2

Biological Classification

Multiple Choice Questions (MCQs)

Q. 1 All eukaryotic unicellular organisms belong to

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

Ans. *(b)* **Protista** is a group of all unicellular eukaryotic plants and animals. The organisms included in this group are either photoautotrophs, heterotrophs or parasites.

On the other hand

Monera includes prokaryotic like bacteria, unicellular organism

Fungi are eukaryotic but are mostly multicellular (exception yeast is unicellular).

Q. 2 The five kingdom classification was proposed by

(a) RH Whittaker (b) C Linnaeus (c) A Roxberg (d) Virchow

Ans. *(a)* RH Whittaker (1969), an American taxonomist in order to develop phylogenetic classification divided organism into five kingdoms, *i.e.*,

(i) Monera (ii) Protista
(iii) Fungi (iv) Plantae
(v) Animalia

Whereas, C Linnaeus developed two kingdom classification, *i.e.,*

(i) kingdom–Plantae (ii) kingdom–Animalia.

and Virchow is associated with the discovery of cell theory.

Q. 3 Organisms living in salty areas are called as

(a) methanogens (b) halophiles (c) heliophytes (d) thermoacidophiles

Ans. *(b)* **Halophiles** are organisms that live in areas of high concentration of salts. The name halophiles is originated from the greek word that means 'salt loving'.

Whereas, **heliophytes** are the plants that grow best in sunlight and can not survive in salty conditions.

Methanogens are the bacteria that produces methane as a metabolic by products in anaerobic conditions.

Thermoacidophiles are archaebacteria striving under strong acidic environments and high temperatures, but can not tolerate high salt concentrations around them.

Q. 4 Naked cytoplasm, multinucleated and saprophytic are the characteristics of

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

Thinking Process

Protoplasm is the living content of a cell that is surrounded by plasma membrane. Naked cytoplasm refers to the cytoplasm that is devoid of cell wall and possess a membrane of mucous or slime hence called naked cytoplasm.

Ans. *(d)* **Slime moulds** are saprophytic protists, moving along the dead leaves engulfing organic material. These are multinucleated and do not possess cell wall and have naked cytoplasm.

Whereas, **monerans** are prokaryotes, which include all bacteria. These do not contain naked cytoplasm, **protist** are a group of eukaryotic organisms, that bear a well defined membrane around cytoplasm, may be uni or multinucleated and fungi lack naked cytoplasm. Their cell has well developed cell wall made of chitin.

Q. 5 An association between roots of higher plants and fungi is called

(a) lichen (b) fern (c) mycorrhiza (d) BGA

Ans. *(c)* **Mycorrhiza** is the symbiotic association of fungus with roots of a higher plants like gymnosperms and angiosperms.

The fungus is dependent on plants for food and shelter, while the plants are benefitted by the fungal hyphae as they are involved in absorption of water and dissolved minerals present in the soil debris and makes it available to the plants.

Whereas lichens are the symbiotic association between algae and fungi. Ferns are group of plants, belong to pteridophytes like other vascular plants and **BGA** is blue-green algae with a prokaryotic cell.

Q. 6 A dikaryon is formed when

(a) meiosis is arrested

(b) the two haploid cells do not fuse immediately

(c) cytoplasm does not fuse

(d) None of the above

Ans. *(b)* Dikaryon is a cell containing two nucleus. This results when two somatic cells fuse but their nucleus does not fuse immediately. Meiosis does not result in such conditions.

Q. 7 Contagium vivum fluidum was proposed by

(a) DJ Ivanowsky (b) MW Beijernek

(c) Stanley (d) Robert Hook

Ans. *(b)* **MW Beijernek** proposed contagium vivum fluidum means contagious living fluid. This phrase was first used to describe virus, characteristic in escaping from the finest mesh available.

DJ Ivanowsky was a Russian Botanist who discovered the filterable nature of viruses and one of the founder of virology.

Stanley Miller was a Jewish American chemist experimented on **origin of life**.

Robert Hooke was the first to study and record cells using his primitive microscope.

Q. 8 Association between mycobiont and phycobiont are found in

(a) mycorrhiza (b) root (c) lichens (d) BGA

Ans. *(c)* **Lichens** are dual organisms which has a permanent symbiotic association of fungus and an alga.The fungal partner is called mycobiont an the algal partner is called phycobiont.

Mycorrhiza is association of fungus with roots, but not with an algae, while **BGA** is blue green alga a member of Monera having a prokaryotic cell.

Q. 9 Difference between virus and viroid is

(a) absence of protein coat in viroid, but present in virus.

(b) presence of low molecular weight RNA in virus, but absent in viroid,

(c) Both (a) and (b)

(d) None of the above

Ans. *(a)* Virus contains DNA or RNA as genetic material and a protein coat, whereas viroids have no protein coat, but only RNA as their nucleic acid. This is the reason why viroids are carried inside viruses. *e.g.,* hepatitis-D is a viroid that is carried in the capsid of hepatitis-B virus.

Q. 10 With respect to fungal sexual cycle, choose the correct sequence of events.

(a) Karyogamy, Plasmogamy and Meiosis

(b) Meiosis, Plasmogamy and Karyogamy

(c) Plasmogamy, Karyogamy and Meiosis

(d) Meiosis, Karyogamy and Plasmogamy

Ans. *(c)* Plasmogamy means fusion of protoplasm and karyogamy means fusion of nucleus. These two events lead to the formation of zygote (*2n*) which is diploid structure where meiosis takes place.

Q. 11 Viruses are non-cellular organisms, but replicate themselves once they infect the host cell. To which of the following kingdom do viruses belong to?

(a) Monera (b) Protista (c) Fungi (d) None of these

Ans. *(d)* In five kingdom classification of Whittaker, non-cellular organisms like viruses and viroids are not mentioned. Viruses did not find a place in classification since they are not truly 'living' and hence, they are considered as non-cellular.

Monera includes all unicellular prokaryotes called bacteria in which viruses can not be included

Protista includes all eukaryotic unicellular plant and animals and **fungi** are heterotrophic /parasitic, cellular organism devoid of chlorophyll.

Q. 12 Members of phycomycetes are found in

(i) Aquatic habitats

(ii) On decaying wood

(iii) Moist and damp places

(iv) As obligate parasites on plants

Choose from the following options.

(a) (i) and (iv) (b) (ii) and (iii) (c) All of these (d) None of these

Thinking Process

Phycomycetes is a lower group of fungi which shows diversity in its habitat Most of the are saprophytes and only few are parasites.

Ans. ***(d)*** Phycomycetes are the members of fungi that can thrive well on dead and decaying wood as saprophytes. These prefer to live in moist and damp places and need water for the movement of zoospore and sexual gametes.

Few members of phycomycetes are obligate parasites like *Phytophthora infestans* causing late blight of potato and *Peronospora viticola* causing downy mildew of grapes.

Very Short Answer Type Questions

Q. 1 What is the principle underlying the use of cyanobacteria in agricultural fields for crop improvement?

Ans. Cyanobacteria are used in agricultural crop improvement because of their adicity to fix atmospheric nitrogen and make it available to the plants. This improves the yield of the crops and also reduces the cost of application of nitrogen fertilisers. *e.g., Anabena* and *Nostoc*.

Q. 2 Suppose you accidentally find an old preserved permanent slide without a label. In your effort to identify it, you place the slide under microscope and observe the following features

(a) Unicellular (b) Well defined nucleus

(c) Biflagellate-one flagellum lying longitudinally and the other transversely

What would you identify it as? Can you name the kingdom it belongs to?

Thinking Process

Identification, classification and nomenclature is based on the morphological characters of an organism. One has to study the characters very throughly, by taking the help of taxonomly.

Ans. All unicellular eukaryotic organisms form a link between plants, and animals. There organisms possess a well defined nucleus with membrane bound organelles and reproduce either sexually or asexually.

The it presence of two flagella one placed longitudanally and other transversely in a furrow between wall plates makes this organisms to be placed under **Kingdom–Protista**.

Q. 3 How is the five kingdom classification advantageous over the two kingdom classification?

Ans. The five kingdom classification, that is proposed by RH Whittaker is based upon cell structure, body structure (unicellular, multicellular), nutrition (autotrophic, heterotrophic) reproduction and way of living either aquatic, terrestrial, or arial and phylogenetic relationship.

So, it is more useful as compared to two kingdom system of classification which does not distinguish between prokaryotes and eukaryotes and no other kingdom except plant and animal are identified.

Q. 4 Polluted water bodies have usually very high abundance of plants like *Nostoc* and *Oscillitoria*. Give reasons.

Ans. Polluted water bodies possess high algal growth due to the presence of nutrient. These nutrients increase the rapid growth of water plants, *i.e*., algae especially *Nostoc* and *Oscillitoria*, etc., and result in colonies. These colonies are generally surrounded by a gelatinous sheath and furtherleads to the formation of blooms in water bodies.

Q. 5 Are chemosynthetic bacteria autotrophic or heterotrophic?

Ans. Chemosynthetic bacteria are capable of oxidising various inorganic substances such as nitrates, nitrites and ammonia and use the energy released for their ATP production. So, they are autotrophs and not heterotrophs.

Q. 6 The common name of pea is simpler than its botanical (scientific) name *Pisum sativum* why then is the simpler common name not used instead of the complex scientific/botanical name in biology?

Ans. The common or vernacular names changes with the change in place, causing confusion regarding the identification of specific specimen, whereas the complex scientific names are in latin and universally accepted and understood.

Hence, scientific names are preferred over the common vernacular names.

Q. 7 A virus is considered as a living organism and an obligate parasite when inside a host cell. But virus is not classified along with bacteria or fungi. What are the characters of virus that are similar to non-living objects?

Ans. Viruses are considered as living when they are inside a host but outside any host they are referred to as non-living due to their

(a) inert nature

(b) inability to reproduce

(c) lack of cellular organisation

(d) inability for growth and cell division

These characters potraited by viruses make them identical to non-living organisms. Viruses are considered a connecting link between living and non-living organisms.

Q. 8 In the five kingdom system of Whittaker, how many kingdoms are eukaryotes?

Ans. In the five kingdom classification given by Whittaker four kingdom belongs to eukaryotes, *i.e.,* Protista, Fungi, Plantae and Animalia, except for the kingdom–Monera that belongs to prokaryotes.

Eukaryotic organism are those that possess

(i) An organised nucleus

(ii) Possess double envelop system

(iii) Presence of cell wall

(iv) Membrane bound organelles are present.

Short Answer Type Questions

Q. 1 Diatoms are also called as 'pearls of ocean', why? What is diatomaceous earth?

Thinking Process

Discuss cellular composition of diatoms and formation of 'diatomaceous earth.

Ans. Diatoms and desmids are inducted under chrysophytes, kingdom–Protista. These are the main producers in the ocean. They prepare food not only for themselves but also for the other life forms in the ocean. This is the reason they are also called as 'pearls of ocean. Body of diatoms is covered by siliceous shell known as frustule.

'Diatomaceous earth' is the accumulation of large deposits of diatoms that forms a siliceous covering extending for several 100 m formed in billions of years. The material obtained from these deposits is used in polishing and filteration of oils and syrups.

Q. 2 There is a myth that immediately after heavy rains in forest, mushrooms appear in large number and make a very large ring or circle, which may be several metres in diameter. These are called as 'fairy rings'. Can you explain this myth of fairy rings in biological terms?

Discuss the mycilial structure in *Agaricus* and its soil borne nature.

Ans. The fruiting bodies in *Agaricus* known as basidiocarps form a concentric ring like structure from the mycelium present in the soil. These basidiocarps resemble button in shape and develop to form a ring like structure.

This fairy ring structure in *Agaricus* have reported stimulation of plants productivity. This rings are infact fruiting bodies of this fungus and the diameter of this fairy ring increases every year due to spread of mycelium.

Q. 3 *Neurospora* an ascomycetes fungus has been used as a biological tool to understand the mechanism of plant genetics much in the same way as *Drosophila* has been used to study animal genetics. What makes *Neurospora* so important as a genetic tool?

Ans. *Neurospora* fungus was selected to be a very good tool in genetics because this fungus can be grown easily under laboratory conditions by providing 'minimal medium' like inorganic salts, carbohydrates source and vitamin (biotin).

Also under X-ray treatment the mutations can be easily introduced in the fungal cells and meiotic division can be easily seen.

Q. 4 Cyanobacteria and heterotrophic bacteria have been clubbed together in eubacteria of kingdom–Monera as per the 'five kingdom classification' even though the two are vastly different from each other. Is this grouping of the two types of taxa in the same kingdom justified? If so, why?

Discuss the cellular composition of cyanobacteria and heterotrophic bacteria that make them introduced in eubacteria.

Ans. Although the two are vastly different from each other. They still bear some common characters, on the basis of which they are introduced in eubacteria of kingdom–Monera. *These characters are as follows*

(i) Both the groups do not possess well defined nucleus.
(ii) Nucleus lacks nucleous and nuclear membrane.
(iii) DNA (genetic material) lies freely in the cytoplasm.
(iv) They possess 70 S type of ribosomes.

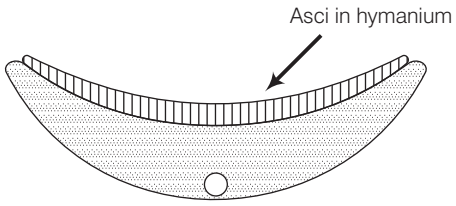
Q. 5 At a stage of their cycle, ascomycetes fungi produce the fruiting bodies like apothecium, perithecium or cleistothecium. How are these three types of fruiting bodies different from each other?

Discuss the type of fruiting bodies formed by ascomycetes fungus and differentiate accordingly on the basic of there structures.

Ans. **Ascomycetes** Consist of sporangial sac called ascus. Asci (singular-ascus) may occur freely or get aggregated with dikaryotic mycelium to form the fruitification called ascocarps.

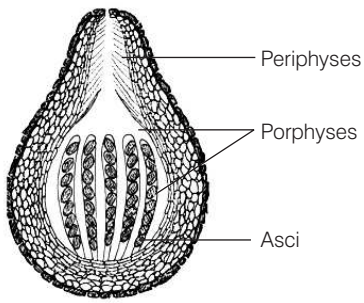
The fruitification formed by asci are like

(i) **Apothecium** is a cup like structure, *e.g., Peziza*.



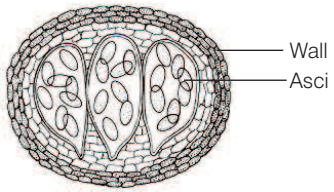
Apothecium

(ii) **Perithecium** flask shaped, *e.g., Neurospora.*



Perithecium

(iii) **Cleistothecium** closed with a slit, *e.g., Penicillium*

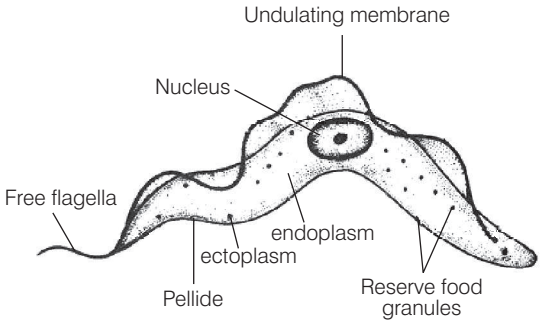


Cleistothecium

Q. 6 What observable features in *Trypanosoma* would make you classify it under kingdom–Protista?

Discuss cell structure of *Trypanosoma* also discuss its different strain in brief.

Ans. On the basis of locomotary organ *Trypanosoma* is included under flagellated protozoans. *It resembles Protista on the basis of following characters*



Trypanosoma gambiens

(i) Possess unicellularity.

(ii) Possess asexual reproduction, *i.e.,* by binary fission.

(iii) Possess centrally located nucleus and also contain an prominent nucleus endosome.

(iv) Reserve food material is in the form of granules, such characters possessed by *Trypanosoma* made it to be included under kingdom–Protista.

Q. 7 Fungi are cosmopolitan, write the role of fungi in your daily life.

Discuss the role of fungi, with respect to its economical importance to humans.

Ans. **Role of Fungi**

Fungi are cosmopolitan in occurrance being present in air, water, soil over and inside animals and plants. The branch of biology dealing with the study of fungi is known as **Mycology**.

(i) Few fungi are used as nutritious and delicious food. *e.g., Agaricus compestris*

(ii) Saprophytic fungi lives upon dead organic matter and breaks complex substances into simple ones, that are absorbed by plants as nutrients.

(iii) Some fungi like *Absidia, mucor* and *Rhizopus* possess soil binding properties and make the soil good for cultivation.

(iv) They also provide pest resistence, *e.g.*, *Empusa, Ferinosa*, etc.

(v) Yeast (*Saccharomyces*) has the property of fermentation, thus used in alcohol and dough preparation.

Long Answer Type Questions

Q. 1 Algae are known to reproduce asexually by variety of spores under different environmental conditions. Name these spores and the conditions under which they are produced.

Asexual reproduction in algae is very common mean of reproduction.

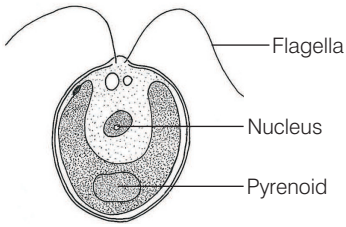
Ans. Algae and their spores exhibit enormous diversity and they vary greatly in their level of specialisation. *Asexual reproduction by spores and their types are described below*

(a) **By Zoospores** These are mobile flagellated spores. In which protoplasm of each vegetative cell undergoes repeated longitudnal division either into 2 or 4 rarely 8 or 16 daughter protoplast. The parent cell loses its flagella, before the onset of division.

After the last series of division, each daughter protoplast secretes a cell wall and neuromotor apparatus that develops two flagella, eyespots and contractile vacuoles.

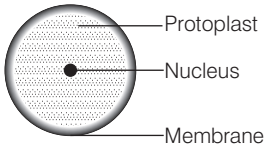
Thus, each of the daughter cell formed resembles the parent cell in all aspects except the small size.

Formation of zoospores is very common under favourable conditions.



Zoospore of *Chlamydomonas*

(b) **By Aplanospores** These are the non-motile spores. They are asexually formed with in a cell, in this the protoplast withdraws itself from the parent wall, rounds up and develops into aplanospores which may either germinate directly or may divide to produce zoospores.



Aplanospore of *Spirogyra*

(c) In this, the protoplasm withdraws from the cell wall, rounds up an develop a thick wall under unfavourable condition. These resting spores are called as hypnospores. They are red in colour due to presence of haematochrome.
e.g., Vaucheria, Ulothrix.

(d) **Akinetes** These are special vegetative thick walled cells present in the filaments which remain under dorment state and return to germination under favourable condition and can also with stand unfavourable condition as *Spirogyra*.

(e) **Statospores** This are thick walled spores produced in diatoms.

(f) **Neutral Spores** In some algae, the protoplast, of vegetative cells directly functions as spores called as neutral spores (*e.g., Ectocarpus*).

Q. 2 Apart from chlorophyll, algae have several other pigments in their chloroplast. What pigments are found in blue, green, red and brown algae, that are responsible for their characteristic colours?

Ans. All photosynthetic organisms contain one or more organic pigments that are capable of absorbing visible radiations, which will initiate the photochemical reaction of photosynthesis. Three major classes of pigments found in plants and algae are the chlorophylls, the carotenoids and the phycobilins.

Carotenoid and phycobilins are called accessory pigments since, the quanta (packets of light) absorbed by these pigments can be transferred to chlorophyll.

The diversity of light harvesting pigments in alga implies that the common ancestor was primitive and that no close affinity exist between blue, green, red, brown, golden brown and green algae, to use their common names.

The characteristic pigments of different classes are mentioned below

Class	Common Name	Major Pigments
Chlorophyceae	Green algae	Chlorophyll-*a* and chlorophyll-*b*.
Phaeophyceae	Brown algae	Chlorophyll-*a*, chlorophyll-*c*, Fucoxanthin.
Rhodophyceae	Red algae	Chlorophyll-*a*, chlorophyll-*d*. Phycoerythrin.

Q. 3 Make a list of algae and fungi that have commercial value as source of food, chemicals, medicines and fodder.

Ans. Algae

Some 70 species of marine algae are used for food, chemical and medicinal purpose.

Medicine	Chemical	Food
Corollina-capable in curing worm infection	**Phycolloids** It includes agar, carrageenin and funori.	*Porphyra* (flower), *Rhodymenia* (pulse), *Chondrus* (Trishmoss).
Polysiphonia-Possess antibacterial property.	**Alginic acid** It is a phycocolloid obtained commercially from *Laminaria, Macrocystis*	*Rhodymenia* (sheep's weed) is also used as fodder
Carrageenan is an coagulant.		*Laminaria, Alariam Macrocystis, Sargassum* are used as food in many countries.
Sodium laminarin sulphate act as a anticoagulant.	*Nerocystis, Fucus, Sargassum*, etc.	The edible brown algae are used as fodder.
Ascophyllum and *Laminaria* bears antibiotic properties.	It is used as salts in obtaining emulsions (ice-creams, ointments, toothpasts, cosmetics, creams, etc)	*Ulva, Caulerpa, Enteromorpha, Chlorella* can yield food rich in lipids, proteins, vitamins and minerals.
Durvillea has vermifuge properties.		
Antibiotics can be extracted from *Chlorella* and *Caulerpa*.	*Chlamydomonas, Chlorella, Scenedesmus* play an important role in sewage oxidation.	—

Fungi

The role of fungi was established in early history yeast have been used in making of bread and alcohol since, the beginning of cultivation the discovery of penicillin, that marked the beginning of a new approach to microbial diseases in human health.

More recent approaches include the application of hydrophins to surfaces leading to biocompatibility of implants and to emulsion formation improving drug delivery.

Products of fungi in medicine, chemical and food are

Medicine	Chemical	Food
Penicillin (*Penicillium notatum* and *P. chyrso* genum), glyotoxin.	*Aspergillus niger*	Fermentation-*Aspergillus* orgzae yeast-*Saccharomyces roxii*
chitrinine (*Trichoderma* sp.) (*Penicillium citrinine*).	A wentil and *Mucor* in production of citric acid.	Cheese production- by *Penicillium comemberti* and *Penicillium roqueforti*
Baccatin-A (*Gibberella baccater*)	*Aspergillus niger* and *P. purpurogenum* in production of (gluconic acid).	Colour of foods - by *Monoasus purpureus*
Ergotine (*Claviceps purpurea*), clavicin (*Aspergillus clouertus*	*P. glacum* and A. *gallomyces* forms (gallic acid)	
Flavin (*A. flavous* and *A. fumigattes*).		

Q. 4 'Peat' is an important source of domestic fuel in several countries. How is 'peat' formed in nature?

Ans. Peat is an organic fuel consisting of spongy material formed by the partial decomposition of organic matter, primarily plant material in wetlands such as swamps ferns and mosses. The development of peat is favoured by warm, moist climatic conditions.

The main producers of peat *Sphagnum* most occurs in bogs. The accumulation of *Sphagnum* plant in due course of time lead this plant to get hardened and change into peat.

Peat is used in preparation of ethyl alcohol, peat, tar, ammonia, paraffin, etc. Peat is also used in covering the roots during transportation. This enormous value shown by peat for man kind makes it as an important domestic fuel and economic source for man kind.

Q. 5 Biological classification is a dynamic and ever evolving phenomenon which keeps changing with our understanding of life forms. Justify, the statement taking any two examples.

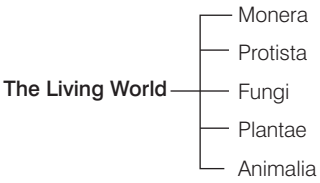
Discuss the changes made in studying biological classification from time to time and also enumerate the need for this changes.

Ans. Classification has been a centre piece of biology ever since Linnaeus, providing a frame work on which existing knowledge can be organised and predictions about unknown traits can be made.

But the basis of biological classification has gone through a series of upheavals over the last 3 centuries, from being considered a plan in mind of the creator, to the neutral assessment of over all similarity, to a reflection of evolutionary niches and finally to a phylogenetic mapping of the tree of life. *e.g.,* in two kingdom classification their are two groups, *i.e.,* Plantae and Animalia.

These groups are made on the basis of structural and cellular difference like plant possess cell wall, central vacuole, whereas animals lack cell wall and central vacuole but the drawback in this system classification is that eukaryotic and prokaryotic organisms like *Euglena*, bacteria and fungi are not included in this kingdom classification.

That are later added in three kingdom classification that in (kingdom–Protista) finally 1969, Whittaker purposed five kingdom classification.



These classifications are done on the basis of increase in understanding regarding organism by the advancements made in scientific techniques and by observing minute detailing that has led this classification more detailed and scientifically correct.