BIOLOGY

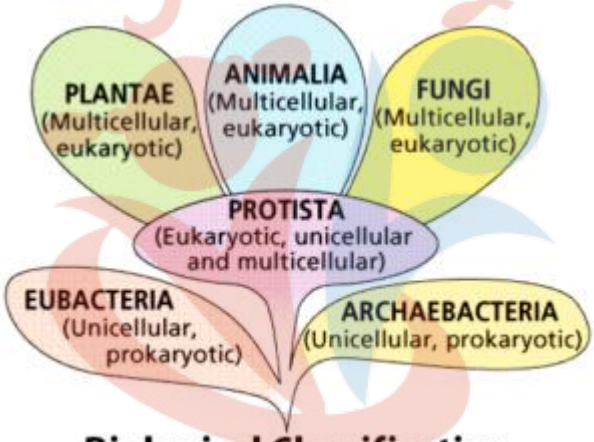
Chapter 2: Biological Classification

BIOLOGICAL CLASSIFICATION

Biological Classification

Biological classification is defined as the process of grouping organisms according to certain similarities.

Linnaeus proposed the two kingdoms of classification, He classified organisms in the animal kingdom as Animalia and in the plant kingdom as Plantae. There were certain limitations related to biological classification. Classification of two kingdoms as it does not distinguish between eukaryotes and prokaryotes, unicellular and multicellular organisms, and photosynthetic and non-photosynthetic organisms. Also, the organisms that are aware and are conscious of their surroundings will be living organisms.



Biological Classification

Five Kingdoms Rankings

RH Whittaker suggested the five rankings. The classification of these five kingdoms is as follows: Monera, Protista, Fungi, Plantae, and Animalia. The classification was based on the organization of the thallus, the cell structure, the diet, the phylogenetic relationship, and the reproduction.

Kingdom Monera

Kingdom Monera is considered as the most primitive group of organisms and monerans are most abundant of all. It generally comprises unicellular organisms with a prokaryotic cell organization. They lack well-defined cell structures including the nucleus and other cell organelles.

They consist of prokaryotes which include species like the Cyanobacteria, archaebacteria, mycoplasma, and bacteria are a few members of this kingdom.

The general features of Monerans are:

- Monerans are present in both aerobic and anaerobic environment.
- Some have rigid cell walls, while some do not.
- The membrane-bound nucleus is absent in monerans.
- Habitat - Monerans are found everywhere in hot or thermal springs, in the deep ocean floor, under ice, in deserts and also inside the body of plants and animals.
- They can be autotrophic, i.e., they can synthesize food on their own while some others have a heterotrophic, saprophytic, parasitic, symbiotic, commensalistic and mutualistic modes of nutrition.
- Locomotion is with the help of flagella.
- Circulation is through diffusion.
- Respiration in these organisms vary, few are obligate aerobes, while some are obligate anaerobes and facultative anaerobes
- Reproduction is mostly asexual, and few also reproduce by sexual reproduction. Sexual reproduction is by conjugation, transformation, and transduction. Asexual reproduction is by binary fission.

Kingdom Protista

All unicellular eukaryotic organisms are placed under the Kingdom Protista.

The term Protista was first used by Ernst Haeckel in the year 1886. This kingdom forms a link between other kingdoms of fungi, plants, and animals.

Kingdom Protista is an important phase in early evolution and the very first protist

probably evolved 1.7 billion years ago.

Kingdom Protista is a very large group comprising of at least 16 phyla. Many species of this kingdom are the primary producers in the aquatic ecosystem, and some are responsible for serious human diseases like malaria.

General features of Kingdom Protista are as follows:

- They are simple, unicellular, eukaryotic organisms.
- Most of the protists live in water, some in moist soil or even the body of human and plants.
- These organisms have a membrane-bound nucleus, endomembrane systems, mitochondria for cellular respiration and some have chloroplasts for photosynthesis.
- Nuclei contain multiple DNA strands, and the number of nucleotides is significantly less.
- Respiration – cellular respiration is the primarily aerobic process, but some living in the moist soil underneath ponds or in digestive tracts of animals are facultative anaerobes.
- Locomotion is often by flagella or cilia.
- Nutrition- include both heterotrophic and autotrophic.
- Reproduction – Some reproduce sexually and others asexually.
- Some protists are pathogens of both plants and animals. Example: Plasmodium falciparum causes malaria in humans.

Kingdom Fungi

Fungi are a group of organisms that are found everywhere from air, water, land to the soil. They are also found in plants and animals.

Some fungi are microscopic, and others are gargantuan – almost extending over a thousand acres. And even though fungi appear like plants, they are in fact closely related to animals.

Fungi have great economic importance and show a great diversity in morphology and habitat. More than 70,000 species of fungi have been recognized and the organisms of kingdom fungi include mushrooms, smuts, yeasts, puffballs, rusts, smuts, truffles, morels, and moulds

General features of fungi are as follows:

- Fungi are eukaryotic, non-vascular and non-motile organisms.
- The growth rate of fungi is slower than that of bacteria
- Fungi grow best in an acidic environment.
- The Kingdom Fungi consist of both unicellular (e.g.: Yeast, Molds) and multicellular (e.g.: mushrooms) organisms.
- Like plant cells, fungi have cell walls made up of complex sugar molecules called chitin. But unlike plants, they do not undergo photosynthesis.
- The cell wall is composed of chitin. The vegetative body of the fungi may be unicellular or composed of microscopic threads called hyphae.
- They have a heterotrophic mode of nutrition. Few species are saprophytes i.e., they feed on dead and decaying organic matters.
- Some fungi are parasitic while some are symbionts. They can live in a symbiotic relationship with algae, like blue-green algae. These are called lichens.
- Reproduction in fungi is both by sexual and asexual means. Asexual reproduction takes place by means of spores and sexual reproduction takes place by means of gametic copulation, somatic copulation, and Spermatization.

KINGDOM FUNGI

Kingdom Plantae

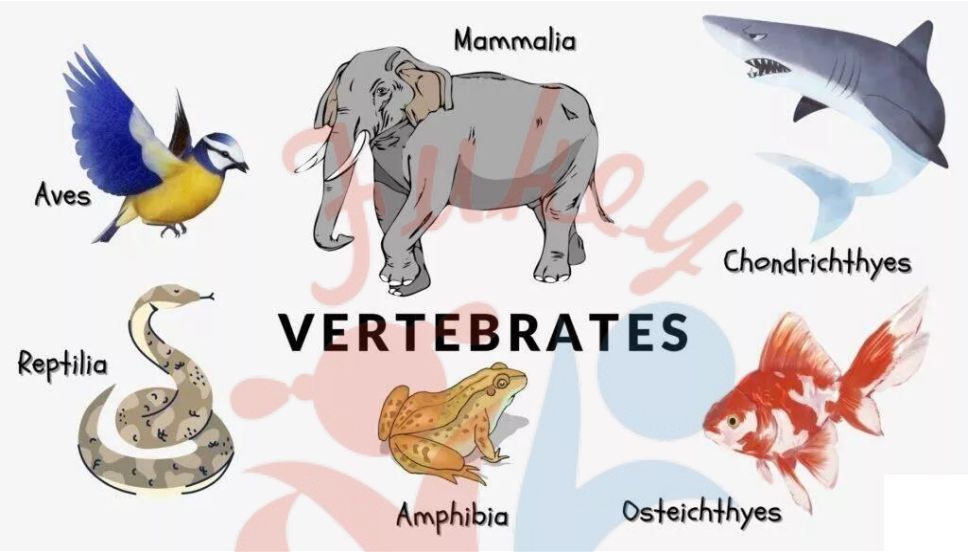
- Includes all eukaryotic, multicellular, and photosynthetic plants.
- The characteristics of the members of Plantae are as follows:
- Most of them are eukaryotic in nature.
- The main pigment present is chlorophyll.
- Its cell wall is made of cellulose.
- Photosynthesis helps in the synthesis of food.
- The process of reproduction can be both sexual and asexual.
- They represent the phenomenon of alternation of generations, i.e., diploid sporophytes, and haploid gametophytes.

Kingdom Animalia

These types of organisms are heterotrophic, eukaryotic. Some of the characteristics of the members of Animalia are the following:

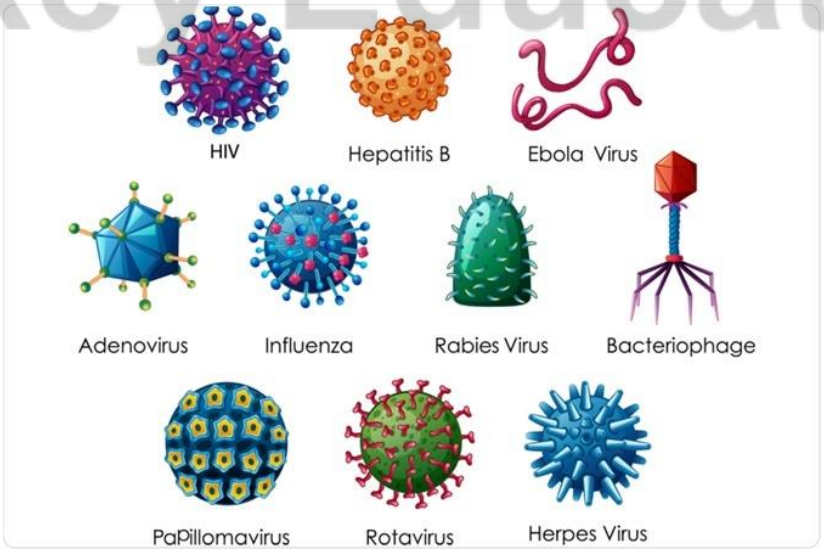
- They are multicellular organisms of various sizes.
- The organ systems are well developed such as the skeletal system, circulatory system, respiratory system, etc.
- They are found to be bilaterally symmetrical.

- They also have well-developed locomotor organs.
- Breathing takes place through gills, book lungs, book gills, skin, lungs, etc.
- Membrane-bound cell organelles with a nucleus bounded by a nuclear membrane.
- The circulation takes place through the blood, the blood vessels, and the heart.
- Reproduction takes place through the formation of haploid gametes. The fusion of the gametes creates a new diploid organism.
- The kidneys are the most important respiratory organs.



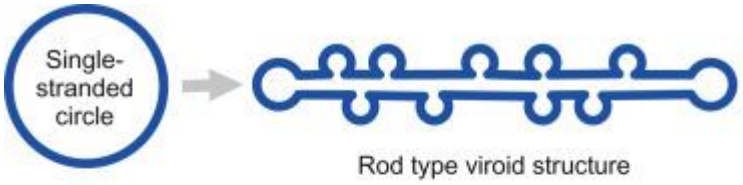
Viruses

The viruses are acellular structures and therefore do not find a place in Whittaker's five kingdom classification. They consist of nucleic acid (either DNA or RNA) that is surrounded by a protein coat. These viruses can grow and multiply only within a host cell. Viruses exist as crystals outside the host cell. They cause disease and severely damage the host. Examples of common viruses are the viruses that cause cold, flu, polio, AIDS, etc.



Viroids

They are the smallest known infectious structures and consist only of nucleic acid without a protein shell.



Rod type viroid structure

Branched viroid structure

Lichens

They are known to be the symbiotic associations of algae and fungi. The pair of algae are autotrophic and synthesized and provide food. The mushroom pair offers protection and shelter.

Archaebacteria

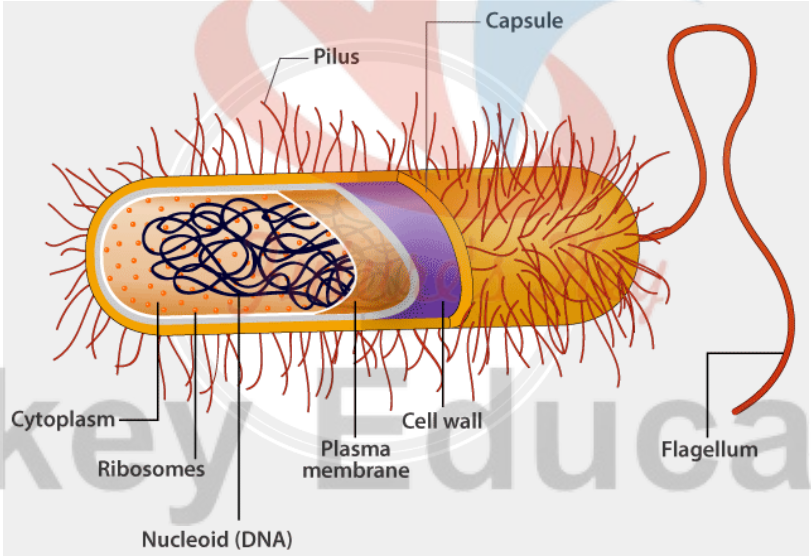
Archaebacteria are one of the oldest living organisms (to be known) on Earth. They are classified as bacteria because many of their features resemble the bacteria when observed

under a microscope. They belong to the kingdom Archaea and hence are named Archaebacteria. They share slightly common features with eukaryotes but are completely different from prokaryotes. They are known as extremophiles as they can easily survive under typically harsh conditions, for example, the bottom of the sea and the vents of a volcano.

Archaebacteria have made scientists reconsider the definition of species. Species are defined as a group with gene flow within its members whereas archaebacteria exhibit gene flow across its species.

Archaebacteria have the capability to produce methane, i.e., are methanogens. They do this by acting on the organic matter and hence decomposing it to release methane. Methane can hence for cooking and lighting purposes,

- Archaebacteria cannot perform photosynthesis.
- They do not produce spores, unlike bacteria.
- 20% of all microbial cells living in the ocean are archaebacteria.
- Archaea was discovered by Carl Woese in 1978.
- Archaebacteria can only reproduce through the asexual mode.

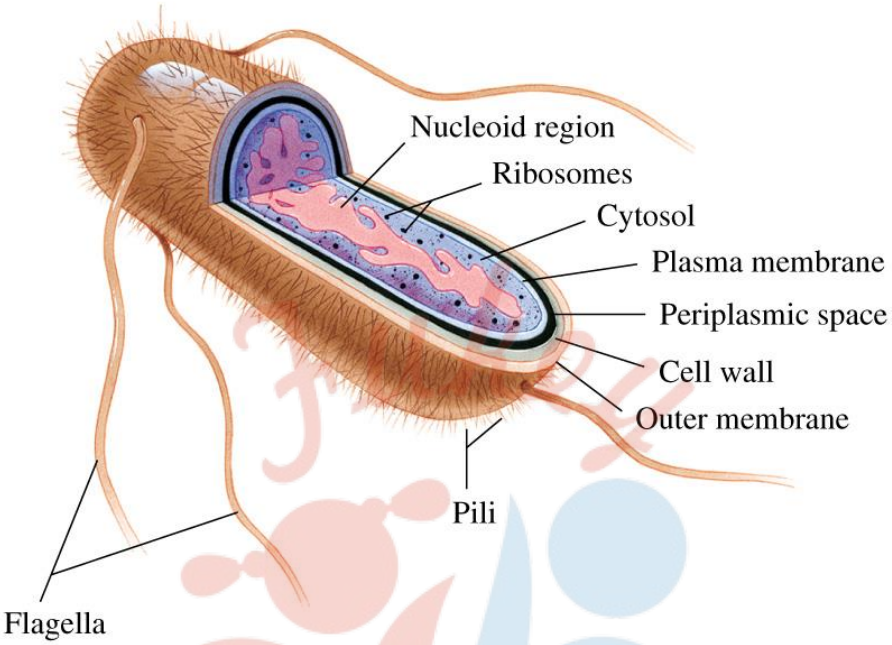


Eubacteria

Eubacteria, also known as "true" bacteria, are single-celled prokaryotic microorganisms that have a variety of characteristics and can be found in a variety of environments around the world. Except for archaebacteria, this term encompasses all types of bacteria. Because eubacteria are so common, they belong to one of the three domains of life: Bacteria. Eubacterium treatment is accomplished through the use of medications.

Both heterotrophic and autotrophic organisms feed on Eubacteria. The most well-known

type of nutrition in eubacteria is heterotrophic, which means they must consume food from other organic carbon sources, primarily plant or animal matter. Autotrophs, on the other hand, produce their own food through photosynthesis.



Types of Protozoan like Protists are there:

Protozoan like protists are heterotrophs in nature and can survive as predators and parasites. There are four main types of protozoans.

They are as follows:

- Amoeboid protozoans have pseudopodia for swallowing food particles like Amoeba. These are found commonly in moist soil or seawater or freshwater.
- Flagellated Protozoans are free-living or parasitic. They are responsible for the different parasitic diseases. For example, sleeping sickness is caused by the parasite Trypanosoma.
- Ciliated Protozoans contain thousands of cilia. The movement of cilia helps the protozoans to move backwards or forward and also allows it to procure food from outside. An example of Ciliated Protozoans is Paramecium.
- Sporozoans are parasitic and pathogenic. They form reproductive cells in them known as spores and thus derive their name. Their reproduction may be asexual or sexual. An example of Sporozoans is the Plasmodium species which causes Malaria.

Classes of kingdom fungi:

There are five main classes in the Fungi Kingdom.

They are as follows:

- **Phycomycetes or Lower Fungi:** Asexual reproduction occurs in Phycomycetes. This takes place by motile spores known as Zoospores and non-motile spores known as Aplanospores. These spores are produced inside the sporangium. Examples of Phycomycetes are Mucor, Rhizopus, Albugo, etc.
- **Zygomycetes or Conjugation Fungi:** Zygomycetes are a primitive group of fungi. Here, asexual reproduction occurs with the help of non-motile sporangiospores. An example of Zygomycetes is Rhizopus.
- **Deuteromycetes:** These are also known as Imperfect Fungi as they do not engage in sexual reproduction at any stage. Only asexual reproduction occurs by conidia. The Mycelium gets separated and ranched due to this. Some examples of Deuteromycetes are Alternaria, Trichoderma, etc.
- **Basidiomycetes or Club Fungi:** In Club Fungi, vegetative reproduction occurs through Fragmentation due to the absence of sexual reproductive organs. Plasmogamy between two vegetative or somatic cells leads to basidium growth, which then undergoes karyogamy and meiosis to produce four basidiospores. Some examples of Club Fungi are Agaricus, commonly known as mushrooms, Ustilago or Smut, etc.
- **Ascomycetes or Sac Fungi:** Sac Fungi are saprophytic as well as parasitic in nature. Here, sexual reproduction occurs by ascospores, while asexual reproduction occurs by conidia. It is branched and separates mycelium in Ascomycetes. Some examples of Sac Fungi are Penicillium, Claviceps, Aspergillus, etc.

Characteristics of the members of Animalia:

The Animalia Kingdom is heterotrophic and eukaryotic.

Their characteristics are as follows:

- They are multicellular and can be of various sizes.
- They are bilaterally symmetrical.
- Their respiratory organs are lungs, book lungs, gills, book gills, skin, etc.
- They have membrane-bound cell organelles that have a nucleus bounded by a nuclear membrane.
- Blood circulation happens through blood, blood vessels, and heart.
- They possess well-developed organs and organ systems like the circulatory system, skeleton system, respiratory system, etc.

Class : 11th Biology
Chapter- 2 : Biololgical Classification

Two kingdom Classification by Linnaeus
Kingdom Plantae
Kingdom Animalia

Viroids
Infectious agent, smaller than virus

Virus
They are non-cellular organisms which remain in inert crystalline form outside the living cell. As they infect a cell, they take over the machinery of the host cell killing the host.

Characters	Five Kingdoms				
	Monera	Protista	Fungi	Plantae	Animalia
Cell type	Prokaryotic	Eukaryotic	Eukaryotic	Eukaryotic	Eukaryotic
Cell wall	Noncellulosic (Polysaccharide + amino acid)	Present in some	Present (without cellulose)	Present (cellulose)	Absent
Nuclear membrane	Absent	Present	Present	Present	Present
Body organisation	Cellular	Cellular	Multicellular/ loose tissue	Tissue/ organ	Tissue/organ/ organ system
Mode of nutrition	Autotrophic (chemosynthetic and photosynthetic) and Heterotrophic (saprophytic/parasitic)	Autotrophic (Photosynthetic) and Heterotrophic	Heterotrophic (Saprophytic/ Parasitic)	Autotrophic (Photosynthetic)	Heterotrophic (Holozoic/ Saprophytic etc.)

Five Kingdom Classification by whittaker

Biological Classification

Lichen
- Phycobiont
  - Algal component
- Mycobiont
  - Fungal component

(Symbiotic association)

Kingdom Monera (Prokaryotes)
- Archaebacteria
  - Methanogens
  - Halophiles
  - Thermoacidophiles
- Eubacteria
  - Photosynthetic Autotrophs
  - Heterotrophic bacteria
  - Chemosynthetic autotrophs

Smallest living Cells
Mycroplasma

Kingdom Fungi Multicellular decomposers
- Phycomycetes
- Ascomycetes
- Deuteromycetes
- Basidiomycetes

Kingdom Protista (Unicellular eukaryotes)
- **Slime Moulds** Plasmodium
- **Euglenoids** Englena Poronema
- **Protozoans** Animal like protists
- **Dinoflagellates** Gonyaulax Noctiluca
- **Chrysophytes** Diatoms and golden algae

Important Questions

Multiple Choice questions-

1. Five kingdom classification was proposed by

   A. Linnaeus
   B. Whittaker
   C. Lamark
   D. Aristotle

2. The Term 'Superparasite' is; meant for

   A. Mycoplasma
   B. Animal parasites
   C. Viruses
   D. A parasite living on another parasite

3. The biologist, who created the kingdom protista for the unicel-lular animals and plants, is

   A. Haeckel
   B. Pasteur
   C. Koch
   D. Lister

4. Organism having characters of both animals and plants is

   A. Bacterium
   B. Paramoecium
   C. Mycoplasma
   D. Euglena

5. On the basis of nucleus, viruses should be included in

   A. Prokaryotes
   B. Eukaryotes
   C. Both (a) and (b)
   D. None of these

6. A unicellular organism often considered a connecting link between plants and animals, is

   A. Paramoecium
   B. Entamoeba
   C. Monocystics
   D. Euglena

7. In Whittaker's classification, the Unicellular organisms having various cell organelles constitute the kingdom

A. Monera
B. Protista
C. Fungi
D. Plantae

8. In five kingdom classification, the kindom that includes the blue green algae, nitrogen fixing bacteria and methanogenic archaebacteria is

A. Plantae
B. Fungi
C. Protista
D. Monero

9. Name the archaebacteria present in the guts of ruminant animals

A. Methanogens
B. Anabaena
C. Nostoc
D. Paramoecium

10. An organism without cell-wall and can survive without oxygen

A. Gonyanlax
B. Rhizopus
C. Mycoplasma
D. Sacharomyces

Fill in the blanks

1. In Linnaeus' time a _____ system of classification with _____ and _____ kingdom was developed that included all plants and animals respectively.
2. R.H. Whittaker (1969) proposed a _____
3. The kingdoms defined by him were named ____, ____, _____, _____ and _____
4. _____ and _____ were placed together under algae.
5. _____ differ from other bacteria in having a different cell wall strcuture and this feature is responsible for their survival in extreme conditions.
6. _____ have chlorophyll a similar to green plants and are photosynthetic autotrophs.
7. _____are the most abundant in nature.
8. All single celled eukaryotes are placed under _____, but the boundaries of this kingdom are not well defined.
9. _____are the chief 'producers' in the oceans.
10. Slime moulds are _____ protists.

True (T) or False (F)

1. All protozoans are heterotrophs and live as predators or parasites.
2. Most Fungi are heterotrophic and absorb soluble organic matter from dead substrates and hence are called saprophytes.
3. Reproduction in fungi can take place by vegetative means frag-mentation, fission and budding.
4. Fusion of protoplasms between two motile or non-motile gemetes is called karyogamy.
5. Fusion of two nuclei is called plasmogamy?
6. Meiosis in zygote resulting in haploid spores.
7. The my celium is aseptate and coenocytic.
8. Some examples are Aspergillus, Claviceps and Neurospora, Neu- rospora is used extensively in biochemical and genetic work.
9. Some examples are Alternaria, Colletotrichum and Trichoderma.
10. Life cycle of plants has two distinct phases-the diploid sporo- phytic and haploid gametophytic?

Very Short Questions :

1. What are imperfect fungi?
2. How many basidiospores are formed after Karyogamy and meiosis?
3. What is plasmogamy?
4. What do you mean by mycorrhiza?
5. How does the spore of slime molds disperse?
6. Name the protein-rich layer found in Euglenoids.
7. Give an example of red dinoflagellates?
8. Who is known as 'Producers of the oceans'?
9. Name the organism responsible for algal bloom?
10. Who has discovered viroids?

Short Questions :

1. What are the slime molds?
2. Write a short note on kingdom Plantae.
3. Write a short note on Mycoplasma.

4. Write a short note on Kingdom Animalia.
5. Write a short note on Lichens.

Long Answer Type

1. Describe the kingdom Monera.
2. Write the distinct characters of protozoa.

Assertion Reason Question-

1. In these questions, a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

   (a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.
   (b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
   (c) If Assertion is true but Reason is false.
   (d) If both Assertion and Reason are false.

   Assertion: Bacteria are prokaryotic.

   Reason: Bacteria do not possess true nucleus and membrane bound cell organelles.

2. In these questions, a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

   (a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.
   (b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
   (c) If Assertion is true but Reason is false.
   (d) If both Assertion and Reason are false.

   Assertion: Bacterial photosynthesis occurs by utilizing wavelength longer than 700 nm.

   Reason: Here reaction centre is P-890.

Case Study Based Question-

1. Bacteria are the sole members of the Kingdom Monera. They are the most abundant micro-organisms. Bacteria occur almost everywhere. They also live in extreme habitats such as hot springs, deserts, snow and deep oceans where very few other life forms can survive. Many of them live in or on other organisms as parasites. Bacteria are grouped under four categories based on their shape –the spherical Coccus (pl.: cocci), the rod-shaped Bacillus (pl.: bacilli), the comma-shaped Vibrium (pl.: vibrio) and the spiral Spirillum (pl.: spirilla).

   Though the bacterial structure is very simple, they are very complex in behaviour. Compared to many other organisms, bacteria as a group show the most extensive metabolic diversity. Some of the bacteria are autotrophic, i.e., they synthesise their own food from inorganic

substrates. They may be photosynthetic autotrophic or chemosynthetic autotrophic. The vast majority of bacteria are heterotrophs, i.e., they depend on other organisms or on dead organic matter for food.

Archaebacteria

These bacteria are special since they live in some of the harshest habitats such as extreme salty areas (halophiles), hot springs (thermoacidophiles) and marshy areas (methanogens). Archaebacteria differ from other bacteria in having a different cell wall structure and this feature is responsible for their survival in extreme conditions. Methanogens are present in the gut of several ruminant animals such as cows and buffaloes and they are responsible for the production of methane (biogas) from the dung of these animals.

Eubacteria

There are thousands of different eubacteria or 'true bacteria'. They are characterised by the presence of a rigid cell wall, and if motile, a flagellum. The cyanobacteria (also referred to as blue-green algae) have chlorophyll a similar to green plants and are photosynthetic autotrophs. The cyanobacteria are unicellular, colonial or filamentous, freshwater/marine or terrestrial algae. The colonies are generally surrounded by gelatinous sheath. They often form blooms in polluted water bodies. Some of these organisms can fix atmospheric nitrogen in specialised cells called heterocysts, e.g., Nostoc and Anabaena. Chemosynthetic autotrophic bacteria oxidise various inorganic substances such as nitrates, nitrites and ammonia and use the released energy for their ATP production. They play a great role in recycling nutrients like nitrogen, phosphorous, iron and sulphur.

Heterotrophic bacteria are most abundant in nature. The majority are important decomposers. Many of them have a significant impact on human affairs. They are helpful in making curd from milk, production of antibiotics, fixing nitrogen in legume roots, etc. Some are pathogens causing damage to human beings, crops, farm animals and pets. Cholera, typhoid, tetanus, citrus canker are well known diseases caused by different bacteria. Bacteria reproduce mainly by fission. Sometimes, under unfavourable conditions, they produce spores. They also reproduce by a sort of sexual reproduction by adopting a primitive type of DNA transfer from one bacterium to the other. The Mycoplasma are organisms that completely lack a cell wall. They are the smallest living cells known and can survive without oxygen. Many mycoplasma are pathogenic in animals and plants.

(1) _____bacteria is responsible for formation of biogas from cow dung / organic waste

(a) cyanobacteria
(b) Halophiles
(c) Thermoacidophiles
(d) Methanogens

(2) _____ are the bacteria that can grow and thrive in salty areas.

(a) Methanogens
(b) Halophobic
(c) Halophiles
(d) Thermoacidophiles

(3) true bacteriaare characterised by _____

(a) Rigid Cell wall
(b) Flagellum present for locomotion
(c) Both a and b
(d) None of the above

(4) Name the eubacteria which is also referred as blue green algae.

(5) What is heterocyst?

(6) What is the thermoacidophiles?

2. The fungi constitute a unique kingdom of heterotrophic organisms. They show a great diversity in morphology and habitat. Some unicellular fungi, e.g., yeast are used to make bread and beer. Other fungi cause diseases in plants and animals; wheat rust-causing Puccinia is an important example. Some are the source of antibiotics, e.g., Penicillium. Fungi are cosmopolitan and occur in air, water, soil and on animals and plants. With the exception of yeasts which are unicellular, fungi are filamentous. Their bodies consist of long, slender thread-like structures called hyphae. The network of hyphae is known as mycelium. Some hyphae are continuous tubes filled with multinucleated cytoplasm – these are called coenocytic hyphae. Others have septae or cross walls in their hyphae. The cell walls of fungi are composed of chitin and polysaccharides. Most fungi are heterotrophic and absorb soluble organic matter from dead substrates and hence are called saprophytes. Those that depend on living plants and animals are called parasites. They can also live as symbionts – in association with algae as lichens and with roots of higher plants as mycorrhiza.

Reproduction in fungi can take place by vegetative means – fragmentation, fission and budding. Asexual reproduction is by spores called conidia or sporangiospores or zoospores, and sexual reproduction is by oospores, ascospores and basidiospores. The various spores are produced in distinct structures called fruiting bodies. The sexual cycle involves the following three steps:

- Fusion of protoplasms between two motile or non-motile gametes called plasmogamy.
- Fusion of two nuclei called karyogamy.
- Meiosis in zygote resulting in haploid spores.

When a fungus reproduces sexually, two haploid hyphae of compatible mating types come together and fuse. In some fungi the fusion of two haploid cells immediately results in diploid cells (2n). However, in other fungi (ascomycetes and basidiomycetes), an intervening dikaryotic stage (n + n, i.e., two nuclei per cell) occurs; such a condition is called a dikaryon

and the phase is called dikaryophase of fungus. Later, the parental nuclei fuse and the cells become diploid. The fungi form fruiting bodies in which reduction division occurs, leading to formation of haploid spores.

(1) _____ Hyphae are without septa and filled with multinucleated cytoplasm.

(a) Septate
(b) Nucleated
(c) Coenocytic
(d) Both a and c

(2) _____ is the only single celled fungi organism.

(a) Penicillium
(b) Yeast
(c) Mycorrhiza
(d) Both a and b

(3) What is saprophytic fungi?

(4) Give reason – why fungi are referred as cosmopolitan organism?

(5) Name the fungi which is responsible for rusting disease in wheat plant.

ANSWER KEY –

➢ Multiple Choice Answer :

1. Whittaker
2. A parasite living on another parasite
3. Haeckel
4. Euglena
5. None of these
6. Euglena
7. Protista
8. Monero
9. Methanogens
10. Mycoplasma

➢ Fill in the blanks :

1. Two kingdom, Plantae, Animalia
2. Five Kingdom Classification
3. Monera, Protista, Fungi, Plantae, Animalia

4. Chlamydomonas, Spirogyra
5. Archaebacteria
6. Cyanobacteria
7. Heterotrophic bacteria
8. Protista
9. Diatoms
10. saprophytic

➢ Write true (T) or false (F) :

1. True
2. True.
3. True
4. False
5. False
6. True
7. True
8. True
9. True
10. True

➢ Very Short Answer :

1. Asexually reproducing fungi belonging to Deuteromycites are imperfect fungi
2. 4
3. Fusion of protoplasms between two motile or non-motile gametes.
4. Mycorrhiza is a symbiotic association between fungi with roots of higher
5. By air currents
6. Pellicle.
7. Gonyaulax.
8. Diatoms.
9. Blue-green algae.

➢ Short Answer :

1. Answer:

1. The slime molds are both plant and animal-like.
2. They are plant-like in the production of spores during reproduction and animal-like in the mode of nutrition and rheumatic organization.
3. Their rheumatic structure consists of an acellular, multinucleate mobile mass of protoplasm which lacks a good wall called plasmodium.
4. The reproductive stage consists of sporangia and spores formed after meiosis. The spores on germination produce either flagellated swarm cells or myxamoebae.
5. These divide mitotically, then behave as gametes and fuse in pairs to form a diploid zygote. The zygote nucleus divides mitotically but the nuclear division is not followed by cell wall formation so that all nuclei lie free in the cytoplasm.
6. The enlargement of the zygote into plasmodium takes place which moves freely on the substratum and feeds on bacteria, fungal and algal spores, and also absorbs nutrients directly from the substratum. The plas¬modium then settles on dry places and develops into sporangia. Therefore asexual stage is plant-like and the sexual stage is animal-like.

2. Answer:

1. Kingdom Plantae includes all autotrophic plants which are photosynthetic forms called green plants starting from simple algae, bryophytes, pteridophytes to gymnosperm and angiosperms.
2. The plant cell has a cell wall mainly made of cellulose and, eukaryotic structure with prominent chloroplasts. Some plants are heterophilic like insectivorous plants which feed on insects and flies e.g. Bladderwort and Venus flytrap.
3. The life cycle has two phases-sporophytic and gametophytic which are diploid (2n) and haploid (n) respectively. That means zygote (2n) undergoes meiosis to form haploid (n) spores these spores germinate into a gametophyte, then these gametes (male and female) fuse to form a zygote (2n) again which gives rise to the sporophyte. This phenomenon is called the alternation of generation.

3. Answer:

1. Discovered by E.Nocard and E.R. Roux (1998) mycoplasma is the smallest known aerobic prokaryotes without a cell wall.
2. They were isolated from cattle suffering from bovine pleuropneumonia and hence they were designated as PPLO (pleuropneumonia-like organisms)
3. They are found in different forms as a spheroid, thin, stellate called pleomorphic.
4. They occur in soil, sewage, human, and plants.

4. **Answer:**

1. Kingdom Animalia includes all animals except the protozoan. The members are multicellular eukaryotes. The cell wall is absent cells, organized into tissue. They directly or indirectly depend on plants for food.
2. They digest their food in an internal cavity and store food reserves as glycogen or fat. They are heterotrophic and the mode of nutrition is holozoic nutrition. They act as decomposers and help in the recycling of minerals.
3. Kingdom Plantae includes the multicellular, photosynthetic eukaryotic forms.
4. They have well-established mechanisms for absorption and Kingdom Animalia includes all animals except the protozoans. They are multicellular eukaryotes and are holozoic. The cells lack walls.

5. **Answer:**

Lichens are a symbiotic association between algae and fungi. The algae component is known as phycobiont and the fungal component as mycobiont which are autotrophic and heterotrophic respectively. Algae prepare food for fungi and fungi provides shelter and absorbs mineral nutrient and water for its partner.

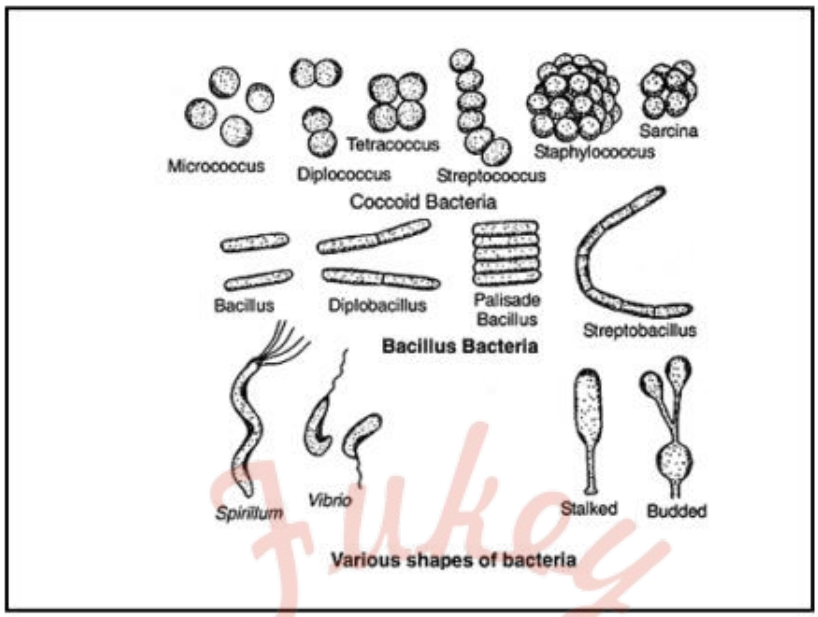
On the basis of the structure of thallus, lichens can be classified into three types

1. **Crustose:** forms a crust on the substrate which is not easily separated from the substrate e.g. Graphis
2. **Foliose:** forms the leafy lobed structure attached to the substrate with the help of rhizines easily separated from substrate eg. Parmelia.
3. **Fruticose:** forms shrubby, cylindrical, and branched thallus. They grow erect or hang from the substrate e.g. Usnea. Lichens are the pioneer colonizers of bare rocks. They also colonize tree trunks in temperate climatic regions.

➢ Long Answer :

1. This kingdom comprises single-celled prokaryotic organisms like bacteria, filamentous actinomycetes, and photosynthetic blue-green algae of Cyanobacteria. The salient features are already given in Table 2.1 we will further discuss the following organisms briefly.

Bacteria: Bacteria are single-celled microscope true prokaryotic organisms which are almost omnipresent. They colonize soil, water, and air. These can survive



in extreme environmental conditions like high temperature, high salt concentration, in absence of oxygen (anaerobic) or in presence of oxygen (aerobic) in high acidic or alkaline pH, etc. (sometimes these are called Archaebacteria).

Some bacteria can be chemotrophs that derive energy from inorganic compounds in absence of oxygen e.g. methanogenic bacteria produce methane gas (CH_4) from CO_2 and H_2, some live by oxidizing hydrogen supplied eg. Thiothsix.

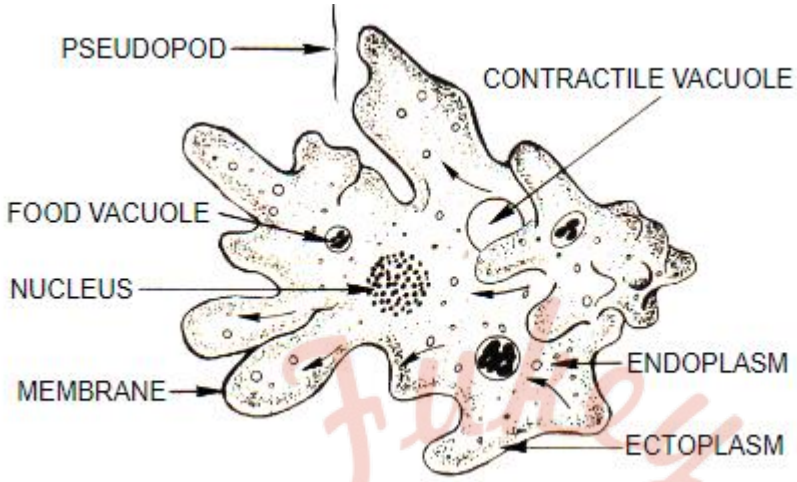
Some are parasites on plants and animals e.g. Xanthomonas citri and Vibrio Cholera; another form symbiotic association with plant roots e.g. Rhizobium.

The bacteria can be of various sizes and shape i.e. spherical or round, coccus (pi. cocci), rod-shaped and bacillus (pi. Bacilli), spiral-shaped spirillum (pi. Priscilla). Long and helical shaped called spirochetes. Many bacteria have one or more slender, long flagellum (pi. flagella) which helps them to move in the liquid substrate. Some bacteria form endospores under poor nutrient conditions.

2. Answer

1. Protozoa are single-celled heterotrophs or 'first animal'. They can be free-living and parasitic members, mobile with flagellar movement, by pseudopodia, or by ciliary movements e.g. Euglena and Amoeba.
2. Cell wall is absent in some like Amoeba so they can change their shape. The Euglena is autotrophic because of the presence of chlorophyll it performs photosynthesis but in the absence of light, it becomes heterotropic and ingests other protists or food particles.
3. They reproduce asexually by binary fission but some reproduce sexually by fusion of gametes followed by meiosis. Another important member of protists is the malarial

parasite, Plasmodium, causing the notorious disease malaria in man, carried by mosquitoes, it multiplies rapidly in the liver of humans and brings about the cyclic fever releasing toxins into the bloodstream of its host.



Photograph of Amoeba and Euglenas

Assertion Reason Answer-

1. (a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.

   Explanation: Bacterial cell is prokaryotic. It lacks true nucleus and membrane bound organelles.

2. (b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

   Explanation: Bacteria utilize the wavelengths longer than 700 nm for photosynthesis and the reaction centre is P-890 the reductant is NADH + H+. In bacteria, donor may be H_2S or malate or succinate.

Case Study Answer-

1. **Answer:**

   (1) d

   (2) c

   (3) c

   (4) The cyanobacteria is also referred to as blue-green algae, they have chlorophyll a similar to green plants and are photosynthetic autotrophs.

   (5) Heterocyst is the specialised cells which facilitate the nitrogen fixation. It is found in cyanobacteria e.g., Nostoc and Anabaena.

   (6) Thermoacidophiles are the bacteria that can survive, grow and thrive in extreme hot temperature condition and acidic environments

2. Answer:

(1) c

(2) b

(3) Saprophytic is the mode of obtaining food by absorption of dissolved organic material which is produced by decaying of organic matters. Those fungi obtain their food by this mode are termed as saprophytic fungi.

(4) Fungi shows a great diversity in morphology and habitat. Fungi are widespread. They can be found in air, water, soil, on the body of other living animal, inside the body. They can be found almost every, because of this fungi are referred as cosmopolitan organism.

(5) Puccinia is the fungi, which case rusting disease in wheat plant.