BIOLOGICAL CLASSIFICATION

Contents

Syllabus

BIOLOGICAL CLASSIFICATION

Five Kingdom classification, Monra, Protista, Fungi, Lichim, Virus, Viroids

Name : _____ **Contact No.** _____

BIOLOGICAL CLASSIFICATION

LEVEL - I

1. Golden dlgoe is -
(A) Desmids (B) Dinoflogellate (C) Ceratium (D) Noctiluca

2. Mycetozoa is -
(A) Euglenoids (B) Slime moulds (C) Amoeboid Protozoa (D) All of these

3. Plagellated protozoa is -
(A) Trypanosava (B) Euglena (C) Vortcella (D) None

4. Sporozoan Hagellata is -
(A) Paramecium (B) Euglena (C) Plasmodium (D) None

5. Red tide repansible protista is -
(A) Chrysophyte (B) Dianohagellate (C) Sliwe mould (D) All

6. Pelicle absent in -
(A) Parameeium (B) Amoeba (C) Trypanosama (D) Plasmodium

7. Chlerophyll absent in -
(A) Euglenoids (B) Algal (C) Diatoms (D) Slime mould

8. Photo syntwlic protoista is not -
(A) Diatams (B) Golden algae (C) Dinoflagellate (D) Slime mould

9. Censumr dieamposer protista is -
(A) Slime mould (B) Eugbnoid (C) both (D) None

10. Which character not match with eugbnoid -
(A) pnesence of pellicle (B) Two flagella
(C) Mixotrophic Nutritian (D) Absence of paramylan

11. Dinoflogellate is -
(A) Desmid (B) Gonyaulax (C) Diatoms (D) Amueba

12. PPLO is -
(A) Diatoms (B) Archae bacteria (C) Mycoplasima (D) Archar bacteria

13. Water bloow cause by -
(A) BGA (B) Myloplasma (C) Sporozoa (D) All

14. Phycomyatis fungi is not -
(A) Aspergillus (B) Albugo (C) Rhizopus (D) pytuie

15. The sexual cycle involves in fungi -
(A) Plasmogamy (B) Plasmogany, Kaeyogawg
(C) Plasmogamg. Kaeyogawy, Meiosis (D) None

16. Fungi shown type of Nutrition -

(A) Parasites (B) Saprotropus (C) Symbiotic association (D) All

17. Plant virus is -

(A) TMV (B) mums virus (C) rhinovirus (D) Small Pox virus

18. Bacterial virus is -

(A) f-phase (B) mumps virus (C) Rhino virus (D) TMV

19. Banana bunchy top cause by

(A) Bacteria (B) Virus (C) Mycoplasma (D) Fungi

20. Vivoids carlais -

(A) DNA (B) RNA (C) Capsid (D) dileroplast

Answer Key (Level - I)

1.	A	**2.**	B	**3.**	A	**4.**	C	**5.**	?	**6.**	B
7.	D	**8.**	D	**9.**	A	**10.**	D	**11.**	B	**12.**	C
13.	A	**14.**	A	**15.**	C	**16.**	D	**17.**	A	**18.**	A
19.	B	**20.**	B								

LEVEL - II

1. Eukaryotic, multi callular, with a cell wall & nuclear mumbrance showing hcterotrophic nutrition can be placed under the kingdam -
(A) Monera (B) Protista (C) Plantae (D) Animalia

2. In five kingdam system of classification how many kingdoam cantain in karyotes -
(A) 4 (B) 1 (C) 2 (D) 3

3. Archae bacteria differ from eubacteria in -
(A) cell membaraqe structure (B) cell shope
(C) mode of nutrition (D) mode of reproduction

4. Bacteria differ from plants in that they do not have -
(A) DNA (B) RNA (C) Cell wall (D) well defined mucleus

5. Which is present in deep sea water -
(A) Archae bacteria (B) Eubacteria
(C) Blue green algae (D) Saprophytic fungi

6. Euglevoids is -
(A) Movera (B) Protista (C) Plantoe (D) Fungi

7. The cyauo bacteria are also referred to as -
(A) Protists (B) Golden algae (C) Slime moulds (D) Blue green algae

8. Moximum nutritional diversity is found in the group -
(A) Fungi (B) Animolia (C) Monera (D) Plantae

9. Spiro chaete is/are -
(A) A class of insect (B) A class of vimses (C) Bacteria (D) Fungi

10. Gram-ive bacteria is -
(A) E-coli (B) Bacillus subtilis (C) Streptomycetes (D) none

11. Teichoic acid is present in -
(A) Cell wall of Gram-ive bacteria (B) Cell wall of Gramtive bacteria
(C) Capsid of virus (D) Protoplasm of mycoplasma

14. According five kingdom classification bacteria belong to -
(A) Protista (B) Monera (C) Plantae (D) Archere

15. Speciallised cells called wterocysts are present in -
(A) dinoflag cllates (B) Chrysophytes (C) archae bacteria (D) Euglenoids

16. Bacterial disease is -
(A) Rust of wheat (B) Potato leaf roll (C) Sugar cane mosaic (D) Brown not of potato

17. Select incorrect pair -
(A) Profera - Chanocytes (B) Annelida - Segen tafia
(C) Coelentrata - Eukaryose (D) Monera - Eukaryose

18. Virus multiple in -

(A) soil (B) dead tissue (C) living tissue (D) Culure medium

19. Virus carsist of -

(A) Nucleci acid (B) Protein (C) 1 & 2 (D) None

20. Which one having SRNA -

(A) TMV (B) T_2 bacteriophase (C) Rcoviru (D) eMV

21. HIV has a protein coat and genetic material -

(A) SS-RNA (B) ds-RNA (C) SS-DNA (D) ds-DNA

22. Potato spindle tuber disease is caused by -

(A) Nematode (B) Virus (C) bacterium (D) Viroid

Answer Key (Level - II)

1.	D	**2.**	A	**3.**	A	**4.**	D	**5.**	A	**6.**	B
7.	D	**8.**	?	**9.**	C	**10.**	A	**11.**	B	**12.**	B
13.	C	**14.**	D	**15.**	D	**16.**	C	**17.**	C	**18.**	A
19.	A	**20.**	D								

LEVEL - III

1. TMV based cantain is -
(A) DNA (B) KNA (C) both 1 & 2 (D) None

2. Pollution indicator is -
(A) Algae (B) Fungi (C) Liclvn (D) Volvox

3. Smut fungi is -
(A) Ustilago (B) Puccinia (C) Neuro spora (D) None

4. Biochemical & cenilical experiments is use in -
(A) Ustilago (B) Neurospora (C) Puccinia (D) None

5. Imperfect fungi is -
(A) Ustilago (B) Altervaria (C) Yeast (D) Aspergillus

6. Bread fungi is -
(A) Rhizopus (B) Yeast (B) Albugo (D) None

7. Toad stool is -
(A) Algae (B) Fungi (C) Bzyo puyte (D) None

8. Sac fungi is -
(A) Phycomy cetes (B) Ascomyates (C) Basideomyates (D) None

9. Penecillium belong with -
(A) Phyco my ates (B) Asco my ates (C) Basideo my ates (D) Deutro my ates

10. Photo syntetic protista is -
(A) Chryosophyta (B) Diawoflagellate (C) Euglenoid (D) All of these

11. Red tide shows by -
(A) Monera (B) Protista (C) Fungi (D) None

12. Plasmodium show by -
(A) slime mould (B) Eugenoid (C) Dianoflagellate (D) Chrysophyte

13. Organism who survive without oxygen -
(A) Mylophasma (B) Euglena (C) Desmid (D) Diatoms

14. Smallest living cell -
(A) Desmid (B) Mycoplasma (C) Desmid (D) Diatoms

15. Xlen parasite protozoa is -
(A) plasmodium (B) Trypanosoma (C) Entamoeba (D) Para mecium

16. Hallophy bacteria is -
(A) Eu bacteria (B) Ardvi bacteria (C) BUA (D) None

17. Meso some present in -

(A) Virus (B) Vivoids (C) Bacteria (D) All

18. Heterocyst presence shows -

(A) Thermo acidophillus (B) Cyanobacteria

(C) Desmid (D) Metanogen

19. Nitrogen fixation shown by -

(A) Mycoplasma (B) Metnawogene (C) Nostoe (D) None

20. Eenjugation neproduction method show by -

(A) Protista (B) Plantae (C) Mavera (D) None

Answer Key (Level - III)

1.	B	**2.**	C	**3.**	A	**4.**	B	**5.**	B	**6.**	A
7.	B	**8.**	B	**9.**	B	**10.**	D	**11.**	B	**12.**	A
13.	A	**14.**	B	**15.**	D	**16.**	B	**17.**	C	**18.**	C
19.	C	**20.**	C								

FIVE KINGDOM CLASSIFICATION

Biological classification is the scientific prodedure of arranging organisms into group and sub-group on the basis of their similarities and dissimilarities and then placing the group in hierarchical categories.

RH Whittaker (1969) classified the organisms into five kingdoms which was most widely accepted. He classified living organisms on the basis of :

* complexity of structure and body structure
* ecological lifestyle including mode of reproduction
* mode of nutrition
* phylogenetic relationship

Characters	Kingdom-Monera	Kingdom-Protista	Kingdom-Fungi	Kingdom-Plantae	Kingdom-Animalia
Cell type	Prokaryotic	Eukaryotic	Eukaryotic	Eukaryotic	Eukaryotic
Complexity of body	Unicellular to multicellular	Unicellular	Unicellular to multicellular	Multicellular	Multicellular
Tissue system	Absent	Absent	Absent	Present	Present
Ecological role	Producers/ Decomposes	Producers/ Decomposers/ Consumers	Decomposer	Produces	Consumers
Cell wall	Non-cellulosic and peptidoglycan	Present or absent	Chitin	Cellulose	Absent
Chloroplast	Present	Present or absent	Absent	Present	Absent
Nucleus	Incipient	Well organised	Well organised	Well organised	Well organised
Nutrition	Autotrophic or heterotrophic	Autotrophic or heterotrophic	Heterotrophic (saprophytic)	Autrotrophic (photosynthetic	Heterotrophic (holozoic or parasitic)
Motility	Present (flagella) or absent	Present (flagella 9+9)	Present (flagella 2+9)	Present (flagella 2+9)	Present (flagella 2+9)
Reproduction	Asexual (fission) or conjugation	Asexual and sexual gametic or zygotic	Asexual and sexual zygotic	Asexual, by vegetative means and sexual (spore or zygotic)	Asexual and sexual (gemetic)
Examples	Archaebacteria (methanogens, halophiles and thermoacidophiles)	Chrysophytes (diatoms and desmids)	Phycomycetes (Mucor, Rhizopus and Albugo)	Algae	Protozoa (Amoeba) Porifera (sponges) Coelenterata (jellyfish) Platyhelminthes(tapeworm) Aschelminthes (roundworm)
	Eubacteria (Cyanobacteria, Mycoplasmas, etc)	* Dinoflagellates (Gonyaulax) Slime moulds * Euglenoids (Euglena) Protozoans (i) Amoeboid protozoans (Amoeba and Entamoeba) (ii) Flagellated protozoans (Trypanosoma) (iii) Ciliated protozoans (Paramecium) (iv) Sporozoans (Plasmodium)	* Ascomycetes (Penicillium, Saccharomyces, Aspergillus, Neurospora, Claviceps, etc) * Basidiomycetes (Agaricus, Ustilago, Puccinia, etc) *Deuteromycetes (Alternaria, Colletotrichum and Trichoderma)	* Bryophytes (liverworts) Pteridophytes (ferns) Gymnosperms (Cycas, Pinus, etc) Angiosperms (Helianthus and Zea)	Annelida (earthworm) Arthropoda (cockroach) Mollusca (snail) Echinodermata (star fish) Chordata (vertebrates)

KINGDOM MONERA

The kingdom-Monera includes all prokaryotes such as **bacteria, mycoplasma, Actinomycetes** and **Cyanobacteria** (blue-green algae).

The characteristic features of kingdom-Monera and given below

(i) They are simplest or most primitive, unicellular prokaryotes.

(ii) The cell wall contains peptidoglycan or murein (no cellulose) and the membrance bound cell organelles are not present.

(iii) They have various types of nutrition like saprophytic, parasitic, chemoautotrohic, photoautotrophic and symbiotic.

(iv) DNA is naked. It lies inside the cytoplasm in coiled form. This is called **nucleoid.**

(v) The flagella, if present are single-stranded instead of being 11 stranded as in eukryotes. These contains a protein called **flagellin.**

(vi) Reproduction is by asexual methods. Gametes are not present.

(vii) Mitotic spindle is absent.

(viii) Some of the monerans have the ability to fix-nitrogen into useful nitrates.

Bacteria

The term Bacteria was proposed by **Ehrenberg** in 1829. They have widespread distribution be it air, water or soil. They can survive in extreme range of temperature like upto 78° C and –190° C.

Important characteristics of bacteria are

(i) Bacteria are found in all kinds of habites.

(ii) They are prokaryotic microorganisms.

(iii) They are unicellular.

(iv) Cell wall contains peptidoglycan.

(v) An organised nucleus in absent.

(vi) Extrachromosomal self replicating DNA segments called plasmids occur in most of the bacteria.

(vii) Mitochondria, plastids, Golgi apparatus, endoplasmic reticulum and other membrane covered cell organelles are absent.

Size

The size of bacteria cell ragne from1-10μm in length and from 0.7-1.5 μm in width.

Shape

The bacteria posses the following forms

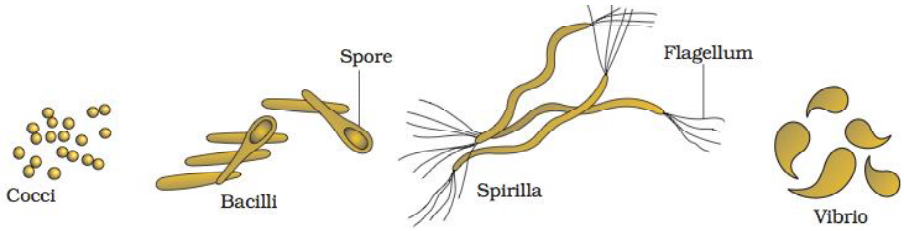
(i) **Coccus** (Pl. cocci) bacteria are oval or spherical cells without flagella. The spheres occur as single cells (*Monococcus*), a pair of cells (*Diplococcus*), in group of four cells (*Tetracoccus*), as chain of cells (*Streptococcus*) or in sheets (*Staphylococcus*).

A few cocci may also occur in cube-like arrangements of 8 or more cells (*Sarcina*).

(ii) **Bacillus** (Pl bacilli) bacteria are rod-shaped cells which many occurs singly (*Monobacillus*), in pairs (*Diplobacillus*), in chains (*Streptobacillus*) or as a layer (Stack) with many cells called Plaisade bacillus.

(iii) Spirillus (Pl. spirilla) bacteria are cells, which are twisted, like a screw. They occur as free single cells, e.g., *Spirillum, Spirochaete*, etc.

(iv) *Vibrio* are cells which are curved, C-shaped or comma-shaped, e.g., *Vibrio cholerae*.

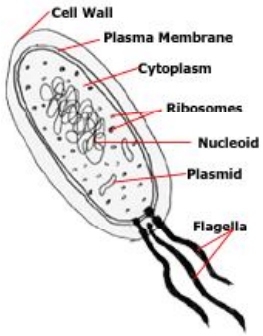


Bacteria were discovered by **Anton von Leeuwenhoek** (1632-1723). He observed bacteria in 1675.

Louis Pasteur laid the foundation of **Bacteriology** by developing culture techniques.

Structure

A bacteria cell is covered by mucilage. It is differentiated into cell wall, plasma membrance, cytoplasm, nucleoid, plasmids, inclusion bodies flagella, pilli and fimbriae. Membrane bound organelles are absent.



Nutrition

Bacteria show both autotrophic and heterotrophic mode of nutrition, i.e., mixotrophic.

On the basis of mode of nutrition, bacteria are of two types.

Autotrophic Bacteria

These are of following two types

(a) **Photosynthetic** These bacteria have green sunlight trapping pigment called **bacteriochlorophyll.**

These are found at the bottom of ponds and lotus. Bacteria photosynthesis does not release oxygen.

(b) **Chemosynthetic** These bacteria are able to synthesise organic food from inorganic raw materials with the help of energy derived from exergonic chemical reactions. Examples Nitrifying bacteria. (Nitrosomonas), iron bacteria (*Ferrobacillus ferroxidants*), sulphur oxidising bacteria (*Beggiatoa*).

Heterotrophic Bacteria

These bacteria obtain food from different sources. These may be of following types.

(a) **Saprophytes** These are called **decomposers**, detrivores or transformers. These obtain food by decomposing dead-bodies, excreta of animals, dead plants and their parts.

(b) **Parasites** These are disease causing bacteria called as **pathogens**, e.g.,*Salmonella typhimurium*, which causes typhoid in human.

(c) **Symbionts** These bacteria live in mutually beneficial association with other organisms, e.g., *Rhizobium* and *Bacillus*, species from nodules in root of leguminous plants.

Reproduction

Bacteria reproduces by asexual and sexual (parasexual) process.

Asexual Reproduction

Asexual reproduction occur by binary fission and endospore formation.

(a) **Binary Fission** It is a simple cell division in which bacterial cell divides in two parts. A constriction appears at the centre of the cell, deepens further and grows from margin to centre and finally two cells are produced.

(b) **Endospore Formation** Endospores are perennial structures which help in survival even during harsh environmental conditions, e.g., in *Clostridium* and *Bacillus*. The endospore has many wall layers. It has heat resistant chemicals called **sialic acid** and **dipicolinic acid**.

Sexual Reproduction

Sexual reproduction occures by a parasexual process actually called **genetic recombination**.

The three methods involved are as follows

(a) **Conjugation** The male cell (donor cells) has fertility plasmid or F-factor, which connect itself to cell wall of female cells (receipient cells).

(b) **Transformation** The process was discovered by **Griffith** in 1928. It is a process where segments of DNA are transferred from one bacterial cell to another via the liquid medium.

(c) **Transduction** During this process, the segment of DNA are transferred from one bacterium to another by the viruses (bacteriophages).

Use of Bacteria

Bacteria is useful in the following ways

(i) Bacteria are natural scavangers. They obtain their nutrition by decomposing dead bodies, dead plants and animal excreta.

(ii) These are used in fermentation process for vingera manufacturing, yogurt making, etc.

(iii) Some bacteria help in retting of jute and coconut plant fobres. The separated fibres are used in making ropes or gunny bags.

(iv) The genus streptomyces has many species used to produce different antibiotics.

Some important antibiotics using various bacteria are neomycin, chloromycetin, streptomycin, gramicidin, bacitracin.

(v) Bacteria play important role in different steps of nitrogen cycle. Some important bacteria in nitrogen cycle, e.g., *Clostridium, Azotobacter* (soil bacteria), *Rhizobium leguminosarum*, *Bacillus radicicola* (in nodules), *Nitrosomonas, Nitrosobacter, Pseudomonas* etc.

Harmful Effects of Bacteria

Bacteria is harmful in the following ways :

(i) Some saprophytic bacteria like Lactobacillus spoil milk and milk products.

(ii) Food poisoning occurs due to the production of toxins by some bacteria like Clostridium botulinum. They cause botulism, which can kill humans by respiratory paralysis.

(iii) Bacteria are responsible for various plant diseases like **citrus canker** in lemon leaves and friuts, **soft rot** in carrot plants, **blight dieses** in rice plants, **crown gall disease** in apple trees and rose plants.

(iv) In humans, bacteria cause diseases like cholera (Vibrio cholerae), gastric ulcer (Heliobacter pylori), tuberculosis (Mycobacterium tuberculosis), sexually transmitted dieases like gonorrhoea (Neisseria gonorrhoeae), syphilis (Treponema pallidum), etc.

(v) In animals like horse, cattle and sheep anthrax disease is caused by Anthracis.

Archaebacteria

Archaebacteria (Archae-ancient ; bact-rod) 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).

The characteristics of this domain are

(i) They are most primitive prokaryotes.

(ii) They are found in stressed environment, sucha as high salt content (Great salt lake, the dead sea), edge of the ocean, hot sulphur springs, volcanic walls, etc.

(iii) Their cell walls lack peptidoglycan. In most cases, the wall composed of non-cellulosic polysaccharides and some protiens. In some members, there is no cell wall. This feature of having different cell walls is responsible for their survival in extreme condition.

(iv) Most of the archaebacteria are chemoautotrophs.

Types of Archaebacteria

Archaebacteria are of following three types

Methanogens

These are strictly anaerobes. They live anaerobically in gut of serveral ruminants such as cows, goat, etc. These bacteria help in fermentation of cellulose. They produce almost 65% of atmospheric methane.

Example Methanobacterium, Methanobacillus, Methanosarcina and Methanococcus.

* Methane is a pollutate that contributes to greenhouse effect and global warming.
* The fermentation of cattle dung by methanogens is done in specially designed gobar gas plants to produce cooking gas.

Halophiles

These are found in extreme saline environments like salt lakes, salt marshes, salt pans, salt solutions, etc. They are mostly anaerobes. They contain a chemical called **halorhodopsin** to pump in chlorides into the cell to prevent cellular dehydration.

Halobacterium develops purple membrane having photoreceptor pigment **bacteriorhodopsin**. In light, it acts as a proton pump and helps in synthesise of ATP. The formation of ATP is a survival mechanism under anaerobic condition.

Examples Halobacterium and Halococcus.

Thermoacidophiles

These archaebacteria can live in both extreme heat and acidic pH (around 2) environment. Under anaerobic conditions, these organisms oxidise sulphur to sulphuric acid.

$$2S + 2H_2O + 3O_2 \longrightarrow 2H_2SO_4 + \text{Energy}$$

Thermoacidophiles can survive in high temperature and low pH conditions because of

(a) Special branched chain lipids in cell membranes that reduce cell fluidity.

(b) Enzymes can work at low pH.

(c) Enzymes are resistant to high temperature coagulation. Examples Sulfobolus, Thermoplasma and Thrmoproteus.

Important of Archaebacteria

Archaebacteria can live in extreme environments, so they are useful in

(i) Modern biotechnology (ii) Generation of biogas

(iii) Thermophilic enzymes (iv) Biosensors

(v) Restriction enzymes etc.

Difference between Eubacteria and Archaebacteria

Eubacteria	Archaebacteria
Cell wall is made up of peptidoglycans.	Peptidoglycan is absent in cell wall. It is made up of cellulosic carbohydrate.
Plasma membrane consists of phospholipids.	It is a single layer of branched chain lipids.

by plasma membrance made up of **lipid** and **proteins**. The membrance bound structure like true mitochondria, endoplasmic reticulum, Golgi bodies, etc., are absent.

The photosynthetic pigment present in the cell are chlorophylla-a, β-carotene, myxoxanthophyll, myxoxanthin, etc., The nucleolus is absent and the nucleoid is not bound by nuclear membrane.

Some cyanobacteria (Nostoc, Anabaena, Scytonema, etc.) posses special type of cells called **heterocysts** to perform special functions. Heterocysts are the sites of nitrogen fixation.

Eubacteria

They are called 'true bacteria' and are characterised by the presence of a rigid cell walls, and if motile, have flagellum.

Cyanobacteria

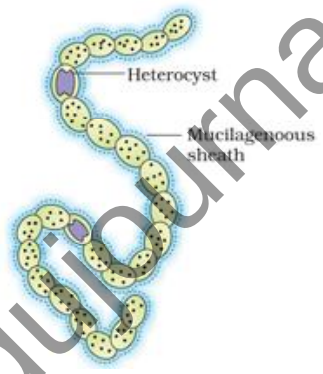
Cyanobacteria, member of this group (blue green algae) have many characters similar to bacteria. The examples of cyanobacteria are Nostoc, Oscillatoria, Spirulina, Rivularia, Anabaena, etc. They can survive in a wide variety of habitats, such as hot springs, sea water, polluted water, etc.,

Cyanobacteria have following three forms

(i) Unicellular as in Chrococcus.

(ii) Colonial as in Microcystic and Gloeocapsa.

(iii) Filamentous as in Nostoc, Oscillatoria and Anabaena.



Cell Structure

Cell has a define firm and rigid cell wall surrounded by mucilaginous sheath. The cell wall is followed pleural fluid of cattle suffering form pleuropneumonia. The organisms are often called **MLOs** (Mycoplasma Like Organisms) or **PPLOs** (Pleuropneumonia Like Organisms).

The characteristic features of mycoplasma are

(i) Their size range from 0.1-0.5 μm and have organised nucleus, plastids, mitochondria and other organelles are absent.

(ii) DNA is naked (because of absence of histones) and ribosomes (of 70S type).

(iii) Mycoplasma posses heterotrophic nutrition. Examples Mycoplasma gallisepticum, M.laidlawii. They cause pleuropneumonia in domestic animals, mycoplasmal urethritis in humans.

Nutrition

Cyanobacteria are mostly photoautotrophs. They contain chlorophyll-a and other photosynthetic pigments.

Reproduction

Cyanobacteria multiply asexually and vegetatively. Sexual reproduction does not occur.

The types of multiplication are

(i) **Binary fission** occurs in unicellular forms.

Genes are not interrupted by non-coding	Geners are interruptedb y introns like eukaryotes.

(ii) **Fragmentation** occurs in colonial and filamentous forms.

(iii) **Conidia** are asexually produced spores of fungi.

(iv) **Endospores** and **exospores** are non-reproductive structure.

Differences between Bacteria and Cyanobacteria

Bacteria	-	Cyanobacteria
Cell are smaller	-	The cells are comparatively larger.
Cell wall is 1-2 layered	-	The cell wall is four layered
They may possess flagella	-	They lack flagella
They are both autotrophic and heterotrophic	-	They are autotrophic
Autotrophic bacteria contain bacteriochorophyll	-	They possess chlorophyll-a as found in eukaryotic autotrophs.
Photosynthesis is anoxygenic	-	Photosynthesis is oxygenic
The may be aerobic or anaerobic	-	They are aerobic
The reserve food is glycogen	-	The reserve food is cyanophycean strach

Uses of Cyanobacteria

Some use of cyanobacteria are

(i) Some cyanobacteria have the ability to fix atmospheric nitrogen. The green manuring by fermers is done on this basis to enrich the soil with nitrogenous fertilisers.

(ii) Cyanobacteria like *Anabaena, Tolypothrix*, etc. help in prevention of soil erosion and its conservation.

(iii) *Spirulina* is a protein rice supplement for humans. It is a fast growing cyanobacteria. It is also known as **Single Cell Protein** (SCP).

Harmful Effects of Cyanobacteria

Some harmful effects of cyanobacteria are

(i) Cyanobacteria discolour the walls and roofs of buildings, movements and statues.

(ii) Oscillatoria causes asthma and gastrointestinal problems by releasing its toxins.

(iii) Growth of Oscillatoria in water bodies shows pollution by organic matter.

(iv) Excessive growth of cyanobacteria form **water blooms**, which decreases oxygen level in water causing death of aquatic animals.

Mycoplasma

Mycoplasma are organisms that completely lack a cell wall. They were discovered by **Roux** (1898) in pleural fluid of cattle suffering from pleuropneumonia. The organisms are ofter called MLOs (Mycoplasma Like Organisms) or PPLOs (Pleuropneumonia Like Organisms).

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KINGDOM PROTISTA

Kingdom-Protista includes all single-celled **eukaryotes** but, the boundries of this kingdom are not well defined. It was first proposed by **Ernst Haeckel** (1866).

Physilogically kingdom-Protista acts as a connecting like between the kingdom-Monera and the complex multicellular kingdom-Fungi, Plantae and Animalia.

Kingdom-protista includes the following categories such as dinoflagellates, chrysophytes, euglenoids, slime moulds and protozoans.

The general characteristic features of Kingdom-Protista are given below :-

(i) These are mostly aquatic organisms. Some protists also living in the bodies of animals as parasites.

(ii) The cells are eukaryotic. These contain membrane bounded cell organelles like mitochondria, Golgi complex, endoplasmic reticulum, 80S ribosomes, etc.

(iii) Locomotion may either occur by **Pseudopodia** (Amoeba, Euglypha), **Cilia** (Paramecium), Wriggling (Sporozoans, non-flagellates) and **Mucilage propulsion** (some protists like diatoms).

Diatoms do not have any organelles for locomotion.

(iv) Protists shows various modes of nutrition such as

(a) **Photosynthetic** (holophytic) Dinoflagella-tes, diatoms and euglenoids.

(b) **Halozoic** (zootrophic) Protozoans like *Amoeba* and *Paramecium*.

(c) **Saprobic** (saprotrophic) In slime moulds.

(d) **Parasitic** *Trypanosoma, Giardia, Plasmodium, Entamoeba.*

(e) **Mixotrophic** In *Euglena*.

(f) **Symbiotic** In zooflagellates like *Trichonympha* and *Lophomonas*.

(g) **Pinocytosis** In *Amoeba* to absorb soluble organic substances.

(v) Most of the protists are aerobic. However, some protists that live at the bottom of aquatic habitats can respire anaerobically.

(vi) Protists reproduces asexually and sexually by a process involving cell fusion and zygote formation.

Protista Kingdom and its Phylum

Phylum	Feature of Some Characteristics	Example
Euglenophyta (euglenoids)	One-called make or take in food. most have one flagellum	Euglena
Chrysophyta (golden algae) diatoms	Most are non-celled, make their own food, yellow-brown in colour.	Navicula
Pyrrophyta (dinoflagellates)	One celled, take in food, have two flagella.	Gonyaulax
Sarcodina (sarcodines)	One-celled, take in food, have pseudopods.	Amoeba
Ciliophora (ciliates)	One-celled, take in food, have cilia.	Paramecium
Mastigophora (flagellates)	One-celled, take in food, have two or more flagella.	Euglena
Sporozoa (sporozoans)	One-celled take in food, no means of movement	Monocystis
Myxomycetes (slime molds)	Many-or one-celled, absorb food, change form during life cycle	Plasmodium

The major groups of Protista are

(a) **Protistan algae** (photosynthetic protists)

(b) **Slime moulds** (consumer-decomposer protists).

(c) **Protozoan protists**.

Photosynthetic Protists

These chrysophytes from the main part of phytoplankton. These include chrysophytes, dinoflagellates and euglenoids.

1. **Chrysophytes**

This group includes diatoms and golden algae (demids).

i. **Diatoms**

(a) Diatoms occur in all aquatic and moist terrestrial habitats and are also known as **chief producer** in the ocean.

(b) They pile up at the bottom of water reservoirs and form big heaps called **diatomaceous earth**.

(c) They are microscopic unicellular organisms of different shapes, such as circles, semicircles, triangular, spindle-shaped, boat-shaped, etc.

(d) They body wall of the diatoms is made up of cellulose impregnated with glass like silica. The cell wall has two overlapping halves like a sapbox called **shell** or **frustule**, i.e., a lid and a lower half fitted together.

(e) Diatoms are variously coloured, do not passess flagella except in the reproductive state.

(f) Each cell has a large central vacuole.

(g) Chloroplast are yellowish brown to greenish brown. They contain chlorophyll-a and c. They contain fucoxanthin that provides brownish ting.

(h) Food is reserved in the form of oils and leucosin (polysaccharide).

(i) The diatoms mostly reproduces asexually by binary fission. Sexual reproduction varies from isogamy to oogamy. example Navicula, Amphipleura.

Economic Importance of Diatoms

Diatoms are economically important in the following ways

* Diatoms are very important photosynthesizers.
* Diatomite deposits are often accompanied by petroleum fields.
* These are used as a cleaning agent in tooth pastes and metal polishes and are use in filtration of oil and syrups.
* Diatoms are used as insulation material in refrigerators boilers and furnaces. These are also used to make sound-proof rooms.
* Diatoms are also very good pollution indicators.

ii **Golden Algae** (Desmids)

These are unicellular green algae. Their cell walls have distinct halves. Sexual reproduction occurs by 'conjugation' (similar to Spirogyra). They are useally found in freshwater and acts as an indicators of polluted water.

2. Dinoflagellates

These are mainly marine and photosynthetic organism. There are about 1,000 species of photosynthetic protists.

The general characteristic features of dinoflagellates are listed below

(i) These are important photoplanktons. Most of them are marine but some occur in freshwater.

(ii) They appear yellow, green, brown, blue or red depending on the main pigments present in

their cells.

(iii) The cell wall in dinoflagellates, if present is composed of number of plates made up of cellulose.

Some dinoflagellates like *Gonyaulax* and *Gymnodinium* grow in large number in sea and make the water look red and form 'red tide'.

Taxins released by such large numbers may even kill other aquatic animals.

(iv) The cell usually possess two flagella which are of different types (heterokont). One flagellum is transverse arising from the another part. The other flagellum arises in thevertical furrow. Both these flagella beat in different directions.

(v) The nucleus is bigger in size, named as mesokaryon. Chromosomes do not have histone and RNA.

(vi) The cells possess an osmoregulatory organelle called **pousule**, which superficially looks like contractile vacuole.

(vii) Dinoflagellates reproduce asexually through cell division or by the formation of zoospores and cysts.

(viii) Varieties of eye spots occur in dinoflagellates. Some of them are like ocelli.

(ix) Reserve food is stored in the form of starch and oils. e.g., *Gonyaulax*, *Ceratium*, *Noctiluca*, *Peridinium* and *Gymnodinium*, etc.

3. Euglenoids

Euglenoids live in fresh aquatic habitats and damp soils.

(i) They are unicellular flagellate protists.

(ii) Body is covered by thin and flexible **pellicle**. It lacks cellulosic cell wall.

(iii) Euglenoids have two flagella, usually one long and one short.

(iv) They perform creeping movements by expresion and contraction of their body. This phenomenon is called **metabody**.

(v) Nutrition is holophytic, saprobic or holozoic. This mode of nutrition is called **mixotrophic**.

(vi) The photosynthetic pigments include chlorophyll-a and b.

(vii) Reserve food is carbohydrate in the form of **paramylon** or **paramylum** bodies.

(viii) Euglenoids reproduce by longitudinal binary fission under favourable conditions. The **palmella stage** is found during unfavourable conditions. Examples *Euglena*, *Perenema*, *Eutreptia*, *Phacus*, etc.

Euglena is considered as plant as well as animal. It is also called as **plant animal**.

Plant and animal features are

* **Plant Features** Chloroplasts and chlorophyll are present has holophytic nutrition.
* **Animal Features** Present of pellicle which is not made of cellulose. Contractile vacuole is present. Longitudinal binary fission.
* Euglenozoa is a diverse clade that includes predatory heterotrophs, photosynthetic autotrophs and pathogenic parasites.
* The main feature that distinguishes protists in this clade is the presence of a spiral or crystalline rod of unknown function inside the flagella.

Consumer-Decomposer Protists

(Slime Moulds)

Theu possess the characters of both animals and fungi.

Slime Moulds

Slime moulds are saprophytic protists. **Anton De Bary** (1887) related them to animals and called them as **Mycetozoa.** These are also named as fungus animals becuase they share the common characters of both animals and are known as *protistian fungi*, and due to their protistian nature.

The general features of slime moulds are discussed here

(i) Slime moulds are acellular and cellular types, about 600 species of slime moulds are reported by biologists out of whihc 27 species are know from india.

(ii) They are found in moist terrestrial places rice in decaying organic food.

(iii) The body of slime moulds is covered with mucilage having gelatinous consistency, they do not have chlorophyll.

(iv) They are surrounded by plasma membrance. However, the spores have the cellulosic cell walls.

(v) They show phagotropic or saprotrophic nutrition.

(vi) Both sexual and asexual modes of reproduction occur.

(vii) They are like Protozoa in their amoeboid plamodial stage and similar to true fungi in spore formation.

(viii) Acellular slime moulds (plasmodial slime moulds) are commonly found on dead and decaying plant matter. The cellular slime moulds occur in all humus-containing upper layer of damp soil. When the food supply is shorter or conditions are not favourable, the amoeboid cells form aggregate without any fusion.

This aggregated mass is called **pseudoplasmodium.** The examples of cellular slime moulds are **dictyostelium and polysphondylium.**

(ix) Plasmodium is the free-living thalloid body of the acellular slime moulds. It is wall-less mass of acellular slime moulds. It is wall-less mass of multinucleate protoplasm covered by slime layer. During unfavourable conditions, the Plasmodium differentiates and forms fruiting bodies bearing spores at their tips. While during favourable spores at their tips. While during favourable conditions, Plasmodium can spread over several feet.

(x) Slime moulds are beneficial as they cause the decomposition of organic matter in the soil.

Protozoa Protists

Include unicellular protists which animal like behaviour. They were first studied by **Leeuwenhoek** (1677). Protozoans protists may be aquatic, terrestrial or parasites. They can cause several diseases in humans and animals.

General characteristics of protozoans are described below :

(i) They are microscopic small unicellular and colourless organism with different shapes.

(ii) Locomotion occurs with the help of finger-like pseudopodia, flagella or hairy cilia.

(iii) All protozoans are heterotrophs and live as predators or parasites.

(iv) Respiration occurs through the general surface of the body.

(v) Reproduction occurs by binary fisison, multiple fission or budding. Sexual reproductin occurs by syngamy and conjugation.

There are four major groups of protozoans

1. Amoeboid Protozoans

These organisms live in freshwater, seawater or moist soil.

Examples *Amoeba, Entamoeba, Radiolarians, Pelomyxa, Foraminiferans* and *Heliozoans.*

General features of this group are following

(i) They move and capture their prey by putting out pseudopodia (flase feet) as in *Amoeba* (as mouth is absent).

(ii) The body is without periplast. It may be naked or have a calcareous sheel.

(iii) Flagella are present in some developmental stages. They also develop when food become scarce.

(iv) Nutrition is holozoic.

(v) Asexual reproduction occurs by binary fission, multiple fission, spores and budding and sexual reproduction occurs by syngamy.

2. Flagellated Protozoans

The members of this group are either free-living or parasitic. Examples *Giardia, Trypanosoma, Leishmania, Trichonympha* and *Trichomonas*.

General features of this group are following

(i) They have flagella for locomotion as their name suggest.

(ii) They may be aquatic, free-living, parasitic, commensals or symbiotic.

(iii) The body is enclosed by a firm pellicle.

(iv) Nutrition is holozoic, saprobic, and parasitic.

(v) Asexual reproduction is by binary fission.

(vi) Sexual reproduction is observed in some forms only.

(vii) Various species of these protozoans causes diseases in humans. For examples,

* Trypanosoma (sleeping sickness)
* Leishmania (kala-azar, dum-dum fever)
* Giardia (giardiasis)
* Trichomonas (laucorrhoea).

3. Ciliated Protozoans

These are aquatic, actively moving organisms because of the presence of thousends of cilia.

Examples *Paramecium, Opalina, Vorticella, Podophyra, Balantidium*, etc.

General features of this group are following

(i) Many ciliates live as free-living individual in fresh and marine water (*Paramecium*).

(ii) A large number of cilia present on whole body surface. Cilia are used to food and for locomotion.

(iii) Nutrition is holozoic except in some parasitic forms.

(iv) The body is covered with flexible pellicle.

(v) There are definite regions for ingestion and egestion.

(vi) Ciliates have a larger macronucleus and smaller **micronucleus.**

(vii) They have small ejectable **trichocysts** for defence.

(viii) **Osmoregulation** occurs by contractile vaculoes.

(ix) Asexual reproduction occurs by transverse binary fission or budding. Cyst formation also occurs during unfavourable condition.

(x) Sexual reproduction by means of conjugation.

4. Sporozoan Protozoans

This group includes organisms that have an infections spore-like stage in their life cycle.

Examples *Plasmodium, Monocystis, Eimeria.*

General *features of this group are following.*

(i) All sporozoans are endoparasites and pathogenic.

(ii) Locomotory organs are absent.

(iii) Nutrition is parasitic (absorptive).

(iv) Body is covered with an elastic pellicle or cuticle and contractile vacuoles are absent.

(v) A sexual reproduction occurs through multiple fission and sexual reproduction by syngamy.

(vi) Life cycle may include two different hosts, e.g., *Plasmodium* requires two hosts (digenetic), female ***Anopheles*** mosquito and human beings. It is responsible for causing malaria, in humans.

KINGDOM FUNGI

The Kingdom-Fungi or Mycota consitute a unique kingdom of heterotrophic organisms. They show a great diversity in morphology and habitat. There are about 1,00,000 species in the kingdom fungi. The characteristic features of kingdom fungi are discussed here.

Mycology is the branch of science that deals with the study of various fungi. A scientist having specialisation in the study of fungi is called mycologist.

Fungal Structure

The fungal body is an assemblage of extremely fine, almost transparent threads called hyphae. Numerous hyphae are twined around one another to form many mycelium (pl.mycelia).

Fungal Hyphae

Fungal hyphae are thin tubular transparent threads or filaments filled with protoplasm and covered by wall.

The hyphae are of following types found in fungi

i. Aseptate Hyphae

In aseptate hyphae cross walls or septa are not formed at the time of nuclear division. Such hyphae are multinucleate. It is called **coenocytic**, if a mycelium contains aseptate and multinucleate hyphae.

ii. Septate Hyphae

In this type, cross walls or septa form after the nuclear division. The cells may have one, two or many nuclei. These have septal pores or cross walls in their hyphae, which allow movement of substances between adjacent cells.

Dolipore Septum

The central septal pore contain a barrel-shaped inflammation in many Basidiomycetes. This kind of septum is called dolipore septum. These pores may get partially plugged by membrance bound bodies and crystalline structures called **woronin bodies.**

Fungal Tissues

In fungi, fungal tissue is formed by interweaving of fungal hyphae called as **plectenchyma**. It can be further divided as **prosenchyma** and **pseudoparenchyma.**

Prosenchyma is formed of distinct hyphae running together in parallel, while pseudoparenchyma is a false parenchyma formed by close packing and fusion of hyphae.

Fungal Cell

Fungi are eukaryotic cell. A cell wall is present on the outside, made of **chitin** and **polysaccharide.** They possess all the eukaryotic cell organelles except plastids. Plasmalemma bears coiled membranous outgrowths called lomasomes lying below the cell wall. Near the hyphal tip the cytoplasm contain small vesicles called **chitosomes.**

These contain cell wall materials. Food reserve is the form of glycogen and oil.

During cell division, the nuclear envelope may not dissolve as in plant and animal cells.

Nutrition

Fungi are mostly heterotrophic. They absorb soluble organic matter from dead substances. Hence, they are called **saprophytes.**

2. Ascomycetes

The common features of Ascomycetes are described below

(i) They are mostly terrestrial, some aquatic. A number of Ascomycetes are parasites on plants, animals and humans.

(ii) Mycelium is branched and septate. It may consists of distinct hyphae or the same may aggregate to produce prosenchyma and pseudoparenchyma.

(iii) Hyphae are septate. They posses central pores. They may however, have plugs like woronin bodies.

(iv) The asexual spores are conidia produced exogenosuly on the special mycelium called **conidiophores**. Conidia on germination produced mycelium.

(v) Sexual spores are called **ascospores** (sign, ascus) endogenously which are produced in sac like. These asci are arranged in different types of fruiting bodies called **ascocarp**. Each ascus bears 4-8 ascospores, sometimes numerous.

(vi) In higher Ascomycetes, asci are aggregated in difinite fruiting bodies called **ascocarps.**

(vii) Sexual reproduction occurs by gametangial copulation, gametangial contact, spermatisation, somatogamy and antogamy.

Examples *Penicillium, Aspergillus, Claviceps, Neurospora,* Yeast etc. Neurospora is used extensively in biochemical and genetic work.

3. Basidiomycetes

These are terrestrial, saprotrophic and parasitic forms also known as **club fungi.** Many of them attack trees. A few species form mycorrhizal association.

(i) The mycelium is branched and septate.

(ii) Rhizomorphs are thick strands of hyphae which are used both for perennation and formation of fructification.

(iii) Asexual spores are generally not found, but vegetative reproduction by fragmentation is common.

(iv) Sex organs are absent but plasmogamy occurs by the fusion of two vegetative or somatic cells of different strains or genotypes. The resultant structure is dikaryon which ultimately gives rise to basidium.

(v) Karyogamy and meiosis take place in basidium producing four basidiospores. The basidiospores are exogenously produced on the basidium (pl. basidial) The basidia are arranged in fruiting bodies called basidiocarpes.

Exaples *Agaricus compestris (edible mushroom), Puccinia (cause rust), Ustilago (cause smut diseases), Amanita (toad stools), bracket fungi, Lycoperdon (puffbals), Armillaria (honey mushroom).*

4. Deuteromycetes

Fungi because only the sexual or vegetative phases of these fungi are known. These are mostly terrestrial, only few of them are aquatic, e.g., *Tricladium, Pyricularia.*

The characteristics of Deuteromycetes are

(i) The mycelium is septate and branched. Cells are usually multinucleate and septa posses simple pores. The lamp connections are absent.

(ii) Asexual reproduction occurs by the formation of conidia or sometimes by oidia and chlmydospores.

(iii) Sexual reproduction is not certain.

(iv) Mycelium structure and conidia indicate that most of the Deuteromycetes belong to Ascomycetes whose sexual reproduction is not know.

Examples of these fungi and diseases caused by them are

(a) *Trichoderma* (soil fungus) leucopenia called alimentary **aleukia.**

(b) *Gibberella fujikuroi* bakane or foolish disease of rise

(c) *Colletotrichum falcatum* red rot of sugarcane.

(d) *Helminthosporium oryzae* leaf spot disease of rise.

(e) *Alternaria solani* early blight of potato and tomato.

(f) *Cercospora personata* tikka disease of groundnut.

(g) *Fusarium oxysporum* wilts in potato, cotton, banana, flax, etc.

LICHEN

The algae component is called **phycobiont** and fungal component is **mycobiont** lichens are found in habitats like walls, window panes, barren rocks, cooled valcanic lava, tree bark, soil and aquatic habitats.

Different forms of lichens are formed based on their habitat such as **saxicolous, lignicolous, corticolous, terricolous, marine** and **freshwater.**

Morphology

Lichens vary in colour like orange, brown dark brown, grey, yellowish green, etc.

Based on their morphology lichens can be of various types

(i) **Crustose** these lichens are crust like, closely attached to the substratum, e.g, *Graphis, Lecanora*.

(ii) **Leprose** These are like minute scales attached superficially to the substratum, e.g., Lepraria.

(iii) **Foliose** These are like twisted and crinkled leaf, e.g., *Parmelia, Physcia*.

(iv) **Fruticose** These are branched, erect with bushy appearance, e.g., *Evernia, Ramalina, Usnea.*

(v) **Filamentous** These lichens consists of chains of algal cells wrapped aroung by fungal hyphae, e.g., *Racodium*.

Internal Structure

The major part of lichen body constitutes fungus and only 5% part is algal component. The body is divided as upper cortex, algal zone (gonidial layer), middle medulla, lower cortex and rhizines.

Only the algal zone contains photosynthetic partner. In about 98% lichens, the fungal partner belongs to Ascomycetes. In the rest, the fungal partner belongs to Basidiomycetes adn Deuteromycetes.

Symbiotic Relationship

The algal partner or phycobiont plays following roles

(i) Nitrogen fixation if cyanobacterial type.

(ii) Photosynthesis.

(iii) Provides vitamins and other growth substances.

The fungal partner or mycobiont is involved in

(i) Outer covering for protection.

(ii) Attachment in substratum.

(iii) Protection aginst harmful radiations.

Sometimes, mycobiont sends haustoria into algal part. It prevents alga to secrete pectic substances or induces alga to secrete nutrients. It this case, fungus is considered to be a **controlled parasite** over the alga. This phenomenon of controlled parasitism is called **helotism.**

Reproduction

Lichens may reproduce vegatatively or sexually. They reproduce vegetatively by the following ways such as fragmentation, death and decay, isidia, soredia etc.

Lichens reproduce sexually by following ways

(i) Formation of ascomycetous fruiting body.

(ii) Formation of basidiocarp.

Sexual reproduction is not considered to be a common means of reproduction to form a new lichen.

Important of Lichens

Lichens have widespread importance for the mankind. Some of the important uses of lichens are listed here.

(i) Lichens contain a complex carbohydrate called **lichenin.** Hence, many lichens are food for many animals.

(ii) Many lichens are useful in producing medicines.

Usnea and *Cladonia* (antiboitics and usnic acid).

Cetraria islandica (laxative mucilage).

Parmelia (curing epilepsy).

Lobaria (treating lung diseases).

(iii) Lichens like *Roccella tinctoria*, *Parmelia omphalodes* are used in making different types of dyes. **Litmus** was also previously obtained from *Roccella montaingne.*

(iv) Extracts of *Lobaria pulmonaria* and *Cetraria islandica* are used in tanning leather.

(v) Some lichens like Usnea are used in brewing industry.

(vi) Lichens are best indicators of air pollution.

(vii) Lichens help in understanding the process of **biological succession** by the ecologist.

fungus and the root of a plant. Mycorrhizal roots often show wooly covering of fungal hyphae on the surface and remain in the upper layers of the soil where organic matter is abundant.

A fungal can form association with roots of many plants and the roots of a plant can form association with many fungi.

Mycorrhizae are of the following two types

1. Ectomycorrhizae

In the type, the bulk of the fungus grows over the surface as a mantle. The only part of it lives in the intercellular speces of the cortex of the root.

2. Endomycorrhizae

In this type, the fungus grows inside the coretx of the roots with some intracellular hyphae tips. In some forms of endomycorrhizae, the fungal hyphae develop some special organs called vesicles with the root cortical cells. This kind of mycorrhizae are calle **Vesicular Arbuscular Mycorrhizae** (VAM).

Important of Mycorrhizal Association

(i) Mycorrhiza help in absorption of minerals from the soil and provide to the root.

(ii) These help in increased absorption of water.

(iii) These produce growth inducing hormones. In the absence of fungus, Pinus and Betula show growth despite of providing all types of nutrients.

(iv) Fungus help in preventing the root from parasitic fungi and harmful bacteria secreting antimicrobial substance.

(v) Mycorrhiza endable the plants to grow in mineral deficient soil, saline soil and unfavourable pH and temperature.

(vi) In case of orchids, the fungus absorbs nourishment from outside and deliver to the germinating seed as the same is devoid of stored food.

(vii) Mycorrhiza have antimicrobial substances which protect the root from parasitic fungi and harmful bacteria by secreting antimicrobial substances.

Kingdom-Plantae

Kingdom-Plantae includes all eukaryotic, chlorophyll containing organisms called **plants.** Some of these members are partially heterotrophic, such as insectivorous plants or parasites.

For example, venus fly trap and bladderwort. *Cuscuta* (dodder) is a parasite. The cell has an eukaryotic type structure with prominent chloroplasts and cell wall containing celluose.

This kingdom includes following classes

(i) Algae (ii) Bryophytes (iii) Pteridophytes

(iv) Gymnosperms (v) Angiosperms

The members of kingdom-Plantae have two distinct phases the diploid saprophytic and the haploid gametophytic. This is called **alternation of generation.**

Kingdom-Animalia

Animal kingdom containsheterotrophic eukaryotic organisms that are multicellular and the cells lack cell walls. The main source of foold of animal kingdom are plants directly or indirectly.

The food is digested in alimentary canal and food is reserved as glycogen or fat. The mode of nutrition is holozoic.

A definite growth pattern is present. Adults have definite shape and size. The higher forms have well developed sensory and neuromuscular mechanism, Locomotion is present.

Sexual reproduction occurs by copulation followed by fertilisation of gametes and embryonic development.

VIRUSES

Five kingdom classification of RH Whittaker has not classified viruses, viroids and lichens in any group.

The viruses are non-cellular organisms that are characterised by having an inert crystalline structure outside the living cell. An inert virus outside the cell called **virion.** These are obligate parasites. They do not have a biosynthetic machinery. Once they infect a cell they take over the machinery of the host cell to replicate themselves, killing the host.

(i) The name virus was given by **Pasteur** (virus-venom or poisonous fluid). **DJ Ivanowsky** (1892) recognised certain microbes as causative organism of the mosaic disease of tobacco.

(ii) **MW Beijerinek** (1898) demonstrated that the extract of the injected plants of tobacco could cause infection in healty plants and called the fluid as *Contagium vivum fluidum* (infectious living fluid).

(iii) **WM Stanley** (1935) showed that viruses could be crystallised and crystals consist largely of proteins.

Size

Virus is a ultramicroscopic nucleoprotein entity. Size of virus ranges from about 10 nm (foot and mouth virus of cattle), 17 nm (alfalfa mosaic virus) to 1250 × 40 nm (beet yellow virus), TMV is 300 × 18.0 nm, 400 nm (parrot fever virus), 1300 × 6 nm (*Pseudomonas*).

Strucrture

A virus has mainly four parts

i. **Envelope**

It is the outer covering present in certian viruses. It is made protein of viral origin, lipid and carbohydrate of host. Spikes or outgrowths may or may not be present. Some common enveloped viruses are HIV, herpes virus, vaccinia virus.

ii. **Capsid**

It is a protein covering around the genetic material. Capsid has protein subunits called **capsomeres**. TMV has 1230 capsomeres. The capsomeres are arranged helically or in geometric forms.

iii. **Nucleoid**

It contains genetic material which is either DNA or RNA but never both. Most of the animal viruses have double-stranded DNA as genetic material, while majority of plant viruses have single-stranded RNA as genetic material.

iv. **Enzymes**

They are rarely present. Lysozyme is found in bacteriophages. In some RNA viruses called retroviruses, RNA polymerase, reverse transcriptase enzymes are present.

Classification

In viruses, genetic material is either DNA or RNA.

Based on the presence of DNA or RNA, viruses are divided in two main groups

i. **Deoxyvira or DNA viruses**

These are generally animal viruses with a few important ones having RNA. For example, rabies virus, polio virus, retroviruses including HIV or AIDS virus. The structurral form of deoxyvira are deoxyhelica, deoxycubica and deoxybinala.

ii. **Ribovira or RNA viruses**

These are generally platn viruses with a few containing DNA. For example, Cauliflower mosaic virus. The structural form of ribovira are ribobelica and ribocubica.

Types of Viruses

Viruses are classified by Holmes (1948) into three groups based on their host types

i. **Plants Viruses (Phytophagineae)**

These virus cause disease in plants. Examplex of plant viruses are Tobacco Virus (TMV), potato mosaic viruses, tomato leaf curl virus, etc,

ii. These viruses causes disease in humans.

For example, influenza virus, smallpox virus, poliomyelitis virus, hepatitis virus, mumps virus, rhino viruses.

iii. Bacterial viruses (Phaginear)

These are also known as bacteriophages and mainly infect lower organisms (phagineae bacteria). Bacteriophages were discovered by **Edward Twort** (1915) and **d' Herelle** (1917) independently. These are bacterial viruses.

For example, T_2, T_4, lambda, coliphages (bacteriophages of E.coli) cyanophages (blue-green algal, viruses, e.g., LPP-1, SM-1, N-1) phycophages (algal viruses), mycophages (fungal viruses), zymophages (mycophages of yeast).

The shape of bacteriophages is tadpole like consisting of a head (icosahadral) and a tail. **Head** has a protein cover or capsid. Internally, the head encloses a highly floded double-standed DNA (approx 50μ in length).

A connector is present in between the head and the tail. The connector contains a neck and a collar. **Coller** posses several whiskers. The **tail** is the norrow cylindrical part. It has central hollow core or tube through which viral DNA is injected into the host.

The core contains enzyme like lysozyme, etc. and is surrounded by sheath proteins (formed of 2000 capsomeres). The tail ends in a **basal plate** or end plate. The basal plate included tail pins and tailfibres (spikes) that are generally involved in attachement to the host cell.

Viruses multiply after entering into living cells. The two types of viral reproduction are lytic and lysogenic cycle.

Some Common Viral Diseases

Plant Viral Disease	**Animal Viral Disease**	**Human Viral Disease**
Tobacco Mosaic	Foot and mouth disease	Poliomyelitis
Potato Mosaic	Equine encephalitis Rinderpest	Rabies
Pumpkin Mosaic	Kysanur Forest Diesease (KFD) of monkeys	Mumps
Apple Mosaic		Measles
Wheat Mosaic Streak	Ranikhet disease of fowl	Chickenpox

Potato Leaf Roll	Dengue
Tobacco Leaf Curl	Encephalitis
Banana Bunchy Top	Common Flu
	Yellow fever
	Hepatitis
	AIDS

VIROIDS

Viroids (satellite RNA) and prions belong to this category.

To Diener (1971) discovered a new infectious agent that was smaller than viruses and caused potato spindle tuber disease, Citrus exocortis disease.

Viroids are small circular RNAs similar to viroids, but are located protein coat of a true. Virusoids require the assistance of virus for their replication.

Viroids are free RNA's devoid of nucleoprotein coat. The RNA has low molecular weight and is tightly folded into circular or linear single-stranded structure. While , prions are obligate parasites made of glycoproteins only. They are formed due to mutation in gene PRNP. Prions are not affected by proteases nucleases, temperature upto 800^0 C, UV radiations and formaldehyde.

These cause disease by accumulating in nervous tissue and cause its degeneration. Some common diseases caused by them are Scrapie of sheep, mad cow disease etc.