

Chapter 7

THE KINGDOM PROTISTA (OR PROTOCTISTA)

BASIC TERMS OF CHAPTER

Aquatic Eukaryotic Organisms: Those nucleated organisms which live in water.

Prokaryote: The non nucleated organisms.

Kingdom: The highest level in taxonomic ranks.

Protozoans: Unicellular eukaryotic organisms usually in aquatic habitat.

Algae: The eukaryotic aquatic plant like organisms in which sex organs are unicellular, commonly.

Slime Moulds: Slime moulds is a class of myxomycota, containing fungus like organisms which have naked protoplasm.

Evolutionary History: The history of genetic changes in populations over millions of years.

Endocytosis: The entry of particles or fluid into cells by diffusion or active transport across the membrane.

Symbiont: A partner of mutual beneficial association (i.e. in symbiosis).

Parasites: The organism which obtains food and shelter from another organism (host). (OR) "Organism living in (endoparasite) or on (ectoparasite) another organism".

Pellicle: A membrane surrounding the protoplast in some unicellular algae with cellulose cell wall (e.g. Euglena)

Conjugation: A form of sexual reproduction in which conjugating tube is developed between organism for exchange of genetic material.

Thallus: Leafless, rootless and stemless plant body.

Xanthophyll: The photosynthetic pigment acts as a primary light absorber in brown algae.

Hyphae: The basic, structural and functional unit of Fungi.

Blooms: A visible increase in the number of species in the plankton.

Malaria: A protozoan disease in which temperature rise up, headache, chilling & nausea occur.

African Sleeping Sickness: The disease, caused by *Trypanosoma*.

Amoebic Dysentery: The disease of intestinal disorder due to attack of *Entamoeba histolytica*.

Habitat: The area in which an organism lives. (OR) An address of an organism is called habitat.

Entangles prey: Means trapping of prey.

Zygote: Fertilized egg.

Phycoerythrin: *Red pigment* in red algae which absorbs dim blue – green light

Carotenoids: The accessory pigments in most photosynthetic cells. These are *yellow, orange* or *red* and *fat soluble*.

Autotrophs: Organisms which can synthesize their food from CO₂ & H₂O.

Heterotrophs: Organisms which cannot synthesize their food and **depend** on ready made food.

Hold Fast: A structure found on the base of algae for attachment.

Coral Animals: The members (polyps) of phylum coelenterata which secrete limestone.

Chitin: A polymer of cell wall of fungi which is contains *acetyl glucose – amine*.

Spore: An asexual unicellular reproductive unit.

Sporangium: A structure in which spores are formed.

Cytoskeleton: The thread like skeletons of micro filaments & microtubules in cytoplasm.

Chlorophyll: The Photosynthetic pigment which *absorbs red & blue – violet* light and *reflects green light*.






Kingdoms of Life	Representative Organisms	Organization	Type of Nutrition	Representative Organisms
Monera		Small, simple, single cell (sometimes chains or mats)	Absorb food (some photosynthesize)	Bacteria including cyanobacteria
Protista		Complex, single cell (sometimes chains or colonies)	Absorb, photosynthesize, or ingest food	Protozoans, algae, water molds
Fungi		Multicellular filamentous form with specialized complex cells	Absorb food	Molds and mushrooms
Plantae		Multicellular form with specialized complex cells	Photosynthesize food	Mosses, ferns, pine trees, woody and non-woody flowering plants
Animalia		Multicellular form with specialized complex cells	Ingest food	Worms, sponges, insects, fish, reptiles, amphibians, birds, and mammals

Fig. Classification of organisms.

- Q.1** (a) What are protists?
 (b) Write down the important features of kingdom protista.
 (c) What are the reasons for grouping simple eukaryotes into separate kingdom protista?

Ans. (a) **PROTISTS**

A vast variety of aquatic eukaryotes which has different structures, body forms, reproductive systems, type of nutrition and life styles, and evolved from prokaryotes are known as Protists:

Protozoans, Unicellular, Multicellular algae, Slime molds, Oomycetes.

(b) FEATURES OF KINGDOM PROTISTA:

- The members of kingdom protista are *Unicellular*, *colonial* and simple *multicellular*.
- Eukaryotic cell organization is found.
- There is *No Embryo* or *Blastula* stages in protists.
- Protists are *evolved from prokaryotes*.
- The Fungi, Plantae & Animalia kingdoms are evolved from protista.

(vi) The Kingdom protista contains following major groups:

- (a) *Unicellular Protozoans* (Animals Like Protists)
- (b) *Unicellular algae* (Plant Like Protists)
- (c) *Multicellular algae* (Plant like protists)
- (d) *Slime Moulds and Oomycetes* (Fungus Like Protists)

(c) REASONS OF SEPARATE KINGDOM:

(i) Vast Variety:

These are primarily *aquatic eukaryotic* organisms. In case of reproduction, nutrition, body forms and life style the protists are so much different to fungi, plants & animals. This vast variation becomes the reasons of an independent kingdom.

(ii) Evolution:

According to evolutionary point of view *all protists are evolved from prokaryotes*. Prokaryotes are placed in kingdom Monera. So protists are evolved from members of monera and other members of kingdom fungi; kingdom plantae and kingdom animalia are evolved from protists. ***Prokaryotes are ancestor of protists while protists are ancestors of plantae, Fungi and animalia.***

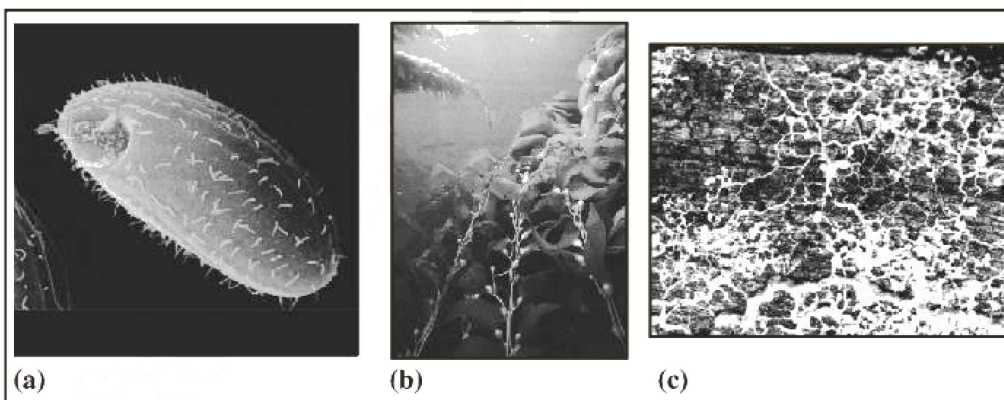


Fig. The kingdom protista includes such diverse species as (a) single celled ciliated protozoan, (b) giant brown algae (kelps) and (c) slime molds.

(iii) Twin Character of Euglena:

Some organisms like Euglena have strange characters. They have characters of plants and animals, (because presence of Chlorophyll and absence of cell wall). Is organism like Euglena has merit in plantae, animalia or fungi? Due to this reason a new kingdom was formed for the accommodation of these dual characteristics organisms.

Q.2 Write a note on historical perspective of protists.

Ans. **HISTORICAL PERSPECTIVE**

(i) **Proposal of J.Hogg: (1861):**

J. Hogg had proposed that kingdom protista is for Microscopic Organisms.

(ii) **Proposal of E.Haeckel (1866):**

He suggested the bacteria and other microorganism i.e. Euglena in kingdom protista. Beasue bacteria & Euglena etc. were not accommodated in plant or animal kingdom. However, Haeckel placed prokaryote i.e. bacteria & cyanobacteria in separate group as Monera. But he kept group monera within kingdom protista.

(iii) **Proposal of H.Copeland (1938):**

H. Copeland gave a separate kingdom status to prokaryotes.

(iv) **Five Kingdom System of R.Whittkar (1969):**

Whittkar was the person who introduced five kingdom system. *Monera, protista, Fungi, Plantae & animalia*. But he placed only Eukaryotes in kingdom protista.

(v) **Margulis & Shwartz's Modifications (1982):**

They modified the five kingdom system. Margulis & Schwart, added simple multicellular & colonial eukaryotes (with unicellular) in kingdom protista.

Q.3 (a) Why are protists polyphyletic?

(b) What type of diversity is found in protists?

Ans. (a) **DIFFERENT BASIS OF EVOLUTIONARY HISTORY**

(a) **Polyphyletic:**

A great diversity is found in the members of kingdom protista. According to narrow and deep point of view, all groups do not share a single common ancestor. Biologists believe protists are polyphyletic (Polyphyletic means based on different evolutionary history. Due to great variety, *Margulis & Schwartz classified the protists into 27 phyla* for the accommodation or adjustments of different organisms.

(b) **Diversity Among Protists:**

Protists show following diversity during the course of evolutionary history (Polyphyletic) in organisms:

- (i) Difference in *size & structure* (ii) Different *means of locomotion*

- (iii) Different types of **nutrition** (iv) **Interactions** with other organism
 (v) **Habitat** are different (vi) Different kinds of **Reproduction**.

Animal – Like Protists:

Sr. No.	Common Name	Form	Locomotion	Examples
1.	Zooflagellates	Unicellular some Colonial	One or more Flagella	<i>Trypanosoma</i> <i>Euglena</i>
2.	Amoebas	Unicellular, no definite shape	Pseudopods	<i>Amoeba</i> <i>Entamoeba</i>
3.	Actinopods	Unicellular	Pseudopods	<i>Radiolarians</i>
4.	Foraminifera	Unicellular	Pseudopods	<i>Forams</i>
5.	Apicomplexans	Unicellular	None	<i>Plasmodium</i>
6.	Ciliates	Unicellular	Cilia	<i>Paramecium</i> <i>Vorticella</i> , <i>Stentor</i> .

- Q.4** (a) *What do you know about animal like protists?*
 (b) *What are salient features of amoebas?*

Ans. (a) **PROTOZOA** (**ANIMAL LIKE PROTISTS**):

Protozoans are unicellular organisms. “Proto” means first Zoo means animals”. Organisms are surrounded by cell membrane/plasma membrane. In case of animals, cell membrane is outer most boundary of the cells. Ingestion (intake of food) occurs by endocytosis. Endocytosis means entry of solid or liquid particles into cell by diffusion or active transport across the membrane. Various types of locomotion occur in protozoa. They have 50,000 species. Animal like protists are divided into following 6 groups:

- (i) *Zooflagellates* (ii) *Amoebas* (iii) *Actinopods*.
 (iv) *Foraminifera* (v) *Apicomplexans* (vi) *Ciliates*

(b) (i) **Amoebas**

- These protozoans are *free living*.
- Body is *irregular*
- They reproduce by binary fission and multiple fission.

- These are *Fresh Water*, Marine & Soil living.
- Movement occurs by ***Pseudopodia***. ("*Pseudo*" means false and "*POD*" means foot.)

As Parasites: *Entamoeba histolytica* is human pathogen in intestine. It causes **human dysentery**.

Pseudopodia: These are irregular cytoplasmic projections by which Amoeba moves.

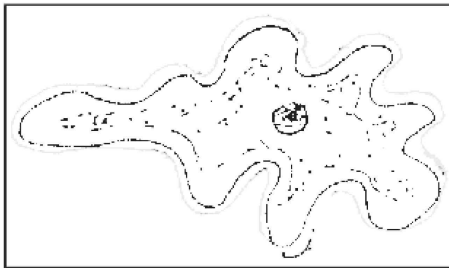


Fig. *Amoeba proteus*

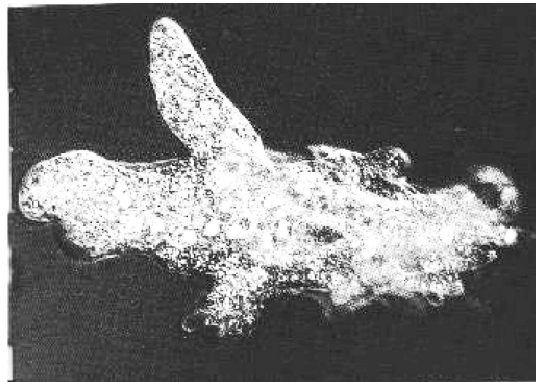


Fig. The flowing pseudopods of *Amoeba* constantly change shape as the organism moves and feeds.

Examples of Amoebas:

Amoeba proteus, *Entamoeba histolytica*, *pelomyxa palustris*.

Q.5 What do you know about Zooflagellates? Explain.

Ans. **ZOOFLAGELLATES**

- These are mostly *unicellular* and *few colonial*.
- Zooflagellates are *spherical or elongated*.
- They have single *central nucleus*.
- **Whip – like** Flagella may be one or many.
- Rapid movement is occurred by *flagella*.

Flagella are located on anterior end.

Ingestion: They obtain food from living organisms and/or dead organisms. They also absorb the nutrients from humus.

As Parasites: Different species of Trypanosomes are parasites of human being and animals. These are blood parasites. *Trypanosoma gambiense* causing *African Sleeping Sickness*. The biting of tsetse flies transmits pathogenic stage of *Trypanosoma*.

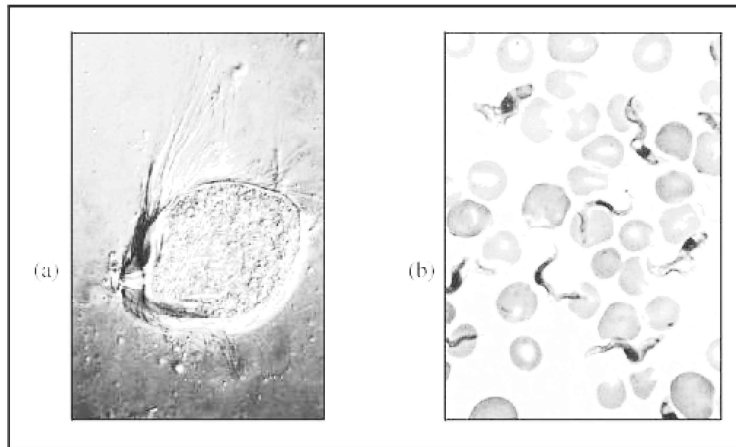


Fig. Zooflagellates (a) *Trichonympha* has hundreds of flagella
(b) *Trypanosoma* causes sleeping sickness

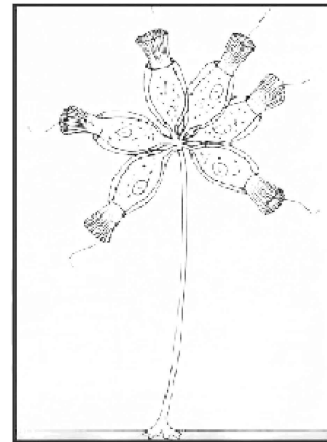
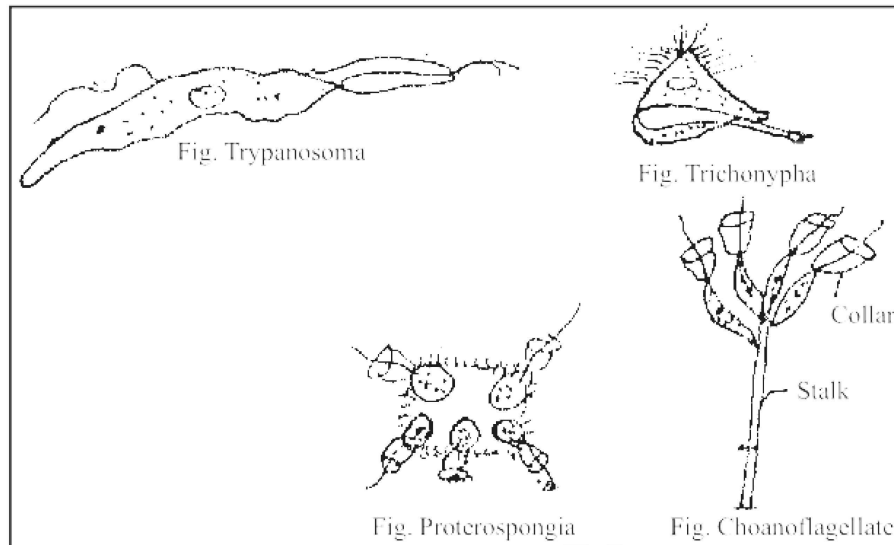


Fig. A colonial choanoflagellate

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As Symbiont: Many flagellated organisms like *Trichonympha* acts as symbiont in the guts of termites. They digest cellulose of termites & obtain food from hosts.

As Sessile: (Choanoflagellates) are non-motile. These are fresh water and marine attached. Flagellates with single flagella with collar are called choanoflagellates. They feed bacteria.

Q.6 Give the Salient Features of Ciliates.

Ans. CILIATES

Ciliates type protozoans have following characters:

- They are **unicellular, heterotrophs**.
- They possess **Cilia**. "The fine hair like structures which beat and help in locomotion and feeding".
- **Pellicle** is present as outer covering of ciliates. "A flexible & thin covering which surrounds the protoplast and gives the definite shape".
- **Micro & Macronucleus** are present with complex cell structure:
Macronucleus is polyploid. It controls **metabolic activities**.
Micronucleus is diploid. It controls **reproduction and formation of new macro nuclei during nuclear division**.
- **Contractile vacuoles** regulate the water in fresh water ciliates.
- **Ingestion of bacteria** & other protists takes place in the ciliates.

- *Sessile ciliated* are attached to rock surface. The cilia are used for feeding & drawing of water currents. e.g. *Stentor*.
- **Sexual** reproduction takes place by **Conjugation**.
- **Asexual** reproduction is occurred by **Binary Fission**.

Example: Paramecium and Stentor are common ciliates.

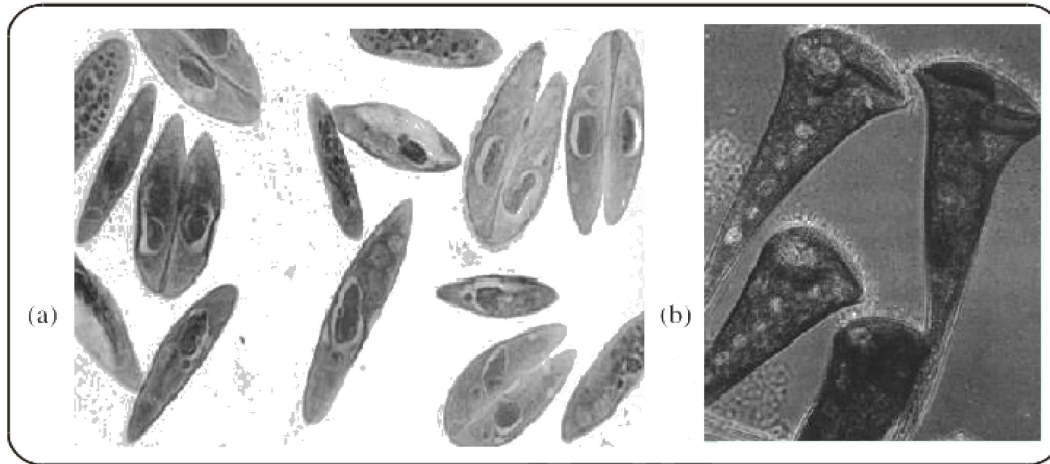


Fig. (a) *Paramecium*, conjugating individuals (b) *Stentor*, a sessile ciliate.

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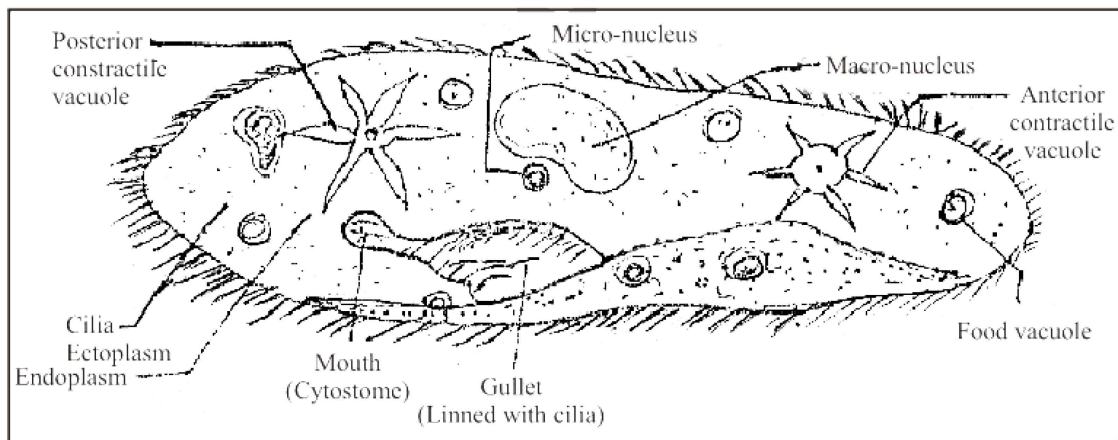


Fig. *Paramecium*

Q.7 Discuss Foraminiferans & Actinopods:

Ans. **FORAMINIFERANS & ACTINOPODS:**

- **Marine** Protozoans
- **Shells** (Tests) are – produced by foraminifera & Actinopods
Calcium shell is present in foraminifera cases.

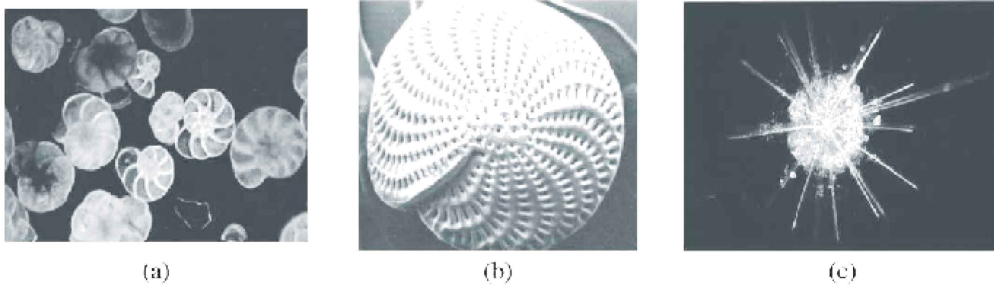


Fig. (a) Foraminiferan tests have (a) beautiful geometric patterns and (b) pores through which cytoplasmic projections are extended (c) Radiolarians are Actinopods with glassy shells.

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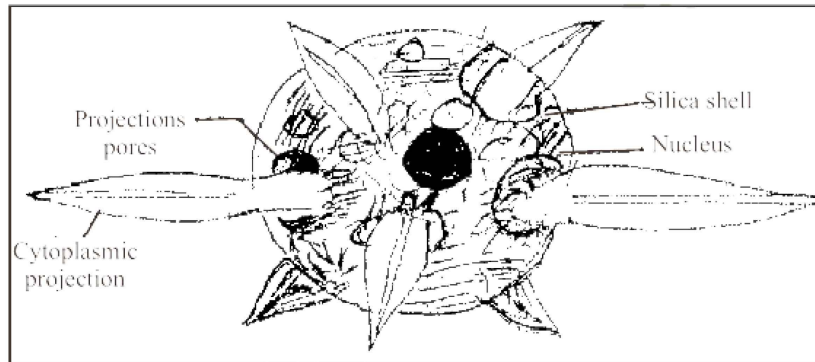


Fig. Radiolaria (Actinopod)

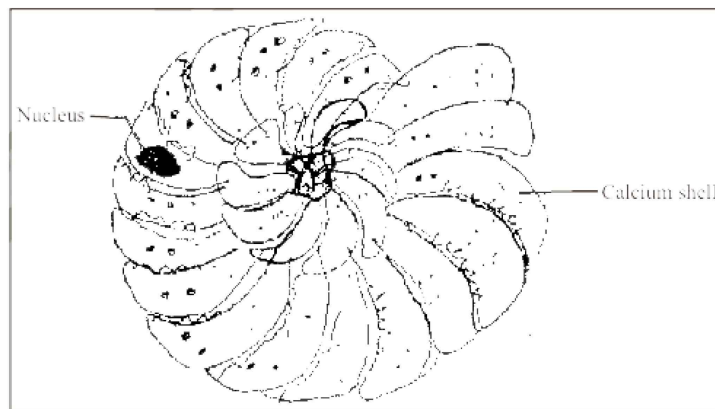


Fig. Foram

- **Pores** are present in shells through which cytoplasmic extensions or projections come out.

- **Entangling of prey** i.e. trapping of prey takes place by cytoplasmic projection.
- These **cytoplasmic projections** form a sticky, interconnected net which grip or entangles prey.
- **Limestone deposits** are created by foraminiferous in the past.
- Grey mud formation is gradually changed into chalk. This is formed by the sinking of dead foraminiferous in bottom of oceans.

Examples: Radiolarians & Actinopods.

Q.8 Write a note on apicomplexans of protozoans & discuss malarial parasite.

Ans. **APICOMPLEXANS** **PARASITIC GROUP:**

- There are parasitic protozoans.
- **Malaria** is caused by apicomplexans in man.
- No special locomotory structures are found in *apicomplexans*. They move by flexing. They have limited movement.
- **Spore production** is a salient feature of apicomplexans.

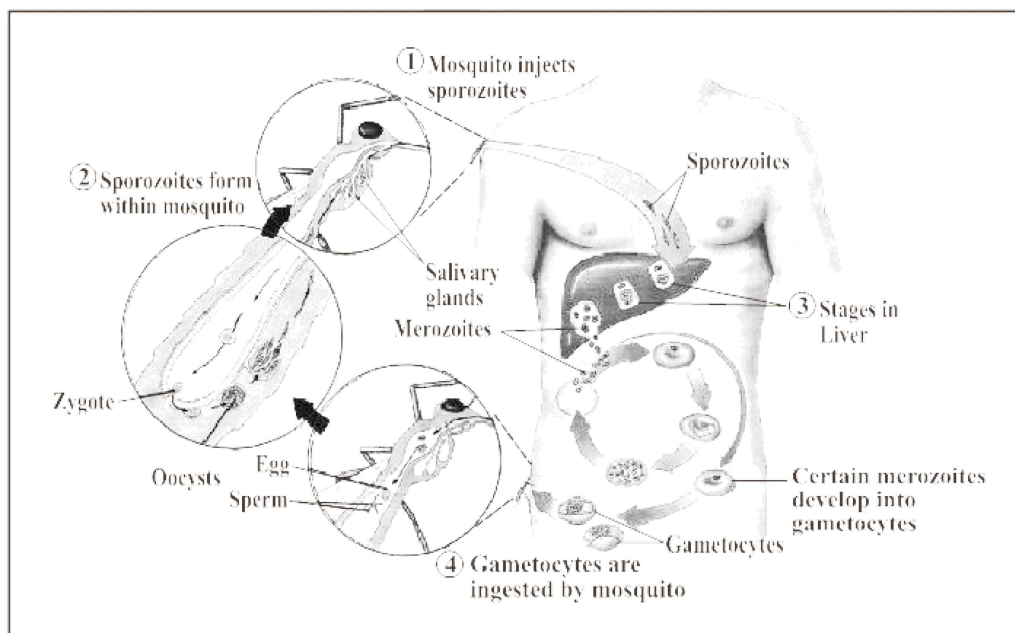


Fig. Life cycle of plasmodium

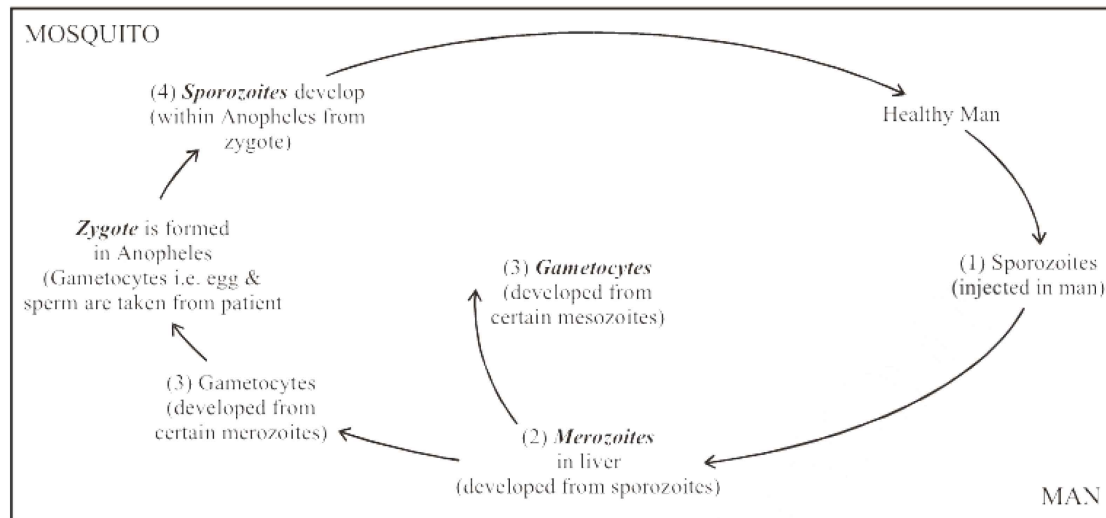
HELP LINE

Fig. The life cycle of the malarial parasite (*Plasmodium*)

Plasmodium falciparum is most widely distributed malarial parasite infecting man.

Female Anopheles (Mosquito) is a vector.

Spot is an immature form of plasmodium which is injected into the BLOOD of humans by mosquito.

Merozoites are formed in liver. From blood **sporozoites** enter into **liver**, stay unit in it & multiplied into large number of merozoites. After it, they enter into RBCs.

RBCs burst by the attack of **merozoites**.

Q.9 Write down general characters of plant like protists.

Ans. ALGAE (PLANT LIKE PROTISTS):

“The Eukaryotic unicellular, colonial and filamentous aquatic plants in which unicellular sex organs found are called algae”. The study of algae is called Phycology.

DISTRIBUTION

Fresh water: Algae are found in ponds, lakes, streams and hot springs.

Marine: Brown algae common in oceans.

Moist Soil/rocks/damp Places: Epiphytes, Endophytes etc.

SHAPE / STRUCTURE.FORM: Algae are unicellular; it is colonial. Multicellular forms are unbranched filamentous (Spirogyra), branched filaments (stigeoclonium), sheath like (Ulva). It may be in the form of leaf like extensions. These are uninucleated multinucleated etc.

SEX ORGANS:

Unicellular sex organs are found in algae. *No multicellular sex organs* are present like other plants.

PIGMENTS:

Chlorophyll a is found in all types of algae. *Chlorophyll b, c, & d* is present in algae. *Carotenes, fucoxanthin, phycoerythrin, phycocyanin & Xanthophylls* are common pigments.

CHLOROPLASTS: Ribbon & girdle shaped chloroplasts are found. These are also cup shaped, rod shaped & oval shaped chloroplast.

LOCOMOTION: Locomotion is generally found by flagella. Biflagellated & quadrofagellated cells are present. Some types are sessile too.

REPRODUCTION: Sexual reproduction is *isogamous, anisogamous* and *oogamous* is found. Asexual reproduction by spore & fragmentation is common.

LIFE CYCLES: *Isomorphic alternation of generation* is found (i.e. ULVA). There are separate sexual life cycles & asexual life cycles too.

COMMON NAMES: Green algae, brown algae, red algae, blue green algae, diatoms, dino-flagellates and euglenoides are common names.

PHYLA:

- | | |
|------------------|-------------------|
| (i) Chlorophyta | (v) Pyrophyta |
| (ii) Rhodophyta | (vi) Euglenophyta |
| (iii) Phaeophyta | are common phyla |
| (iv) Chrysophyta | |

THINKING & ROOM**EXAMPLES:**

<i>Spirogyra</i> , (filamentous)	<i>Firequilaria</i>
<i>Ulva</i> , (sheath like)	<i>Diatoms (unicellular)</i>
<i>Acetabularia</i> (unicellular)	<i>Ceratium</i>
<i>Chlorella</i> (non-motile unicellular)	<i>Gonyaula</i>
<i>Stigeoclonium</i> (branched filamentous)	<i>Euglena (unicellular)</i>
<i>Polysiphonia</i> (filamentous)	<i>Chlamydomonas (motile unicellular)</i>
<i>Chondrus</i>	<i>Laminaria (Thalloid)</i>
<i>Fucus</i> (Thalloid)	
<i>Macrocystis</i> (Thalloid)	
<i>Pinnularia</i>	

Phylum	Common name	Form	Locomotion	Pigments	Examples
Euglenophyta	Euglenoids	Unicellular	<i>Two flagella</i> one long one short	Chl.a, Chl.b Carotenoids	<i>Euglena</i>
Phyrrrophyta	Dinoflagellats	Unicellular	<i>Two flagella</i>	Chl.a, Chl.c Carotenes including Fucoxanthin	<i>Gonyaulax</i> <i>Ceratium</i>
Chrysophyta	Diatoms	Usually unicellular	Usually none	Chl.a, Chl.c Carotenes including Fucoxanthin	<i>Diatoma</i> , <i>Frequiaria</i> <i>Pinnularia</i>
Phaeophyta	Brown Algae	Multicellular	<i>Two flagella</i> on reproductive cells	Chl.a, Chl.c Carotenes including Fucoxanthin.	<i>Fucus</i> , <i>macrocystis</i>
Rhodophyta	Red algae	Multicellular or unicellular	None	Chl.a, carotenes Phycoerythrin	<i>Chondrus</i> <i>Polysiphonia</i>
Chlorophyta	Green algae	Unicellular, Colonial multicellular	Most have <i>flagella</i>	Chl. A, Chl.b, Carotenes	<i>Chlorella</i> , <i>Ulva</i> , <i>Acetabularia</i> <i>Spirogyra</i> .

Euglenoids

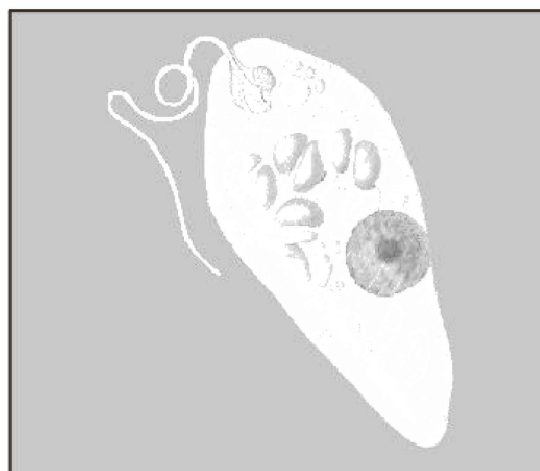
Euglenoids have been classified as a algae in plant kindom & as a protozoans of animal kindom.

Euglenoids are thought to be closely related to zooflagellates on the basis of molecular data.

Due to present of pigments, they resemble with plants. They behave like Autotrophs.

Like Autotroph:

Some Euglenoids lose their chlorophyll in dark condition. Then, they obtain their food like heterotrophs.



Like Heterotroph (Chl.a, b):

Some species of Euglenoids are always heterotrophs and colourless.

Euglenoids are very special (Autotroph) & animal (heterotroph). Due to this doubling, they have specific evolutionary importance.

Dinoflagellates Chl.a, c) (GRWO1)

Dinoflagellates are mostly *unicellular* & unusual protists. The cell are covered by *shells*. *Shells have interlocking of cellulose plate*. Cellulose plate have silicates in it.

In *marine* ecosystem, Dinoflagellates are *important* as *producers*. e.g., *Ceratium*.

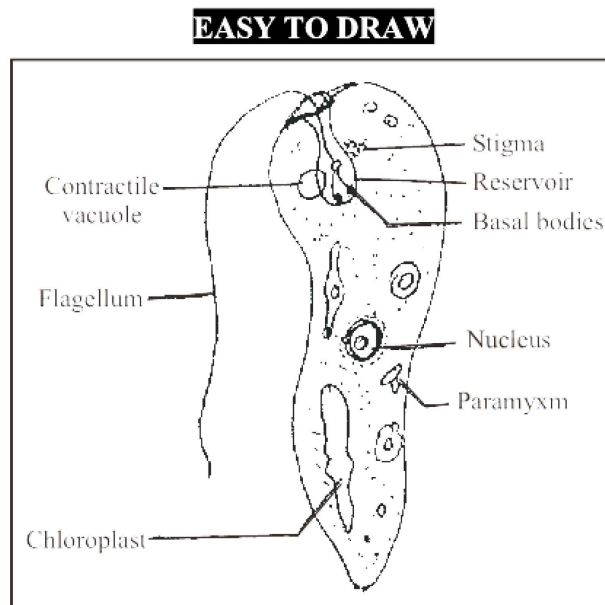


Fig. Euglenoids have special evolutionary significance as they resemble with plants and green algae in having similar pigments and, on the other hand, are also related to zooflagellates.

Ecosystem means environment with living & non-living links.
Producer means autotrophic i.e., food providing)

Dinoflagellates 'blooms' which may cause the water to become yellowish, redish or orange.

Some Dinoflagellates produce toxins in marine and become the reason of pollution as blooms.

Examples: *Gonyaulax* and *Ceratium* are common.

(ii) Diatoms (Chrysophyta) (Chl. a) (GRWO1)

"A group of non-flagellated algae in which unicellular & colonial members having silica shells (silica cell wall) divided into two overlapping.

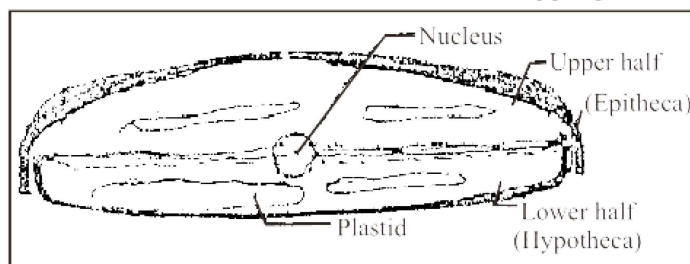


Fig. Pinnularia

General Characters:

- Diatoms are major producers (autotrophs) in *fresh water* and *marine* ecosystem.
- They are very important in food chain of aquatic ecosystem.
- They may be *radially symmetrical* (centro diatom) and *bilaterally symmetrical* (pinnate diatoms).
- Each diatom consists of two *silica under shells*. Two shells fit together like *petridish*. It is glass like material.

*Fig. Centric diatoms*

Examples: *Diatoms, Frequilaria, Pinnumeia* etc.

In short, Euglenoids, Dinoflagellates & Diatoms are plant-like protists, but these are unicellular. While other multicellular algae are Brown algae, Red algae & Green algae etc. *(see next question)

Q.10 Write an account on multicellular algae.

(OR)

Discuss multicellular plant-like protists.

(OR)

What are phaeophyta, Rhodophyta & Chlorophyta?

(OR)

Write notes on the multicellular algae like rhodophyta, phaeophyta and chlorophyta.

Ans. (i) **BROWN ALGAE** — **PHAEOPHYTA:**

“The marine algae including sea weeds and kelps with parenchymatous thallus, have chlorophyll a & c, carotene, xanthophylls & fucoxanthin pigments, are called brown algae”.

GENERAL FEATURES:

- **Habitat:**

They are commonly in cool marine water along rocky coastline in the intertidal zone.

- **Shape/form/structure:**

Brown algae is *multicellular*.

They have length up to **75 meters**.

The largest brown algae is called **kelp**.

They tough & leathery.

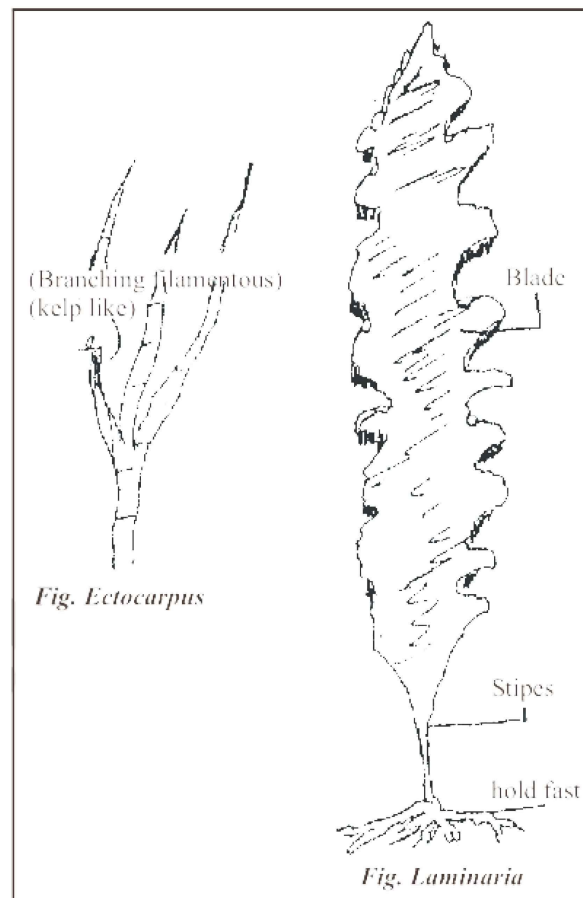
They have **parenchymatous** body:

Leaf like ——— BLADES

Stem like ——— STIPES

Root like ——— HOLD FASTS

Examples: *Ectocarpus* (Branching filamentous), *Laminaria* (Kelp like) and *Fucus* *Macrocystis* etc.



RED ALGAE (RHODOPHYTA):

“The non flagellate usually thalloid algae contain phycoerythrin and phycocyanin pigments and have red colour called red algae”.

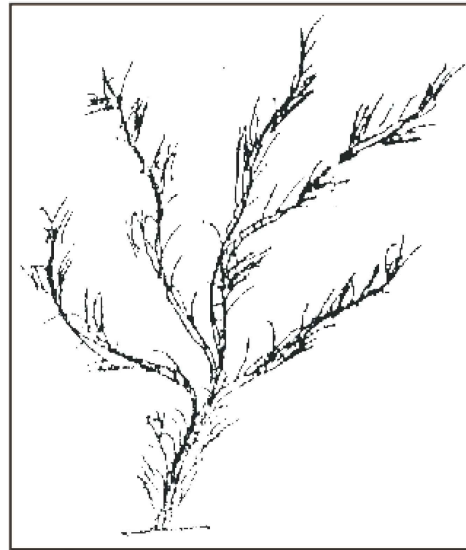
General Characteristics

- They are **multicellular**. Body commonly composed of **interwoven filaments**.
- They are mostly marine organisms.
- Many red algae precipitate (secrete) **calcium carbonates** on their walls. So they become calcae.
- They are important in **reef formations**.
- Marine red algae are beautiful with delicate and **feathery structures**.

Examples:

Chondrus

Polysiphonia

*Fig. Polysiphonia***GREEN ALGAE (CHLOROPHYTA):**

“They commonly fresh water & moist terrestrial group in which reserve – food material is starch & cell wall is formed by cellulose and chlorophyll –a chlorophyll –b are present, it is green algae”.

DISTINGUISH FEATURES

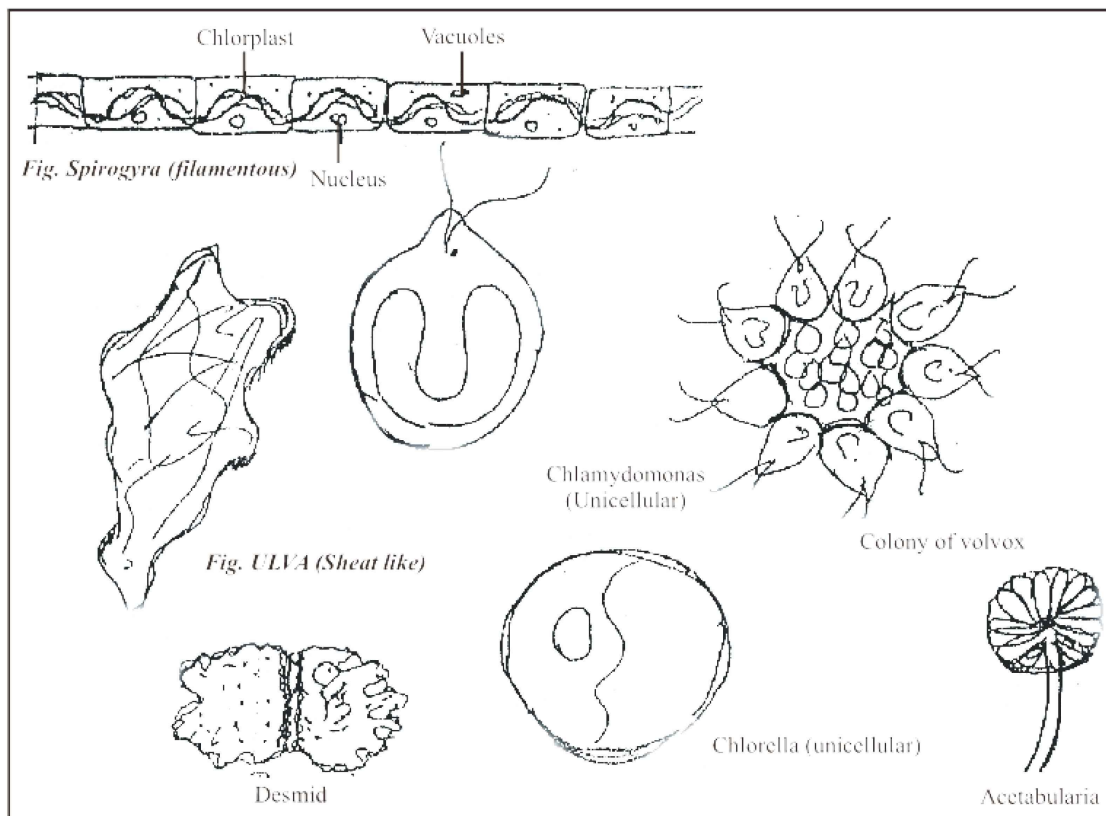
- * **Plant like Characteristics:** They resemble the plants (more than other algae) due to presence of cellulose cell wall & starch as a reserve food material.
- * **Pigments:** They contain chlorophyll a & b, xanthophylls & carotenes.
- * **Reproduction:** Algae have wide range of sexual & asexual reproductions methods.
- * **Habit:** They have unicellular, multicellular, branched filament, un-branched filaments forms.
- * **Habitat:** This green pigmented algae commonly found in fresh water & moist terrestrial habitats.
- * **Evolutionary Importance:**
 - (i) Green algae is considered as **ancestors of plants**.
 - (ii) The sequence of RNA shows **monophyletic lineage** of green algae & plants.

Examples:

Chlorella ————— (Unicellular)

Ulva ————— (Sheat like)

Spirogyra	_____	(Unbranched filament)
Stigeoclonium	_____	(Branched filament)
Acetabularia	_____	(Unicellular macroscopic)

EASY TO DRAW

Q.11 What are specific characters of green algae which show it as ancestor of green plants? (OR)

Green Algae considered ancestral organisms of green land plants, discuss.

Ans. Following characters of green algae show evidences of evolutionary traces of green plants:

- Similar pigmentation
- Starch as a reserve food material.
- Cellulose forms cell wall.
- RNA shows same sequences.

ECONOMIC IMPORTANCE OF ALGAE

Useful Aspects:

Human Food: Laminaria is used as food. In Japan & China, it is commonly used, vitamins A, C, D, & E are obtained from algae.

Cattle Food: Sea weed are used for animals. In past sea weeds were used for cow & horses. Macrocytis is used for poultry.

Producer in Ecosystems: In aquatic ecosystem, algae provide food to aquatic animals. It behaves as producer in food chain. It is considered as basic food

Examples: Diatoms & Euglena etc.

Role in O₂ Supply: Algae is autotroph. During photosynthesis O₂ is released from algae. This O₂ is used for aquatic animal.

Antiseptic Role: Algae is used in medicines. Chlorella is used for synthesis of antibiotic *chlorellin*. Agar is useful for stomach diseases.

Source of Algin, Agar & Carageenan: Fucus sp., Laminaria & Macrocytis etc., are source of algin, agar & carra – geenan. Gelidium is a big source of agar.

Experimental Organisms: These are used for study of genetics and other physiological processes.

HARMFUL EFFECTS:

In some places it acts as *pollutants*. Sometimes it becomes the reason of closing of pipes.

Q.12 (a) Write down the salient features of Fungus – like – protists.
(b) Discuss characters of slime moulds & water moulds:

Ans. **FUNGUS LIKE PROTISTS**

“Those organisms which are not photosynthetic and have thread like hyphae but possess centrioles and cell wall of cellulose are called fungus like protists”.

These Protists are divided into:

- (i) Myxomycota – or *slime moulds*.
- (ii) Oomycetes – or *water moulds*.

GENERAL CHARACTERS OF FUNGUS LIKE PROTISTS:

They are *non photosynthetic*, and having *hyphae* as a basic structural and functional units. “Hyphae are thread like structures which are basic structural & functional units of fungi”. So these heterotrophic & hyphal character similar to fungi.

Non-Fungal Features:

Centroiles are present in these protists.

Cell wall is made up of *cellulose*.

While true fungi lack centroiles & cell wall is made up of chitin.

Ans. (a) Slime Moulds or Myxomycete:

- These protests are also called *Plasmiodial Slime*.
- The vegetative phase (feeding stage) of these organisms is known as the *Plasmodium*.
- Plasmodium is multinucleated & free living *mass of protoplasm*.
- They can grow to 30cm or 1 ft in diameter.
- Plasmodial stage is frequently overlooked. It occurs on grass, decaying leaves (litter), wood & soil in moist, dark situations.
- Visible mass forms *channel network* which cover surface area.
- The protoplasm ingests (intake of food) bacteria, yeasts, spores & decaying organic matter.
- After prolonged vegetative phase the plasmodium enters the reproductive phase and it occurs in unfavourable condition.
- *Resistant haploid spores* are formed by meiosis in sporangia. *Sporangia* are sac like spore box which have stalks.
- Again, in favourable condition, spores germinate into biflagellated or amoeboid reproductive swarm cells.
- These cells are irregular, uninucleated & motile they form diploid zygote after fusion. Then zygote produces multinucleate plasmodium by mitosis. Each nucleus is diploid.
- *Physarium polycephalum* is a plasmodial slime mold.

It is a model organism for the study of processes as experimental level. It provides knowledge of growth, cytoskeleton, differentiation and cytoplasmic streaming.

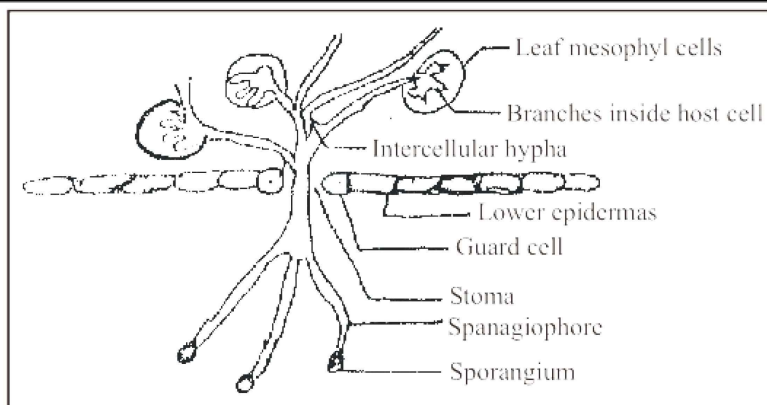
(b) Water moulds or Oomycetes:

Water moulds are closely resemble to fungi due to presence of hyphae. Hyphae are *aseptate*. Aseptate means no cross walls.

A group of hyphae is called **mycelium**. They are commonly **pathogens**.

No chitin is found in cell walls but cellulose is present.

Example: *Phytophthora infestans* is disease causing organism of potatoes. The disease of potato is called late blight.



In Ireland, the multiplication of water H_2O molds was increased during 1840. This was due to several rain, cool summer. The increase of water molds became the reasons of *blight of potatoes*. *Rotting of potatoes* was due to attack of *late blight disease*.

Starvation took place, and more than 1 million people died. Due to shortage of diet, they migrated to south countries as USA.

HELP LINE

FILAMENT means row of cells.

FROND means leaf like structure.

CELL WALL means external layer of protoplast of plant cells.

PIGMENTS means light absorber molecules.

CHLOROPHYLL is photosynthetic pigment.

PROTIST means organism without multi-cellular sex organ.

ALGAE means autotrophs without multi-cellular sex organs.

ANIMAL means heterotroph with multi-cellular sex organ.

FUNGI means heterotrophs with cell walls of chitin.

SPORANGIUM means spore box.

SPORE means unicellular asexual reproductive unit.

SKELETON means frame work of body.

HABIT means form and structure.

HABITAT means living area.

ITEMS FOR SPECIAL ATTENTION