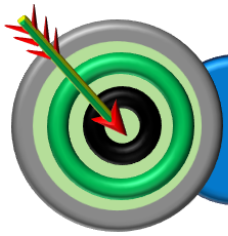
Chapter
02

Biological Classification



OBJECTIVES

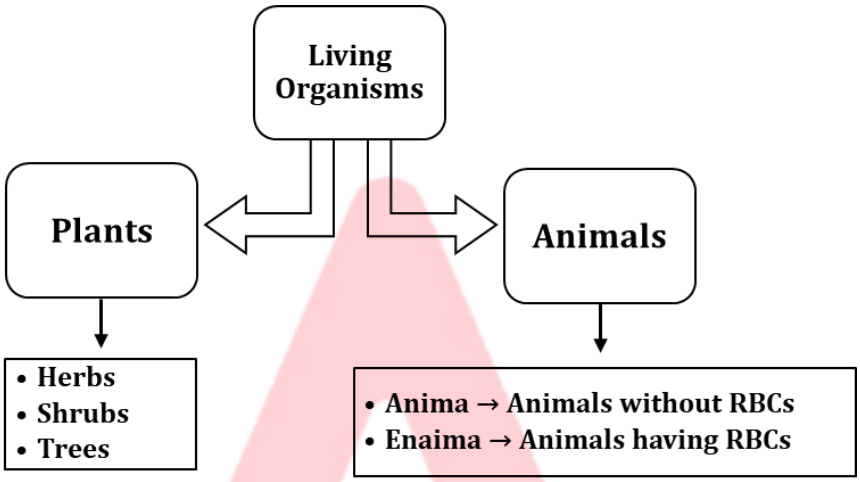
- INTRODUCTION
- KINGDOM SYSTEMS OF CLASSIFICATION
- KINGDOM MONERA
- KINGDOM PROTISTA
- KINGDOM FUNGI
- KINGDOM PLANTAE
- KINGDOM ANIMALIA
- VIRUSES, VIROIDS AND LICHENS

INTRODUCTION

Biological classification is a scientific approach to categorizing organisms based on their similarities, differences, and evolutionary relationships, organizing them into a hierarchical system. Since ancient times, various attempts have been made to classify organisms, but many early methods were based solely on human utility, such as their use for food, shelter, and clothing, lacking a scientific basis. Over time, more refined classification systems have emerged, focusing on morphological, physiological, reproductive, and phylogenetic (evolutionary) characteristics. In this chapter, we will explore the features of the kingdoms Monera, Protista, and Fungi according to Whittaker's classification system, along with a brief overview of Kingdom Plantae and Animalia.

2.1 KINGDOM SYSTEMS OF CLASSIFICATION

The earlier systems of classification of organisms were simple and based on one or two characters. First scientific attempt for classification was performed by Aristotle in following manner:



Aristotle used simple morphological characters to classify plants into herbs, shrubs and trees. He classified animals into Anaima and Enaima, on the basis of absence and presence of RBCs respectively.

- **Two Kingdom Classification-**

Linnaeus classified all living organisms into two kingdoms - Plantae and Animalia. The criteria for classification used by him include cell wall, locomotion, mode of nutrition, response to external stimuli and contractile vacuole.

Features	Kingdom Plantae	Kingdom Animalia
1. Cell wall	Present	Absent
2. Locomotion	Absent	Present
3. Mode of nutrition	Do not eat	Eat
4. Response to external stimulus	Slow	Fast
5. Contractile system	Absent	Present
6. Organisms	Bacteria, algae, fungi, bryophytes, pteridophytes, gymnosperms, angiosperms	Protozoa, vertebrates, invertebrates

Limitations of Two-Kingdom System

(i) Unicellular and multicellular forms have been placed in both the kingdoms though they have different organisation.
(ii) Bacteria and cyanobacteria are included under plants but they are prokaryotes.
(iii) Lichens are also included in plants but they are symbiotic organisms.
(iv) Fungi are included under plantae but they are non-photosynthetic and heterotrophic.

Critical Thinking

A. Three kingdom classification: Haeckel, suggested that a third kingdom Protista should be created to include all unicellular microorganisms. This includes a wide variety of unicellular, mostly aquatic eukaryotes. Example - Fungi, Protozoa, Algae, Bacteria and Slime moulds. Thus, he proposed three kingdoms, namely - Plantae, Protista and Animalia.

B. Four kingdom classification: Copeland gave four kingdom of classification and included Monera as fourth kingdom. This kingdom includes all the prokaryotic organisms i.e. eubacteria (including cyanobacteria or blue-green algae) and archaebacteria.

- **Five Kingdom Classification**

R.H. Whittaker (1969) proposed five kingdom classification. He divided organisms into kingdom Monera, Protista, Fungi, Plantae and Animalia, on the basis of following criteria:

1. Cell structure (either prokaryotic or eukaryotic)
2. Thallus organisation (body differentiated or not)
3. Mode of nutrition (autotrophic or heterotrophic)
4. Reproduction
5. Phylogenetic (or evolutionary) relationship

Table: Characteristics of the Five Kingdoms

Characters	**Five Kingdoms**				
	Monera	**Protista**	**Fungi**	**Plantae**	**Animalia**
Cell type	Prokaryotic	Eukaryotic	Eukaryotic	Eukaryotic	Eukaryotic
Cell wall	Non-cellulosic (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/parasite)	Autotrophic (Photosynthetic) and Heterotrophic	Heterotrophic (Saprophytic/ Parasitic)	Autotrophic (Photosynthetic)	Heterotrophic (Holozoic etc.)

Earlier classification systems included bacteria, blue green algae, fungi, mosses, ferns, gymnosperms and the angiosperms under 'Plants'. The character that unified this whole kingdom was that all the organisms included had a cell wall in their cells. This placed together groups which widely differed in other characteristics. It brought together the prokaryotic bacteria and the blue green algae with other groups which were eukaryotic. It also grouped together the unicellular organisms and the multicellular ones. *Chlamydomonas* and *Spirogyra* were placed together under algae. The classification did not differentiate between the heterotrophic group fungi and the autotrophic green plants, though they also showed a characteristic difference in their walls composition - the fungi had chitin in their walls while the green plants had a cellulosic cell wall. When such characteristics were considered, the fungi were placed in a separate kingdom - Kingdom **Fungi**.

All prokaryotic organisms were grouped together under kingdom **Monera** and the unicellular eukaryotic organisms were placed in kingdom **Protista**. Kingdom Protista has brought together *Chlamydomonas*, *Chlorella* (earlier placed in Algae within plants and both having cell walls) with Paramoecium and Amoeba (which were earlier placed in the animal kingdom) which lack it. It has put together organisms which, in earlier classifications, were placed in different kingdoms. This happened because the criteria for classification changed. Such kind of changes will take place in future also. This will depend on the improvement in our understanding of characteristics and evolutionary relationship.

- **Six kingdom classification:**

  Carl Woese proposed six kingdom classification. These six kingdoms are Kingdom-**Archaebacteria**, Kingdom-**Eubacteria**, Kingdom-**Protista**, Kingdom-**Fungi**, Kingdom-**Plantae** and Kingdom-Animalia. He separated the archaebacteria from eubacteria on the basis of some major differences such as the absence of peptidoglycan in the cell walls of the former and the occurrence of branched chain lipids (a monolayer instead of a phospholipid bilayer) in the membrane.

Based on the sequence of 16S ribosomal RNA genes, Woese found that the six kingdoms naturally cluster into three main categories. He called these categories as **domains of life**. These domains are **Bacteria**, **Archae** and **Eukarya** and are believed to have originated from common ancestor called **progenote**.

TOPIC CENTRIC EXERCISE -01

Q1. Who divided the animals into 2 groups, those which had red blood and those that did not?
(a) Whittaker (b) T.O. Diener
(c) Aristotle (d) W.M. Stanley

Q2. Which of the following classification systems introduced additional kingdoms to address the limitations of the two kingdom system?
(a) Two kingdom system (b) Five kingdom system
(c) Linnaean system (d) None of the above

Q3. Which of the following statements accurately describes the limitations of the earlier classification system that grouped organisms solely based on the presence of a cell wall?
(a) It failed to differentiate between prokaryotic and eukaryotic organisms.
(b) It did not consider variations in cell wall composition.
(c) It grouped together unicellular and multicellular organisms.
(d) All of the above.

Q4. Which of the following classification systems is based on evolutionary relationships and includes the concept of common ancestry?
(a) Two kingdom system (b) Five kingdom system
(c) Linnaean system (d) Domain system

Q5. Which of the following was a limitation of the two-kingdom system of classification?
(a) It did not distinguish between the eukaryotes and prokaryotes.
(b) It did not differentiate between unicellular and multicellular organisms.
(c) It did not consider evolutionary relationships.
(d) All of the above

2.2 Kingdom Monera (All Prokaryotes)

Kingdom Monera includes the most ancient, the smallest, the simplest and the most abundant micro-organisms. These organisms are most primitive. They were the first inhabitants of the earth, and they still continue to flourish. Bacteria are the sole members of this kingdom. They occur almost everywhere. Hundreds of bacteria are present in a handful of soil. 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.

Characteristics of Monera-

- They are unicellular, colonial or filamentous, prokaryotic organisms without nuclear membrane, nucleolus, chromatin and histone proteins.
- Nucleoid or incipient nucleus is composed of naked DNA, RNA and non-histone proteins. DNA is circular and double stranded.

- Cell wall is made up of peptidoglycan (Amino acids + Sugar) except in Archaebacteria and Mycoplasma.
- Membrane bound cell organelles are absent.
- Ribosomes are of 70S type.
- Some of bacteria are autotrophic but vast majority are heterotrophic.
- Respiratory enzymes are found associated with plasma membrane.
- Reproduction is asexual type.
- Bacteria show both autotrophic and heterotrophic nutrition. Autotrophic nutrition involves synthesis of organic material from inorganic substances with the help of light energy (photosynthetic autotrophic) or chemical energy (chemosynthetic autotrophic). Majority of them show heterotrophic nutrition which involves the obtaining of readymade organic nutrients from outside sources. It is of three types saprotrophic, symbiotic and parasitic.

➢ Types of bacteria-

1. On the basis of their shape-

Bacteria show large variations in their shape.

On the basis of their shape bacteria are of different types.

Coccus/Cocci	Bacillus/Bacilli	Spirillum/Spirilla	Comma/Vibrio
• These Bacteria are spherical • These are the smallest bacteria • Maximum resistant bacteria *e.g. Streptococcus pneumoniae*	• This group includes most of the bacteria • These are rod-shaped *e.g. E. coli, Bacillus vulgaris*	• These are spiral shaped bacteria *e.g. Spirillum volutans*	• These are commashaped bacteria *e.g. Vibrio cholerae*

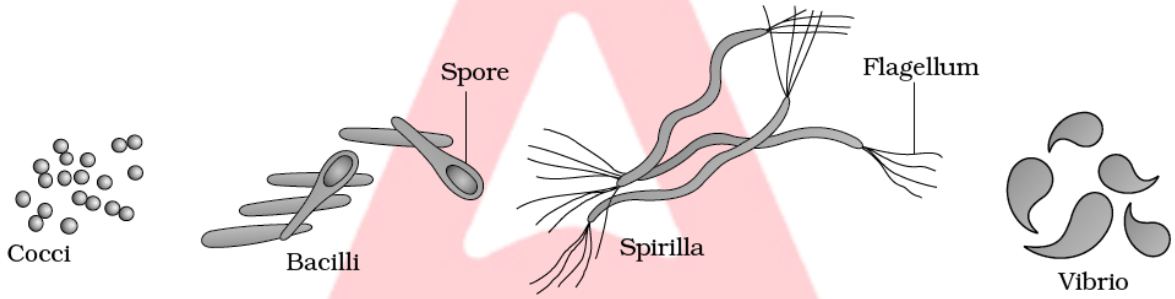


Fig.: Bacteria of different shapes

2. On the basis of nutrition-

Compared to many other organisms, bacteria as a group show the most extensive metabolic diversity. Most of the bacteria are heterotrophic but some are autotrophic. On the basis of nutrition bacteria' are classified into following three categories.

(i) Autotrophs: These bacteria use light or chemical energy for their own food synthesis.

On the basis of source of energy autotrophs are of following two types

(a) Photosynthetic Autotrophs:

- These bacteria use light energy for food synthesis.
- Photosynthetic pigments are present.
- In these bacteria photosynthesis is non oxygenic.
- They need hydrogen ion for photosynthesis, so hydrogen ion is received from sources like inorganic Sulphur compound (H_2S).
  - Purple Sulphur bacteria
  - Green Sulphur bacteria

(b) Chemosynthetic Autotrophs:

- These are non-photosynthetic autotrophs i.e., photosynthetic pigments are absent.
- They use chemical energy instead of light energy for food synthesis.
- Chemical energy is obtained from oxidation of chemical compounds.
- These bacteria oxidise chemical compounds and release energy which is used for food synthesis.

- ❖ All Nitrifying bacteria like Nitrosomonas, Nitrococcus, Nitrobacter
- ❖ Hydrogen bacteria, Iron bacteria, Sulphur bacteria
- ❖ Chemosynthetic bacteria play an important role in nutrient recycling e.g. N, P, K, S. etc

(ii) Heterotrophs: Most of the bacteria are heterotrophic i.e., they cannot manufacture their own food.

- They receive their own food from dead organic matter or living organism. These are of following types

(a) Saprotrophic Bacteria: These bacteria obtain food from dead and decaying organic matter.

(b) Parasitic Bacteria: They obtain their food from living organism These are of two types

- **Obligate Parasite** - They always remain parasitic. e.g., ***Mycobacterium leprae***
- **Facultative Saprotrophic** - They are normally parasitic in nature but in the absence of living host, they may become saprotrophs e.g., ***Mycobacterium tuberculosis***

(c) Symbiotic Bacteria: These **bacteria** convert atmospheric nitrogen into nitrogenous compounds like Amino acid, NO_3 or Salts of ammonia. e.g., ***Rhizobium, Frankia***.

➢ Reproduction

Bacteria reproduce by following methods:

1. By Binary Fission:

This is the most common method. Under favorable conditions first of all DNA replication takes place in bacterial cell. Bacterial cell divides into two daughter cells due to formation of transverse septum in the center of the cell. Each daughter cell grows into a new bacterium. Under favorable conditions, the cells of bacteria divides by amitosis which is faster than mitosis and meiosis.

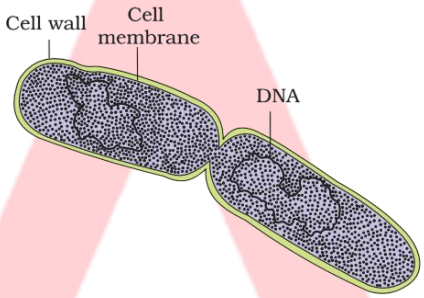


Fig.: A dividing bacterium

2. By Endospore Formation:

It takes place in adverse conditions. Endospore is thick walled, highly resistant and surrounded by four layers.

(a) Exosporium: Outermost lipoproteinaceous layer.

(b) Spore coat: Disulfide rich protein, impervious, tough and, resistant.

(c) Cortex: Very thick and composed of peptidoglycan.

(d) Core wall or spore wall : Thick delicate proteinaceous innermost layer.

Critical Thinking

The endospore contains anticoagulant dipicolinic acid (DPA) and calcium in the form of calcium dipicolinate which provides high temperature resistant property.

➢ Respiration

On the basis of respiration bacteria are of two types.

(i) Aerobic Bacteria:

(a) Obligate Aerobic: These are completely aerobic and die in the absence of O_2. e.g. *Azotobacter*, *Bacillus subtilis.*

(b) Facultative Anaerobic: These are normally aerobic bacteria but can survive in the absence of O2. e.g., *Acetobacter aceti*, *Clostridium tetani***.**

(ii) Anaerobic Bacteria:

(a) Obligate Anaerobic: These are completely anaerobic bacteria and do not have capacity of aerobic respiration. e.g. *Clostridium botulinum***.**

(b) Facultative Aerobic: These are normally anaerobic but also have capacity of aerobic respiration. e.g. Fermentation bacteria except *Acetobacter aceti*, *E.coli***.**

- **Domains of Kingdom Monera**
  1. Archaebacteria
  2. Eubacteria

2.2.1 Archaebacteria

These bacteria are special since they live in some of the most harsh 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.

2.2.1.1 Types of Archaebacteria:

1. Methanogens:

They are obligate anaerobes. These bacteria convert CO_2 of swampy areas (Marshy) into methane (CH_4). These bacteria convert the organic substance (cellulose) present in cow dung into methane by fermentation (Gobar gas fermenter). Archaebacterium is found in the rumen of cattle as a symbiont, where it digests the cellulose and by fermentation convert it into methane. e.g., *Methanobacterium*, *Methanococcus*

2. Halophiles:

These archaebacteria are found in extreme salty areas e.g., *Halobacterium, Halococcus*.

3. Thermoacidophiles:

These archaebacteria are found at those places where temperature is approx. 80° - 90°C and medium is acidic (pH = 2). Hot water Sulphur springs are found in the Himalayan region. e.g., *Thermoplasma*, *Sulfolobus*.

2.2.2 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. Types of eubacteria are-

2.2.2.1 Blue green algae (BGA)

(A) According to Two Kingdom classification BGA were included in class Cyanophyceae or Myxophyceae of Algae. But now they are included in Kingdom Monera, because of their prokaryotic nature.
(B) It is now known as cyanobacteria.
(C) 1st oxygenic photosynthetic organism on earth because they use water as source of electron.
(D) BGA are found in fresh water (mostly), marine water and terrestrial habitat.
(E) They have following pigments.

- Chlorophyll 'a' - green
- Carotenoids - yellow
- C - Phycoerythrin – red (Phycobillins)

- **Different Forms of BGA or Cyanobacteria:**

(A) Unicellular - *Spirulina*

Critical Thinking

Spirulina is an edible BGA because it has very large number of proteins. So, it is used as single cell protein. It is also used in space by scientist as food.

(B) Colonial – *Anabaena*

(C) Filamentous – *Nostoc, Oscillatoria*

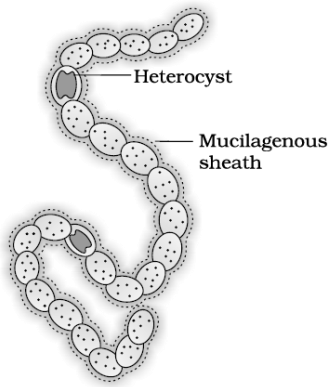


Fig.: A filamentous blue-green algae – *Nostoc*

- **Structure of BGA:**
  (i) The structure of BGA is similar to Gram (-ve) eubacteria.
  (ii) BGA is surrounded by a **mucilaginous sheath/gelatinous sheath**. The cell wall of BGA is also bilayer. Outer wall is made up of lipopolysaccharides and-the inner wall is made up of peptidoglycan.
- **Stored Food:**
  BGA stores its food in the form of cyanophycean granules.
- **Nitrogen Fixation in BGA:**
  (A) Some of the BGA, can perform Nitrogen fixation. They convert atmospheric nitrogen in to nitrogenous compounds like amino acids, nitrates. These nitrates increase the fertility of soil. Hence B.G.A. improves the fertility of soil by nitrogen fixation. Nitrogen fixation in BGA occurs in heterocyst. Heterocyst is thick walled, non-green cell.
- **Economic Importance of BGA**
  Useful Activities:
  (1) Nitrogen Fixation: They provide fertility to soil by nitrogen fixation. e.g. *Nostoc, Anabaena, Aulosira, Oscillatoria*
  (2) Food Supplement: e.g., *Spirulina*
- **Harmful Activities:**
  (1) Water Bloom: Excessive Growth of BGA in Polluted Water.
  BGA grow rapidly in polluted water and secrete toxic substances. These toxic substances are known as death factor. Death factor is the main cause of death in aquatic animals. It also gives toxicity and bad odour to the water. For e.g. *Anabaena, Microcystis*

2.2.2.2 Mycoplasma

They are also called as PPLO i.e. Pleuro pneumonia like organisms. Mycoplasmas unicellular, smallest prokaryotic organisms. The diameter of cell varies from 0.1 μm to 0.3 μm Both DNA (ds DNA linear) and RNA are present. Mycoplasmas may be the simplest form of life capable of independent growth, reproduction and metabolism. They lack cell wall and the cell membrane is outermost boundary. Osmotrophic mode of nutrition (absorption of nutrients by osmosis) is found in Mycoplasma. They are resistant to antibiotics such as penicillin that act on cell wall. They are sensitive to tetracycline & chloramphenicol that act on metabolic activities. Most of the species of Mycoplasma are facultative anaerobes. They can survive in absence of oxygen also. Species of Mycoplasma are saprophyte or facultative parasite. Many mycoplasma are pathogenic in animals and plants.

- **Staining of Bacteria**
  Gram Staining Technique:
  1. First of all, H.C. Gram differentiated bacteria on the basis of staining.
  2. In the first step of this method bacteria are stained with **Crystal Violet or gentian violet** and then KI solution.
  3. After staining, bacteria are washed with **Acetone or Ethyl alcohol**. After washing some bacteria retain the stain and some bacteria are decolourised.

4. Bacteria which retain stain (violet or purple) are called Gram (+) bacteria which decolourise are known as Gram (-). Gram (-) bacteria are counter stained by safranin.

➢ **Economic Importance of Bacteria**

- **Saprophytic bacteria**: These are major decomposers or mineralisers of earth for regulating biogeochemical cycles.
- **Ammonifying bacteria**: They convert nitrogeneous compounds / proteins of dead plants and animals or their excretory products into ammonia. E.g., Bacillus ramosus, B. mycoides, B. vulgaricus.
- **Symbiotic nitrogen fixers**: E.g., *Rhizobium* in root nodules of leguminous plants; *Frankia* in root nodules of *Casuarina, Alnus*; *Nostoc* in Trifolium alexandrium;etc.
- **Retting of fibres:** Some bacteria dissolve pectin of middle lamella to separate individual fibres of flax, jute, hemp. E.g., *Clostridium perfringens, Pseudomonas fluorescence*.
- **Production of vinegar**: E.g., *Acetobacter aceti*.
- **Single cell protein (SCP):** Dried biomass of microorganism obtained after culturing, harvesting and drying is called SCP. The latter is used as protein source in animal feeds and food supplement of man. E.g., *Methylophilus methylotropus, Rhodopseudomonas capsulata*.
- **Production of Lactic acid:** It is performed by the activity of various lactic acid bacteria (LAB)
- **Antibiotics:** Many types of antibiotics are obtained by eubacteria and actinomycetes.
- **Vitamins:** E.g., *Clostridium butylicum* is used to prepare riboflavin.
- **Enzymes:** Many enzymes are extracted commercially by bacterial activities. E.g., streptokinase from *Streptococcus pyrogens*, protease from *Bacillus subtilis*, pectinase from *Clostridium perfringens*.

Harmful Activities

1. **Disease in Human Beings:**

Disease	Bacterium
Tuberculosis (T.B.)	*Mycobacterium tuberculosis*
Leprosy	*Mycobacterium leprae*
Diphtheria	*Corynebacterium diphtheriae*
Tetanus	*Clostridium tetani*
Typhoid	*Salmonella typhi*
Cholera	*Vibrio cholerae*
Pertussis	*Bordetella pertusis*

1. **Disease in Plants:**

Citrus canker – *Xanthomonas citri*

Bacterial leaf blight of rice – *Xanthomonas oryzae*

TOPIC CENTRIC EXERCISE -02

Q1. Which bacteria are most abundant in nature?

(a) Archaebacteria
(b) Photosynthetic autotrophic bacteria
(c) Chemosynthetic autotrophic bacteria
(d) Heterotrophic bacteria

Q2. Which of the pigment present in cyanobacteria?

(a) Chlorophyll a (b) Chlorophyll b
(c) Chlorophyll c (d) Xanthophylls

Q3. The conditions which would be favoured by thermoacidophiles are

(a) Hot and alkaline (b) Snow and acidic
(c) Hot and sulphur spring (d) Gut of cows

Q4. Which of the following statements accurately describes the metabolic diversity of bacteria?
(a) Bacteria are exclusively autotrophic, synthesizing their own food from inorganic substrates.
(b) Bacteria are primarily photosynthetic autotrophs, relying on sunlight for food production.
(c) Bacteria exhibit extensive metabolic diversity, including both autotrophic and heterotrophic modes of nutrition
(d) Bacteria are mainly heterotrophs, obtaining their food solely from other organisms.

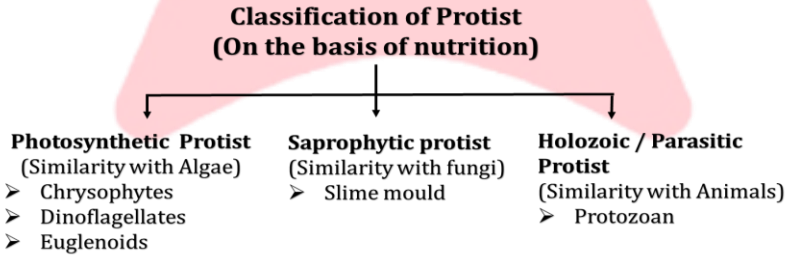
Q5. Archaebacteria can survive in extreme conditions because of the
(a) Complex metabolic reactions in their body
(b) Fact that they are the oldest life forms on the earth
(c) Complex cell wall structure
(d) Double membrane nucleus

2.3 Kingdom Protista

All unicellular eukaryotes, irrespective of their mode of nutrition, are included in the kingdom Protista in Whittaker's system. The term 'protista' was coined by Ernst Haeckel. This kingdom forms a link between kingdom Monera on one hand and other three kingdoms i.e., Plantae, Fungi and Animalia on the other hand. Protistans are ancestors of all multicellular eukaryotes (plants, fungi and animals).

General Characteristics of Protista:

- Unicellular, eukaryotic organisms.
- Some are colonial without much cellular differentiation. Organisation at tissue level is absent. Mostly aquatic organisms.
- Cell structure is eukaryotic type having all kinds of membrane bound organelles and 80 S cytoplasmic ribosomes and cells may possess cellulosic cell wall.
- Flagella and cilia have (9+2) pattern of microtubule organization consisting of tubulin protein.
- Movement by pseudopodia, flagella or cilia where ciliary mode is fastest.
- Mode of nutrition may be photosynthetic (holophytic), holozoic (ingestive), saprobic or parasitic (absorptive). Some have mixotrophic nutrition (photosynthetic and saprobic) as in *Euglena*.
- Protists reproduce asexually and sexually by a process involving cell fusion and zygote formation.
- These are decomposers, photosynthetic or parasites. Parasitic protists may cause diseases like dysentery, malaria, sleeping sickness etc.



2.3.1 Chrysophytes

Diatoms are golden brown photosynthetic protists and are called Chrysophytes (**including both diatoms and desmids**). They are both aquatic and terrestrial. Some are marine. They support much of marine life. Their important characters are:

- These are microscopic organisms possessing varying colours.
- They are basically unicellular, **lacking flagella except in the reproductive stage.**
- They may be free floating (phytoplanktonic), float on surface of water due to presence of light weight lipids.
- The cellulosic cell wall is impregnated with **silica** to form transparent siliceous shell.
- The cell wall is characteristic, made up of two halves; one half covering the other - resembling a soap box.
- Mode of nutrition is holophytic (photoautotrophic), photosynthetic pigments are chlorophyll a, chlorophyll c, ß-carotene and special carotenoids containing fucoxanthin; xanthophylls
- They are responsible for almost 50% of the total organic matter synthesized in the biosphere.

Critical Thinking

Due to a transparent siliceous shell (silica deposited in cellulosic cell wall), the cell wall of diatoms is hard. It does not get destroyed after their death and deposited at the bottom of sea. This accumulation occurs over billions of years and is referred to as diatomaceous earth or diatomite.

The reserved food is oil and chrysolaminarin or leucosin (a polysaccharide).

2.3.2 Dinoflagellates

Dinoflagellates are **golden brown photosynthetic protists**, belonging to class **Dinophyceae (Pyrrophyta)**. They are mainly marine, though few are fresh water forms. They may appear red, yellow, green, brown or blue depending upon the main pigment present in cell.

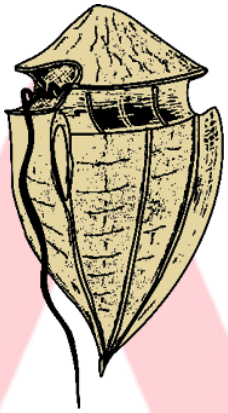


Fig.: *Dinoflagellates*

General characters of dinoflagellates are as follows:

- Unicellular, motile, biflagellate, golden brown photosynthetic protists (some are non-motile, amoeboid, palmelloid or filamentous).
- They are mostly marine, some are found in fresh water. The body is enclosed by a rigid coat called theca or lorica consisting of 2 to many articulated or sculptured plates of cellulose and pectin, hence are also called armoured dinoflagellates.
- Flagella are **heterokont** (different). One is longitudinal and other is transverse. Both are oriented at right angle to each other producing spinning movements. Therefore, these protists are also called 'whirling whips'.
- Most of the species have brown, green or yellow chromatophores with chlorophyll a, c, a-carotene, xanthophyll. Plastids are generally surrounded by 3-membrane envelope and contain 3-thylakoid lamellae.
- They are autotrophic or photosynthetic, a few are saprobic or parasitic.
- Reserve food is carbohydrate and oils. Nucleus is relatively larger in size, has condensed chromosomes even in interphase, chromosomes do not have histone.

Clue Finder

Very often, red dinoflagellates undergo such rapid multiplication that they make the sea appear red (red tides). Toxins released by such large numbers may even kill other marine animals such as fishes. E.g., *Gonyaulax*.

2.3.3 Euglenoid

It is a group of chlorophyllous and non chlorophyllous flagellate protists. Largest genera being Euglena amongst them. Previously euglenoids were placed in plant kingdom due to their photosynthetic ability. But due to the absence of cell wall and animals like nutrition some scientists placed them in animal kingdom. But now according to five kingdom classification, they are included in Protista.

General characters of Euglena -

- They are unicellular protists found in fresh water habitats and damp soils.
- Their cell membrane is covered with *pellicle*. Pellicle is made up of lipoprotein and it is elastic in nature.
- They have a contractile vacuole. These contractile vacuoles help in osmoregulation.
- Though they are photosynthetic in the presence of sunlight, when deprived of sunlight they behave like heterotrophs by predating on other smaller organisms.
- On the basis of nutrition, they are known as **mixotrophic**. E.g., Euglena (shows both holophytic and holozoic nutrition).
- The reserve food is paramylum as paramylum granules that is stored in the cytoplasm instead of chloroplasts.
- They perform multiplication by longtiudinal binary fission in favourable conditions and by cyst formation in unfavourable conditions.
- Euglena is considered as a connecting link between plant kingdom and animal kingdom because it shows features of both plants and animals.

Fig.: *Euglena*

2.3.4 Slime Moulds or Consumer-Decomposer Protists

They were included in class myxomycetes of fungi in two-kingdom classification. They were called **mycetozoa** by **DeBary** as they are closely related to animals. Mycologists include them in **gymnomycota**. Because of their nature they are called **protistan fungi.**

General characteristics of the slime moulds are:

- They are usually free-living, creeping over debris like fallen leaves and rotting logs of wood. They have naked protoplast, not covered by any cell wall in vegetative stage.
- They lack chlorophyll and have saprobic or phagotrophic mode of nutrition.
- The body moves along decaying twigs and leaves engulfing organic material. Under favourable conditions, they form an aggregation called **plasmodium** which may grow and spread over several feet.
- During unfavourable conditions, the plasmodium differentiates and forms fruiting bodies bearing spores at their tips.
- During life cycle they are amoeboid and non-cellulosic, but spores have cellulosic wall so that their vegetative phase resembles with animals while reproductive phase resembles with plants.
- Amoeboid plasmodial stage resembles protozoa and spore forming nature is like fungi. Spores are extremely resistant and survive for many years, even under adverse conditions. The spores are dispersed by air currents.

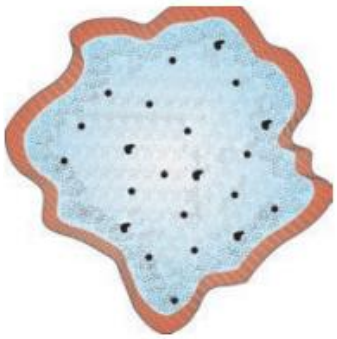


Fig.: *Slime mould*

Clue Finder

The cellular slime moulds bear features of both plants and animals.
Animal-like features: Absence of cell wall in vegetative phase and feeding like Amoeba
Plant-like feature: the reproductive phase is plant-like as the spores have a cell wall composed of cellulose.

2.3.5 Protozoans

These are unicellular organisms with heterotrophic nutrition. They are believed to be primitive relatives of animals. There are four major groups of protozoans.

Characteristics	Amoeboid protozoans	Flagellated protozoans	Ciliated protozoans	Sporozoans
Habitat and habit	Fresh water, sea water or moist soil mostly free living, few parasites.	Free living (aquatic) or parasitic.	Fresh water or marine, few parasite.	All endoparasites
Locomotory structure	Pseudopodia (false feet)	Flagella	Cilia	Absent
Special feature	Silica shells in some forms.	Rare sexual reproduction with diverse type of associations - commensal, symbiont, parasitic.	Possess definite region of ingestion (gullet) and egestion).	Infectious spore-like stage is present in life cycle.
Example and diseases	*Amoeba, Entamoeba* (Dysentery)	*Trypanosoma* (Sleeping sickness)	*Paramoecium*	*Plasmodium* (Most notorious causing malaria)

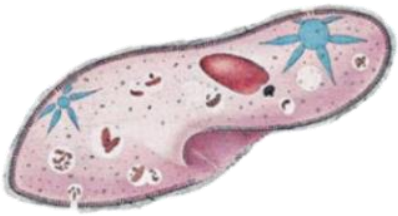


Fig.: *Paramoecium*

TOPIC CENTRIC EXERCISE-03

Q1. Diatomaceous earth is the deposition of cell wall in their habitat by diatoms takes over
(a) Millions of years (b) Billions of years
(c) Trillions of years (d) housands of years

Q2. Cell wall of diatoms is composed with
(a) Cellulose (b) Chitin
(c) Silica (d) Peptidoglycam

Q3. What is not true of Euglena?

(a) Presence of cellulosic cell wall (b) Presence of proteinaceous pellicle

(c) Presence of chlorophyll (d) Presence of flagellum

Q4. What is red tide?

(a) Accumulation of cell wall deposits of red algae is called red tide

(b) Accumulation of red blood cells in water

(c) Colouration of water due to rapid multiplication of red dinoflagellates

(d) Spread of chrysophytes due to rapid reproduction

Q5. What of the following characteristics accurately describe the kingdom protista?

(a) Prokaryotic cell structure and heterotrophic nutrition

(b) Eukaryotic cell structure and autotrophic nutrition.

(c) Prokaryotic cell structure and photosynthetic nutrition.

(d) Eukaryotic cell structure and both autotrophic and heterotrophic nutrition.

2.4 KINGDOM – FUNGI

General characters

(i) The fungi constitute unique kingdom of heterotrophic organisms. Members of this kingdom are called fungi. They show great diversity in their morphology and habitat. They can be seen on moist bread, butter, leather, wood, pickle, rotten fruits (orange rotting) and vegetables or as parasites on plants (white spot-on mustard leaves) and animals.

(ii) Fungi are cosmopolitan and occur in air, water, soil, and on animals & plants. Fungi prefer to grow in warm and humid places so, we keep food in refrigerator, which prevents food from going bad due to bacterial or fungal infections. Fungi do not have chlorophyll and chloroplasts.

(iii) Most of fungi are heterotrophs. On the basis of source of food, fungi are of two types

(a) Saprophytic :- These fungi obtain their own food from dead substrate or organic matter (absorb soluble organic matter) such as bread, rotting fruits, vegetables and dung.

- Nutrition is of absorptive type in saprophytic fungi

(b) Parasitic :- These obtain their own food from living organism such as plants, animals and human beings.

- They obtain nutrition with the help of haustoria.

(iv) Some fungi are found symbiotically associated with algae and form lichens. Some fungi are found symbiotically in the roots of higher plants and form mycorrhiza.

(v) With the exception of yeasts which are unicellular, fungi are filamentous. Their body consist of long, slender thread-like structures called hyphae. The network of hyphae is known as mycelium. Some hyphae are continuous filled with multinucleated cytoplasm (coenocytic hyphae), other have septae or cross walls in their hyphae.

(vi) Cell wall composed of chitin (fungal cellulose) and polysaccharides.

Critical Thinking

- ❖ Cell wall of the members of class-oomycetes is mainly made up of cellulosic compounds & glycans
- ❖ In fungi the stored food remains in the form of glycogen and oil.

- **Reproduction**

Reproduction in fungi can take place by vegetative means – fragmentation, budding or fission. Asexual reproduction is by spores called conidia or sporangiospores (zoospores, aplanospores) and sexual reproduction by oospore, zygospore, ascospores and basidiospores.

(i) Vegetative reproduction -

(a) Fragmentation:-

If due to some reason, the fungal filament, i.e., mycelium, breaks into small pieces then these pieces form a new fungal filament.

(b) Budding :-

Sometimes a bud-like protuberance is formed in non–mycelial fungus which gets separated from the mother fungi and functions as young fungi. At the time of separation of bud from its mother cell or fungi, the nucleus of mother cell divides mitotically (or amitotically - in yeast) into two parts. Out of these two nuclei, one remains within the mother cell while the other migrates to the bud. E.g., *Saccharomyces*.

(c) Fission:-

Sometimes the fungal cell divides into two parts. The division of nucleus also occurs. E.g., *Schizosaccharomyces* (Yeast).

(ii) Asexual reproduction -

Asexual reproduction takes place by the formation of different types of spores (Conidia/sporangiospores). These spores are formed by mitotic division.

Spores are of following types :-

(a) Sporangiospores -

They are formed in sporangia. Sporangium is formed at the tip of fungal filament. The fungal filament on which sporangium is formed is called as sporangiophore. Numerous spores (sporangiospores) are present in the sporangium, they come out by rupturing of sporangia and germinate to form fungal filaments. The formation of sporangiospores takes place endogenously.

Sporangiospores are of two types :-

- **Zoospore:** When the sporangiospores formed in sporangia are flagellated and motile, then they are called as zoospores.
- **Aplanospore:** When sporangiospores are non-flagellated and non-motile then they are called aplanospores.

(b) Conidia -

The formation of conidia takes place **exogenously**. These conidia are formed at the tip of conidiophores.

- **Conidiophore** - Erect fungal filament on which conidia are formed is called conidiophore.
- **Conidia** - Conidia are formed in chain. Each conidium forms new fungal filament (mycelium) by germination

(iii) Sexual Reproduction:

The structure in which gametes are formed is called gametangium.

- Sexual reproduction takes place by oospores, ascospores and basidiospores.
- The various spores are produced in distinct structures called fruiting bodies.
- The structure in which gametes are formed are called gametangia.

The sexual cycle involves the following three steps:

(i) Fusion of protoplasm between two motile or non-motile gametes called plasmogamy.
(ii) Fusion of two nuclei called karyogamy.
(iii) Meiosis in zygote resulting in haploid spores.

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**.**

2.4.1 Phycomycetes

- **Habitat:**

  All the fungi included in this class are called lower fungi.

  Members of phycomycetes are found in aquatic habitat (members of this class are known as algal fungi) and on decaying wood in moist and damp place or as obligate parasites on plants.

- **Mycelium:**
  The fungal filament (mycelium) of all the fungi included in this class are coenocytic, aseptate and branched.
- **Asexual reproduction:**
  By zoospores, aplanospores and conidia.
- **Sexual reproduction:**
  May be isogamous, anisogamous and oogamous.

Phycomycetes is further classified into some classes like Oomycetes, Zygomycetes

1. Oomycetes:

Asexual reproduction - By sporangiospores (Zoospores) & Conidia.
Sexual reproduction - By Gametangial contact, Oogamous.

Examples: -

(a) *Phytophthora infestans* - Causes "Late blight of potato". This disease is known as "Famine of Ireland" – 1845

(b) *Albugo candida or Cystopus candidus* - Albugo causes "White rust or white spots disease" in the members of cruciferae or brassicaceae family. (Mustard)

(c) *Pythium* species - Causes ‘‘Damping off’’ disease in tobacco & vegetable crops.

(d) *Sclerospora graminicola* causes ‘‘Green ear disease of bajra’’

2. Zygomycetes -

Asexual reproduction - By sporangiospores (aplanospores)
Sexual reproduction - By Gametangial copulation, Isogamous

Examples**:** *Rhizopus* & *Mucor* - These are known as **Bread mould** - They prefer to grow on bread.

Fig.: *Mucor*

Critical Thinking

The mycelium of oomycetes and zygomycetes classes is same in structure i.e. coenocytic & aseptate. But they are dissimilar on the basis of sexual reproduction.

2.4.2 Ascomycetes: "The sac fungi"

- **Habitat:**
  They are saprophytic, decomposers, parasitic or coprophilous (growing on dung). Members of ascomycetes are multicellular but rarely unicellular, like yeasts.
- **Mycelium:**
  Uninucleate branched and septate. Pores are present in septum.
- **Asexual reproduction**

Asexual reproduction takes place by asexual spores conidia which are produced exogenously on the special mycelium called conidiophores.

- **Sexual reproduction**

  Sexual reproduction occurs by ascospores (sexual spores) which are produced endogenously in sac like asci. These asci are arranged in different types of fruiting bodies called ascocarps

Examples :-

(a) ***Penicillium*: -**

Penicillin antibiotic was obtained from *Penicillium notatum*. First discovered antibiotic was Penicillin it was obtained from fungi Penicillium.

(b) ***Aspergillus*: -**

Different species of Aspergillus are related to **"aspergillosis"** disease.

Secrete **"aflatoxins"** (carcinogenic) in stored crop plants.

Aspergillus niger – Known as weed of laboratory and produce citric acid.

Fig.: *Aspergillus*

(c) ***Claviceps*: -**

Claviceps purpurea – It causes "Ergot disease" of Bajra and Rye. "Ergotin" (drug) is obtained from it.

A narcotic drug (LSD) is also obtained from it. LSD (Lysergic acid diethylamide) is a hallucinogenic drug.

(d) ***Neurospora*:** - Red or Pink mold "Drosophila of plant Kingdom". It is used for the study of genetics and biochemical studies in Plant kingdom.

Beadle and **Tatum** proposed "One gene - one enzyme theory" in Genetics by experimenting on *Neurospora*. They were awarded Nobel prize for it.

(e) ***Morchella*: -** The species of *Morchella* are commonly called as morels.

(f) **Truffles: -** Some members of Ascomycetes are known as Truffles.

- **YEAST**

  Yeast are **unicellular fungi.** Yeast grows on ripened fruits like grapes, sugarcane, date palm and flowers. Mycelium is absent in yeast.

  Economic Importance: -

  It is used as fermentation agent in bakery (bread industry) and brewery (wine industry).

  So, ***Saccharomyces cerevisiae*** is also called **''Baker's yeast''** or **Brewing yeast**.

2.4.3 Basidiomycetes "Club fungi"

- **Habitat:**

  They grow in soil, **on logs** (thick wooden pieces), **tree stumps** and in living plant bodies as **parasites e.g. rusts and smuts**.

- **Mycelium:**

  Branched, Septate and uni or binucleate -In basidiomycetes, septa are of special type and they are called **dolipore septa**.

Critical Thinking

Clamp connection: – It is a tubular relationship between two neighbouring cells. With the help of this connection the nucleus of one cell can migrate to the neighbouring cell, due to which the other cell becomes dikaryotic (binucleate). Clamp connection is used to change monokaryotic mycelium to dikaryotic mycelium in basidiomycetes.

- **Asexual reproduction: -**
  The asexual spores are generally not found, but vegetative reproduction by fragmentation is common.
- **Sexual reproduction: -**
  The sex organs are absent, but plasmogamy is brought about by fusion of two vegetative or somatic cells of different strains or genotypes. The resultant structure is dikaryotic which ultimately gives rise to basidium. Karyogamy and meiosis take place in the basidium producing four basidiospores. The basidiospores are exogenously produced on the basidium. The basidia are arranged in fruiting bodies called basidiocarps.

Example :-

Commonly known forms are mushroom, bracket fungi and puff ball.

(a) Rust fungi: *Puccinia* : It cause rust disease in wheat.

(b) Bracket or Shelf fungi:-

Their fruiting body is similar to bracket therefore they are called as bracket fungi.

(c) Puff balls – Fruiting body of some fungi are puff like so these fungi are called puff ball.

(d) Mushrooms– These are umbrella like fungi often seen growing in grounds during rainy season. Some mushrooms are edible.

Most delicious mushroom - ***Agaricus bisporus***

Fig.: *Agaricus*

World's most poisonous mushroom - ***Amanita muscaria*** – [It is hallucinogenic]

(Poisonous mushrooms are known as Toad - stool)

(e) Smut fungi: – It causes smut disease on plant. Smut diseases mainly affect the seeds of crop plants. Smut fungi infect seed and form black sooty spores inside the seed.
eg. Ustilago nuda tritici – It causes "loose smut of wheat." This disease spreads by infected flowers and seeds.

2.4.4 Deuteromycetes

- **Habitat:**
  Some members are saprophytic or parasitic, while a large number of members of this class are decomposers of litter and help in mineral cycling. e.g. *Trichoderma*
- **Mycelium:** Septate and branched
- **Asexual reproduction:** Takes place with the help of conidia.

It is also called "**fungi Imperfecti**", because only the asexual or vegetative phase of these fungi are known. When the sexual forms of this class of fungi were discovered, they were moved into right class ascomycetes or basidiomycetes from deuteromycetes. e.g. *Alternaria, Colletotrichum* and *Trichoderma*.

TOPIC CENTRIC EXERCISE -04

Q1. Which of the following characteristics is unique to fungi?
(a) Photosynthetic mode of nutrition.
(b) Presence of a cell wall composed of chitin.
(c) Multicellular organization with specialized tissues.
(d) Prokaryotic cell structure.

Q2. Which of the following does not belong to class basidiomycetes?
(i) Agaricus
(ii) Trichoderma
(iii) Puccinia
(iv) Saccharomyces
(v) Ustilago
(a) (i) and (ii) only (b) (ii) and (iii) only
(c) (ii) and (iv) only (d) (ii), (iii) and (iv) only

Q3. Which characteristic placed the fungi in a separate kingdom?
(a) Cell wall composition (b) Cell wall structure
(c) Nutrition (d) Nuclear membrane

Q4. Fungi imperfecti (deuteromycetes) lack
(a) Spores (b) Sexual reproduction
(c) Asexual reproduction (d) Hyphae

Q5. The members of which of the following are litter decomposers?
(a) Deuteromycetes (b) Ascomycetes
(c) Basidiomycetes (d) Phycomycetes

2.5 KINGDOM PLANTAE

- All eukaryotic chlorophyll containing organisms commonly called plants are included under kingdom plantae. Few of them are partially heterotrophic such as insectivorous plants (e.g. Bladderwort and Venus fly trap) or parasites (e.g., Cuscuta).
- The plant cells have a eukaryotic structure with prominent chloroplasts and cell wall which is mainly made up of cellulose.
- Kingdom Plantae includes algae, bryophytes, pteridophytes, gymnosperms and angiosperms.
- In plants, life cycle has two distinct phases i.e. the diploid sporophytic and haploid gametophytic that alternate with each other. This phenomenon is called **alternation of generation**.
- The lengths of haploid and diploid phases, and whether these phases are free living or dependent on others, vary among different groups in plants.

2.6 KINGDOM ANIMALIA

- The members of this kingdom are multicellular and their cells lack cell walls.
- They directly or indirectly depend on plants (autotrophs) for nutrition.
- In these members, the digestion of food takes place in an internal cavity and they store their food reserves in the form of glycogen or fat.
- Their mode of nutrition is holozoic by ingestion of food.
- They follow a definite growth pattern and grow into adults that have a definite shape and size.
- Most of them are capable of locomotion. Higher forms of kingdom animalia show elaborate sensory and neuromotor mechanism.

TOPIC CENTRIC EXERCISE -05

Q1. All members of kingdom planate consists of_____.
(a) Eukaryotic organisms (b) Chlorophyll containing organisms

(c) Prokaryotic organisms (d) Both (a) and (b).

Q2. Bladderwort and venus fly trap are examples of_____.
(a) Parasitic plants (b) Insectivorous plants
(c) Bryophytes (d) Pteridophytes

Q3. Body oraganisation of members of kingdom planate is_____level(s).
(a) Organ (b) Loose tissue
(c) Tissue (d) Both (a) and (c)

Q4. Cuscuta is a_____plant.
(a) Parasitic (b) Insectivorous
(c) Xerophytic (d) Aquatic

Q5. Which of the following cannot be included in kingdom planate?
(a) Bryophytes (b) Gymnosperms
(c) Angiosperms (d) Lichens

Q6. Which of the following shows holozoic mode of nutrition?
(a) Kingdom animalia (b) Kingdom fungi
(c) Kingdom Protista (d) Kingdom Monera

Q7. Members of kingdom animalia show_____level of body organization.
(a) Tissue (b) Organ
(c) Organ system (d) All of these

2.7 VIRUSES, VIROIDS, PRIONS AND LICHENS

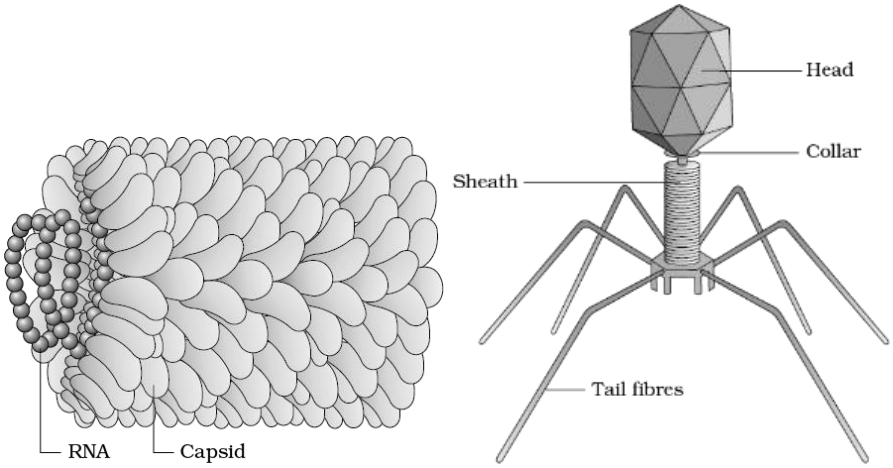
A. History

- **Virus: The name virus**, which means "**poisonous fluid**" or "**venom**"
- **D.J. Ivanowsky** recognized certain micro-organism as causal agent of mosaic disease of tobacco. He reported that viruses are smaller than bacteria and they can pass through the bacteria proof filters.
- **M.W. Beijerinek** demonstrated that the extract of the infected plants of tobacco could cause infection in healthy plants and named the new pathogen "**virus**" and called the fluid as "***contagium vivum fluidum*** (Infectious living fluid)".
- **W.M. Stanley** (1935) showed that viruses could be crystallized and crystals **consist largely of protein**.
- Viruses did not find a place in classification since they are not considered truly living.

B. Characteristic features of viruses

- These are **submicroscopic** & **non-cellular** organisms.
- They are obligate intracellular parasites.
- They have either RNA or DNA. No virus contains both DNA and RNA.
- They are **inert** outside their specific host cell in crystalline form.
- Once they infect a cell, they take over the machinery of the host cell to replicate themselves.
- They contain nucleic acid so they are capable of protein synthesis by the help of ribosomes of host cell.

C. Morphology and structure of viruses Shape:



(a) (b)

Fig.:(a) Tobacco Mosaic Virus (TMV) (b) Bacteriophage

D. Chemical composition:

(i) Nucleic acid: Either RNA or DNA

- Generally, viruses that infect plants have ssRNA, but in **Cauliflower mosaic virus** dsDNA is present and in Gemini virus ss-DNA is present.
- Viruses that infect animals have generally double stranded DNA or ss or dsRNA

(ii) Protein coat:

- It is known as **capsid** and made up of small sub units called capsomeres, protecting the nucleic acid.
- Central core & Capsid are collectively known as **nucleoprotein.**

E. Symmetry of viruses:

(i) Helical symmetry: Capsomeres are arranged in helical manner in the capsid
e.g. TMV and Mumps virus etc.

(ii) Icosahedral: It is a type of polyhedral ***e.g.*** Herpes virus, Adeno virus, ϕ× 174 bacteriophage

➢ **TMV (Tobacco Mosaic Virus)**

- It is the most thoroughly studied virus and was discovered by the Russian worker D.J. Ivanowsky (1892).
- It has helical symmetry.
- Having single stranded RNA
- 5% RNA and 95% protein are present in TMV.

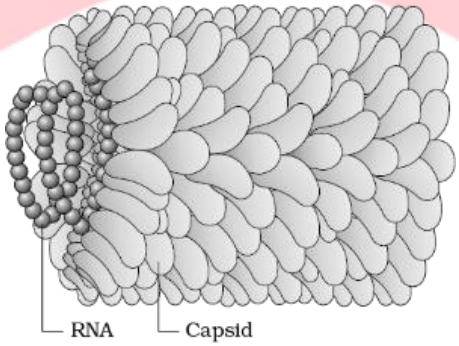


Fig.: TMV

➢ **Bacteriophage**

- The Virus which infect the bacteria are called bacteriophage.
- Bacteriophages are generally double stranded DNA virus.
- **Transduction:**
- Transfer of genetic material from one bacterium to another by bacteriophage is known as transduction.

➢ **Plant Diseases caused by viruses: -**

- Tobacco mosaic disease.
- Leaf curl of **papaya**

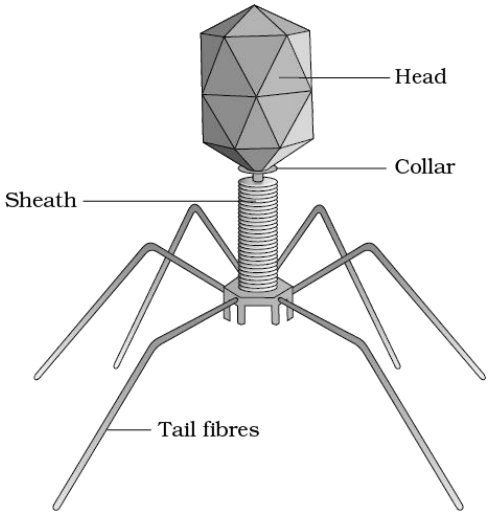


Fig.: Bacteriophage

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

Human disease caused by virus: -

- **Influenza**
- **Mumps**
- **Small pox**
- **Herpes disease**
- **AIDS**

➢ **Viroids (Free infectious RNA):**

- **T.O. Diener** (1971) discovered some new infectious agents, which are smaller than viruses, called **viroids**. It was found to be free RNA.
- Viroids contain only very low molecular weight RNA (ss RNA) and not the protein coat.
- Viroids cause **Potato spindle tuber disease.**

➢ **Prions or Slow viruses (Smallest proteinaceous infectious agent):**

In modern medicine certain infections neurological diseases were found to be transmitted by an agent consisted of abnormally folded protein. The agent was similar in size to viruses. These agents were called prions. The most notable diseases caused by prions are **bovine spongiform encephalopathy (BSE)** commonly called **mad cow disease** in cattle and its analogous variant **Cr-Jacob disease (CJD)** in humans.

➢ **LICHENS**

- Lichens are distinct group of organisms having two components.
- Algal component of lichen is known as phycobiont and prepare food for algae and fungi. Fungal component is known as mycobiont and provides shelter and absorbs mineral nutrients and water for its partner. Hence lichen is an example of **symbiosis**.
- Major part of lichen's thallus is composed of fungal component.

➢ **Importance of Lichens:**

Indicator of air pollution:

- Lichens are very good pollution indicator they do not grow in polluted area.
- Lichens are very sensitive to SO2 and die at higher level of SO_2. So, lichens are not found in industrial areas where atmosphere is polluted by smoke (specially SO_2), So lichens are **biological indicator** of air pollution.
- Lichens are pioneer species during the process of succession on rocks.

TOPIC CENTRIC EXERCISE -06

Q1. Viruses that infect bacterium are known as

(a) Bacteriophages (b) Viral bacterium
(c) Bacteiocapsid (d) Bacteriomycin

Q2. Those viruses that infect plants have which type of genetic - material?

(a) Single stranded DNA (b) Single stranded RNA
(c) Double stranded RNA (d) Double stranded DNA

Q3. Lichens are indicators of pollution because

(a) They grow in oxygen depleted regions
(b) They don't grow in polluted regions
(c) They grow in polluted regions
(d) Their growth indicates that the region has very high carbon levels

Q4. Who crystallized and isolated viruses for the first time?

(a) WM Stanley (b) Pasteur
(c) D.J. Ivanowsky (d) M.W. Beijernick

Q5. Viroids differ from viruses in being

(a) Naked RNA molecules only (b) Naked DNA molecules only red
(c) Naked DNA packaged with viral genomes (d) Satellite RNA packaged with viral genome

Solved Examples

Ex: 1. Which of the following live in extreme saline habitats?

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

Sol. **(a)** Halophiles live in extreme saline habitats

Ex: 2. Which of the following is wrong about fungi?

(a) They are eukaryotic
(b) All fungi possess a purely cellulosic cell wall
(c) They are heterotrophic
(d) They are both unicellular and multicellular.

Sol. **(b)** Fungi have a cell wall made of chitin, not cellulose

Ex: 3. Diatomaceous Earth is made by:

(a) Euglenoids (b) Dinoflagellates
(c) Diatoms (d) Protozoan

Sol. **(c)** Diatomaceous Earth is made by Diatoms

Ex: 4. Which of the following fungi contains hallucinogenic components?

(a) *Morchella esculenta* (b) *Amanita muscaria*
(c) *Neurospora* species. (d) *Ustilago* species

Sol. **(b)** *Amanita muscaria* contains psychoactive compounds which have hallucinogenic effects when ingested

Ex: 5. All single-celled eukaryotes are included in:

(a) Fungi (b) Protista
(c) Monera (d) Animalia

Sol. **(b)** All single-celled eukaryotes are classified under the kingdom Protista.

Ex: 6. Chlorophyll a is present in

(a) Archaebacteria (b) Mycoplasma
(c) Cyanobacteria (d) All of the above

Sol. **(c)** Chlorophyll *a* is present in cyanobacteria, enabling them to perform photosynthesis.

Ex: 7. Archaebacteria differs from Eubacteria in:

(a) Cell wall structure (b) Mode of Nutrition
(c) Cell shape (d) Mode of Reproduction

Sol. **(a)** Archaebacteria have unique cell wall compositions that lack peptidoglycan, unlike the peptidoglycan-rich cell walls of eubacteria.

Ex: 8. Which one of the following does not differ in *E. coli* and *Chlamydomonas*?

(a) Ribosomes (b) Chromosomal Organization
(c) Cell Wall (d) Cytokinin

Sol. **(a)** Both *E. coli* (a prokaryote) and *Chlamydomonas* (a eukaryote) have ribosomes, though their types differ (70S in *E. coli* and 80S in *Chlamydomonas*).

Ex: 9. Morels and truffles groups of fungi are classified as

(a) Phycomycetes (b) Deuteromycetes
(c) Basidiomycetes (d) Ascomycetes

Sol. **(d)** Morels and truffles belongs to class Ascomycetes of Fungi

Ex: 10. When deprived of sunlight, euglenoids behave as

(a) Autotrophs
(b) Heterotrophs
(c) Chemosynthetic organisms
(d) Osmotrophs

Sol. **(b)** When deprived of sunlight, euglenoids behave as heterotrophs

Exercise-01 Level -01

1. Blue green algae are grown in paddy fields-
(a) For medicinal use
(b) To increases fertility of soil
(c) To serve as food for fishes
(d) To pollute the water

2. The organism which is devoid of cell wall in their vegetative phase but develop a wall in their reproductive stage like spore-
(a) Nostoc (b) Slime moulds
(c) Euglena (d) Diatoms

3. All are the characteristics of *Rhizopus*, except
(a) Multicellular
(b) Reproduce sexually by zygospores
(c) Reproduce asexually by conidia
(d) Ribosome 80S

4. The feature that differentiates Diatoms from other protists is-
(a) Pigments
(b) Unicellular
(c) Cell wall
(d) Non oxygenic photosynthesis

5. Choose correct match w.r.t. different classes of fungi
(a) Deuteromycetes - zoospore – septate mycelium
(b) Basidiomycetes – zygospore – septate mycelium
(c) Ascomycetes - conidia - aseptate mycelium
(d) Phycomycetes – aplanospores - coenocytic mycelium

6. The similarity in TMV and viriods is-
(a) Genetic material
(b) Protein coat
(c) Metabolic pathway
(d) Ribosomes

7. Which of the following feature is not related with prions?
(a) Similar size to virus
(b) Causes disease in humans
(c) Abnormally folded protein
(d) Presence of respiration

8. Select the **correct** statement
(a) Viroids have double stranded RNA
(b) RNA of viroids have high molecular weight than viruses
(c) Mumps and herpes are viral diseases
(d) The name virus was given by D.J. lvanowsky

9. Cyanobacteria are neither
(a) Parasitic nor saprophytic
(b) Colonial nor filamentous
(c) Aquatic nor terrestrial
(d) Freshwater nor marine forms

10. The flexibility in Euglena is due to the presence of-
(a) Protein rich layer called pellicle
(b) Cell wall rich in polypeptides
(c) Cilia all around the cell envelope
(d) Protein-less plasma membrane

11. According to three kingdom classification, Alternaria and Nostoc are placed under-
(a) Plantae (b) Animalia
(c) Protista (d) Monera

12. Out of *Nostoc, Alternaria, Dinoflagellates, Slime moulds, Euglena, Pinus, Cycas, Neem, Puccinia, Bacillus*.
How many are multicellular?
(a) Five (b) Four
(c) Six (d) Three

13. Under favorable conditions, slime moulds form ___A___ while under unfavorable conditions they from ___B____.
(a) A- Plasmodium, B- Fruiting bodies
(b) A- Spores, B- Plasmodium
(c) A- Fruiting bodies, B- Spores
(d) A- Fruiting bodies, B-Plasmodium

14. In *Puccinia*, karyogamy and meiosis take place in
(a) Ascus (b) Basidium
(c) Zygospore (d) Basidiospore

15. Out of Mycobacterium, Nitrosomonas, Amoeba, Moss, Spirogyra, Paramoecium, Anabaena.
How many have autotrophic nutrition?
(a) Three (b) Four
(c) Five (d) Six

16. From dung of cattles, a gas is produced by special class of archaebacteria. This gas is
(a) Carbon dioxide (b) Methane
(c) Hydrogen sulphide (d) Carbon monoxide

17. Ciliates differ from all other protozoans in
(a) Using pseudopodia for capturing prey
(b) Having a contractile vacuole for removing excess water
(c) Using flagella for locomotion
(d) Having two types of nuclei.

18. Heterocysts are present in
(a) Chemosynthetic autotrophic bacteria
(b) Photosynthetic autotrophic bacteria
(c) Heterotrophic bacteria

(d) Saprophytic bacteria.

19. Which of the following bacterium is associated with the roots of legumes?
(a) Photosynthetic autotrophs
(b) Hetrotrophic bacteria
(c) Chemosynthetic autotrophs
(d) Archaebacteria

20. From the features given below, how many are associated with the most primitive bacterial group?

Associated with eukaryotes, Heterotrophic nutrition only, Survival in harsh habitats, May be photosynthetic, have a different cell wall structure

(a) 2 (b) 3
(c) 4 (d) 1

21. Sleeping sickness is caused by
(a) Amoeboid protozoan
(b) Flagellated protozoan
(c) Ciliated protozoan
(d) Sporozoan.

22. Yeast is not included in protozoans but in fungi because
(a) It has chlorophyll
(b) It shows saprotrophic mode of nutrition
(c) It has eukaryotic organisation
(d) Cell wall is made up of cellulose and reserve food material as starch.

23. Fungi can be distinguished from algae by the fact that
(a) Motile ciliated gametes are absent
(b) Cell wall is cellulosic and chlorophyll is absent
(c) being coenocytic
(d) Cell wall is chitinous and chlorophyll is absent.

24. Which one of the following is wrong for fungi?
(a) They are cosmopolitan and occur everywhere.
(b) All fungi possess a purely cellulosic cell wall.
(c) They are heterotrophic or parasitic.
(d) They are both unicellular and multicellular.

25. Which of the following is considered as neither prokaryotes nor eukaryotes?
(a) Bacteriophages
(b) Bacteria
(c) Fungi
(d) Monera

26. Which of the following options contains insectivorous plants?
(a) Bladderwort and Cuscuta
(b) Cuscuta and Solanum
(c) Venus fly trap and bladderwort
(d) Solanum and Venus fly trap

27. Which of the following statements is incorrect?
(a) Yeasts have filamentous bodies with long thread like - hyphae.
(b) Morels and truffles are edible delicacies.
(c) *Ustilago*, a member of basidiomycete is a smut.
(d) Conidia are produced exogenously and ascospores endogenously in ascomycetes.

28. The imperfect fungi which reproduce by asexual spores conidia are
(a) Phycomycetes (b) Ascomycetes
(c) Deuteromycetes (d) Basidiomycetes.

29. Which of the following statements regarding Kingdom Plantae is correct?
(a) It includes all eukaryotic chlorophyll containing organisms.
(b) Few of its members are partially heterotrophic.
(c) The cell wall is made up of cellulose.
(d) All of these

30. Select the incorrect statement.
(a) Most plant viruses are RNA viruses.
(b) Bacteriophages possess dsDNA.
(c) Virus that infect bacteria is called bacteriophage.
(d) Prions possess only nucleoid and no proteins.

31. Cyanobacteria are classified under which of the following kingdoms?
(a) Monera (b) Protista
(c) Fungi (d) Plantae

32. Eukaryotic, chlorophyllous and autotrophic organisms are grouped under which of the following kingdoms?
(a) Monera (b) Protista
(c) Fungi (d) Plantae

33. Select the incorrect statement.
(a) Fungi are cosmopolitan in nature.
(b) Most fungi are heterotrophic and absorb soluble inorganic matter from dead substrates.
(c) Some unicellular fungi are used to make bread and beer.
(d) Fungi prefer to grow in warm and humid places.

34. Kingdom plantae includes all
(a) Eukaryotic chlorophyll - containing organisms
(b) Prokaryotic chlorophyll - containing organisms
(c) Eukaryotic heterotrophic organisms
(d) Prokaryotic heterotrophic organisms.

35. Which of the following characters served as the criteria for five kingdom system of classification as used by R.H Whittaker?
(a) Cell structure
(b) Mode of nutrition and reproduction

(c) Phylogenetic relationships
(d) All of these

36. Which is wrong about viruses?
(a) All are parasites.
(b) Antibiotics have no effect on them.
(c) All of them have helical symmetry.
(d) They have the ability to synthesise nucleic acids and proteins.

37. Read the following statements and select the incorrect one.
(a) The name virus means venom or poisonous fluid.
(b) Many mycoplasmas are pathogenic in animals and plants.
(c) Toxins released by large number of red dinoflagellates may even kill other marine animals such as fishes.
(d) Beside the cell wall, euglenoids have a protein rich laver called pelicle which makes their body flexible.

38. Which of the following statements is incorrect?
(a) Methanogens are present in the gut of cows and buffaloes.
(b) The vast majority of bacteria are autotrophs.
(c) Bacteria live in extreme habitats such as hot springs, deserts, snow and deep oceans.
(d) Archaebacteria differ from other bacteria in having a different cell wall structure and this feature is responsible for their survival in extreme conditions.

39. What may be a 'photosynthetic protistian' to one biologist may be 'a plant to another. Which of the following feature of slime mould shows linkage with plant?
(a) Presence of holozoic nutrition
(b) Presence of diverse sexual reproduction
(c) Slime moulds have cellulosic spore wall
(d) Formation of fruiting bodies

40. Which of the following statements about Mycoplasma is true?
(a) They are smallest, disease causing thin walled organisms.
(b) They differ from viruses in being cellular in organisation.
(c) They have an inert crystalline structure outside the living cell.
(d) They can survive without photosynthetic pigments and genetic material.

41. Select the incorrect statement.
(a) In Phycomycetes, asexual spores are produced endogenously.
(b) In Ascomycetes, asexual spores are produced exogenously.
(c) In Ascomycetes, sexual spores are produced endogenously.
(d) In basidomycetes, asexual spores are produced exogenously.

42. Select the incorrect statement regarding protists.
(a) They are connecting link between prokaryotes and other eukaryotes.
(b) Members of Protista are primarily aquatic.
(c) Protistan cell body does not contain membrane-bound organelle.
(d) They may have both plant and animal-like characters.

43. Select the incorrect statement regarding protozoans.
(a) They are the primitive relatives of animals.
(b) All protozoans are autotrophs.
(c) Amoeboid protozoans move and capture their prey by putting out pseudopodia.
(d) Ciliated protozoans have a cavity that opens to the outside of the cell surface.

44. The cell wall has stiff cellulose plates on the outer surface
(a) *Gonyaulax* (b) *Euglena*
(c) Slime mould (d) *Entamoeba*.

45. The antibiotics have no effect on viruses because
(a) They kill all bacteria, which act as host of virus
(b) Viruses are too small in size for antibiotics to act upon them
(c) Viruses show no metabolism of their own
(d) Viruses produce a thick covering and encyst themselves as endospores.

46. Viruses cannot reproduce on its own because
(a) It has undeveloped sex organs
(b) It cannot reproduce at all
(c) It lacks the cellular machinery to use its genetic material
(d) None of these.

47. Which of the following disease is caused by prions?
(a) Bovine spongiform encephalopathy
(b) Mad cow disease
(c) Jacob disease
(d) All of these

48. Select the correct statement among the following
(a) Smut is caused by *Ustilago*, whereas rust is by Puccinia
(b) *Claviceps* is used extensively in biochemical and genetic work.
(c) The deuteromycetes reproduce only by sexual spores called conidia.

(d) In *Agaricus*, sexual spores are called ascospores which are produced endogenously.

49. In plants mosaic formation, leaf rolling and curling yellowing of plant parts vein clearing, dwarfing and stunted growth, necrosis, etc., are the symptoms of
(a) Bacterial diseases
(b) Mycoplasmal diseases
(c) Viral disease
(d) Fungal diseases

50. Which of these is a defining character of plants only?
(a) Autotrophic nature
(b) Eukaryotic cell structure
(c) Cellulosic cell wall
(d) Aerobic respiration

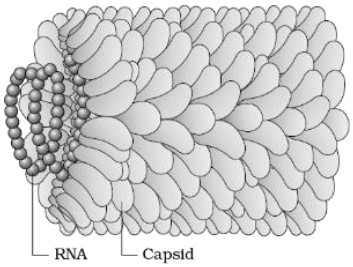
Exercise-02 Level -02

1. Mode of nutrition in members of a kingdom which includes all prokaryotes can be
(A) Photosynthetic
(B) Parasitic
(C) Chemosynthetic
(D) Saprophytic
(a) Only (a) & (b) (b) Only (b) & (c)
(c) Only (c) & (d) (d) All (a), (b), (c) & (d)

2. Select the true features for Mycoplasma
(A) Protoplasmic matrix contains 70 s type of ribosomes.
(B) Are obligate aerobes.
(C) Insensitive to penicillin.
(D) Mostly parasitic.
(a) (a) & (b) (b) (b) & (c)
(c) (a), (c) & (d) (d) (a), (b) & (c)

3. Methanogens are responsible for production of biogas and they are
(a) Obligate aerobes
(b) Obligate anaerobes
(c) Facultative aerobes
(d) Facultative anaerobe

4. Identify the genetic material of the virus in the given figure.



(a) ssRNA (b) dsRNA
(c) ssDNA (d) dsDNA

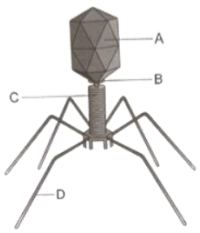
5. State **true (T)** or **false (F)** for the following statements.
A. Cyanobacteria often form blooms in polluted water bodies.
B. Archaebacteria are eubacteria.
C. Mycoplasma are organisms that completely lack a cell wall.
(a) A–T, B–T, C–T (b) A–F, B–T, C–F
(c) A–T, B–T, C–F (d) A–T, B–F, C–T

6. Select the correct statement.
(a) Cholera, typhoid, tetanus are well-known diseases caused by viruses
(b) Dinoflagellates, euglenoids and slime moulds are placed under kingdom Monera
(c) Members of kingdom Protista are primarily aquatic
(d) Dinoflagellates are the chief 'producers' in the oceansm

7. Select the incorrect statement.
(a) Nostoc and Anabaena have heterocysts for nitrogen fixation
(b) Cyanobacteria often form blooms in polluted water bodies
(c) Heterotrophic bacteria are more abundant in. nature
(d) The cell wall of Mycoplasma are made up of chitin

8. Which of the following statement is incorrect about viruses?
(a) Viruses contain either RNA or DNA
(b) Viruses do not have their own metabolic system
(c) Bacteriophages are usually double stranded DNA viruses
(d) TMV contains both RNA and DNA as their genetic material

9. Identify A, B, C and D parts in this diagram of bacteriophage.



(a) A-Head, B - Sheath, C-Collar, D- Tail fibres
(b) A-Head, B - Collar, C-Sheath, D - Tail fibres
(c) A-Head, B-Collar, C-Tail fibres, D - Sheath
(d) -Head, B - Sheath, C- Tail fibres, D - Collar

10. Identify the following statements as **true(T)** or **false (F)** and choose the option accordingly.
A. Mumps is a bacterial disease
B. Leaf rolling and curling can be a symptom of viral infection
C. Both bacteria and viruses play a great role in nutrient recycling
(a) A–T, B–T, C–T (b) A–F, B–T, C–T
(c) A–F, B–F, C–F (d) A–F, B–T, C–F

11. In which of the following groups, at least one member is imperfect fungi?
A. Ustilago, Claviceps, Neurospora
B. Saccharomyces, Aspergillus, Albugo
C. Neurospora, Alternaria, Puccinia
D. Rhizopus, Trichoderma, Colletotrichum
(a) c & d (b) a & c
(c) a, c & d (d) b, c & d

12. Which of the given statements is not true for viruses?
(a) They are nucleoproteins where protein is infectious in nature
(b) They can be crystallised and crystals consist largely of proteins
(c) Virus means venom or poisonous fluid
(d) A virus can never have both DNA and RNA as its genetic material

13. Read the following statements and select the option with correct statements-
(A) Bacteria produce spores under favourable conditions
(B) Disease caused by Plasmodium has a staggering effect on the human population.
(C) Saccharomyces being Ascomycete have septate and branched mycelium.
(D) Coenocytic hyphae are continuous tubes filled with multinucleated cytoplasm.
(a) (A) and (C) (b) (A) and (B)
(c) (C) and (D) (d) (B) and (D)

14. Bacterial viruses
A. Infect the bacteria
B. Usually have double stranded DNA
C. Are also called bacteriophages
D. Lack protein coat
(a) Only A is correct
(b) Only A & C are correct
(c) Only B is correct
(d) Only D is incorrect

15. Select correct match w.r.t. Whittaker' system of classification
(a) Monera: Unicellular, autotrophs, producers and decomposers, true cellulosic cell wall
(b) Protista: Unicellular, eukaryotic, photoautotrophs and chemoautotrophs
(c) Fungi: Multicellular/loose tissue, eukaryotic, heterotrophs, chitinous wall
(d) Animalia: Multicellular, eukaryotic, organ or organ system, holozoic, no saprophyte

16. Bacteria are considered primitive organisms because they
(a) Possess incipient nucleus
(b) Are small, microscopic plants, which are not seen by the naked eyes
(c) Cause serious diseases to human being, domesticated animals and crop plants
(d) Produce endospores which are very resistant to adverse conditions

17. Which is the incorrect statement regarding fungi?
(a) Wheat rust causing agent is *Puccinia*
(b) Penicillium is a source of antibiotic
(c) The cell wall of fungi are composed of peptidoglycans
(d) Fungi prefer to grow in warm and humid places

18. How many organisms in the list given below are autotrophs?
Lactobacillus, Nostoc, Chara, Nitrosomonas, Nitrobacter, Streptomyces, Saccharomyces, Trypanosoma, Porphyra, Wolfia
(a) Four (b) Five
(c) Six (d) Three

19. Select the correct combination of the statements (a-d) regarding the characteristics of certain organisms
(a) Methanogens are Archaebacteria which produce methane in marshy areas.
(b) Nostoc is a filamentous blue-green alga which fixes atmospheric nitrogen.
(c) Chemosynthetic autotrophic bacteria synthesize cellulose from glucose.
(d) Mycoplasma lack a cell wall and can survive without oxygen.
The correct statements are
(a) (b), (c) (b) (a), (b), (c)

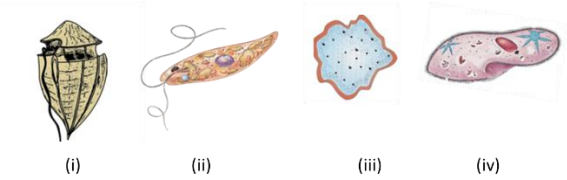
(c) (b), (c), (d) (d) (a), (b), (d)

20. How many of the following fungi have septate mycelium and reproduce via exogenously produced asexual spores?

(1) *Albugo*
(2) *Trichoderma*
(3) Puffballs
(4) *Claviceps*

(a) One (b) Two
(c) Three (d) Four

21. Refer to the given organisms (i) to (iv) and select the correct statement regarding them.



(a) (i) and (iv) belong to Kingdom Fungi whereas (iii) belong to Kingdom Monera. (ii) and
(b) (ii) and (iv) have cellular body organisation while (i) and (iii) have tissue level body organisation.
(c) All these organisms are single celled eukaryotes belonging to Kingdom Protista.
(d) (i), (ii) and (iv) have cellulosic cell wall while chitinous cell wall.

22. Study the given group with a characteristic feature.

(i) Diatoms - They are chief producers in the oceans.
(ii) Dinoflagellates - They have a protein rich layer called pellicle.
(iii) Slime moulds - They are saprophytic protists.
(iv) Protozoans - They are primitive relatives of animals.
(v) Euglenoids - Their cell wall has stiff cellulose plate on the outer surface.

Which of the following two pairs are incorrectly matched?

(a) (i) and (iii) (b) (ii) and (iv)
(c) (iii) and (iv) (d) (ii) and (v)

23. Consider the following statements with respect to characteristic features of the kingdom.

(i) In animalia, the mode of nutrition is autotrophic.
(ii) In monera, the nuclear membrane is present.
(iii) In protista, the cell type is prokaryotic.
(iv) In plantae, the cell wall is present.

Of the above statements, which one is correct?

(a) (i) only (b) (ii) only
(c) (iii) only (d) (iv) only

24. Select the correct match.

(a) D.J. Ivanowsky - He named virus.
(b) W.M. Stanley - Viruses could be crystallised.
(c) Louis Pasteur - *Contagium vivum fluidum*
(d) M.W. Beijerinck - Mosaic disease of tobacco.

25. Read the following statements regarding archaebacteria and choose the correct option.

(i) Archaebacteria differs from other bacteria in having different cell wall structure.
(ii) Their cell wall is made up of cellulose and contains high amount of unsaturated fatty acid, which is responsible for their survival in extreme conditions.
(iii) Thermoacidophiles have dual ability to tolerate high temperature as well as high acidity.

(a) (i) and (ii) are true
(b) (ii) and (iii) are true
(c) (i) and (iii) are true
(d) (i), (ii) and (iii) are true

26. In the five kingdom system of classification, which single kingdom out of the following can include cyanobacteria and methanogenic archaebacteria?

(a) Plantae (b) Protista
(c) Monera (d) Fungi

27. Identify the organism and select the correct option-

(a) Majority of them are fresh water organisms
(b) Lack cell wall
(c) The cell wall has stiff silicaceous plates on the outer surface
(d) Mostly marine and photosynthetic

28. Which of the following class of fungi is being described by the given statements?

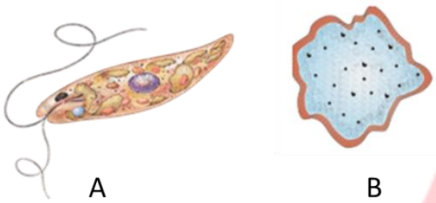
(i) They are found in aquatic habitats and on decaying wood in moist and damp places.
(ii) Mycelium is aseptate and coenocytic.
(iii) Asexual reproduction takes place by zoospores (motile) or by aplanospores (non-motile).
(iv) Some common examples are mucor, *Rhizopus* and *Albugo*.

(a) Ascomycetes (b) Phycomycetes
(c) Basidiomycetes (d) Deuteromycetes

29. Refer to the given figure and select the incorrect option regarding it.

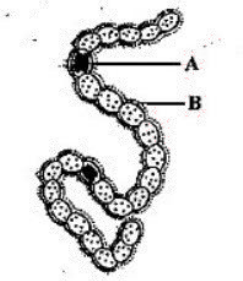
(a) It belongs to Class Basidiomycetes.
(b) It is a non-edible, poisonous mushroom.
(c) It possesses an umbrella-like basidiocarp.
(d) The basidiospores in it, are exogenously produced on basidiocarp

30. Which of the following statements is correct for the given figures?



(a) Both the organisms belong to Kingdom Protista.
(b) Both move with the help of flagella.
(c) 'A' shows heterotrophic as well as autotrophic mode of nutrition, while 'B' shows only heterotrophic mode of nutrition.
(d) Both (a) and (c)

31. Recognise the figure and find suitable matching



(a) Anabaena, A-Heterocyst, B-Gelatinous sheath
(b) Nostoc, A-Heterocyst, B-Chitinious sheath
(c) Nostoc, A-Heterosome, B-Mucilagenous sheath
(d) Nostoc, A-Heterocyst, B-Mucilagenous sheath

32. Read the following statements about viruses.
(I) A virus is a nucleoprotein.
(II) Genetic material in some viruses is non-infectious
(III) Viruses that infect plants have double stranded RNA only.
(IV) Coat in viruses in made up of nucleic acids.

Choose the correct answer from the options given below
(a) I, II and III (b) II and IV only
(c) II, III and IV (d) I only

33. Read the following statements about Kingdom Animalia.
(I) They digest their food in an internal cavity.
(II) They store their food in the form of a protein residue.
(III) Higher forms of animals have sensory and neuromotor mechanism.
(IV) Embryological development precedes copulation.

Choose the correct answer from the options given below
(a) I, and IV only (b) I, II, III and IV
(c) I, II and III (d) I and III only

34. Read the given statements and select an option stating which ones are True **(T)** or False **(F).**
A. Mycelium is septate and branched in deuteromycetes.
B. Deuteromycetes include only saprophytic members
C. Deuteromycetes include only parasitic members
D. Deuteromycetes are decomposers of litter.
(a) A–T, B–F, C–F, D–T (b) A–F, B–T, C–F, D–T
(c) A–T, B–F, C–T, D–F (d) A–F, B–F, C–T, D–T

35. Read the following statements about ascomycetes.
(I) They are not parasitic.
(II) Mycelium is unbranched and septate.
(III) Conidia on germination produce mycelium.
(IV) Some of the members are edible.

Choose the correct answer from the options given below
(a) I, II and III only (b) III and IV only
(c) II and III only (d) I, II, III and IV

36. Read the following statements about phycomycetes.
(I) Asexual reproduction takes place by aplanospores only.
(II) The gametes are always similar in morphology (isogamous),
(III) Mucor and Rhizopus are examples.
(IV) Spores are endogenously produced in the sporangium.

Choose the correct answer from the options given below
(a) I, II and III only (b) II, III and IV only
(c) III and IV only (d) I, II, III and IV

37. Read the following statements on protozoans and find out the correct set of statement.

(I) Silica shells are associated with ciliated protozoans.
(II) Sleeping sickness is associated with flagellated protozoan
(III) Infectious spore-like stage is associated with amoeboid protozoans
(IV) Staggering effect on human population is associated with sporozoans.

Choose the correct answer from the options given below.

(a) I, II and III only (b) I and IV
(c) II only (d) I, II, III and IV

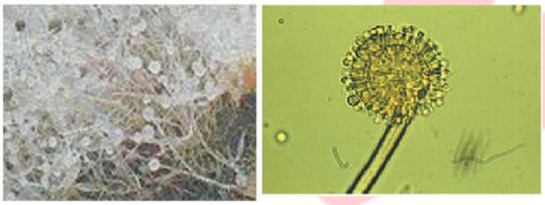
38. Which of the following is the incorrect information related to diatoms?

(a) The cell walls in the diatoms have overlapping shells
(b) They leave behind large amount of cell wall deposits in their habitats.
(c) Diatoms are the chief consumers of the oceans.
(d) These diatoms can float passively in water currents.

39. Sexual reproduction in bacteria takes place by

(a) Transfer of DNA from one bacterium to other
(b) By transfer of endospore from one bacterium to another
(c) By transfer of bacterial proteins from one bacterium to another
(d) All of these

40. Identify (1) and (2) correctly.



1 2

(a) 1-Agaricus, 2 - Mucor
(b) 1-Mucor, 2 - Aspergillus
(c) 1-Agaricus, 2-Mucor
(d) 1-Aspergillus, 2 - Mucor

41. Mycorrhiza is correctly described as

(a) Parasitic association between roots and some fungi
(b) Symbiotic relationship between fungi and roots of some higher plants
(c) Symbiosis of algae and fungi
(d) Relation of ants with the stem of some trees.

42. Read the given statements and answer the question.

(i) It includes unicellular as well as multicellular fungi.
(ii) In multicellular forms, hyphae are branched and septate.
(iii) Conidiophore produces conidia (spores) exogenously in chain.
(iv) Sexual spores are ascospores produced endogenously in chain.
(v) Fruiting body is called ascocarp.

Identify the correct class of fungi which have all the above given characteristics.

(a) *Albugo* (b) *Penicillium*
(c) Toadstool (d) *Trichoderma*

43. Which of the following combinations of characters is true for slime moulds?

(a) Parasitic, plasmodium with true walls, spores dispersed by air currents.
(b) Saprophytic, plasmodium without walls, spores dispersed by water.
(c) Parasitic, plasmodium without walls, spores dispersed by water.
(d) Saprophytic, plasmodium without walls, spores dispersed by air currents.

44. Which one of the following sets includes the bacterial diseases?

(a) Cholera, typhoid, mumps
(b) Tetanus, tuberculosis, measles
(c) Malaria, mumps, poliomyelitis
(d) Cholera, typhoid, tetanus

45. Identify incorrectly matched pair.

(a) Protista - Cellular body organisation
(b) Fungi - Eukaryotic structure
(c) Animalia - Cell wall present
(d) Monera - Nuclear membrane absent

46. Identify the correct statement regarding bread mould.

(a) Mycelium is aseptate and coenocytic
(b) It is a coprophilous fungus.
(c) Mycelium is branched and septate.
(d) Spores are exogenously produced in sporangium.

47. X commonly known as sac-fungi are mostly multicellular organisms. It includes Y and Z.

Select the correct option for X, Y and Z.

	X	Y	Z
a	Phycomycetes	*Mucor*	*Rhizopus*
b	Basidiomycetes	*Ustilago*	*Agaricus*
c	Ascomycetes	*Penicillium*	*Saccharomyces*
d	Deuteromycetes	*Alternaria*	*Trichoderma*

48. Which of the following statements are correct?

(i) Bacterial viruses or bacteriophages (viruses that infect the bacteria) are usually double stranded DNA viruses.

(ii) Prions are free RNA and they lack the protein coat that is found in viruses.
(iii) Viroids cause diseases like mumps, small pox, herpes and influenza.
(iv) The RNA of the viroids was of low molecular weight.

Choose the answer from the following options.
(a) (i) and (ii)
(b) (i), (ii) and (iii)
(c) (i) and (iv)
(d) (i), (ii), (iii) and (iv)

49. Select the wrong statement.
(a) The term 'contagium vivum fluidum' was coined by M. W. Beijerinck.
(b) Mosaic disease in tobacco and AIDS in human being are caused by viruses.
(c) The viroids were discovered by D.J. Ivanowsky.
(d) W.M. Stanley showed that viruses could be crystallised.

50. Which of the following statements regarding Kingdom Animalia is incorrect?
(a) It includes autotrophic, unicellular eukaryotic organisms.
(b) The members of this kingdom do not have cell walls.
(c) The mode of nutrition is holozoic.
(d) The sexual reproduction is by copulation.

Exercise-03 Level -03

Assertion & Reason Based Questions

1. **Assertion:** Several ruminant animals contain methanogens within their gut.
Reason: Methanogens helps in the production from dung of ruminants.
(a) If both Assertion & Reason are True & the Reason is a correct explanation of the Assertion.
(b) If both Assertion & Reason are True but Reason is not a correct explanation of the Assertion.
(c) If Assertion is True but the Reason is False.
(d) If both Assertion & Reason are false.

2. **Assertion:** Penicillium contain conidia as a means of asexual reproduction
Reason: They are endogenously formed inside hyphae.
(a) If both Assertion & Reason are True & the Reason is a correct explanation of the Assertion.
(b) If both Assertion & Reason are True but Reason is not a correct explanation of the Assertion.
(c) If Assertion is True but the Reason is False.
(d) If both Assertion & Reason are false.

3. **Assertion:** The cell wall of diatoms is easily destructible.
Reason: The cell wall of diatoms is embedded with calcium carbonates.
(a) If both Assertion & Reason are True & the Reason is a correct explanation of the Assertion.
(b) If both Assertion & Reason are True but Reason is not a correct explanation of the Assertion.
(c) If Assertion is True but the Reason is False.
(d) If both Assertion & Reason are false.

4. **Assertion:** Slime moulds lacks chlorophyll
Reason: Spores of slime moulds have cell walls.
(a) If both Assertion & Reason are True & the Reason is a correct explanation of the Assertion.
(b) If both Assertion & Reason are True but Reason is not a correct explanation of the Assertion.
(c) If Assertion is True but the Reason is False.
(d) If both Assertion & Reason are false

5. **Assertion:** Dikaryophase is seen in ascomycetes and basidiomycetes during their sexual life.
Reason: During sexual reproduction of Ascomycetes and Basidiomycetes plasmogamy is not immediately followed by karyogamy.
(a) If both Assertion & Reason are True & the Reason is a correct explanation of the Assertion.
(b) If both Assertion & Reason are True but Reason is not a correct explanation of the Assertion.
(c) If Assertion is True but the Reason is False.
(d) If both Assertion & Reason are false.

6. **Assertion:** Archaebacteria can survive in extreme conditions.
Reason: In archaebacteria, cell wall structure is highly complex.
(a) If both Assertion & Reason are True & the Reason is a correct explanation of the Assertion.
(b) If both Assertion & Reason are True but Reason is not a correct explanation of the Assertion.
(c) If Assertion is True but the Reason is False.
(d) If both Assertion & Reason are false.

7. **Assertion:** Mycorrhiza is parasitic association.
Reason: In lichen, both partners are affected.
(a) If both Assertion & Reason are True & the Reason is a correct explanation of the Assertion.
(b) If both Assertion & Reason are True but Reason is not a correct explanation of the Assertion.
(c) If Assertion is True but the Reason is False.
(d) If both Assertion & Reason are false.

8. **Assertion:** Methanogens are obligate anaerobes.
Reason: They respire only anaerobically and generally get killed under aerobic conditions.
(a) If both Assertion & Reason are True & the Reason is a correct explanation of the Assertion.
(b) If both Assertion & Reason are True but Reason is not a correct explanation of the Assertion.
(c) If Assertion is True but the Reason is False.
(d) If both Assertion & Reason are false.

9. **Assertion:** Viruses have the properties of both living and non-living things.
Reason: Viruses do not replicate outside the host.

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

10. **Assertion:** Kingdom-Plantae includes all eukaryotic, chlorophyll containing organisms.
Reason: Few of its members are partially heterotrophic.
(a) If both Assertion & Reason are True & the Reason is a correct explanation of the Assertion.
(b) If both Assertion & Reason are True but Reason is not a correct explanation of the Assertion.
(c) If Assertion is True but the Reason is False.
(d) If both Assertion & Reason are false.

11. **Assertion:** Diatomaceous earth is used in polishing, filtration of oil and syrups.
Reason: Diatoms are chief producers in ocean.
(a) If both Assertion & Reason are True & the Reason is a correct explanation of the Assertion.
(b) If both Assertion & Reason are True but Reason is not a correct explanation of the Assertion.
(c) If Assertion is True but the Reason is False.
(d) If both Assertion & Reason are false.

12. **Assertion:** Trypanosoma is a parasitic flagellated protozoon.
Reason: Trypanosoma causes sleeping sickness disease.
(a) If both Assertion & Reason are True & the Reason is a correct explanation of the Assertion.
(b) If both Assertion & Reason are True but Reason is not a correct explanation of the Assertion.
(c) If Assertion is True but the Reason is False.
(d) If both Assertion & Reason are false.

13. **Assertion:** Deuteromycetes are called as imperfect fungi.
Reason: Only asexual or vegetative phases of these fungi are known.
(a) If both Assertion & Reason are True & the Reason is a correct explanation of the Assertion.
(b) If both Assertion & Reason are True but Reason is not a correct explanation of the Assertion.
(c) If Assertion is True but the Reason is False.
(d) If both Assertion & Reason are false.

14. **Assertion:** Bacteria are the sole members of kingdom monera.
Reason: Bacteria have eukaryotic cellular organization.
(a) If both Assertion & Reason are True & the Reason is a correct explanation of the Assertion.
(b) If both Assertion & Reason are True but Reason is not a correct explanation of the Assertion.
(c) If Assertion is True but the Reason is False.
(d) If both Assertion & Reason are false.

15. **Assertion:** The two-kingdom classification was found to be inadequate**.**
Reason: Two kingdom system of classification did not distinguish between the eukaryotes and prokaryotes, unicellular and multicellular organisms and green algae and fungi.
(a) If both Assertion & Reason are True & the Reason is a correct explanation of the Assertion.
(b) If both Assertion & Reason are True but Reason is not a correct explanation of the Assertion.
(c) If Assertion is True but the Reason is False.
(d) If Assertion is false but Reason is true

Statement Based Questions

16. **Statement-I:** Viruses are facultative parasites.
Statement-II: The RNA of the viroid was of low molecular weight.
(a) Both the statements are correct
(b) Statement I is correct but statement II is incorrect
(c) Statement II is correct but statement I is incorrect
(d) Both the statements are incorrect

17. **Statement-I:** Bacteriophages are usually single-stranded RNA viruses.
Statement-II: *Penicillium* yields the antibiotic penicillin.
(a) Both the statements are correct
(b) Statement I is correct but statement II is incorrect
(c) Statement II is correct but statement I is incorrect
(d) Both the statements are incorrect

18. **Statement-I:** Ascomycetes are saprophytic, decomposer, coprophilous (growing on dung) and parasitic
Statement-II: In puffballs, asexual spores are aplanospores.
(a) Both the statements are correct
(b) Statement I is correct but statement II is incorrect
(c) Statement II is correct but statement I is incorrect
(d) Both the statements are incorrect

19. **Statement-I:** Sexual reproduction is absent in all fungi.
Statement-II: Archaebacterial cell membrane shows ester linkage.
(a) Both the statements are correct
(b) Statement I is correct but statement II is incorrect
(c) Statement II is correct but statement I is incorrect
(d) Both the statements are incorrect

20. **Statement-I:** *Aspergillus* is used extensively in biochemical and genetic work.
Statement-II: *Gonyaulax* proliferate in large number and causes red tide of sea.
(a) Both the statements are correct
(b) Statement I is correct but statement II is incorrect
(c) Statement II is correct but statement I is incorrect
(d) Both the statements are incorrect

21. **Statement-I:** Euglena has mixotrophic mode of nutrition
Statement-II: Trypanosoma is a ciliated protozoan.
(a) Both the statements are correct
(b) Statement I is correct but statement II is incorrect
(c) Statement II is correct but statement I is incorrect
(d) Both the statements are incorrect

22. **Statement-I:** Chromatophores are present in *Frankia.*
Statement-II: *Nostoc* and *Anabaena* bears tuft of flagella
(a) Both the statements are correct
(b) Statement I is correct but statement II is incorrect
(c) Statement II is correct but statement I is incorrect
(d) Both the statements are incorrect

23. **Statement-I:** *Nitrosomonas* and *Nitrococcus* belongs to chemosynthetic autotrophic bacteria.
Statement-II: Chemosynthetic autotrophs utilize light as energy source
(a) Both the statements are correct
(b) Statement I is correct but statement II is incorrect
(c) Statement II is correct but statement I is incorrect
(d) Both the statements are incorrect

24. **Statement-I**: Prions are free RNA that lack protein coat.
Statement-II: The most notable diseases caused by prions are bovine spongiform encephalopathy (BSE) commonly called mad cow disease.
(a) Both the statements are correct
(b) Statement I is correct but statement II is incorrect
(c) Statement II is correct but statement I is incorrect
(d) Both the statements are incorrect

25. **Statement-I:** Puccinia belongs to basidiomycetes.
Statement-II: Puccinia causes rust disease in wheat.
(a) Both the statements are correct
(b) Statement I is correct but statement II is incorrect
(c) Statement II is correct but statement I is incorrect
(d) Both the statements are incorrect

26. **Statement-I:** M.W. Beijerinck crystallized TMV for the first time.
Statement-II: A large number of deuteromycetes are decomposers of litter and help in mineral cycling.
(a) Both the statements are correct
(b) Statement I is correct but statement II is incorrect
(c) Statement II is correct but statement I is incorrect
(d) Both the statements are incorrect

27. **Statement-I:** D.J Ivanowsky recognized certain microbes as causal organism of the mosaic disease of tobacco.
Statement-II: Sexual reproduction involves sex organs in case of basidiomycetes.
(a) Both the statements are correct
(b) Statement I is correct but statement II is incorrect
(c) Statement II is correct but statement I is incorrect
(d) Both the statements are incorrect

28. **Statement-I:** Majority of *Euglena* are fresh water organisms found in stagnant water.
Statement-II: In 1950, T.O. Diener discovered a new infectious agent that was smaller than viruses.
(a) Both the statements are correct
(b) Statement I is correct but statement II is incorrect
(c) Statement II is correct but statement I is incorrect
(d) Both the statements are incorrect

29. **Statement-I:** Dinoflagellates are multicellular and non-motile.
Statement-II: Mode of nutrition in diatoms is holophytic as they have photosynthetic pigments.
(a) Both the statements are correct
(b) Statement I is correct but statement II is incorrect
(c) Statement II is correct but statement I is incorrect
(d) Both the statements are incorrect

30. **Statement-I:** Prions are similar in size to viruses.
Statement-II: No virus contains both RNA and DNA.
(a) Both the statements are correct
(b) Statement I is correct but statement II is incorrect
(c) Statement II is correct but statement I is incorrect
(d) Both the statements are incorrect

31. **Statement-I:** Sporozoans are aquatic, actively moving organisms because of the presence of thousands of cilia.
Statement-II: The most notorious sporozoan is. Paramoecium (malarial parasite) which causes malaria.
(a) Both Statement-I and Statement-II are correct.
(b) Both Statement-I and Statement-II are incorrect.
(c) Statement-I is correct & Statement-II is incorrect.
(d) Statement-I is incorrect & Statement-II is correct.

32. **Statement-I:** Heterocysts are specialized cells of green algae for phosphorus fixation.
Statement-II: Heterocyst cells lack photosynthetic oxygen evolution.
(a) Both Statement-I and Statement-II are correct.
(b) Both Statement-I and Statement-II are incorrect.
(c) Statement-I is correct & Statement-II is incorrect.
(d) Statement-I is incorrect & Statement-II is correct.

33. **Statement-I:** Archaebacteria differ from other bacteria in having a different cell wall structure.
Statement-II: Methanogens are present in the gut of several ruminant animals.
(a) Both Statement-I and Statement-II are correct.
(b) Both Statement-I and Statement-II are incorrect.
(c) Statement-I is correct & Statement-II is incorrect.
(d) Statement-I is incorrect & Statement-II is correct.

34. **Statement-I:** Kingdom Animalia directly or indirectly depend on plants for food.
Statement-II: Kingdom Plantae includes all eukaryotic chlorophyll-containing organisms.
(a) Both Statement-I and Statement-II are correct.
(b) Both Statement-I and Statement-II are incorrect.
(c) Statement-I is correct & Statement-II is incorrect.
(d) Statement-I is incorrect & Statement-II is correct.

35. **Statement-I:** Cyanobacteria are photosynthetic green algae.
Statement-II: Cyanobacteria have chlorophyll a similar to eukaryotes.
(a) Both Statement-I and Statement-II are correct.
(b) Both Statement-I and Statement-II are incorrect.
(c) Statement-I is correct & Statement-II is incorrect.
(d) Statement-I is incorrect & Statement-II is correct.

Match up Based Questions

36. Match the following column:

A.	M.W. Beijerinek	1.	First crystallised TMV
B.	T.O. Diener	2.	Viroids
C.	DJ Ivanowsky	3.	Contagium vivum fluidum
D.	W.M Stanley	4.	Mosaic disease of tobacco

(a) A- 4, B-2, C-1, D-3
(b) A- 2, B-1, C-3, D-4
(c) A- 3, B-2, C-4, D-1
(d) A-1, B-2, C-3, D-4

37. Match the following column:

A.	Phycomycetes	1.	Alternaria
B.	Ascomycetes	2.	Agaricus
C.	Basidiomycetes	3.	Neurospora
D.	Deuteromycetes	4.	Rhizopus

(a) A-1, B-2, C-3, D-4
(b) A- 4, B-3, C-2, D-1
(c) A-3, B-2, C-1, D-4
(d) A-4, B-3, C-1, D-2

38. Match the following column:

A.	Blue- green algae	1.	Cell membrane have ether linkage
B.	Heterotrophic bacteria	2.	Helpful in making curd
C.	Archaebacteria	3.	Algal blooms

(a) A-3, B-2, C-1
(b) A-1, B-2, C-3
(c) A-2, B-1, C-3
(d) A-3, B-1, C-2

39. Match the following column:

A.	Plant virus	1.	Mad cow disease
B.	Animal virus	2.	Potato spindle tuber
C.	Viroids	3.	Small pox
D.	Prions	4.	Tobacco mosaic

(a) A-1, B-2, C-3, D-4
(b) A-3, B-4, C-1, D-2
(c) A-4, B-3, C-2, D-1
(d) A-4, B-3, C-1, D-2

40. Match the following column:

A.	Phycomycetes	1.	Algal fungi
B.	Ascomycetes	2.	Imperfect fungi
C.	Basidiomycetes	3.	Bracket fungi
D.	Deuteromycetes	4.	Sac fungi

(a) A- 1, B-4, C-3, D-2
(b) A-3, B-2, C-1, D-4
(c) A-1, B-2, C-3, D-4
(d) A-2, B-3, C-4, D-1

41. Match the following column:

A.	Chitin	1.	Cell wall of bacteria
B.	Puffballs	2.	Cell wall of fungi
C.	Yeast	3.	Basidiomycetes
D.	Peptidoglycan	4.	Ascomycetes

(a) A-2, B-3, C-1, D-4
(b) A-1, B-4, C-3, D-2
(c) A-2, B-3, C-4, D-1
(d) A-1, B-2, C-3, D-4

42. Match the following column:

A.	Chief producers in oceans	1.	Dinoflagellates
B.	Mixotrophic nutrition	2.	Euglena
C.	Holophytic nutrition	3.	Diatoms
D.	Saprophytic protists	4.	Slime moulds

(a) A-3, B-2, C-1, D-4
(b) A-1, B-2, C-3, D-4
(c) A-3, B-1, C-4, D-2
(d) A-4, B-3, C-1, D-2

43. Match the following column:

A.	Aristotle	1.	Used simple morphological characters to classify plants into trees.
B.	R.H Whittaker	2.	Two kingdom system of classification
C.	Linnaeus	3.	Five kingdom system of classification

(a) A-1, B-2, C-3
(b) A-1, B-3, C-2
(c) A-2, B-1, C-3
(d) A-3, B-1, C-2

44. Match the following column:

A.	Parasitic fungi on mustard	1.	Diatoms
B.	Soap box like structure	2.	Bladderwort
C.	Insectivorous	3.	Albugo

(a) A-1, B-2, C-3
(b) A-1, B-3, C-2
(c) A-2, B-1, C-3
(d) A-3, B-1, C-2

45. Match the following column:

A.	Viroids	1.	Infectious RNA particles
B.	Prions	2.	Symbiotic association of algae and fungi
C.	Lichens	3.	Similar in size to viruses

(a) A-1, B-2, C-3
(b) A-1, B-3, C-2
(c) A-2, B-1, C-3
(d) A-3, B-1, C-2

46. Match the column-I w.r.t. to the nature of cell wall in Column-II

	Column-I		**Column-II**
A.	Monera	1.	Chitinase
B.	Fungi	2.	No cell wall
C.	Planate	3.	None cellulosic cell wall
D.	Animalia	4.	Cellulosic cell wall

(a) A-4, B-3, C-1, D-2
(b) A-2, B-1, C-3, D-4
(c) A-3, B-4, C-2, D-1
(d) A-3, B-1, C-4, D-2

47. Match the columns and find out the correct combination:

	Column-I		**Column-II**
A.	Desmids	1.	Dinoflagellates
B.	Gonyaulax	2.	Chrysophytes
C.	Euglena	3.	Euglenoids
D.	Plasmodium	4.	Protoza

(a) A-1, B-3, C-4, D-2
(b) A-2, B-3, C-1, D-4
(c) A-3, B-2, C-1, D-4
(d) A-2, B-1, C-3, D-4

48. Match the column and find out the correct combination:

	Column-I		Column-II
A.	Free RNA	1.	Tobacco mosaic disease
B.	Mad cow disease	2.	Viroids
C.	Dmitri Ivanowsky	3.	Prions
D.	Crystallisation of virus	4.	W.M. Stanley

(a) A-2, B-3, C-1, D-4
(b) A-2, B-1, C-3, D-4
(c) A-1, B-3, C-4, D-2
(d) A-3, B-2, C-1, D-4

49. Find the mis-match pair.
(a) Phycomycetes –Albugo
(b) Deuteromycetes –Trichoderma
(c) Ascomycetes –Agaricus
(d) Basidiomycetes –Puccinia

50. Find the mis-match pair.
(a) Prions- consists of abnormally folded nucleoprotein
(b) Slime Molds- spore possess true walls
(c) Pellicle- Proteinaceous
(d) Bacteria- Produce spores in unfavorable conditions

Exercise-04 Previous Year Questions

1. Match List I with List II **(2024)**

List – I		List – II	
A.	Rhizopus	I.	Mushroom
B.	*Ustilago*	II.	Smut fungus
C.	*Puccinia*	III.	Bread mould
D.	*Agaricus*	IV.	Rust fungus

Choose the correct answer from the options given below:
(a) A – I, B – III, C – II, D – IV
(b) A – III, B – II, C – I, D – IV
(c) A – IV, B – III, C – II, D – I
(d) A – III, B – II, C – IV, D – I

2. Which one of the following is not a criterion for classification of fungi? **(2024)**
(a) Mode of nutrition
(b) Mode of spore formation
(c) Fruiting body
(d) Morphology of mycelium

3. Identify the reproductive structure associated with Penicillium: **(2022)**
(a) Conidia
(b) Gemmules
(c) Buds
(d) Zoospores

4. Given below are two statements:
Statement I: Mycoplasma can pass through less than 1 micron filter size.
Statement II: Mycoplasma are bacteria with cell wall
In the light of the above statements, choose the most appropriate answer from the options given below: **(2022)**
(a) Both Statement I and Statement II are incorrect
(b) Statement I is correct but Statement II is incorrect
(c) Statement I is incorrect but Statement II is correct
(d) Both Statement I and Statement II are correct

5. Which of the following is a correct statement? **(2022)**
(a) Bacteria are exclusively heterotrophic organisms.
(b) Slime moulds are saprophytic organisms classified under Kingdom Monera.
(c) Mycoplasma have DNA, Ribosome and cell wall
(d) Cyanobacteria are a group of autotrophic organisms classified under Kingdom Monera.

6. Which of the following statements is correct? **(2021)**
(a) Fusion of protoplasms between two motile or non-motile gametes is called plasmogamy.
(b) Organisms that depend on living plants are called saprophytes.
(c) Some of the organisms can fix atmospheric nitrogen in specialized cells called sheath cells.
(d) Fusion of two cells is called Karyogamy.

7. Which of the following is correct about viroids? **(2020)**

(a) They have free RNA without protein coat.
(b) They have DNA with protein coat.
(c) They have free DNA without protein coat.
(d) They have RNA with protein coat.

8. Which of the following is incorrect about Cyanobacteria?

(2020 Covid Re-NEET)

(a) They lack heterocysts
(b) They often form blooms in polluted water bodies
(c) They have chlorophyll 'a' similar to green plants
(d) They are photoautotrophs

Answer keys

TOPIC CENTRIC EXERCISE -01 Answer Key

1. (c)	**2.** (b)	**3.** (d)	**4.** (d)	**5.** (d)

TOPIC CENTRIC EXERCISE -02 Answer Key

1. (d)	**2.** (a)	**3.** (c)	**4.** (c)	**5.** (c)

TOPIC CENTRIC EXERCISE -03 Answer Key

1. (b)	**2.** (c)	**3.** (a)	**4.** (c)	**5.** (d)

TOPIC CENTRIC EXERCISE -04 Answer Key

1. (b)	**2.** (c)	**3.** (a)	**4.** (b)	**5.** (a)

TOPIC CENTRIC EXERCISE -05 Answer Key

1. (d)	**2.** (b)	**3.** (d)	**4.** (a)	**5.** (d)
6. (a)	**7.** (d)			

TOPIC CENTRIC EXERCISE -06 Answer Key

1. (a)	**2.** (b)	**3.** (b)	**4.** (a)	**5.** (a)

Exercise-01 Level -01 Answer Key

1. (b)	**6.** (a)	**11.** (c)	**16.** (b)	**21.** (b)	**26.** (c)	**31.** (a)	**36.** (c)	**41.** (d)	**46.** (c)
2. (b)	**7.** (d)	**12.** (a)	**17.** (d)	**22.** (b)	**27.** (a)	**32.** (d)	**37.** (d)	**42.** (c)	**47.** (d)
3. (c)	**8.** (c)	**13.** (a)	**18.** (b)	**23.** (d)	**28.** (c)	**33.** (b)	**38.** (b)	**43.** (b)	**48.** (a)
4. (c)	**9.** (a)	**14.** (b)	**19.** (b)	**24.** (b)	**29.** (d)	**34.** (a)	**39.** (c)	**44.** (a)	**49.** (c)
5. (d)	**10.** (a)	**15.** (b)	**20.** (b)	**25.** (a)	**30.** (d)	**35.** (d)	**40.** (b)	**45.** (c)	**50.** (c)

Exercise-02 Level -02 Answer Key

1. (d)	**6.** (c)	**11.** (a)	**16.** (a)	**21.** (c)	**26.** (c)	**31.** (d)	**36.** (c)	**41.** (b)	**46.** (a)
2. (c)	**7.** (d)	**12.** (a)	**17.** (c)	**22.** (d)	**27.** (d)	**32.** (d)	**37.** (b)	**42.** (b)	**47.** (c)
3. (b)	**8.** (d)	**13.** (d)	**18.** (c)	**23.** (d)	**28.** (b)	**33.** (d)	**38.** (c)	**43.** (d)	**48.** (c)
4. (a)	**9.** (b)	**14.** (c)	**19.** (d)	**24.** (b)	**29.** (b)	**34.** (a)	**39.** (a)	**44.** (d)	**49.** (c)
5. (d)	**10.** (d)	**15.** (c)	**20.** (b)	**25.** (c)	**30.** (d)	**35.** (b)	**40.** (b)	**45.** (c)	**50.** (a)

Exercise-03 Level -03 Answer Key

1. (b)	**6.** (a)	**11.** (b)	**16.** (c)	**21.** (b)	**26.** (c)	**31.** (b)	**36.** (c)	**41.** (c)	**46.** (d)
2. (c)	**7.** (d)	**12.** (b)	**17.** (c)	**22.** (d)	**27.** (b)	**32.** (d)	**37.** (b)	**42.** (a)	**47.** (d)
3. (d)	**8.** (a)	**13.** (a)	**18.** (b)	**23.** (b)	**28.** (b)	**33.** (a)	**38.** (a)	**43.** (b)	**48.** (a)
4. (b)	**9.** (b)	**14.** (c)	**19.** (d)	**24.** (c)	**29.** (c)	**34.** (a)	**39.** (c)	**44.** (d)	**49.** (c)
5. (a)	**10.** (b)	**15.** (a)	**20.** (c)	**25.** (a)	**30.** (a)	**35.** (a)	**40.** (a)	**45.** (b)	**50.** (a)

Exercise-04 Previous Year Questions

1. (d)	**2.** (a)	**3.** (a)	**4.** (b)	**5.** (d)	**6.** (a)	**7.** (a)	**8.** (a)