Diversity in Living Organisms

1. Introduction to Biodiversity

- **Diversity in Living Organisms**: Refers to the wide variety of life forms on Earth, differing in size, shape, habitat, nutrition, and reproduction.
- **Environments**: Includes aquatic, terrestrial, desert, forest, grassland, and icy regions.
- **Classification**: The process of grouping organisms based on similarities and differences.

2. Hierarchical Classification System

- **Developed by**: Carolus Linnaeus.
- **Levels of Classification**: Organisms are classified in a hierarchy of taxonomic levels, from broad to specific:
  1. Kingdom
  2. Phylum
  3. Class
  4. Order
  5. Family
  6. Genus

3. Classification Systems

- **Two-Kingdom Classification (by Carolus Linnaeus):**
  - **Plants**: Autotrophic organisms that produce their own food via photosynthesis.
  - **Animals**: Heterotrophic organisms that depend on other organisms for food.
- **Five-Kingdom Classification (by R.H. Whittaker):**
  - **Monera**: Comprises prokaryotic organisms like bacteria, which lack a true nucleus.
  - **Protista**: Includes single-celled eukaryotes, such as amoebas and algae.
  - **Fungi**: Consists of eukaryotic organisms like mushrooms, which absorb nutrients from decaying organic matter.
  - **Plantae**: Encompasses all multicellular plants, which carry out photosynthesis.
  - **Animalia**: Comprises all multicellular animals, which rely on other organisms for nutrition.

4. Characteristics of the Five Kingdoms

- **Kingdom Monera**:
  - Prokaryotic, Unicellular, lacking a true nucleus.
  - **Mode of Nutrition**: Can be autotrophic or heterotrophic.
  - **Examples**: Bacteria, Cyanobacteria, Mycoplasma.
- **Kingdom Protista**:
  - Unicellular Eukaryotes.
  - **Mode of Nutrition**: Can be autotrophic or heterotrophic.
  - **Locomotion**: Use structures like pseudopodia, cilia, or flagella for movement.
  - **Examples**: Amoeba, Paramecium, Euglena.

- **Kingdom Fungi:**
  - Eukaryotic, Multicellular (except yeast).
  - **Mode of Nutrition**: Saprophytic, obtaining nutrients from decomposing organic material.
  - **Cell wall**: Composed of chitin.
  - **Examples**: Yeast, Aspergillus, Mushrooms.
- **Kingdom Plantae:**
  - Multicellular Eukaryotes, Autotrophic.
  - **Cell wall**: Made of cellulose, aiding in structural support.
  - Examples: Ferns, Pine trees, Mango trees.
- **Kingdom Animalia:**
  - Multicellular Eukaryotes, Heterotrophic.
  - **Lack of Cell Walls**: Distinguishes them from plants and fungi.
  - **Examples**: Humans, Dogs, Insects.

5. Detailed Classification of Kingdom Plantae

- Classification Based on:
  - **Body Structure**: Complexity of the plant body.
  - **Vascular System**: Presence or absence of specialized tissue for water and nutrient transport.
  - **Seed Formation**: Whether seeds are produced and if they are enclosed within a fruit.
- **Subgroups:**
  - **Thallophyta** : Simple, non-differentiated plant body; mostly aquatic (e.g., Algae).
  - **Bryophyta**: Non-vascular plants with root-like, stem-like structures; known as amphibians of the plant kingdom (e.g., Mosses).
  - **Pteridophyta**: Vascular plants without seeds; differentiated into root, stem, and leaves (e.g., Ferns).
  - **Gymnosperms**: Seed-producing plants with naked seeds, typically evergreen (e.g., Pines, Cycads).
  - **Angiosperms**: Flowering plants with seeds enclosed within fruits; largest group (e.g., Roses, Mango trees).
- **Cryptogams**: Non-flowering, non-seed bearing plants (e.g., Thallophyta, Bryophyta, Pteridophyta).
- **Phanerogams**: Flowering, seed-bearing plants (e.g., Gymnosperms, Angiosperms).

Classification of Kingdom Animalia

- Introduction: Kingdom Animalia is the most diverse kingdom, encompassing all animals, which are multicellular, eukaryotic organisms. Animals differ from plants and fungi as they lack chlorophyll and cell walls, and they rely on other organisms for nutrition (heterotrophy).

Body Structure and Complexity

- Animals range from simple, non-differentiated forms to highly complex organisms with specialized organ systems.
- They are characterized by their ability to move, a feature absent in plants and most fungi.

Subdivisions of Kingdom Animalia

The animal kingdom is divided into multiple phyla based on body design, level of organization, and other distinguishing features. Below are the main phyla with examples and key characteristics:

1. Phylum Porifera (Sponges):

- **Structure**: Simplest multicellular animals with porous bodies and a lack of true tissues and organs.
- **Habitat**: Primarily marine environments.
- **Key Features**: Sessile (non-motile), have a skeleton made of spicules.
- Examples: Spongilla, Sycon.

2. Phylum Coelenterata (Cnidaria):

- **Symmetry**: Radially symmetrical with a hollow body cavity.
- **Body Forms**: Can exist as polyps (e.g., Hydra) or medusae (e.g., Jellyfish).
- **Special Features**: Possess specialized cells called cnidocytes for capturing prey.
- Examples: Corals, Sea anemones.

3. Phylum Platyhelminthes (Flatworms):

- **Structure**: Dorsoventrally flattened, bilaterally symmetrical bodies.
- **Habitat**: Many are parasitic in nature.
- **Body Organization**: Triploblastic, but lack a true body cavity (acoelomates).
- Examples: Tapeworm, Planaria.

4. Phylum Nematoda (Roundworms):

- **Body Shape**: Cylindrical and tapered at both ends.
- **Symmetry**: Bilaterally symmetrical and triploblastic.
- **Significance**: Many are parasitic, causing diseases in humans and animals.
- Examples: Ascaris, Wuchereria.

5. Phylum Annelida (Segmented Worms):

- **Structure**: Segmented bodies with repeating units.
- **Symmetry**: Bilaterally symmetrical, with a true coelom.
- **Habitat**: Found in marine, freshwater, and terrestrial environments.
- Examples: Earthworm, Leech.

6. Phylum Arthropoda (Jointed-Leg Animals):

- **Distinguishing** Features: Possess jointed appendages, an exoskeleton made of chitin, and a segmented body.
- **Symmetry**: Bilaterally symmetrical.

- **Diversity**: The largest phylum, including insects, arachnids, and crustaceans.
- Examples: Spiders, Butterflies, Crabs.

7. Phylum Mollusca:

- **Body Structure**: Soft-bodied, often with a hard external shell.
- **Symmetry**: Bilaterally symmetrical.
- **Circulatory** System: Usually possess an open circulatory system.
- Examples: Snails, Octopus.

8. Phylum Echinodermata:

- **Structure**: Spiny-skinned animals with radial symmetry in adults.
- **Skeleton**: Composed of calcium carbonate plates.
- **Habitat**: Exclusively marine.
- Examples: Starfish, Sea urchins.

9. Phylum Hemichordata:

- **Unique Feature**: Possess a structure similar to a notochord called a stomochord.
- **Symmetry**: Bilaterally symmetrical.
- **Circulatory System**: Open, with gills for respiration.
- Examples: Balanoglossus, Saccoglossus.

10. Phylum Chordata:

- **Structure**: Animals with a notochord, dorsal nerve cord, and pharyngeal slits at some stage in their life cycle.

Subphylum Vertebrata

Includes animals with a backbone.

- **Class Pisces (Fishes):**
  - **Habitat**: Aquatic environments, both freshwater and marine.
  - **Body Covering**: Skin covered with scales or plates.
  - **Respiration**: Through gills.
  - **Circulatory System**: Two-chambered heart, adapted for life in water.
  - **Reproduction**: Most species lay eggs.
  - Examples: Sharks, Salmon, Goldfish.
- **Class Amphibia (Amphibians):**
  - **Habitat**: Can live both in water and on land; often rely on moist environments.
  - **Respiration**: Through gills during the larval stage and lungs in adulthood; some respiration occurs through the skin.
  - **Circulatory System**: Three-chambered heart.
  - **Body Covering**: Moist, glandular skin.
  - **Reproduction**: Typically lay eggs in water.

- **Examples**: Frogs, Salamanders, Newts.

- **Class Reptilia (Reptiles):**
  - **Habitat**: Primarily terrestrial, though some species are aquatic.
  - **Body Covering**: Dry skin with protective scales.
  - **Respiration**: Exclusively through lungs.
  - **Circulatory System**: Usually a three-chambered heart, except for crocodiles, which have a four-chambered heart.
  - **Reproduction**: Lay eggs with leathery shells.
  - Examples: Snakes, Lizards, Turtles, Crocodiles.

- **Class Aves (Birds):**
  - **Habitat**: Wide range, from terrestrial to aerial environments.
  - **Body Covering**: Feathers, which aid in flight and insulation.
  - **Respiration**: Through lungs, with an efficient system of air sacs.
  - **Circulatory System**: Four-chambered heart.
  - **Reproduction**: Lay hard-shelled eggs.
  - Examples: Eagles, Sparrows, Penguins.

- **Class Mammalia (Mammals):**
  - **Habitat:** Diverse environments, including terrestrial, aquatic, and aerial.
  - **Body Covering**: Hair or fur covering the body.
  - **Respiration**: Through lungs.
  - **Circulatory System**: Four-chambered heart.
  - **Reproduction:** Most are viviparous, giving birth to live young; females have mammary glands to produce milk.
  - Examples: Humans, Whales, Bats, Lions.