# 1. Living World and Classification of Microbes

**Can you recall?**

1. What is the hierarchy for classification of living organisms?
2. Who invented 'bionomial system' of nomenclature?
3. Which levels of hierarchy are considered while writing the name in binomial nomenclature?

## Biodiversity and need of classification

Last year we learnt that all the living organism on earth have adapted according to geographic regions, food ingestion, defence etc. While adapting, many differences are observed in the organisms of same species too.

According to 2011 census, around 87 million species of living organisms are found on the earth- including land and sea. To study such a vast number, it was essential to divide them into groups. So groups and subgroups were created considering the similarities and differences among the living organisms.

This process of dividing living organism into groups and subgroups is called Biological classification.

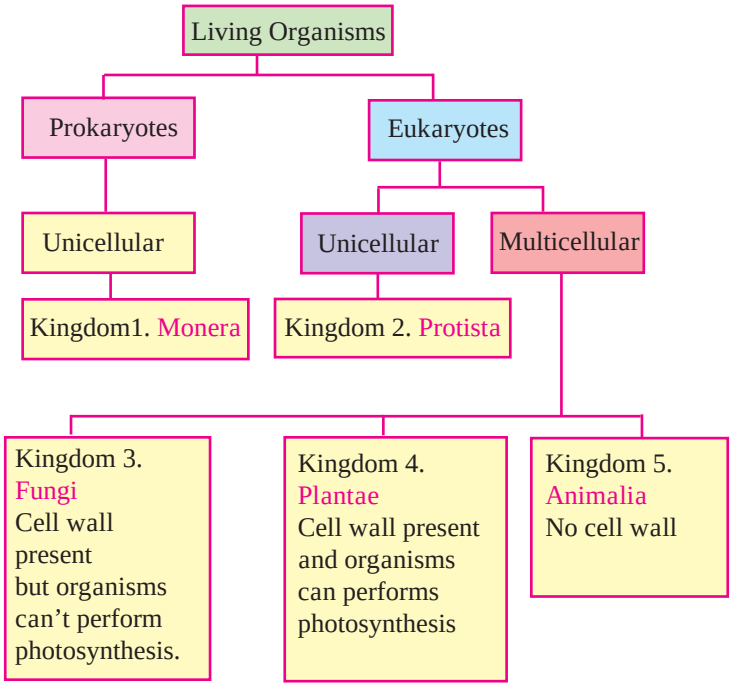
**In History.....**

- Carl Linnaeus in 1735 divided living world in 2 kingdoms - Vegetabilia and Animalia.
- Haeckel in 1866 considered 3 kingdoms- Protista, Plants and Animals.
- In 1925 - Chatton created two groups Prokaryotes and Eukaryotes.
- In 1938 Kopland divided living organisms into 4 kingdoms- Monera, Protista, Plants and Animals.

Robert Harding Whittaker (1920-1980) was an American Ecologist. In 1969 he divided living organisms into 5 groups.

**For this classification Whittaker considered following criteria**

1. **Complexity of cell structure** : Prokaryotic and Eukaryotic.
2. **Complexity of organisms** : Unicellular or Multicellular.
3. **Mode of nutrition :**
   Plants - Autotrophic- Photosynthetic
   Fungi- Saprophytic- Absorption from dead organisms.
   Animals- Heterotrophic and ingestive.
4. **Life style :**
   Plants - Producers
   Animals - Consumers
   Fungi - Decomposers
5. **Phylogenetic relationship :**
   Prokaryotic to Eukaryotic, unicellular to multicellular.




**1.1 Five Kingdom system of classification**



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**Try this**

## Kingdom 1 : Monera

**Activity :** Take a small drop of curd or buttermilk on a clean glass slide. Dilute it with a little water. Carefully keep a cover slip. Observe it under high power of compound microscope. What did you see ?

Moving, small rod-like microbes are lactobacilli bacteria.

All type of bacteria and blue green algae are included in the kingdom Monera.

**Characteristics :**

1. All the organisms are unicellular.
2. They may be autotrophic or heterotrophic.
3. These are prokaryotic cells without distinct nucleus or cell organelles

## Kingdom 2. Protista

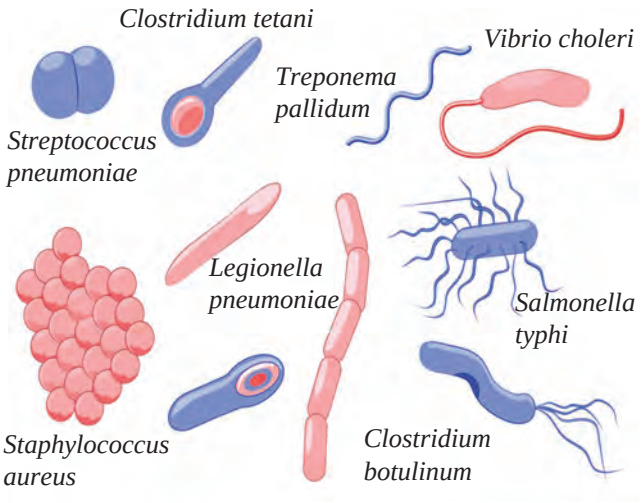
**Activity :** Prepare a temporary mount of one drop of pond water on a glass slide. Observe it under low power and high power of microscope. You will find some motile microbes with irregular shape. These are amoebae.

**Characteristic :**

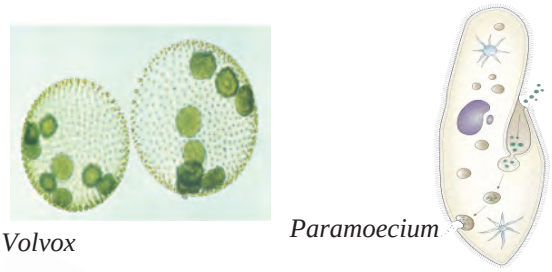
1. Protista are single celled organisms with well defined nucleus enclosed in a nuclear membrane.
2. They have pseudopodia or hair like cilia or whip like flagella for locomotion.
3. Autotrophs- eg. *Euglena*, *Volvox* contain chloroplast.
   Heterotrophs- eg. *Amoeba*, *Paramoecium*

## Kingdom 3. Fungi

**Activity :** Take a moist piece of bread or bhakri and keep it in a container with lid for 2-3 days. After 2-3 days a fine cotton thread like tuft is found growing on the surface of the bread. Prepare a temporary mount of few threads from this culture and observe it under the microscope.

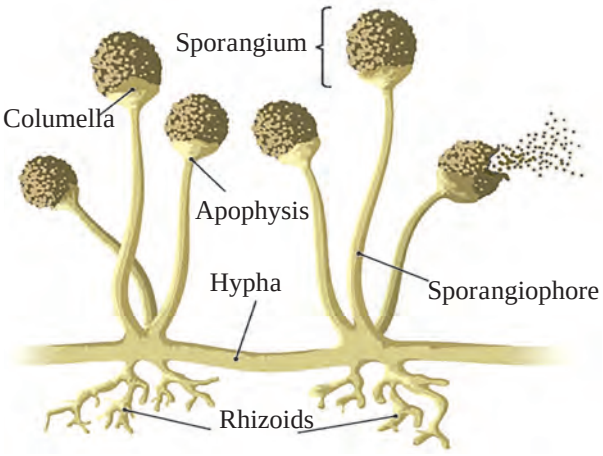



1.2 Organisms from Kingdom Monera





1.3 Organisms from Kingdom Protista




1.4 Fungi

**Institutional Work :** National Institute of Virology, Pune is involved in research on viruses. This institute has been founded in 1952 under the jurisdiction of Indian Council of Medical Research.



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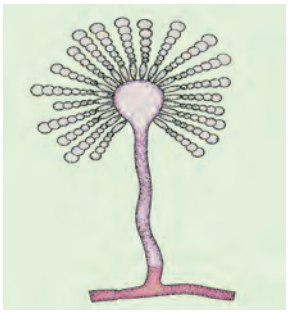
**Characteristics :**

1. These are non-green, eukaryotic, heterotrophic organisms.
2. Most of them are saprotrophs. They feed upon decaying organic matter.
3. Their cell wall is made up of tough and complex sugar called 'Chitin'.
4. Some fungi are thread like and many nuclei are present in the cytoplasm.
5. Examples- Baker's yeast, *Aspergillus* (Fungus on corn), *Penicillium*, Mushrooms.

Though many systems of classification are introduced after the Whittaker's, his five kingdom system is widely accepted.

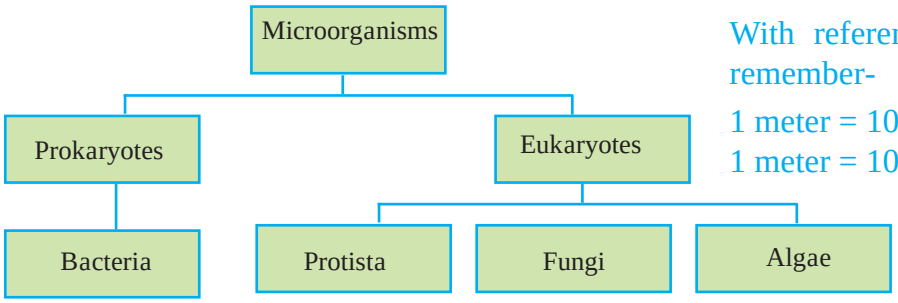
**Use your brain power** Explain merits and demerits of Whittaker's classification.



**1.5 Some Fungi**

## Classification of Microbes

Among the living organisms, microorganisms are largest in number. Hence they are classified as follows.



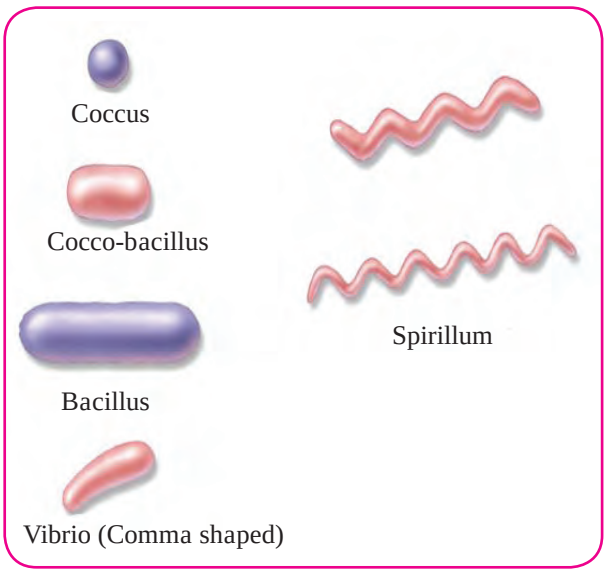

With reference to size of microbes, remember-

1 meter = $10^6$ micrometer (µm)
1 meter = $10^9$ nanometer (nm)

**1.6 Classification of Microorganisms**

**1. Bacteria** (size – 1 µm to 10 µm)

1. Unicellular, independent / parasitic organisms. Sometimes many bacteria together form colonies.
2. Bacterial cell is prokaryotic with cell wall, but distinct nucleus or cell organelles are absent.
3. They reproduce by simple binary fission.
4. In favourable conditions, bacteria grow vigorously and can double their number in 20 minutes.




**1.7 Some Bacteria**



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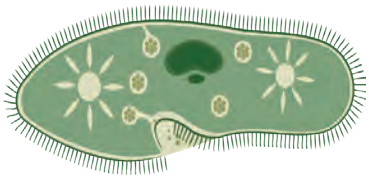
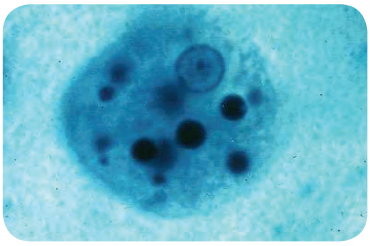
**2. Protozoa** (size - approximately 200 µm)

1. Protozoans are found in soil, fresh water and sea water. Some are found in the body of other organisms and are pathogenic.
2. These are unicellular organisms with eukaryotic cell.
3. There is great variation in cell structure, organs of locomotion and modes of nutrition among protozoans.
4. These organisms reproduce by simple cell division.
   Eg.- *Amoeba*, *Paramoecium* - Free living in dirty water.
   *Entamoeba histolytica* - causes amoebiasis.
   *Plasmodium vivax*- causes malaria
   *Euglena* - autotrophic



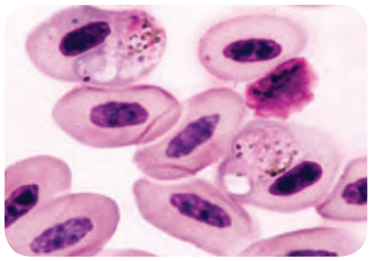
*Paramoecium*



*Entamoeba*

**3.Fungi-** (size- approximately 10 µm to 100 µm)

1. These are found on decaying organic matter and dead bodies of plants and animals.
2. These are eukaryotic organisms. Some are unicellular and others are visible with naked eyes.
3. Saprotrophic, absorb their food from decaying organic matter.
4. They reproduce sexually and asexually by cell division or by budding.
   Eg. Baker's yeast, *Candida*, Mushroom.



*Plasmodium*

**4. Algae-** (size- approximately 10 µm to 100 µm)

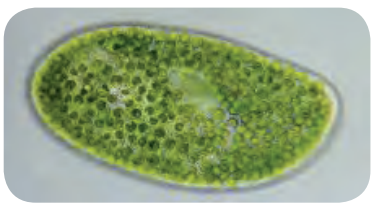
1. They are aquatic.
2. Eukaryotic, unicellular, autotrophic organisms.
3. Photosynthesis is carried out with the help of chloroplast present in the cell.
   Eg. *Chlorella, Chlamydomonas*
   very few species of algae are unicellular. Most of them are multicellular and visible with naked eyes.

*Saccharomyces*

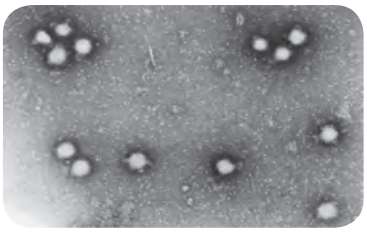
**5. Viruses-**( size- approximately 10 nm to 100 nm)

Generally, viruses are not considered as living organisms or they are said to be "Organisms at the edge of living and nonliving." They are studied under microbiology.

1. Viruses are extremely minute i.e. they are 10 to 100 times smaller than bacteria and can be seen only with electron microscope.
2. They are found in the form of independent particles .
   Virus is a long molecule of DNA (Deoxyribo Nucleic Acid) or RNA (Ribo Nucleic Acid) covered by a protein coat.
3. Viruses survive only in living plant or animal cells and produce their own proteins with help of host cell and create their numerous replica. Then they destroy the host cell and become free. These free viruses again infect new cells.
4. Viruses cause many diseases to plants and animals.



*Chlorella*



Tomato Wilt Virus

**1.8 Some Microorganisms**



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**Do you know?**

Human – polio virus, Influenza virus, HIV – AIDS virus etc.
Cattle- picorna virus
Plants- Tomato- Wilt virus, Tobacco mosaic virus etc.
Bacteria- Bacteriophage (viruses attack bacteria).

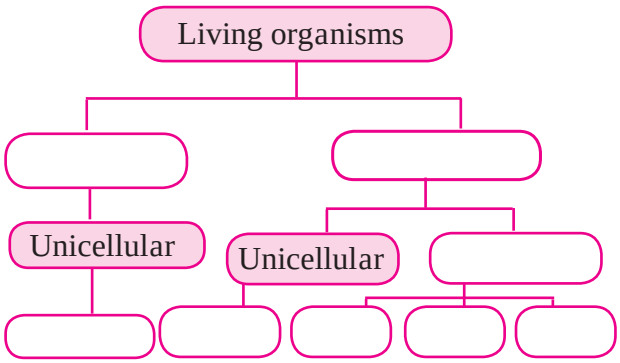
**Internet My Friend**

Collect pictures and characteristics of different microbes. Prepare a chart.

## Exercises

**1. Use Whittaker method to classify bacteria, protozoa, fungi, algae, prokaryotic and eukaryotic microbes.**

**2. Complete the five kingdom method of classification using- living organism, prokaryotes, eukaryotes, multicellular, unicellular, protista, animals, plants, fungi.**




**3. Find out my partner**

| A | B |
|---|---|
| Fungi | *Chlorella* |
| Protozoa | Bacteriophage |
| Virus | *Candida* |
| Algae | *Amoeba* |
| Bacteria | Prokaryotic |

**4. State whether the following statements are true or false. Explain your statement.**

a. *Lactobacilli* are harmful bacteria.
b. Cell wall of fungi is made up of chitin.
c. Organ of locomotion in amoeba is pseudopodia.
e. Tomato wilt is a viral disease.

**5. Give answers.**

a. State the merits of Whittaker's method of classification.
b. Write the characteristics of viruses.
c. Explain the nutrition in fungi.
d. Which living organisms are included in the kingdom monera ?

**6. Who am I ?**

a. I don't have true nucleus, cell organelles or plasma membrane.
b. I have nucleus and membrane bound cell orgenelles.
c. I live on decaying organic matter.
d. I reproduce mainly by cell division.
e. I can produce my replica.
f. I am green, but don't have organs.

**7. Draw neat and labelled diagrams.**

a. Different types of bacteria.
b. Paramoecium
c. Bacteriophage.

**8. Arrange the following in ascending order of size Bacteria, Fungi, Viruses, Algae.**

**Project :**

1. Prepare a chart showing infectious bacteria and the diseases caused by them.
2. Visit a nearby pathology lab. Get the information about pathogenic microbes, methods to observe them, different microscopes from the technicians there.

JTHIQ3



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