Always heterotrophic (saprophytes)
- Cell wall made of chitin

Kingdom Plantae

- Important features of Plantae:
- Multicellular eukaryotic organisms
- Most of the plants contain chlorophyll. Hence, they are autotrophic
- Cell wall is made of cellulose

Kingdom Animalia

- Important features of Animalia:
- Multicellular eukaryotic organisms
- Chloroplast is absent. Hence, they have heterotrophic mode of nutrition
- Cell wall is absent

Kingdom Plantae: It include five divisions:

- 1. Division Thallophyta: Includes Spirogyra, Cladophora, Ulva
 - <u>Characteristic feature of Thallophyta:</u>
 - Plant body is not differentiated into true root, stem, and leaves
 - Spores are produced as a result of fertilization

2. Division Bryophyta (also called amphibians of plant kingdom): Includes

mosses, Riccia, Marchantia

- <u>Characteristic feature of Bryophyta:</u>
- Specialised vascular tissues (such as xylem) for the conduction of water are absent
- Body is differentiated into stem and leaf-like structures
- Naked embryo i.e. spores are present.

3. Division Pteridophyta: Includes ferns, Marsilea, Equisetum

- <u>Characteristic feature of Pteridophyta</u>
- Specialised vascular tissues for the conduction of water are present.
- Naked embryo i.e. spores are present
- The plant body is differentiated into roots, stems, and leaves.
- 4. Division Gymnospermae: Includes *Pinus*, cedar, fir, Juniper, *Cycas*, etc
 - <u>Characteristic feature of Gymnospermae:</u>
 - Seed bearing, non-flowering plants.
 - Bear naked seeds, not enclosed inside fruits.
 - Vascular bundles are present, but xylem lacks vessels and phloem lacks companion cells.
 - Flowers are absent. Instead, male and female cones are found.

5. Division Angiospermae: Includes all flowering plants

- <u>Characteristic feature of Angiospermae:</u>
- Flowering plants in which seeds are enclosed inside fruits.
- These plants bear flowers that consist of four whorls calyx, corolla, androecium, and gynoecium
- Seeds develop inside the ovary, which develops into a fruit
- <u>Major groups of Angiosperms</u>
- **Monocotyledons:** Seeds that have one cotyledon. E.g. maize, wheat etc
- **Dicotyledons**: Seeds that have two cotyledons. E.g. Sunflower, gram etc

Kingdom Animalia

- Kingdom Animalia can be divided into two major groups on the basis of the presence or absence of notochord- Non-chordata and Chordata
- Non-chordata can be further divided into the following phyla:

i. Phylum Porifera: Includes sponges such as Spongilla, Euplectella, etc

- Characteristic features of Porifera:
- Cellular level of organisation
- Mainly found in marine habitats
- Posses canal system for circulating water.

ii. Phylum Coelenterata: Includes organisms such as hydra, sea anemone, etc.

- Characteristic features of Coelentrata:
- Tissue level of organisation
- Body cavity (coelom) is present
- Diploblastic i.e body is made of two layers of cells.

iii. Phylum Platyhelminthes: Includes flatworms, liver flukes and planarians

Characteristic features of Platyhelminthes:

- Bilateral symmetry
- Triploblastic i.e. three layers of cells are present
- true internal body cavity is absent

iv. Phylum Nematoda (Aschelminthes): Includes roundworms - Ascaris

- Characteristic features of Nematoda:
- Bilaterally symmetrical
- Triploblastic
- Pseudocoelom (false coelom) is present

v. Phylum Annelida: Includes segmented worms such as earthworms and leeches

- Characteristic feature of Annelida:
- Bilaterlly symmetrical
- Triploblastic
- Body is segmented

vi. Phylum Arthropoda: Includes crabs, prawns, insects, spiders, scorpions, etc

Characteristic features of Arthropoda:

- Largest group of the animal kingdom.
- Bilaterally symmetrical and segmented
- Coelomic cavity is blood-filled
- Presence of Jointed legs and open circulatory system

vii. Phylum Mollusca: Includes snails, octopus, Pila, etc

- Characteristic features of Mollusca:
- Bilaterally symmetrical, little segmentation
- Coelomic cavity is reduced
- Open circulatory system and kidney-like organ for excretion is present.

viii. Phylum Echinodermata: Includes marine animals such as starfishes, sea urchins, etc

- Characteristic feature of Echinodermata:
- Spiny skinned organisms

- Free living marine organisms
- Triploblastic and coelomate
- Skeleton is made of calcium carbonate

Chordata can be further divided into sub-phyla Protochordata and Vertebrata (1) Protochordata: Includes *Herdmania* and *Amphioxus*

Characteristic features of Protochordates

- Triploblastic, and have a coelom
- Bilaterally symmetrical
- Notochord at some stages of life is present.
- Notochord is a flexible rod-like structure that forms the supporting axis of the body in the chordates.

(2) Vertebrata: Animals having true vertebral column. Some common features are-presence of notochord, coelom, dorsal nerve chord.

The sub-phylum Vertebrata is further divided into five classes:

i. Class Pisces: Includes all fishes

Characteristic features of Pisces:

- Exclusively aquatic animals
- Body is streamlined and covered with scales
- They are cold blooded animals
- Heart is two chambered
- Skeleton is bony or cartilaginous
- Oviparous, they lay eggs in water

ii. Class Amphibia: Includes frogs, toads, and salamanders

Characteristic features of Amphibia:

- Scales are absent
- Cold blooded animals
- Heart is three chambered
- Respire through gills /lungs
- Oviparous, they lay eggs in water
- These animals have a dual mode of life (in water and land); respire through gills, skin, and lungs

iii. Class Reptilia: Includes reptiles such as lizard, snake, turtle, etc

Characteristic features of Reptilia:

- Cold blooded animals
- Most of them have three chambered heart (Crocodiles have four chambered heart)
- Skin is covered with scales

- These animals are completely terrestrial. They breath through lungs
- Lay eggs on land (oviparous)
- Heart is four chambered

iv. Class Aves: Includes all birds

Characteristic features of Aves:

- Warm-blooded animals with four chambered heart
- They breathe through lungs
- Have feathers and forelimbs modified for flight.
- Exclusively egg-laying animals
- v. Class Mammalia: Includes kangaroo, rat, dolphin, elephant, horse, human, tiger, etc

Characteristic features of Mammalia:

- Warm-blooded animals with four chambered heart
- Most of them are viviparous except for platypus and *Echidna* which are oviparous.
- These animals have milk-producing glands (mammary glands) to nourish their young ones.