Biological Classification

Classification

- The process of grouping living organisms into convenient categories based on simple characters is known as classification.

1. Two kingdom classification

- Carolus Linnaeus divided all living things into two kingdoms- Plantae and Animalia.

2. Five kingdom classification

- R.H. Whittaker divided all living things into five kingdoms- Monera, Protista, Fungi, Plantae, and Animalia.
- The main criteria for classification included
  - cell structure
  - thallus organisation
  - mode of nutrition
  - reproduction
  - phylogenetic relationship (evolutionary relationship)

Kingdom Monera

- It includes all prokaryotes. Bacteria are the sole members of this kingdom.
- They have autotrophic (photosynthetic or chemosynthetic) or heterotrophic mode of nutrition.
- Bacteria can be classified into four categories based on their shapes.
  - Spirillum – spiral-shaped
  - Coccus – spherical-shaped
  - Bacillus – rod-shaped
  - Vibrium – comma-shaped

1. Archaebacteria

- It includes halophiles, which are found in extreme salty areas; thermoacidophiles, which are found in hot springs; and methanogens, which are found in marshy areas.
- Methanogens are found in the gut of ruminants and are used for the production of biogas from cow dung.

2. Eubacteria (also known as true bacteria)

- It includes blue-green algae (cyanobacteria) such as *Nostoc, Anabaena*, etc.
- Photosynthetic bacteria contain chlorophyll *a*. Chemosynthetic bacteria oxidise various inorganic compounds and use the released energy for their ATP production.
- They have rigid cell wall and flagellum (if motile) for locomotion.
- They have specialised cells known as heterocysts, which are involved in nitrogen fixation.
- Bacteria reproduce mainly by binary fission. Spore formation and primitive type of DNA transfer techniques from one bacterium to another are also seen for reproduction.
- Mycoplasma is the smallest cell that can survive in the absence of oxygen and completely lacks a cell wall. Many of them are pathogenic to plants and animals.

Viruses

- Viruses are living only when found in living organisms.
- Viruses are non-cellular organisms having either DNA or RNA as the genetic material and a protein coat.
- W.M. Stanley showed that virus can be crystallized.
- Viruses that infect bacteria are called bacteriophages.
- A bacteriophage consists of head, tail, sheath, and tail fibres.

Viroids and lichens

- Viroids are infectious agents, smaller than viruses having free RNA. These lack protein coat.
- Discovered by T.O. Diener
- Lichens are symbiotic associations of algae and fungi.
  - The algal component in lichen is referred to as phycobiont while fungal component is referred to as mycobiont.
  - Lichens are good pollution indicators.

Kingdom Protista

- It includes all unicellular eukaryotes.
- They have autotrophic or heterotrophic mode of nutrition.
- Have well-defined nucleus and membrane-bound organelles
- Reproduce asexually and sexually by a process of cell fusion and zygote formation
- Classes of kingdom Protista-

1. Chrysophytes

- This group includes diatoms and desmids (golden algae).
- The deposition of cell walls of diatoms in their habitat is known as diatomaceous earth.
- The soil of diatomaceous earth is gritty. Therefore, it is used in polishing, filtrations of oils and syrups.
- Diatoms form the chief producers in the oceans.

2. Dinoflagellates

- This group includes red dinoflagellates such as *Gonyaulax*.
- These are mostly marine and photosynthetic.
- They make the sea appear red, forming red tides. The toxins released by them are harmful to marine animals.

3. Euglenoids

- It includes fresh water organisms such as *Euglena*.
- These organisms have both autotrophic (in presence of sunlight) and heterotrophic (in absence of sunlight) mode of nutrition.
- The outer layers of these organisms are made up of pellicle, which makes the body more flexible.
- These possess two flagella for locomotion and engulfing food.
- *Euglena* is called the connecting link between plants and animals as it possesses characteristics of both plants and animals.

4. Slime moulds

- This group includes saprophytic protists. They feed upon decaying parts of plants.
- Under favourable conditions, slime moulds form plasmodium.
- During unfavourable conditions, plasmodium gets differentiated and forms fruiting bodies bearing spores at their tips.

5. Protozoans

- They have heterotrophic mode of nutrition.
- They include four major groups of protozoans:
- Amoeboid protozoans - Examples include *Amoeba*, *Entamoeba*.
- Flagellated protozoans - Example includes *Trypanosoma.*
- Ciliated protozoans - Example includes *Paramoecium*.
- Sporozoans - Example includes *Plasmodium* (malarial parasite).

Kingdom Fungi

- It includes eukaryotes with cell wall (made of chitin), which have heterotrophic mode of nutrition.
- They may be saprophytic, parasitic, or symbiotic.
- Their body consists of long slender thread-like structures called hyphae. The network of hyphae is called mycelium.
- The symbiotic association of fungi and algae is known as lichens.
- The fungi living in symbiotic association with roots of higher plants are known as mycorrhiza.
- Fungi reproduce asexually through spores called conidia, sporangiospores, or zoospores.
- Fungi reproduce sexually through oospores, ascospores, and basidiospores.
- The sexual cycle involves three steps:
  Plasmogamy (fusion of protoplasm) →Karyogamy (Fusion of nuclei) →Meiosis in zygote, which leads to production of haploid spores

Four classes of kingdom fungi:

1. Phycomycetes

- Mycelium is aseptate and coenocytic.
- Asexual reproduction through zoospores or aplanospores
- Sexual reproduction - isogamous, anisogamous, or oogamous
- Examples include *Rhizopus*, *Mucor*, and *Albugo*.

2. Ascomycetes (sac fungi)

- They are saprophytic, decomposers, parasitic, or coprophilous.
- Mycelium is branched and septate.
- Asexual reproduction through Conidia
- Sexual reproduction through asci
- Examples include *Aspergillus, Claviceps*, and *Neurospora*.

3. Basidiomycetes (club fungi)

- Mycelium is branched and septate.

- Asexual reproduction is normally absent, but it reproduces vegetatively through fragmentation.
- Sexual reproduction is through basidia.
- Examples include *Agaricus, Puccinia*, and *Ustilago*.

4. Deuteromycetes (known as imperfect fungi)

- Mycelium is branched and septate.
- Asexual reproduction through conidia
- Sexual reproduction absent
- Examples include *Alternaria, Colletotrichum*, and *Trichoderma*.

Kingdom Plantae

- It includes all eukaryotic chlorophyll-containing organisms known as plants.
- They have autotrophic mode of reproduction.
- Cell wall is made up of cellulose.
- It exhibits the phenomenon of alternation of generation. The diploid sporophytic phase alternates with haploid gametophytic phase.
- Few members such as Venus fly trap and *Cuscuta* are heterotrophic.

Kingdom Animalia

- It includes eukaryotic multicellular organisms without cell wall and having heterotrophic mode of nutrition.
- They directly or indirectly depend on plants for food.