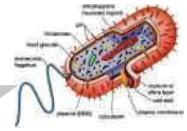


Chapter - 2

# Biological Classification

## Points to Remember

### Systems of Classification :

- Earliest classification was given by Aristotle.

  Divided plants into herbs, shrubs and trees.

  Animals into those with red blood and those who do not have it.
- **Two kingdom classification :** Given by Carolus Linneaeus–Kingdom–plantae and kingdom–Animalia.
- **Five kingdom classification :** By R.H. Whittaker, Monera, Protista, Fungi, Plantae and Animalia are the five kingdoms.
- The main criteria for classification of organisms into five kingdoms include cell structure, thallus organisation, mode of nutrition, reproduction and phylogenetic relationships.
- **Three Domains of Life** : Proposed by Carl Woese in 1990, who also proposed the six kingdom classification for living organisms. The three Domains of life are Archaea, Bacteria and Eukarya.

| | | | | |
|---|---|---|---|---|
| | 1 | Archaea | → 1. Archaebacteria | Kingdom |
| | 2 | Bacteria | → 2. Eubacteria | Prokaryotic organisms in extreme conditions |
| Domains of life | 3 | Eukarya | → 3. Protista | Eukaryotic Organisms |
| | | | → 4. Fungi | |
| | | | → 5. Plantae | |
| | | | → 6. Animalia | |

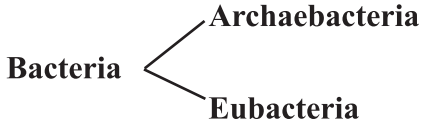
1. **Artificial System of Classification**
    1. It utilise one or two morphological traits.
    2. Homology is never standard.
    3. The system does not employ characters from anatomy, cytology, biochemistry, genetics, etc. for grouping of organisms.
2. **Natural System of Classification**
    1. The system employs several morphological character for grouping of organisms.
    2. It studies homology in all characters including morphology, anatomy, etc.
    3. This system gives information about both natural relationship and phylogeny.
3. **Phylogenetic System of Classification**

    It was proposed by Engler and Prantl. They arranged flowering plants according to increasing complexity of their floral morphology.

    It was based on possible evolution of different traits.
4. **Objections to two kingdom system**
    1. Lichen with dual mode.
    2. Fungi remain fixed but nutrition saprophytic.
    3. No distribution of unicellular and multicellular organism.
    4. No distribution of prokaryotic and eukaryotic organisation.
    5. Euglena can move as well as can do photosynthesis.

## Kingdom Monera :

- Has bacteria as sole members.
- Cell wall made up of peptidoglycan.
- Bacteria can have shapes like : Coccus (spherical), Bacillus (rod-shaped), Vibrium (comma shaped) and Spirillum (spiral shaped).
- Bacteria found almost everywhere and can be Photosynthetic autotrophs, Chemosynthetic autotrophs or Heterotrophs.



- Archaebacteria
- Halophiles (salt-loving)
- Thermoacidophiles (in hot springs)
- Methanogens (in marsh and in gut of ruminant animals. Produce methane gas.)
- Eubacteria
- Photosynthetic autotrophs:

  1. Cyanobacteria (Blue-green algae). Some like *Anabaena* and *Nostoc* have specialized cells called heterocysts for nitrogen fixation.
  2. *Algae bloom* is rich growth of blue green algae over the surface of polluted water bodies.

  Algae bloom releases neurotoxins, deplete oxygen and makes water unfit for use.

- **Chemosynthetic autotrophs :** Oxidise various inorganic substances like nitrates/nitrites, ammonia and use released energy for their ATP production. They helps in nutrients recycling of N, P, Fe and S.
- **Heterotrophic bacteria :** Decomposers help in making curd, production of antibiotic, $N_2$ fixation, casuse diseases like cholera, typhoid, tetanus and citrus canker.

  **Mycoplasmas :** Completely lack cell wall. Smallest living cells. Can survive without oxygen. Pathogenic in animals and plants.

## Kingdom PROTISTA

(Comprises of all single celled eukaryotes)

- Forms a link between plants, animals and fungi.

(i) **Chrysophytes** (Has diatoms and golden algae/desmids)

Fresh water/marine, photosynthetic, microscopic plankton.

- Chief producers in Ocean.
- Cell walls have silica, which makes it indestructible and cell walls overlap to fit together like a soap box.
- Their accumulation forms “Diatomaceous Earth” (gritty soil)
- Used in polishing, filtration of oils and syrups.

(ii) **Dinoflagellates :**

- Marine, photosynthetic, cell wall has stiff cellulose plates.
- Two flagella–one longitudinal and other transverse in a furrow between wall plates.
- **Example :** *Gonyaulax* multiples rapidly, make sea appear red (red tides) and produce toxins to kill marine animals.

(iii) **Euglenoids :**

- Found in stagnant fresh water.

  Have protein rich layer 'pellicle' which makes body flexible.
- Photosynthetic in presence of sunlight but become heterotrophs if they do not get sunlight. (Mixotrophic nutrition)
- **Example :** *Euglena*

(iv) **Slime Moulds :**

- Saprophytic protists
- Under suitable conditions form an aggregates called plasmodium, grows on decaying twigs and leaves.
- During unfavourable conditions, plasmodium differentiates and forms fruiting bodies bearing spores at their tips.
- Spores have true walls which are extremely resistant and survive for many years and dispersed by air currents.

(v) **Protozoans :** Are heterotrops and live as parasites. Have four major groups.

**Amoeboid :** Catch prey using pseudopodia, *e.g., Amoeba, Entamoeba* which are parasite.

**Flagellated :** Have one or more flagella. Cause disease like Sleeping Sickness *e.g., Trypanosoma.*

**Ciliated :** Have cilia to move food into gullet and help in locomotion. *e.g., Paramoecium.*

**Sporozoans :** Have infective spore like stage in life cycle, *e.g., Plasmodium* which causes malaria.

## Kingdom Fungi

1. Heterotrophic organisms
2. Non chlorpohyllous hyphae
3. Network of hyphae called mycelium
4. Hyphae which have multinucleated cytoplasm are called coenocytic hyphae
5. Cell wall of chitin and polysaccharides
6. Cosmopolitan. Grow in warm and humid places.
7. Saprophytic, parasitic, symbiotic (Lichen and Mycorrhiza) *e.g.,* ***Puccinia,*** (wheat rust disease), ***Penicillium,*** Yeast (unicellular fungus).
8. Reproduction can take place by vegetative means fragmentation, fission and budding. Asexual reproduction by spores–conidia, sporangiospores or zoospores. Sexual reproduction by oospores, ascospores and basidiospores–produced in fruiting bodies.
9. **Sexual cycle involves 3 steps :**
   (i) Plasmogamy (fusion of Protoplasms.)
   (ii) Karyogamy (fusion of two nuclei.)
   (iii) Meiosis in zygote resulting in haploid spores.
10. Dikaryophase is a condition of having dikaryon in an intervening dikaryotic stage (n + n *i.e.,* two nuclei per cell) between plasmogamy and karyogamy in fungi like ascomycetes and basidiomycetes.

## Classes of Fungi

**(i) Phycomycetes :**

- grow on decaying wood or as obligate parasites on plants
- Mycelium aseptate and coenocytic
- Spores produced endogenously in sporangium.
- Asexual reproduction by Zoospores or Aplanospores
- Zygospores are formed by the fusion of gametes.

  *e.g.,* ***Rhizopus, Albugo, Mucor***

**(ii) Ascomycetes :**

- Also known as 'sac fungi'
- Are saprophytic, decomposers, parasitic or coprophilous (growing on dung).
- Mycelium branched and septate
- Asexual spores are called conidia produced exogenously on the conidiophores.

  Sexual spores are called ascospores produced endogenously in ascus, produced inside fruiting body called Ascocarp.

  *e.g.,* ***Aspergillus, Neurospora, Saccharomyces*** **(Unicellular fungi),** ***Claviceps,*** **morels, truffles**

**(iii) Basidiomycetes :**

- Mycelium septate and branched.
- Generally asexual spores are not found.
- Vegetative reproduction by fragmentation.
- Sexual reproduction by fusion of vegetative or somatic cells to form basidium produced in basidiocarp.
- Basidium produces four basidiospores exogenously after meiosis.

  *e.g.,* ***Agaricus, Ustilago, Puccinia***

**(iv) Deuteromycetes :**

| Taxnomic of Fungi | Hypha | Type of Reproduction | Characteristic spore | Origin of Spore | Examples of Fungi |
|---|---|---|---|---|---|
| Phycomycetes | Aseptate Coenocytic | Asexually<br><br>Sexually | Sporangiospore Zoospore Aplanospore<br><br>Zygospore or oospore | Sporangiophore<br><br>Fusion of nuclei of gametes | Nuisance fungi including genera *Albugo*, *Mucor*, and *Rhizopus* |

| | | | | | |
|---|---|---|---|---|---|
| Ascomycetes | Septate branched | Asexually | Blastospore<br><br>Conidium/ conidia | Budding Exoge-neously on Conidio-phore | *Penicillium Aspergillus Clavicep Neurospora* |
| | | Sexually | Ascospore | Ascus in Ascocarp | *Sacchaaro-myces* (perfect yeast) |
| Basidiomy-cetes | Septate branched | Sexually | Basidiospore | Basidium | Mushrooms, smuts and rusts |
| Deuteromy-cetes (fungi imperfecti) | Septate branched | Asexually | Thallospore<br><br>Conidium | Thallus (hypha)<br><br>Conidio-phore | Most sapro-phytes and pathogens encountered in medical mycology (Imperfect mould) |

- Called as 'Fungi Imperfecti' as sexual form (perfect stage) is not known for them.
- Once sexual form is discovered the member is moved to Ascomycetes or Basidiomycetes.
- Mycelium is septate and branched.
- Are saprophytic parasitic or decomposers.

  *e.g.,* ***Alternaria, Colletotrichum, Trichoderma.***

## Viruses :

- They did not find a place in biological classification.
- Not truly living.

- Non-cellular organisms which take over the machinery of host cell on entering it and become living but as such they have inert crystalline structure appear non-living. So, difficult to call them living or non-living.
- Virus means venom or poisonous fluid. Pasteur gave the term 'virus'.
- D.J. Ivanowsky found out that certain microbes caused Tobacco Mosaic Disease in tobacco plant.
- M.W. Beijerinek called fluid as '*Contagium vivum fluidum*' as extracts of infected plants of tobacco could cause infection in healthy plants.
- W.M. Stanely showed viruses could be crystallized to form crystals of protein which are inert outside their specific host.
- Viruses are obligate parasites.

## Structure of Virus :

- It is a nucleoprotein made up of protein coat called Capsid. Capsid is made up of capsomeres arranged in helical or polyhedral-geometric forms. Have either DNA or RNA as genetic material which may be single or double stranded.
- Usually plant viruses have single stranded RNA; bacteriophages have double stranded DNA and animal viruses have single or double stranded RNA or double stranded DNA.

## Diseases caused in humans :

Mumps, small pox, herpes, influenza and AIDS etc.

In plants, symptoms can be mosaic formation, leaf rolling and curling, yellowing and vein clearing, dwarfing and stunted growth.

## Viroids :

- Infectious agent, free RNA (lack protein coat)
- RNA is of low molecular weight.
- Causes potato spindle tuber disease.
- Discovered by T.O. Diener.

## Prions

- They are highly resistant glycoproteins molecule which function as infectious agent.

## Lichens :

- Symbiotic association between algal component (Phycobiont) and fungal component (Mycobiont). Algae provides food via photosynthesis. Fungi provides shelter and absorb nutrients and water for alga.
- Good pollution indicators as they do not grow in polluted areas. ($SO_2$ rich areas)

## Questions

### (SRT) Select Response Type Question (1 mark each)

1. There are specialised cells called heterocysts in *Nostoc* and *Anabena*. The function of heteocyst is to

   (a) To absorb nutrients from thin water film over the body of the organisms

   (b) To fix carbon-di-oxide into carbohydrates

   (c) To synthesise protein from absorbed nitrogen

   (d) To fix nitrogen into products such as ammonia

2. One of following Ascomycetes is called model organisms and is used extensively in genetic research.

   (a) *Neurospora* (b) *Saccharomyces*

   (c) *Penicillium* (d) *Aspergillus*

3. Archaebacteria and eubacteria differ in

   (a) Eubacteria live in harsh environments

   (b) Eubacteria have rigid cell wall

   (c) Cell wall is absent in eubacteria

   (d) Eubacteria are autotrophs only

### CONSTRUCTED RESPONSE TYPE (CRT)

### Very Short Answer Question (1 mark each)

4. Which group comprises of single celled eukaryotes only ?

5. Which organisms are the chief producers in oceans ?
6. Name the fungus which causes disease in wheat (i) rust (ii) smut.
7. What is the principle underlying the use of cyanobacteria in agriculture ?
8. Define dikaryon stage. Where do you observe this stage?
9. Differentiate between zoospore and zygospore?

## Short Answer Question-I (2 marks each)

10. How are bacteria classified on the basis of their shapes ?
11. What is the mode of reproduction in bacteria ?
12. Why are red tides caused and why are they harmful ?
13. Viruses and viroids differ in structure and the diseases they cause. How ?
14. Which class of kingdom fungi has both unicellular as well as multicellular member ? When is a fungus called coprophilous ?
15. Why two kingdom classification was not sufficient? Explain with the help of two examples.
16. How flexibility is maintained in the body of Euglena?

## Short Answer Question-II (3 marks each)

17. Who gave five kingdom classification ? What was the criteria used for such classification ?
18. What are the modes of nutrition in fungi ?
19. Some symbiotic organisms are very good pollution indicators and composed of a chlorophyllous and a non-chlorophyllous member. Describe them.
20. Who gave two kingdom classification? Write its draw backs?
21. Explain how reproduction takes place in phycomycetes?
22. Differentiate between mode of sexual reproduction in ascomycete and basidiomycetes.

## Long Answer Questions (5 mark each)

23. Some primitive relatives of animals live as predators or parasites and are divided into four major groups. Elaborate.
24. Differentiate between various classes of kingdom Fungi on the basis of their (i) Mycelium, (ii) Types of spores and (iii) Types of fruiting body. Also give two examples for each class.
25. Describe sexual reproduction in fungi.
26. Draw a labelled diagram of bacteriophage. Write its characters also.
27. Discuss how the system of biological classification has been evolved in past?

## Answers

### Select Response Type Question (1 mark each)

1. (d) To fix nitrogen into products such as ammonia
2. (a) Neurospora
3. (b) Eubacteria have rigid cell wall

### CONSTRUCTED RESPONSE TYPE (CRT)

### Very Short Answers (1 mark each)

4. Kingdom Protista.
5. Diatoms
6. (i) *Puccinia,* (ii) *Ustilago*
7. Capability of nitrogen fixation
8. Refer to point to remember on page 11.
9. Motile asexual spores of class phycomycetes are known as zoospores whereas zygospores are formed by fusion of two gametes.

### Short Answers-I (2 marks each)

10. Bacillus (rod-shaped), Coccus (spherical), Vibrio (comma shaped) and Spirillum (spiral shaped).

11. Mainly by fission; Production of spores in unfavourable conditions. Sexual reproduction by DNA transfer.

12. Rapid multiplication of dinoflagellates like *Gonyaulax*. Harmful as they release toxins which kill marine animals.

13. Refer 'Points to Remember'.

14. Ascomycetes : Yeast (Unicellular), *Penicillum* (Multicellular), Coprophilous, means fungi which grow on dung.

15. Refer 'Points to Remember'.

16. Instead of cell wall, they have a protein rich layer called pellicle which makes their body flexible.

## Short Answers-II (3 marks each)

17. R.H. Whittaker, Criteria for classification : Cell structure, thallus organisation, mode of nutrition, reproduction and phylogenetic relationships.

18. Saprophytes, Parasites, Symbionts-Lichens and Mycorrhiza.

19. Lichens, Refer 'Points to Remember'.

20. Carolous Linnaeus. Refer 'Points to Remember'.

21. Refer 'Points to Remember'.

22. Refer page no. 23 and 24, NCERT, Text Book Biology class XI.

## Long Answers (5 marks each)

23. Protozoans. Refer for class 10.

24. Refer points to remember table on page 10.

25. The steps are :

    (i) Plasmogamy : fusion of protoplasm of two motile or non-motile gametes.

    (ii) Karyogamy : fusion of two nuclei.

    (iii) Zygotic Meiosis to form haploid spores.

(iv) Dikaryophase in ascomycetes and basidiomycetes where before karyogamy two nuclei per cell (dikaryon) are found.

26. NCERT page no. 26 Fig 2.6 (b), for characters refer Page 14 of points to remember.

27. Refer to point to remember on page 6, 7 and 8.

28. Refer point to remember on page 7.

29. Refer point to remember on page 7.

## Case Study (4 Mark each)

Corona viruses are a broad family of viruses that cause illnesses ranging from the common cold to many serious respiratory disorders. SARS-CoV 19 is a novel Corona Virus strain that has never been found in humans before. Corona viruses spread from animals to humans. Fever, cough, shortness of breath, and breathing difficulties are all common symptoms of infection. Infection can lead to pneumonia, severe acute respiratory syndrome, kidney failure, and even death in more severe cases. Hand washing, coughing with your mouth and nose covered, are all standard advice for preventing infection spread. Close contact with anyone who has respiratory symptoms like coughing or sneezing should be avoided.

1. Novel corona virus belongs to the category of viruses having :

   (a) DNA as genetic material

   (b) Double stranded RNA as genetic material

   (c) Single stranded DNA as genetic material

   (d) Single stand RNA as genetic material

Ans.: (d)

2. **Assertion:** An effective antibiotic should be used to prevent the disease

caused by Novel corona virus.

**Reason :** Effective antibiotic will reduce the chance of getting infection from viruses including Novel corona virus.

(a) Both assertion and reason are true, and the reason is the correct explanation of the assertion.

(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.

(c) Assertion is true but reason is false.

(d) Both assertion and reason are false.

Ans.: (d)

3. Read the following statements :

Statement I : The new coronavirus can be transmitted through mosquito bites

Statement II : The COVID-19 virus does not transmit through water while swimming.

Choose from below the correct alternative.

(a) Only I is true. (b) I and II true.

(c) I is true but II is false. (d) I is false but II is true.

Ans.: (d)

4. Which of the following methods should not be used to prevent infection from Novel corona virus?

(a) Regular hand washing.

(b) Covering mouth and nose when coughing and sneezing.

(c) Thorough cooking of meat and eggs.

(d) Use of Hand dryers

Ans.: (d)