# NEET Revision Notes
# Biology
# Biological Classification

## Introduction:

- Classification is a very important aspect of Biology.
- It has greatly eased the study of various organisms and their evolution.
- All living organisms are widely classified into kingdoms based on their particular characteristics.
- The process of grouping various organisms according to their similarities, dissimilarities, and phylogenetic descent is known as biological classification.
- There have been various attempts to classify organisms. The earliest was by Aristotle, who classified plants into herbs, shrubs, and trees. He classified animals into two groups, based on the presence and absence of red blood cells.
- Linnaeus gave the Two Kingdom system of classification and divided living organisms into two kingdoms Plantae and Animalia.
- R.H. Whittaker proposed the Five Kingdom system of classification and classified organisms, based on cellular structure, complexity, mode of nutrition, phylogenetic relationship, and ecological role performed by them.
- Whittaker divided organisms into Monera, Protista, Fungi, Plantae, and Animalia.

| **Five Kingdom Classification by Whittaker** | | | | | |
|---|---|---|---|---|---|
| **Attributes** | **Monera** | **Protista** | **Fungi** | **Plantae** | **Animalia** |
| Cell type | Prokaryotic | Eukaryotic | Eukaryotic | Eukaryotic | Eukaryotic |
| Cell wall | Polysaccharide + amino acid | May be present | Chitin | Cellulose | Absent |
| Organ complexity | unicellular | Unicellular | Multicellular | Multicellular | Multicellular |
| Mode of Nutrition | Chemosynthetic | Autotrophic/ | Heterotrophic Absorption | Autotrophic | Heterotrophic Holozoic |

| | | | | | |
|---|---|---|---|---|---|
| | Autotrophic/ heterotrophic | heterotrophic | | | |

## Kingdom Monera

- The Monera Kingdom is entirely made up of bacteria.
- They are the most common microorganisms.
- Bacteria can be found almost everywhere.
- Hundreds of microorganisms can be found in a single sample of soil.
- They can also be found in severe habitats such as hot springs, deserts, snow, and deep oceans, where few other animals can survive.
- Many of them live in or on other species as parasites.
- Bacteria are divided into four types based on their shape: spherical Coccus (pl. cocci), rod-shaped Bacillus (pl. bacilli), comma-shaped Vibrium (pl. vibrio), and spiral Spirillum (pl. spirillum) (pl.: spirilla)
- Bacteria have a simple structure, yet their behaviour is very complex.
- Bacteria have the most metabolic diversity compared to other organisms.
- Some bacteria are autotrophic, which means they feed themselves from inorganic sources.
- Autotrophs can be either photosynthetic or chemosynthetic.
- The bulk of bacteria are heterotrophs, which means they devour dead organic stuff or other bacteria.

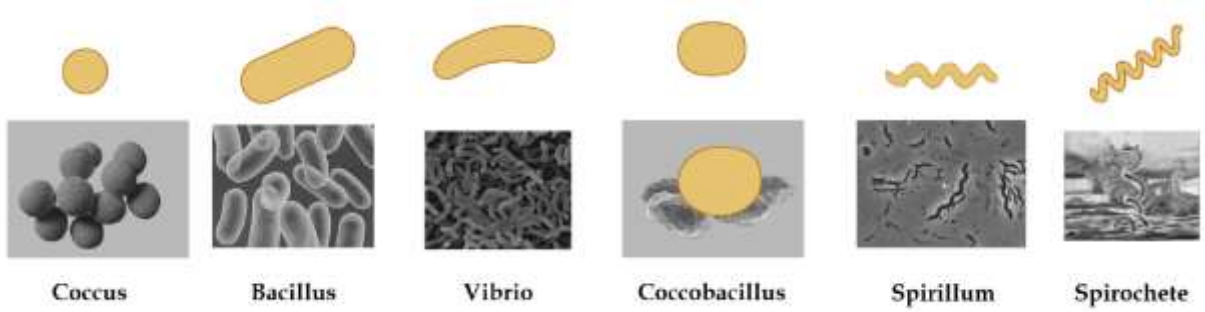


*Image: Shapes of Bacteria*

## Archaebacteria

- These bacteria are one of a kind because they can thrive in extremely saline conditions (halophiles), hot springs (thermoacidophiles), and marshy habitats (thermoacidophiles) (methanogens).
- Archaebacteria are distinguished from other bacteria by their unique cell wall structure, which allows them to thrive in severe settings.

**Eubacteria**

- There are thousands of different types of eubacteria, or "true bacteria."
- They are distinguished by the presence of a rigid cell wall and, if motile, a flagellum.
- Photosynthetic autotrophs having chlorophyll akin to green plants, cyanobacteria (also known as blue-green algae) are photosynthetic autotrophs.
- Cyanobacteria are unicellular, colonial, or filamentous algae that can be found in freshwater, seawater, or on land.
- In most cases, the colonies are surrounded by a gelatinous layer.
- In contaminated water sources, blooms are common. Some of these species, such as *Nostoc* and *Anabaena*, have specialised cells called heterocysts that can fix atmospheric nitrogen.
- Chemosynthetic autotrophic bacteria make ATP from the energy released when inorganic chemicals such as nitrates, nitrites, and ammonia are oxidised.
- They play an important role in the recycling of nutrients like nitrogen, phosphorus, iron, and sulphur.
- Heterotrophic bacteria are the most common in nature.
- The vast majority of them are active decomposers.
- Many of them have a significant impact on human affairs.
- Mycoplasma is an organism that is completely devoid of a cell wall. They are the tiniest living cells on the planet, capable of thriving in the absence of oxygen.
- In animals and plants, many mycoplasmas are pathogenic.

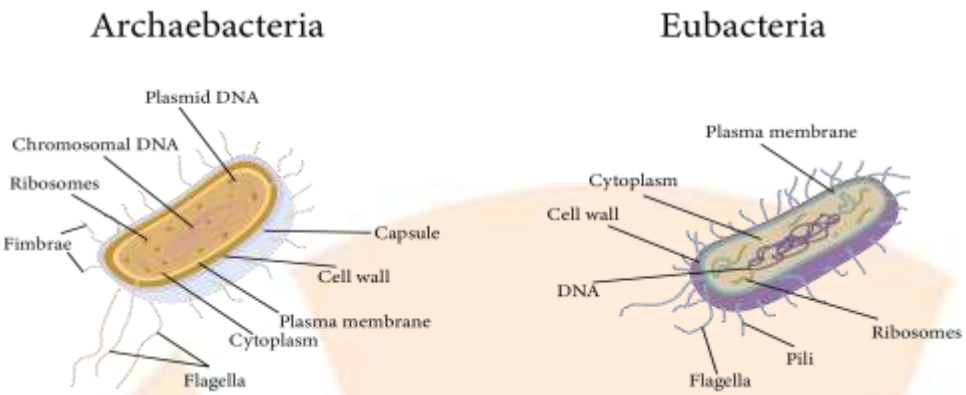


*Image: Archaebacteria and Eubacteria*

## Kingdom Protista

- This category includes unicellular eukaryotes.
- Photosynthetic protists connect plants and animals.
- They have their nucleus and other membrane-bound cell organelles.
- Among them are protozoa, slime moulds, chrysophytes, dinoflagellates, and euglenoids.

## Chrysophytes

- Desmids and diatoms should both be included (golden algae)
- Oceans contain a significant amount of diatoms. They do photosynthesis and consume $CO_2$ in the waters when they have access to enough nutrients. They are the chief producers and provide food for many marine species.
- They are mostly photosynthetic and have indestructible cell walls due to the presence of silica.
- The cell wall divides into two thin overlapping shells that fit together like a soapbox on the exterior surface.
- The accumulated deposit of the cell wall is diatomaceous earth. Filtering and polishing are two of its functions.

## Dinoflagellates

- They are photosynthetic and saltwater organisms.

- On the cell wall were stiff cellulose plates that came in a variety of colours, including yellow, green, red, blue, and brown, depending on the pigment present.
- They multiply rapidly, resulting in a red tide (gonyaulax).
- Many dinoflagellates emit a blue-green light that is bioluminescent.

**Euglenoids**

- They're photosynthetic protists with flagellated flagella.
- Euglena connects animal and plant kingdoms. They have no cell wall and can photosynthesize.
- A unique trait is the presence of pellicle, a protein-rich covering that allows them to bend their bodies.
- In the absence of sunlight, they are heterotrophic, feeding on small organisms.

**Slime molds**

- They are saprophytic protists, meaning they eat organic matter like rotting twigs and leaves.
- In unfavourable conditions, fruiting structures carrying spores grow at the plasmodium's apex.
- These spores have cellulose cell walls and can survive in harsh conditions for lengthy periods of time.

**Protozoans**

All unicellular, eukaryotic, heterotrophic parasites and predators belong to this group.
These are classified into four categories:

| Characters | Amoeboid | Flagellated | Ciliated | Sporozoan |
|---|---|---|---|---|
| **Habit and Habitat** | Freshwater, seawater and moist soil. Most are | Aquatic. Free-living and parasitic. | Freshwater and marine. Few of them are parasitic. | All of them are endoparasites |

| | | | | |
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| | parasitic but some are free living. | | | |
| **Locomotory organs** | Pseudopodia (false feet) | Flagella | Cilia | Absent |
| **Special features** | In marine forms silica shells are present. | Rarely sexual reproduction is seen, | | An infectious spore-forming stage is present in the life cycle. |
| **Examples** | *Amoeba, Entamoeba* | *Trypanosoma* (cause sleeping sickness) | *Paramecium* | *Plasmodium* (causes malaria) |

**Kingdom Fungi**

- Fungi are cosmopolitan i.e. can be found everywhere.
- They are heterotrophic, which means they take up nutrients from other organisms.
- Their cell wall is made out of chitin or fungal cellulose.
- Glycogen is their primary food in reserved form, and they eat saprophytically, parasitically, or symbiotically.
- Vegetative reproduction involves fragmentation, budding, and fission.
- Asexual reproductive spores include conidia, zoospores, and sporangiospores.
- Sexual reproduction is accomplished through the growth and development of oospores, ascospores, and basidiospores in different fruiting structures.
- In sexual reproduction, plasmogamy (protoplasm fusion) is followed by karyogamy (fusion of nuclei).
- In basidiomycetes and ascomycetes, plasmogamy is not immediately followed by karyogamy, resulting in a separate dikaryon (n+n) cell with two nuclei per cell.

- Fungi are divided into four classes based on the types of fungi and how they reproduce.

| **Attributes** | **Fungi** | | | |
|---|---|---|---|---|
| **Class** | **Phycomycetes** | **Ascomycetes** | **Basidiomycetes** | **Deuteromycetes** |
| Habit and habitat | Moist damp areas or an obligate parasite on plants | Saprophytic, coprophilous, parasite, and decomposers | Found in soil, logs, or as a parasite in plant bodies causing rust and smuts | Saprophytes, parasites, or decomposers help in mineral recycling |
| Structure of mycelium | Aseptate, **coen ocytic** | Branched, septate | Branched, septate | Branched, septate |
| Asexual Reproduction | Zoospores (motile) Aplanospores (non-motile) | Conidia (formed exogenously in conidiophores) | Vegetative reproduction is by fragmentation, with no asexual spore formation | conidia |
| Sexual Reproduction | Isogamous, anisogamous or oogamous Zygospores | Ascospores (formed endogenously in ascii) | No sexual organs, basidiospores are formed in the basidium Karyogamy after the dikaryon phase | In imperfect fungi, sexual reproduction is not found |
| Examples | *Mucor*, *Rhizopus*, *Albugo* | Commonly known as sac-fungi. *Penicillium*, *Aspergillus*, *Neurospora*, *Claviceps*, *Yeast* (unicellular) | Commonly known as mushrooms, bracket fungi, or puffballs *Agaricus*, *Ustilago*, *Puccinia* | *Trichoderma*, *Colletotrichum*, *Alternaria* |

**Phycomycetes**

Phycomycetes can be found in aquatic areas and on decaying wood in moist and humid environments, as well as obligate parasites on plants. The mycelium is coenocytic and aseptate. Asexual reproduction occurs via zoospores (motile) or aplanospores (asexual) (non-motile).

**Ascomycetes**

Ascomycetes, sometimes known as sac-fungi, are typically multicellular, such as *Penicillium*, or occasionally unicellular, such as yeast (*Saccharomyces*). Saprophytes, decomposers, parasitic, or coprophilous (growing on dung). Mycelium is septate and branching.

**Basidiomycetes**

Mushrooms, bracket fungi, and puffballs are examples of basidiomycetes. They live as parasitic rusts and smuts in soil, on logs and tree stumps, and in living plant bodies as parasites. The mycelium is septate and branching. Asexual spores are rarely observed, whereas vegetative reproduction through fragmentation is common.

**Deuteromycetes**

Because only the asexual or vegetative phases of such fungi are known, they are commonly referred to as imperfect fungi. When the sexual forms of this fungus were discovered, they were placed in the appropriate groups.

**Kingdom Plantae**

- Plants are eukaryotic chlorophyll-containing creatures that belong to the kingdom Plantae.
- The cell wall of Plants is made of cellulose.
- Insectivorous plants such as bladderwort and Venus's flytrap exist, while Cuscuta is a parasite.
- Plant cells are eukaryotic in nature, with significant chloroplasts and cellulose-based cell walls.
- Plants have two unique phases in their life cycle: diploid sporophyte and haploid gametophyte, which alternate.

- The lengths of the haploid and diploid phases, as well as whether they are free-living or dependent on others, varied between plant families.
- Alternation of generation is the term for this phenomenon.

**Kingdom Animalia**

- This kingdom is made up of heterotrophic eukaryotic creatures that are multicellular and lack cell walls.
- Plants provide food to them directly or indirectly.
- Dietary food is digested in an interior cavity, and food reserves are stored as glycogen or fat.
- Their nutrition is holozoic, meaning they eat food.
- They have a distinct growth pattern and mature into adults with distinct shapes and sizes.
- Higher forms have more complex sensory and motor mechanisms.
- The majority of them can move around.
- Male and female copulation is followed by embryological development in sexual reproduction.

**Viruses, viroids, prions and lichens**

**Viruses**

- The pathogenic organism of tobacco mosaic disease was given the label "virus" by Dmitri Ivanowsky (TMV).
- Beijerinek coined the term "*Contagium vivum fluidum*" to describe the fluid recovered from tobacco plants that was infectious to healthy plants.
- For the first time, Stanley crystallised TMV (tobacco mosaic virus).

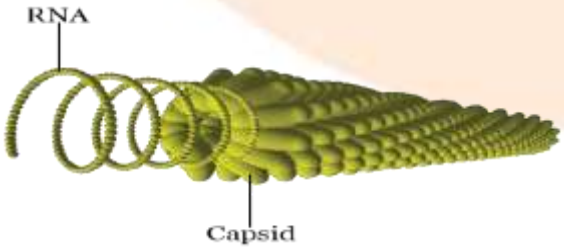


*Image: Tobacco mosaic virus*

- They are acellular and contain a nucleic acid core (DNA or RNA) encased in a protein covering known as the capsid.
- Viruses replicate inside the host cell using the host machinery, but they also exist outside the host cell in a crystalline form.
- A virus is a nucleoprotein with infectious genetic material. Viruses that infect plants typically have single-stranded RNA, whereas viruses that infect animals typically have either double-stranded DNA or single or double-stranded RNA.

**Viroid**

- They are the tiniest infectious agents ever discovered. They are nucleic acid-based but lack a protein covering.
- Diener discovered a viroid that causes spindle tuber disease in potato.

**Prions**

- They are similar in size to viruses and include improperly folded proteins.
- By transmitting their misfolded proteins, they can affect the form of normal proteins.
- They produce a variety of neurological disorders in cattle and people, including bovine spongiform encephalopathy (BSE) and Cr-Jakob disease.

**Lichens**

- They are a mutually advantageous symbiotic relationship between algae (phycobiont) and fungi (mycobiont). The alga produces food and the fungus provides shelter.
- Because lichens do not develop in contaminated environments, they are an excellent pollution indicator.

**Key Points to Remember**

- Aristotle presented the first biological classification of plants and animals based on simple morphological characteristics.
- Later, Linnaeus divided all living beings into two kingdoms: Plantae and Animalia.
- Whittaker proposed a five-kingdom classification that includes Monera, Protista, Fungi, Plantae, and Animalia. The five-kingdom classification used cell structure, mode of nutrition, body organisation, mode of reproduction, and evolutionary relationships as the primary criteria.
- Bacteria are classified as Kingdom Monera in the five-kingdom classification. These organisms have the greatest metabolic diversity. Bacteria can feed either autotrophically or heterotrophically.
- Chrysophytes, Dinoflagellates, Euglenoids, Slime-moulds, and Protozoans are all members of the kingdom Protista. The nucleus and other membrane-bound organelles have been defined as protists. They reproduce asexually as well as sexually.
- Members of the Kingdom Fungi exhibit a wide range of structures and habitats. Saprophytic nutrition is used by the majority of fungi. They reproduce both asexually and sexually. This kingdom is divided into four classes: Phycomycetes, Ascomycetes, Basidiomycetes, and Deuteromycetes.
- All eukaryotic organisms having chlorophyll pigment are classified as plantae. This group includes algae, bryophytes, pteridophytes, gymnosperms, and angiosperms. Plants have two generations that alternate: gametophytic and sporophytic generations.
- The Kingdom Animalia includes heterotrophic eukaryotic multicellular organisms without a cell wall. These organisms feed in a holozoic fashion. They primarily reproduce sexually.
- Some acellular organisms, such as viruses and viroids, as well as lichens, are not among the five-kingdom classifications.