

EXTENSIVE QUESTIONS

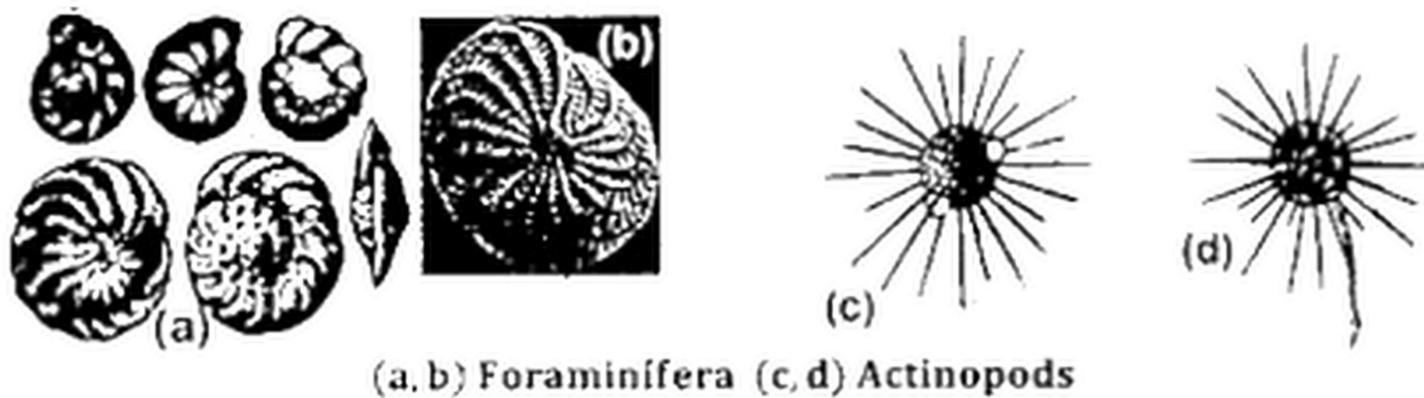
14. Explain protists as a diverse group of eukaryotes.

Ans: Protozoa: The Animal like Protists:

The name protozoa comes from the Latin word meaning “**first animals**” (sing protozoon). The term protozoa is used today to designate an informal group of protists that ingest food. Protozoa are polyphyletic group.

Mode of life:

Protozoans are mostly aquatic, **freshwater**, e.g. *Amoeba*, *Paramecium*, **Parasitic** e.g. *Plasmodium*, *Entamoeba histolytica*. Some are marine, e.g. Actinopods.



Cell morphology:

Body of the protozoan is a single mass of cytoplasm and consists of one cell containing all the structures of a typical cell.

Protozoans have organelles called **vacuoles** to perform special function. Their food is digested inside **food vacuoles**. Freshwater protozoans

have **contractile vacuoles** for the elimination of water. Some protozoans have **shell**, e.g. Foraminifera.

Reproduction:

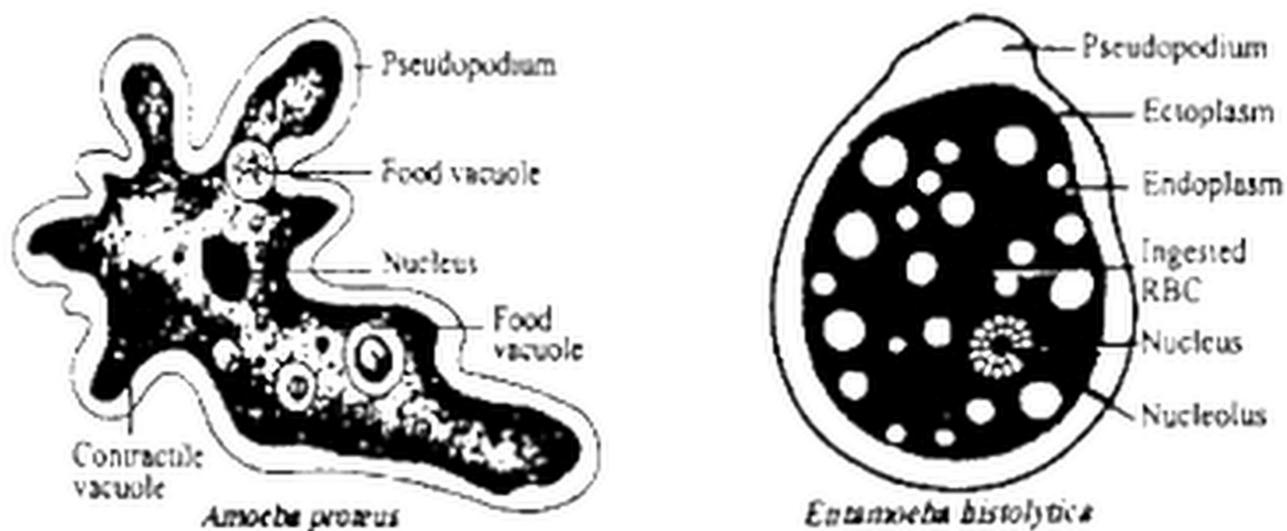
Reproduction takes place by asexual and sexual method.

Locomotion:

The organs of locomotion are pseudopodia, e.g. *Amoeba*, cilia, e.g. *Paramecium*, flagella, e.g. *Trypanosoma*, the parasitic protozoans do not have any specific means of locomotion, e.g. *Plasmodium* (malarial parasite).

Regeneration:

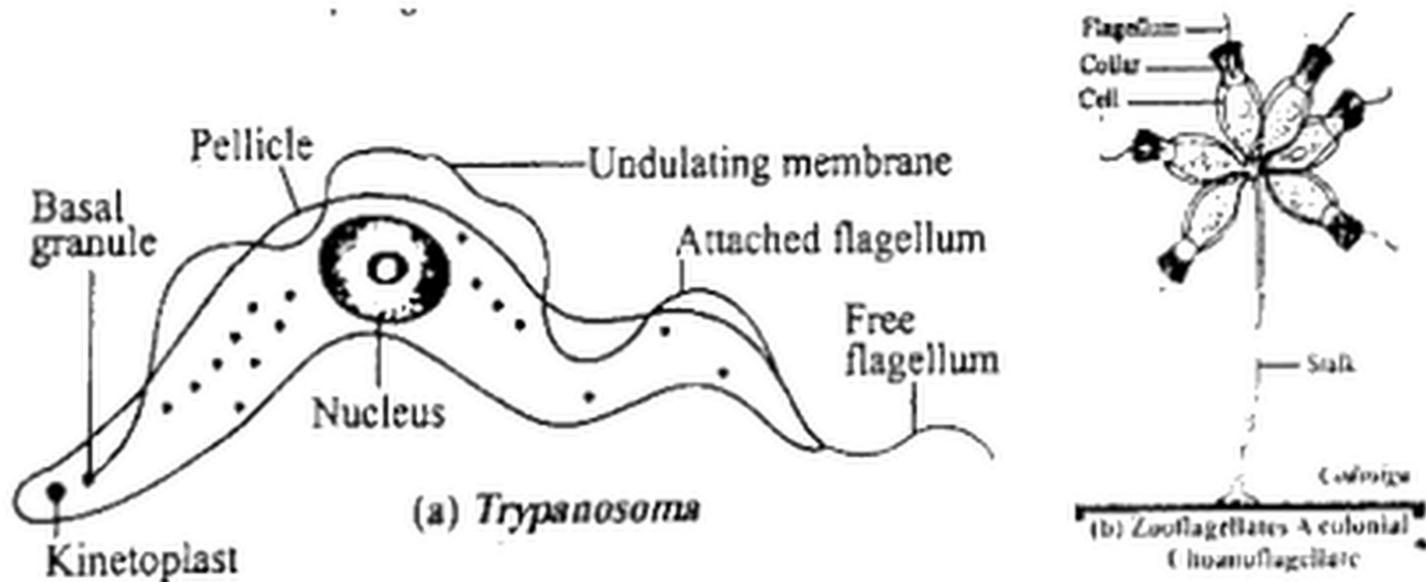
Regeneration is common in protozoans. Protozoans form resistant cyst to overcome unfavorable conditions. Amoebas move and feed with the help of pseudopodia, e.g. *Amoeba proteus*, *Entamoeba histolytica*.



Zooflagellates:

Protozoans that move by means of flagella are called **zooflagellates**. *Trypanosoma* is a human parasitic flagellate.

Choanoflagellate is marine or freshwater flagellate. It is sessile and remains attached by a stalk. Flagellum is surrounded by a delicate collar which resembles the collar cell of sponges.



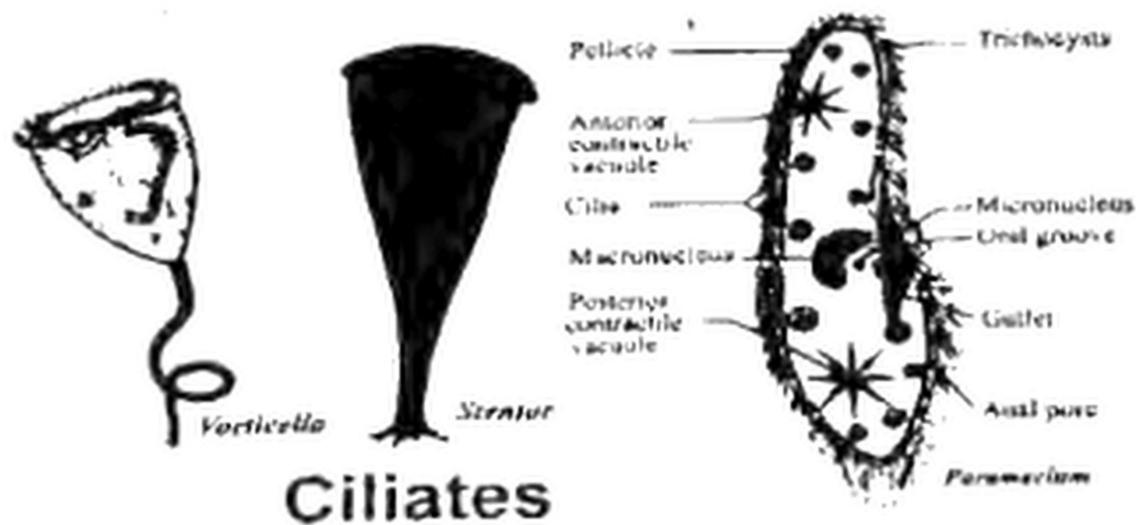
Ciliates: Ciliates have hair like extensions called cilia, e.g. *Paramecium*.

Protozoans with shells:

Foraminifera and Actinopods are marine protozoans. They produce tests or shells. In actinopods shells are made up of silica.

Apicomplexans:

Apicomplexans is a large group of parasitic protozoa. Some cause diseases in man, e.g. *Plasmodium* (malarial parasite).



Algae: The Plant like Protists:

Occurrence:

Algae (singular: *alga*) are found in ocean, freshwater ponds, lakes, streams, hot springs, polar ice, moist soil, trees and rocks.

Cell morphology and organization:

Algae may be unicellular, filamentous or multicellular. Filaments are composed of multicellular structures, with distinct cells or lack cross-walls (coenocytes). In multicellular algae **e.g. sea weeds**, the body is branched or leaf-like called thallus.

Pigment composition:

The photosynthetic pigments found in algae are *chlorophyll "a"* yellow and orange carotenoid, xanthophyll and phycoerythrin.

Variation in Algal life cycle:

Algal life cycle shows extreme variations. All algae except the red algae (Phylum Rhodophyta) have forms with flagellated motile cells in at least one stage of their life cycle.

Peculiar nature:

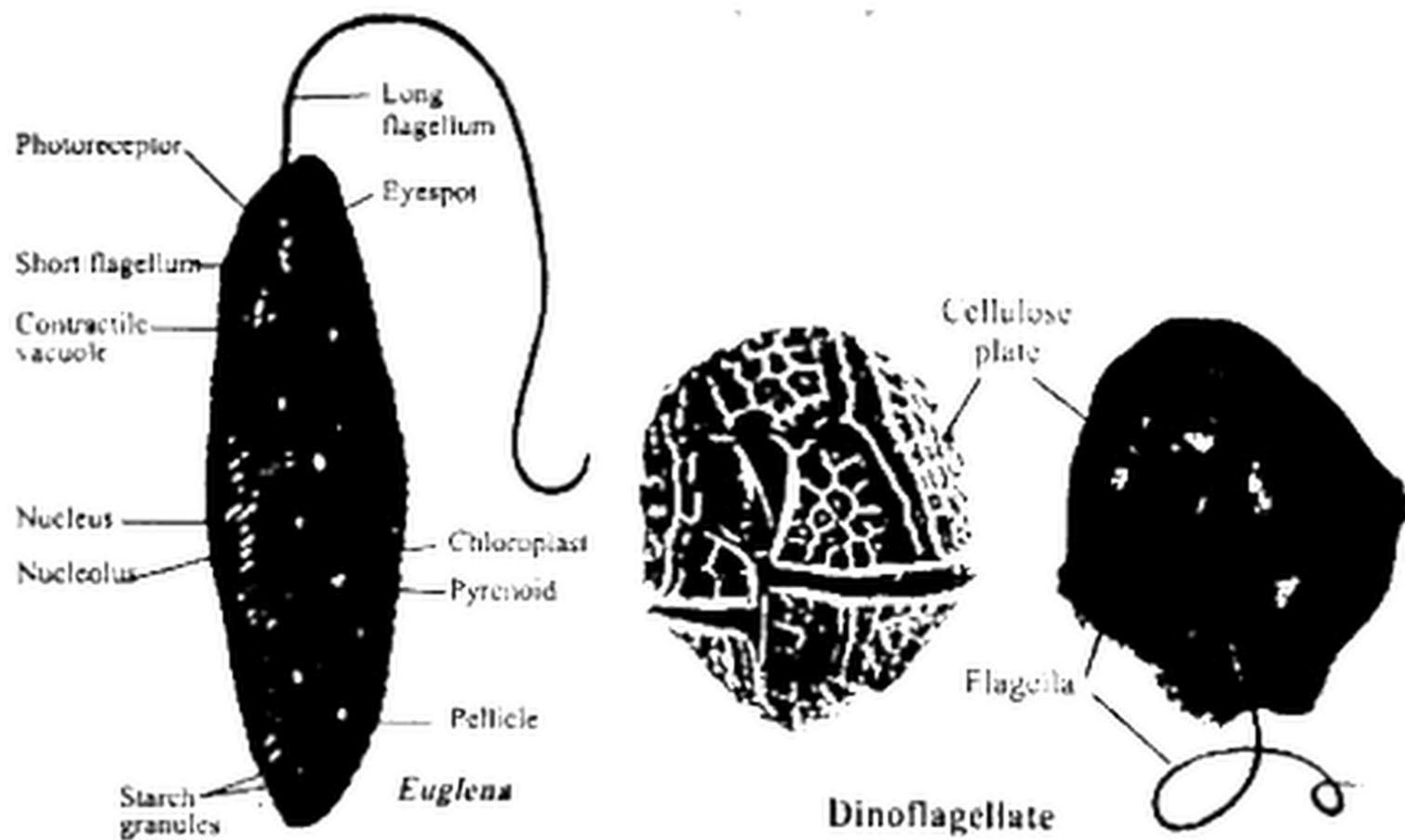
Algae differ from the plants in this respect that the sex organs in algae are unicellular, the zygote is not protected by the parent body and embryo is not formed.

Classification:**Euglenoids:**

Euglenoids are small freshwater organisms, e.g. *Euglena*.

Dinoflagellates:

Dinoflagellates vary in colour from yellow, green to brown.

**Diatoms:**

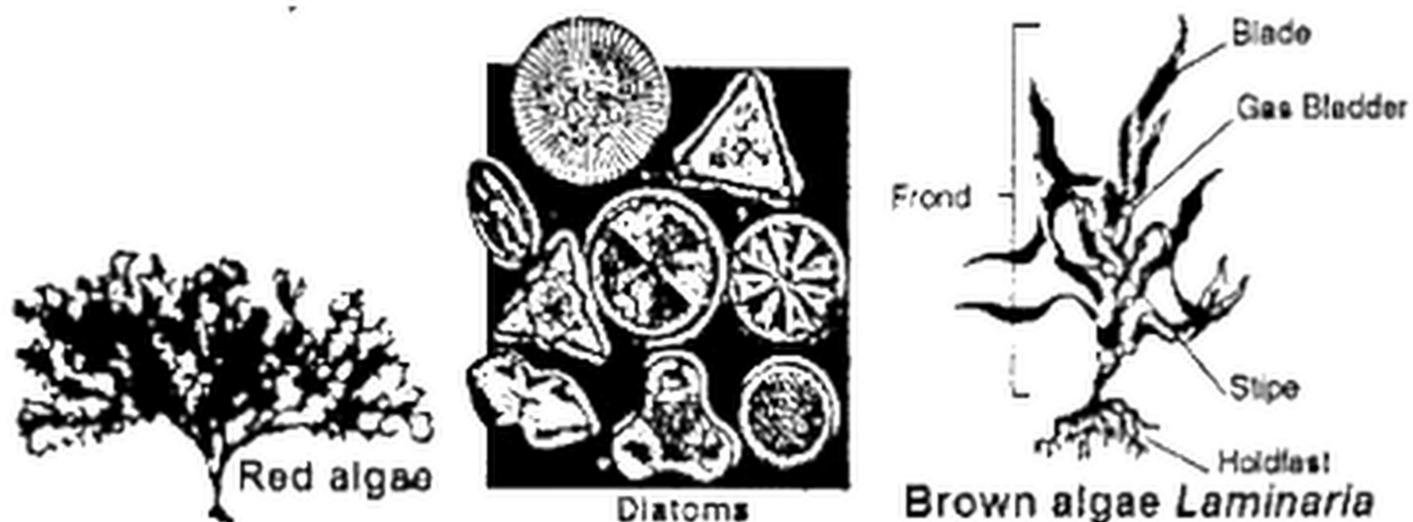
Diatoms are the most numerous unicellular algae in the oceans. They are also plentiful in freshwater. The cell wall has two halves, with the larger halves acting as a "lid" for the smaller half.

Brown algae:

Brown algae range from small forms with simple filaments to large multicellular forms up to 75 meter in length, live in cooler marine water. The large brown algae are called **kelps**.

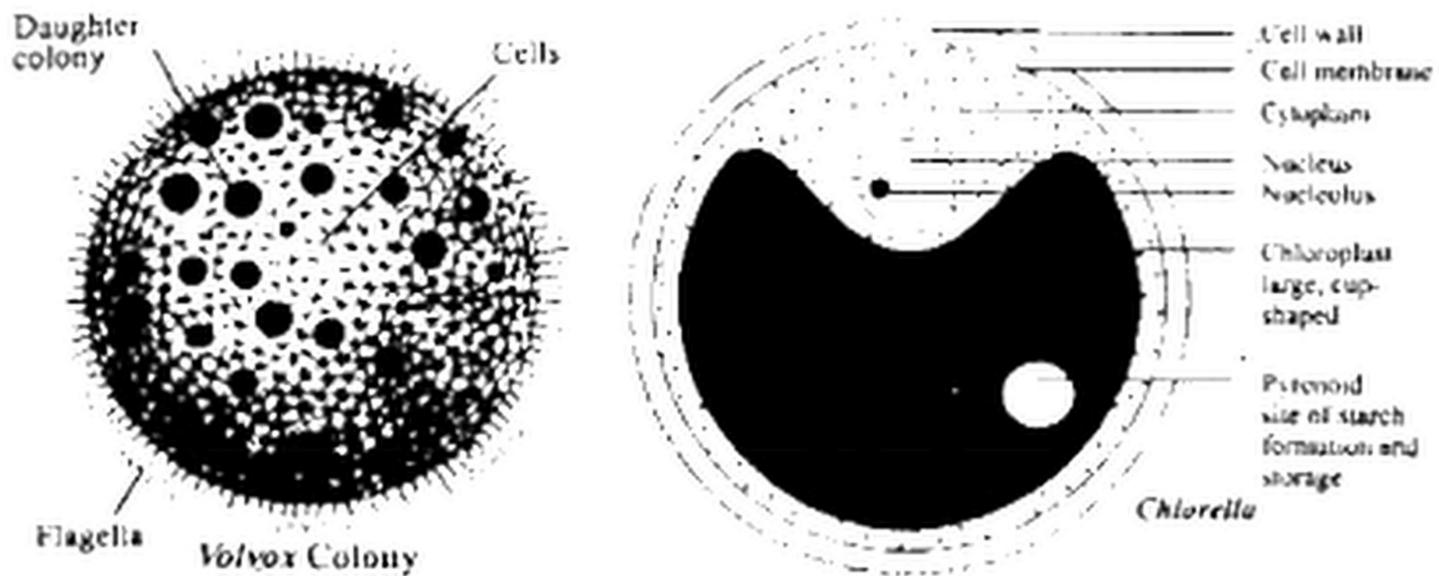
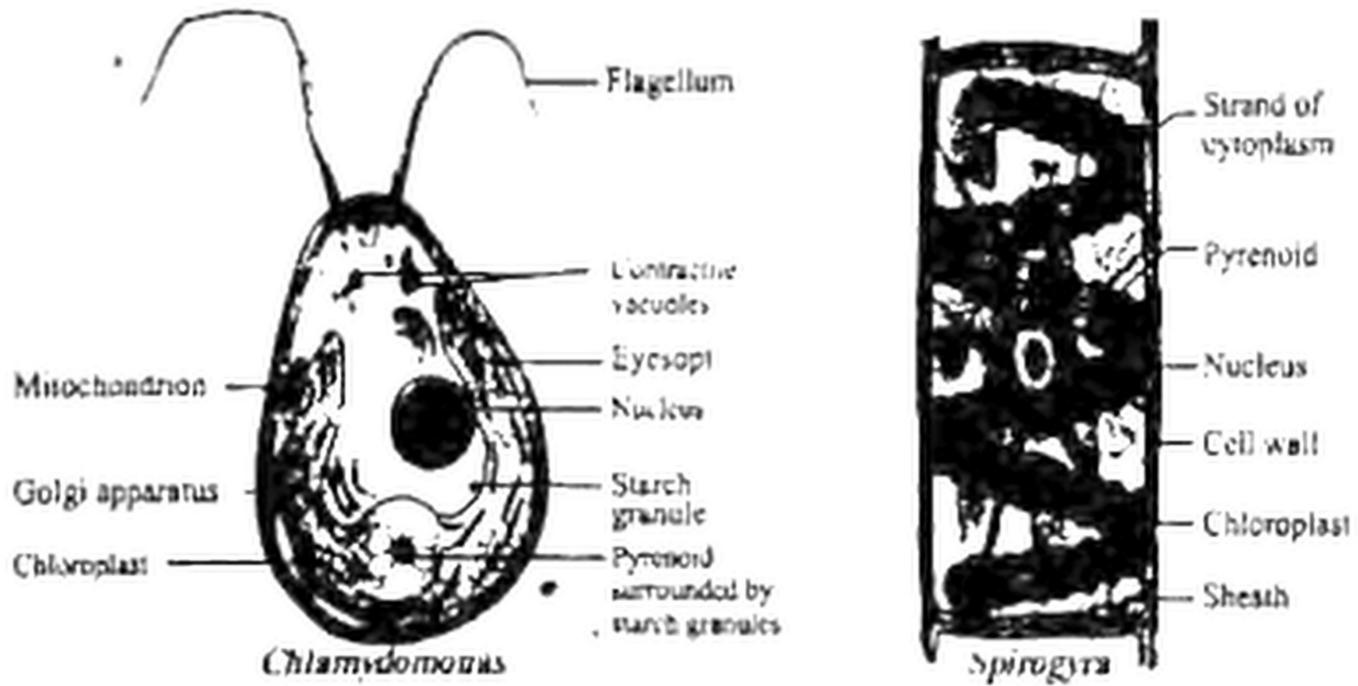
Red algae:

Red algae are multicellular present chiefly in warmer seawater growing both shallow and deep waters. They can be up to a meter long attached to rocks or other substances by a basal holdfast.



Green Algae:

Green algae (*al-ji*) live in the ocean but are more likely found in freshwater and can even be found on land, e.g. *Chlamydomonas*, *Spirogyra*, *Volvox*, *Chlorella*, *Ulva*.



Fungi like protists: Myxomycota and Oomycota:

Myxomycota: Slime Molds:

Usually **plasmodial slime molds** exist as a **Plasmodium**. It is a diploid multinucleated cytoplasmic mass enveloped by slime sheath.

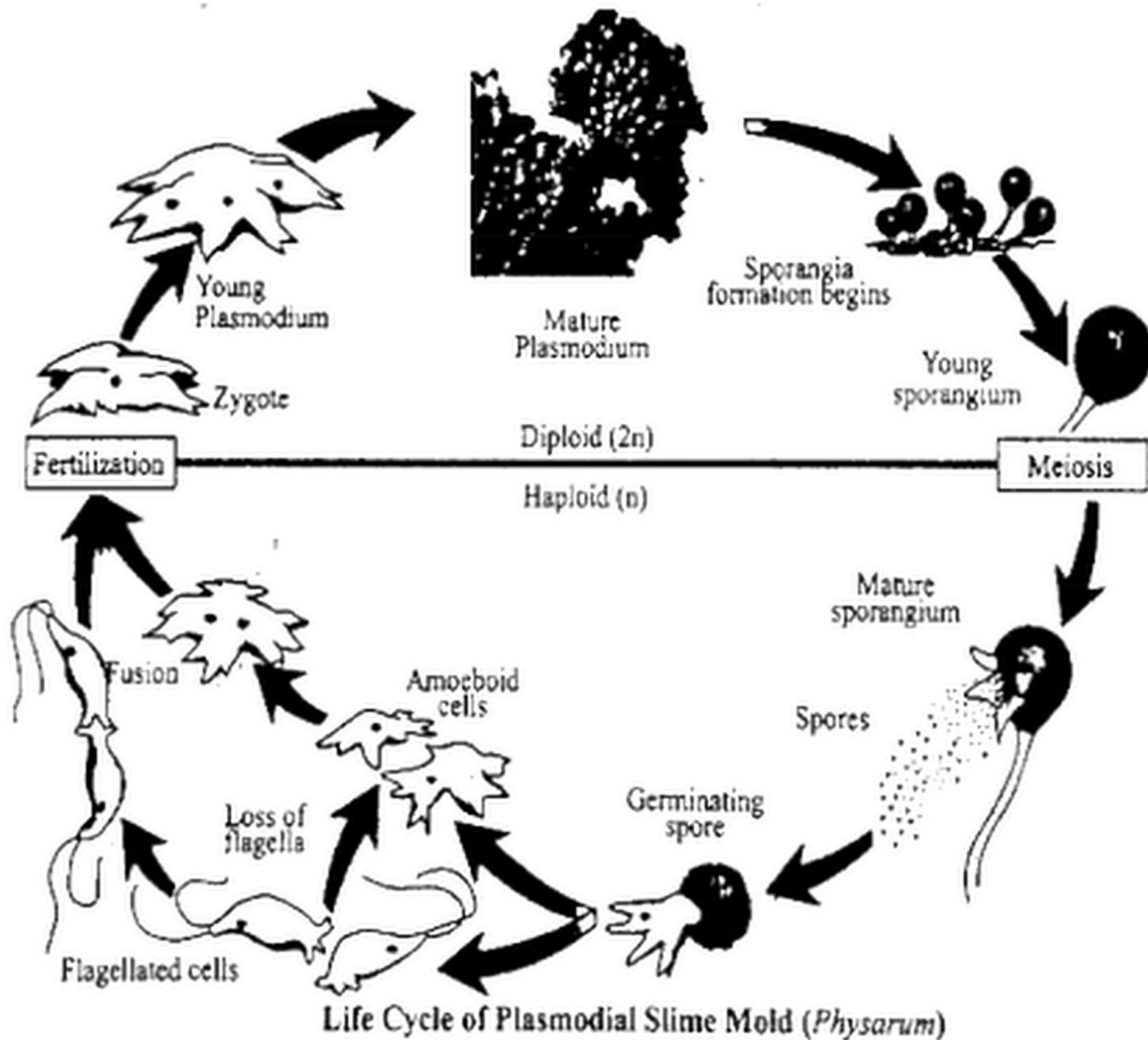
Characteristics:

Characteristics of slime molds are interesting to biologists because the life cycle involves many changes in form. These different forms resemble other types of protists.

Life cycle:

At times unfavourable to growth, such as during drought the Plasmodium develops many sporangia. A sporangium (Gk. *Spora*, seed, and *angeion*, vessel) is a reproductive structure that produces spores by meiosis.

In **plasmodial slime molds**, spores release a haploid flagellated cell or an **amoeboid cell**. Eventually two of them fuse to form a diploid zygote that feeds and grows, producing a multinucleated Plasmodium once again.



Oomycota: The Water Molds:

Oomycotes include water molds, white rusts and downy mildews.

Characteristics:

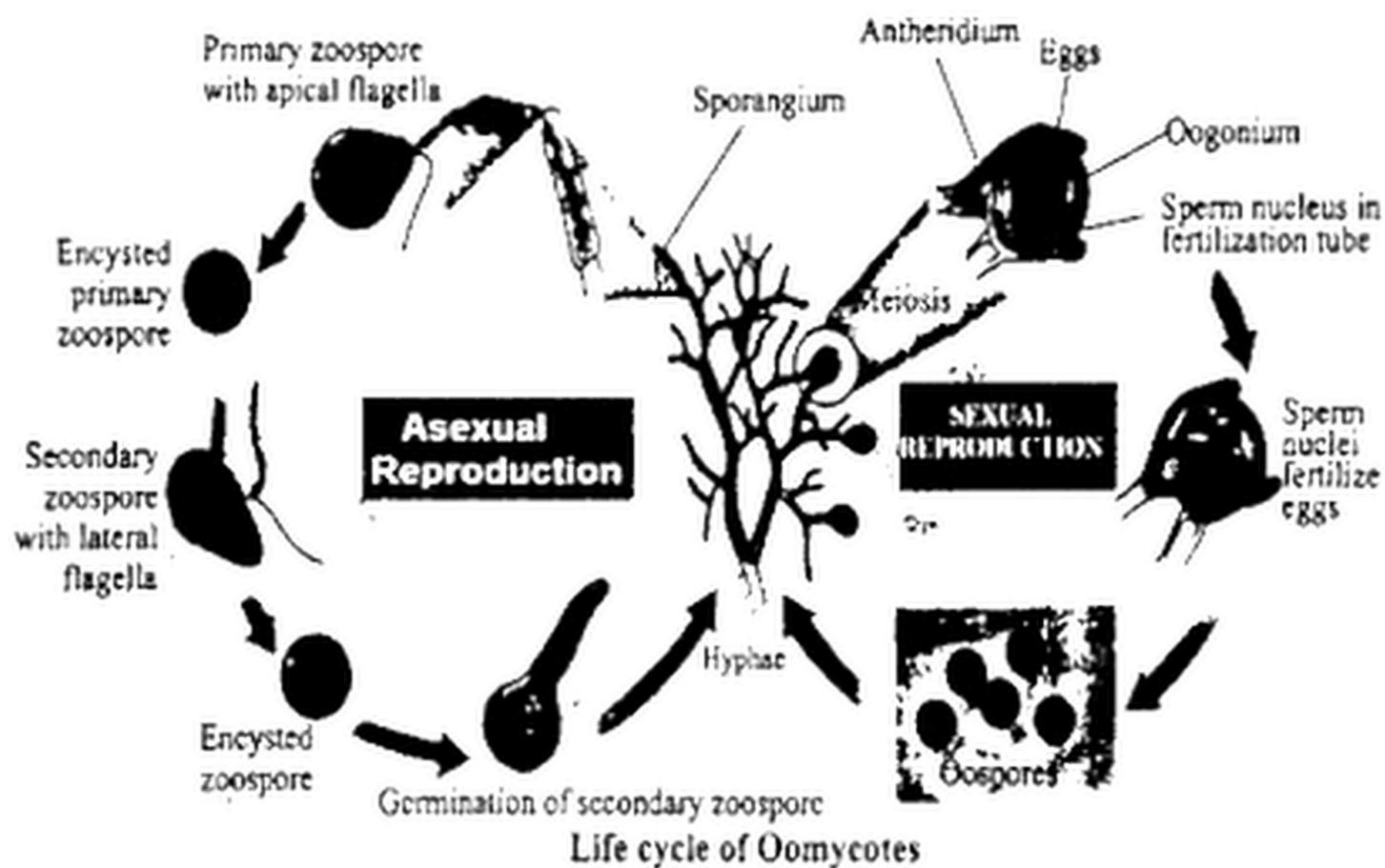
- (i) All of the members of the group are either parasites or saprotrophs.
- (ii) The cell wall contains cellulose, not chitin like fungi.
- (iii) Their life cycles are characterized by gametic meiosis resulting in diploid phase.
- (iv) The filamentous structures are called hyphae as in fungi. The hyphae are aseptate, i.e., without intercellular cell wall.

- (v) Most oomycetes live in freshwater or saltwater or in soil. Some are plant parasites. A few aquatic oomycetes are animal parasites.

Life cycle:

Zoospores are motile and have two flagella. Zoospores are produced asexually in sporangium. For sexual reproduction there are two types of **gametangia**. The female **gametangium** is called **oogonium** and the male gametangium is called an **antheridium**.

The flowing of the contents of an antheridium leads to the individual fusion of one or more pairs of male nuclei with eggs. This produces a special kind of thick walled cell called an **oospore**. This structure gives the phylum its name, i.e. phylum oomycota, e.g. *Phytophthora infestans*.



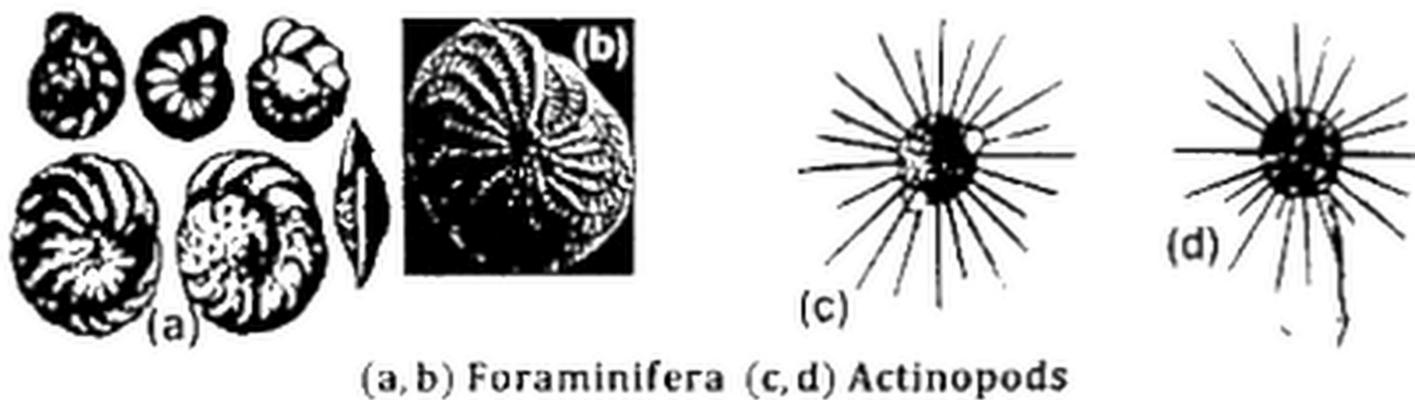
15. Explain the salient features of the protists Protozoa and give examples.

Ans: Protozoa: The Animal like Protists:

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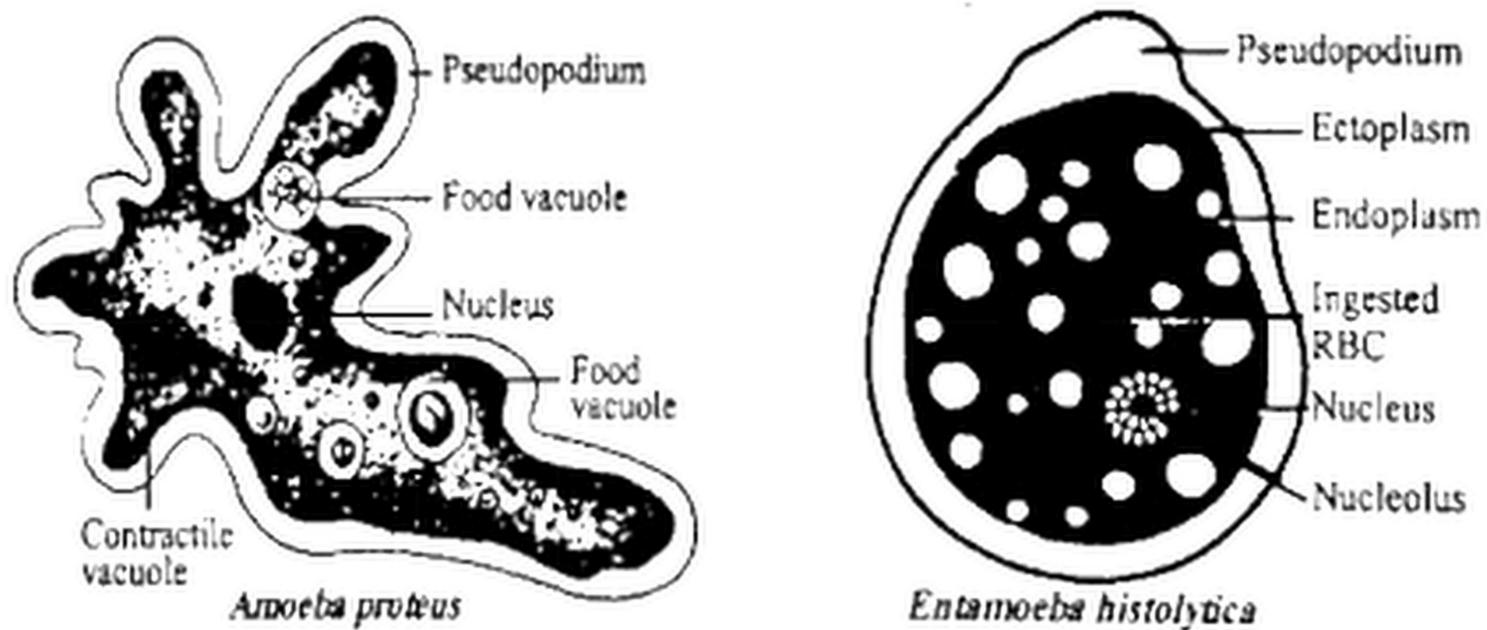
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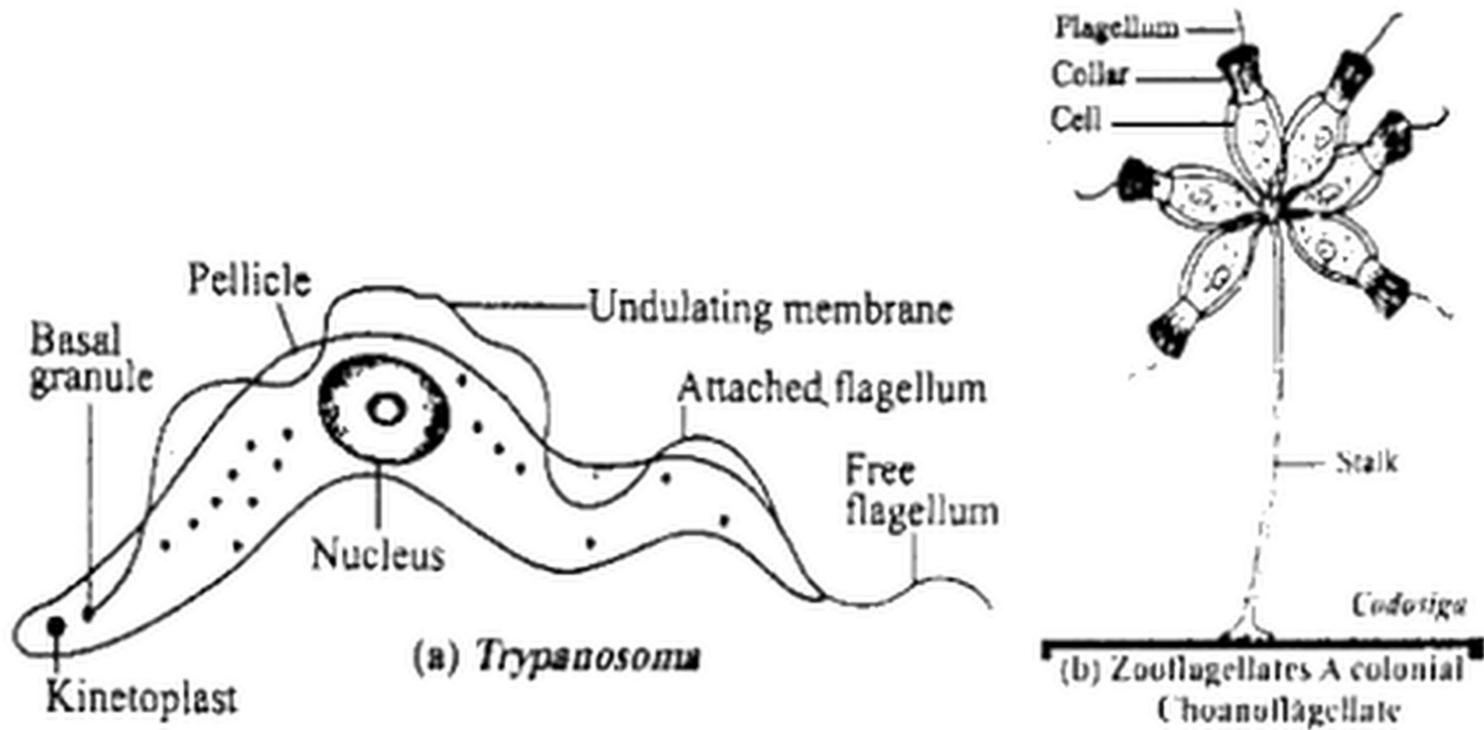
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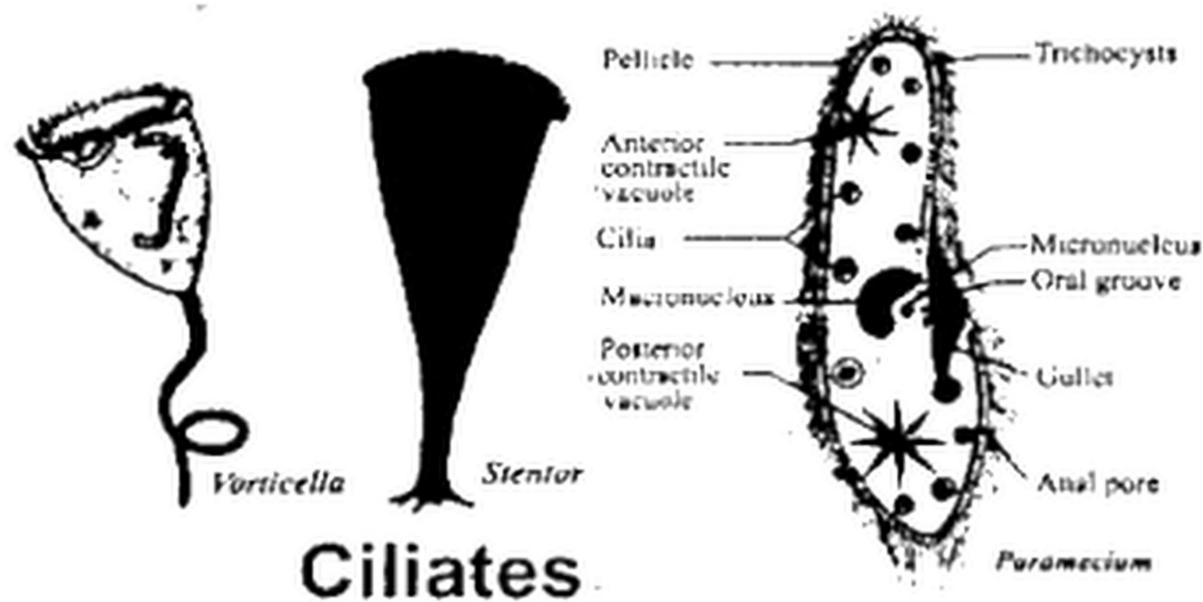
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Algal life cycle shows extreme variations. All algae except the red algae (Phylum Rhodophyta) have forms with flagellated motile cells in at least one stage of their life cycle.

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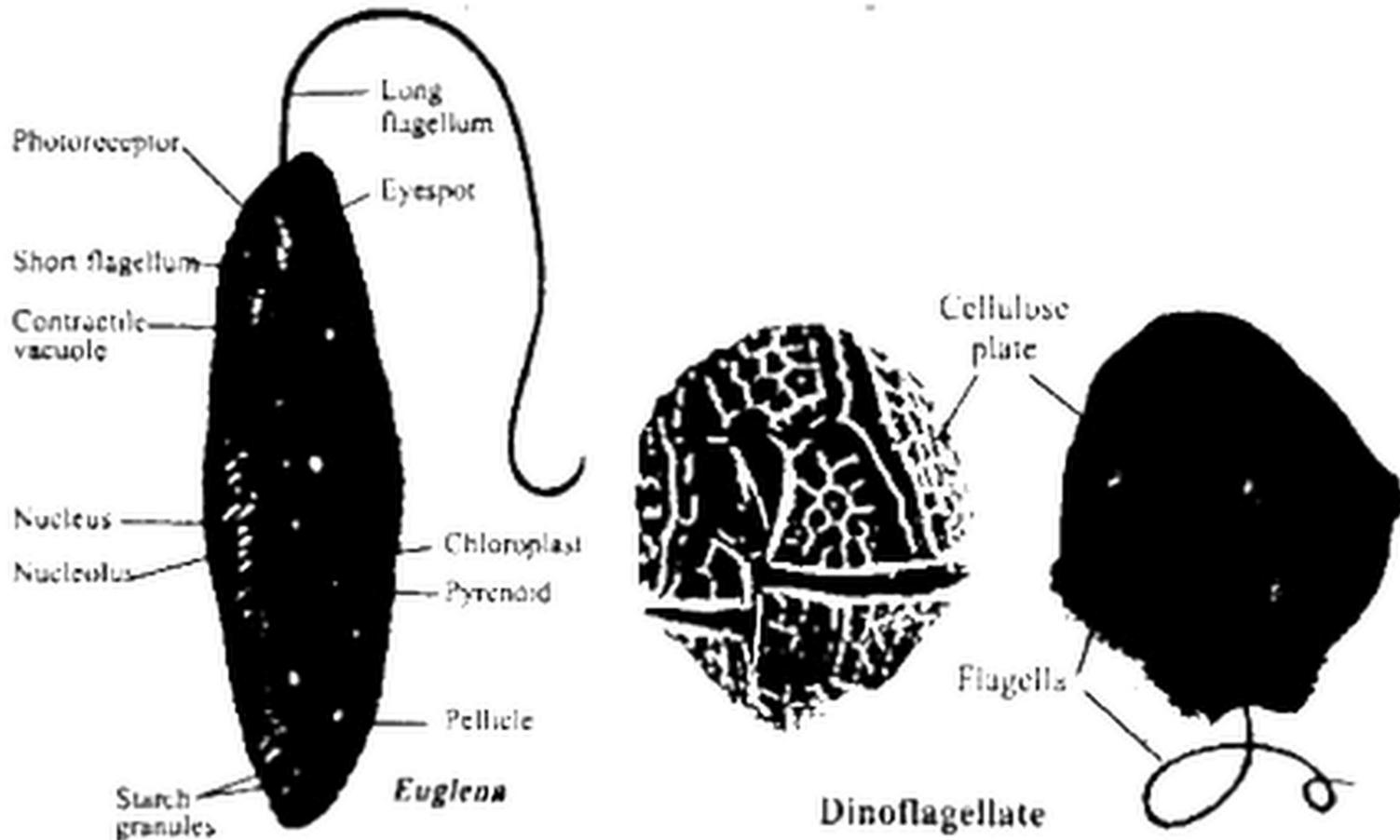
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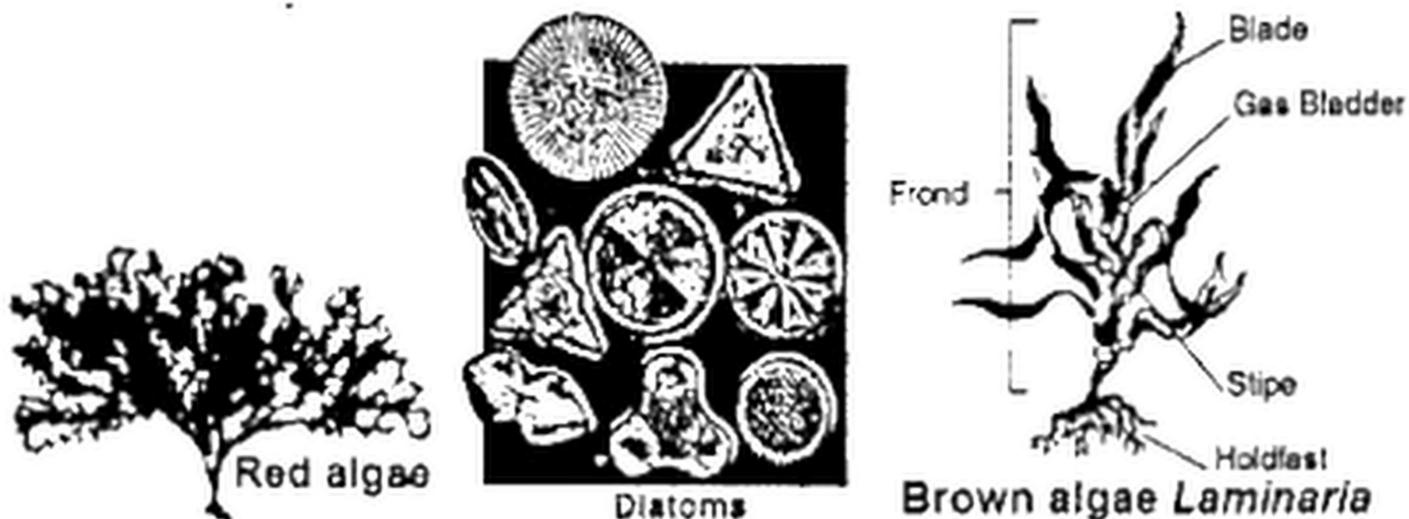
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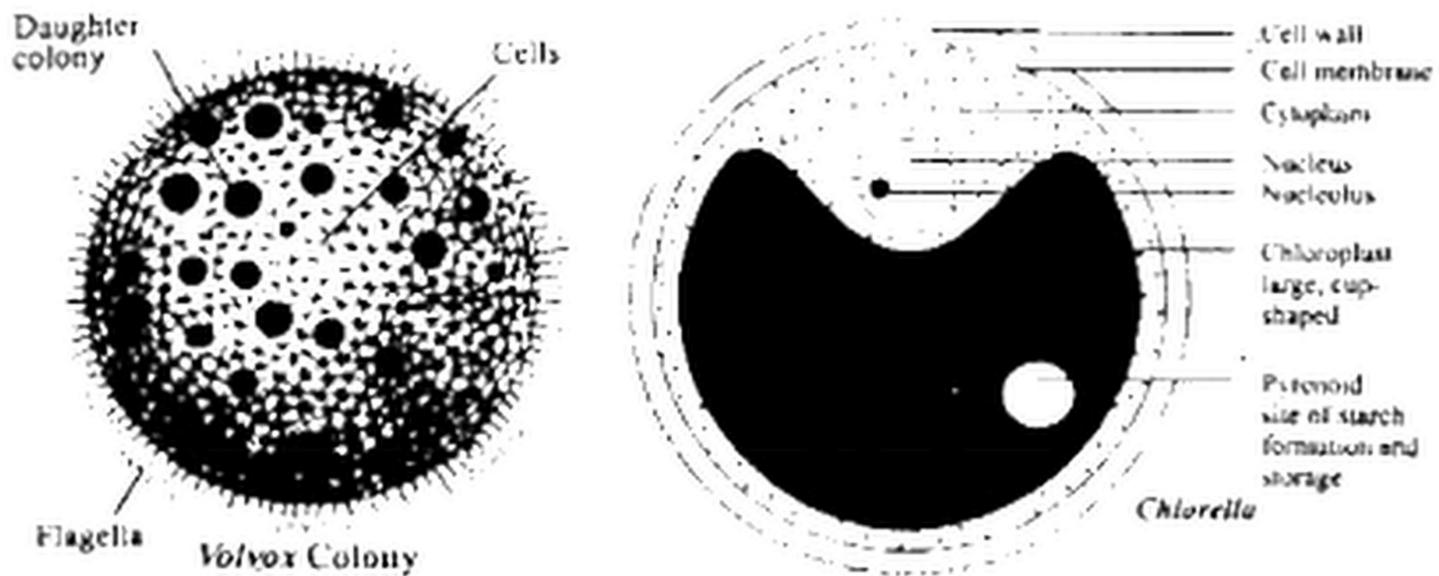
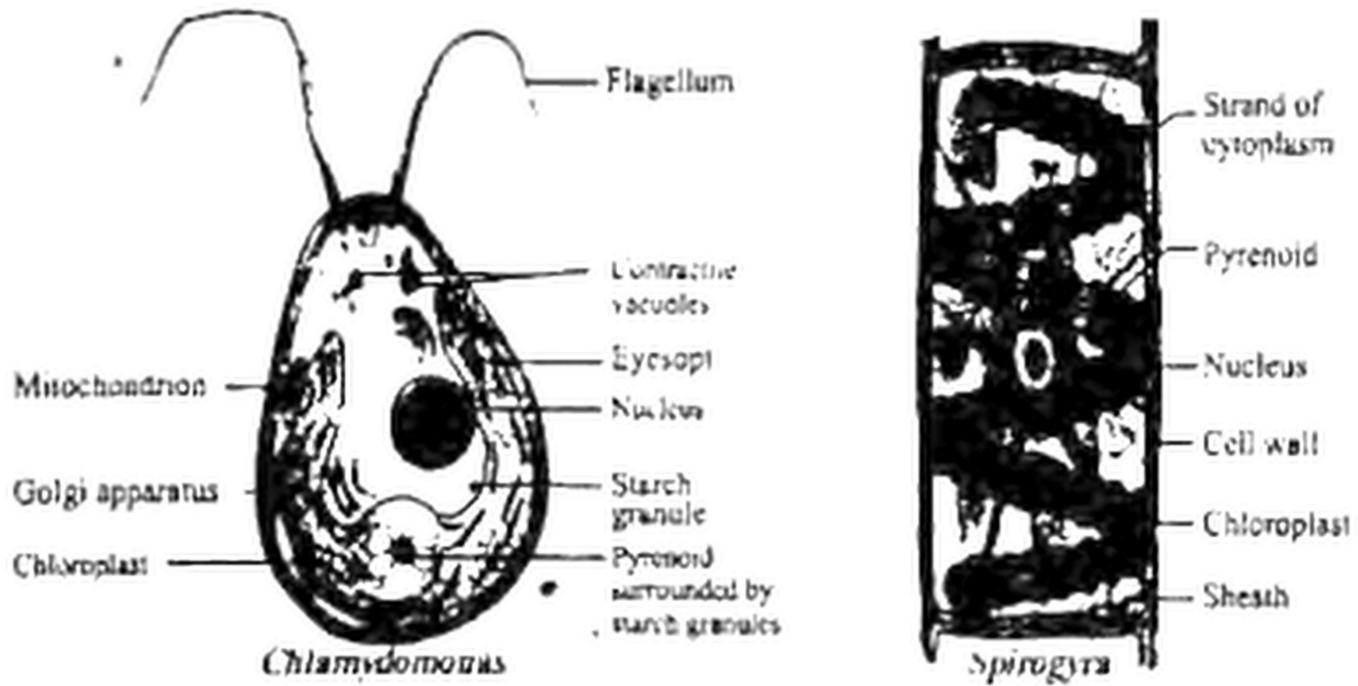
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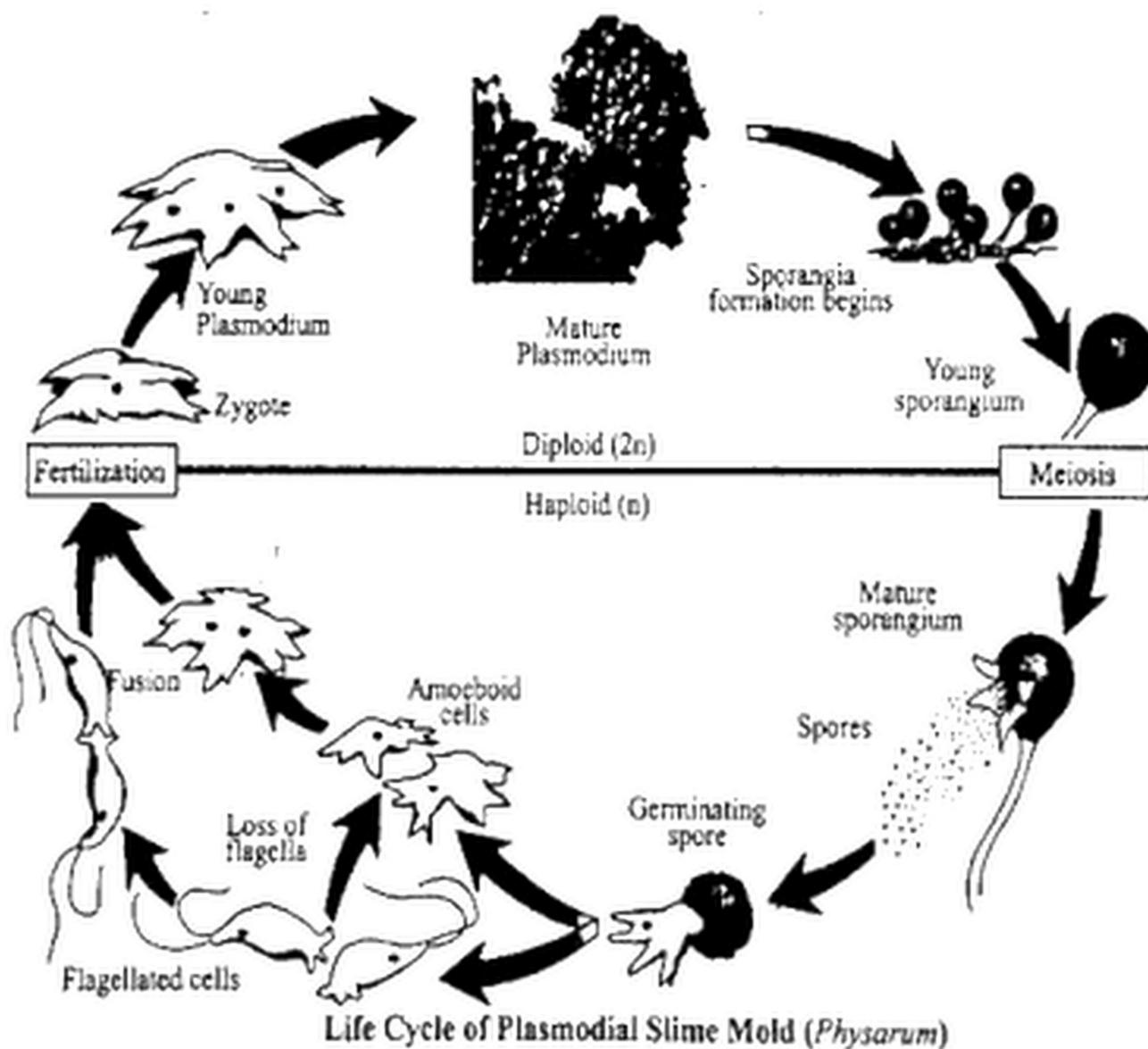
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18. Explain the salient features of the protists Oomycota and give examples:

Ans: Oomycota: The Water Molds:

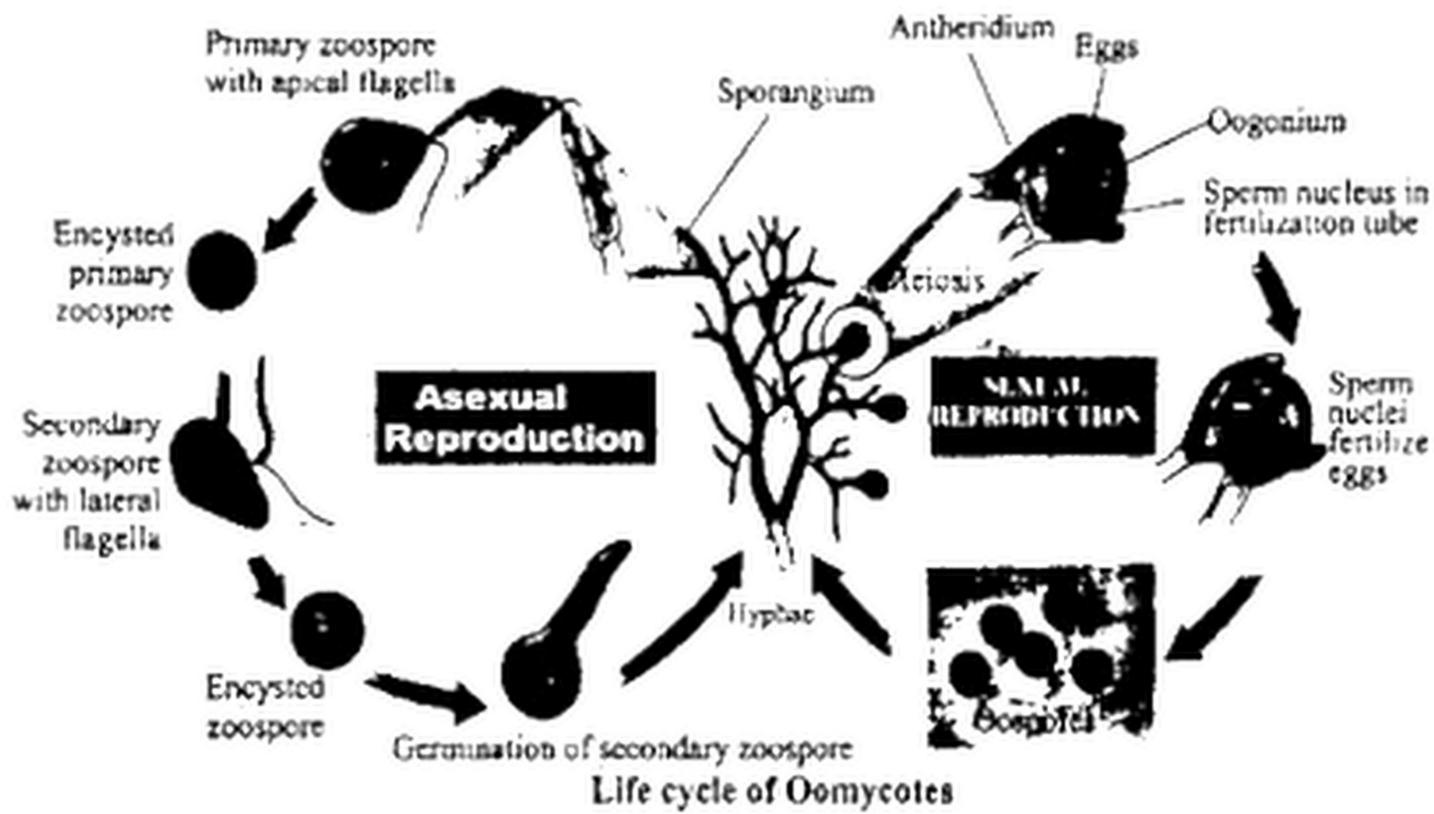
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Characteristics:

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- (iii) Their life cycles are characterized by gametic meiosis resulting in a diploid phase.
- (iv) The filamentous structures are called hyphae as in fungi. The hyphae are aseptate, i.e. without intercellular cell wall.
- (v) Most oomycotes live in freshwater or saltwater or in soil. Some are plant parasites. A few aquatic oomycotes are animal parasites.

Life cycle:

Zoospores are motile and have two flagella. Zoospores are produced asexually in sporangium. For sexual reproduction there are two types of **gametangia**. The female **gametangium** is called **oogonium** and the male gametangium is called an **antheridium**. The flowing of the contents of an antheridium into an oogonium leads to the individual fusion of one or more pairs of male nuclei with eggs. This produces a special kind of thick-walled cell called an **oospore**. This structure gives the phylum its name, i.e. phylum oomycota, e.g. *Phytophthora infestans*.



19. How are protists important to humans?

Ans: Importance of protists to humans:

Diatoms are an important source of food and oxygen for heterotroph in both freshwater and marine ecosystem. **Brown algae** not only provides food to organisms, but is also harvested for human food and for fertilizer in several parts of the world

Red algae:

Red algae are economically important. The mucilaginous material in the cell walls of certain genera of red algae is a source of agar used commercially to make capsules for vitamins and drugs, as a material for making dental impression and a base for cosmetics. In laboratory agar is a culture medium for bacteria.

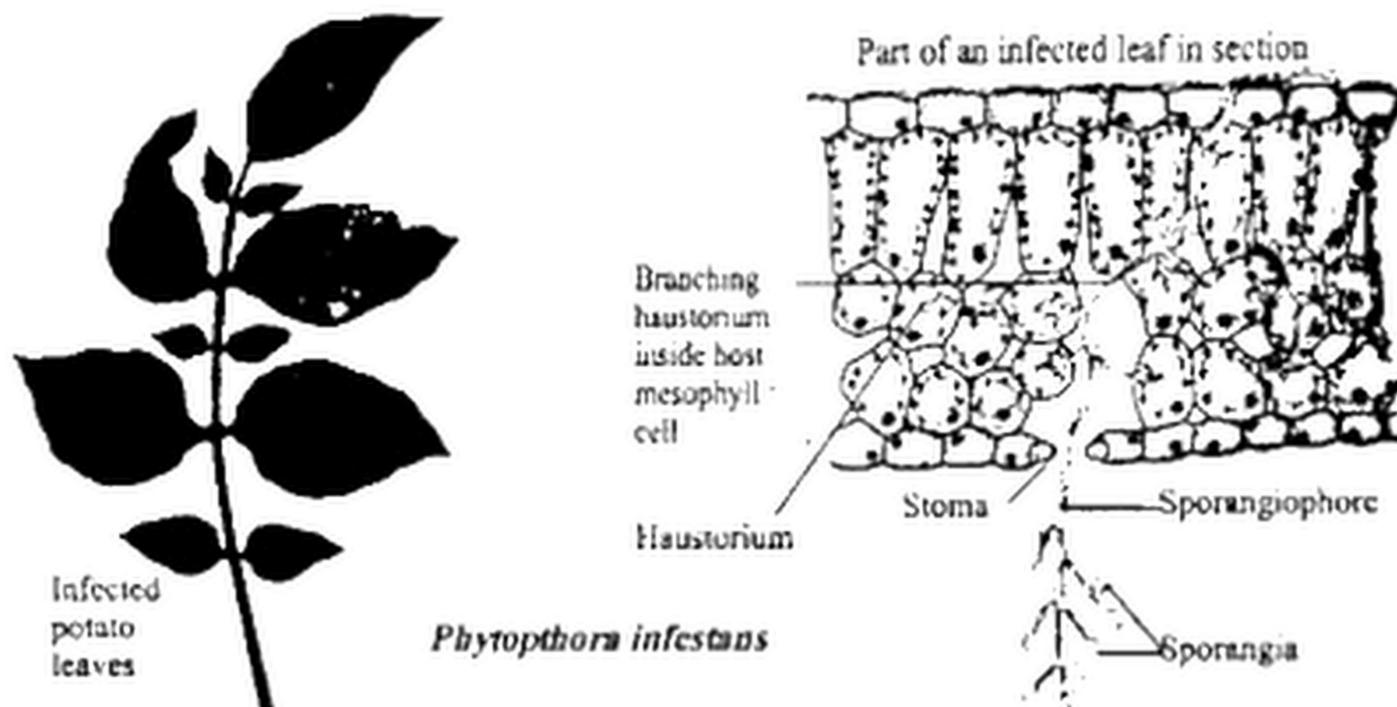
Green algae:

Green algae are important producers. *Chlorella* has been used as an experimental organism in research in photosynthesis. A relatively new food source is single cell protein (SCP).

Disease causing protists: Malaria caused by *Plasmodium* (malarial parasite) is one of the world's most common serious infectious diseases. According to world health organization about one to two million people die each year from malaria.

Other important protozoans are *Entamoeba histolytica* causes amoebic dysentery. *Trypanosoma* causes sleeping sickness.

In oceans freshwater lakes and ponds are **zooplanktons** that feed on phytoplanktons, and are important as primary consumers in the food chain. *Phytophthora infestans* causes late blight disease in potatoes.



20. What are the characteristics that distinguish fungi from other groups?

Ans: General Characteristics of Fungi:

- (i) Fungi (singular, *fungus*) can live in darkness and also in light. The study of fungi is called mycology. The person who studies fungi is called mycologist.
- (ii) Fungi occupy a wide range of habitats, aquatic, terrestrial and as parasites on plants and animals.
- (iii) The mode of life shows that fungi can be parasites, saprotrophs or mutualists.
- (iv) Fungi range in size from unicellular yeasts to the large toadstool.
- (v) Fungi lack chlorophyll, so they are non-photosynthetic. Thus, mode of nutrition is heterotrophic. Digestion takes place outside the body and nutrients are absorbed directly.
- (vi) Cell walls are rigid containing chitin as fibrillar material. If carbohydrate is stored, it is usually as glycogen and not starch.
- (vii) Fungi do not have root, stem or leaves. The thallus or the body of most fungi is a multicellular structure known as mycelium. A mycelium (Gk: mycelium, fungus filaments) (pl. mycelia) is a network of filaments called hyphae (Gk: hyphae, web).
 - (viii) The hyphae may be Nonseptate (aseptate) or septate. Nonseptate (L. septum, wall) hyphae have no cross walls are multinucleated, e.g. *Rhizopus*. Septate fungi have cross wall, e.g., *Penicillium*.
 - (ix) Fungi are non-motile, lack basal bodies and do not have flagella at any stage of their life cycle. They move towards a food source by going towards it.
- (x) A fungus reproduces both asexually and sexually.

Fungi as separate kingdom:

According to five kingdom system of classification, "Fungi" is now a separate kingdom.

Fungi are different from plants:

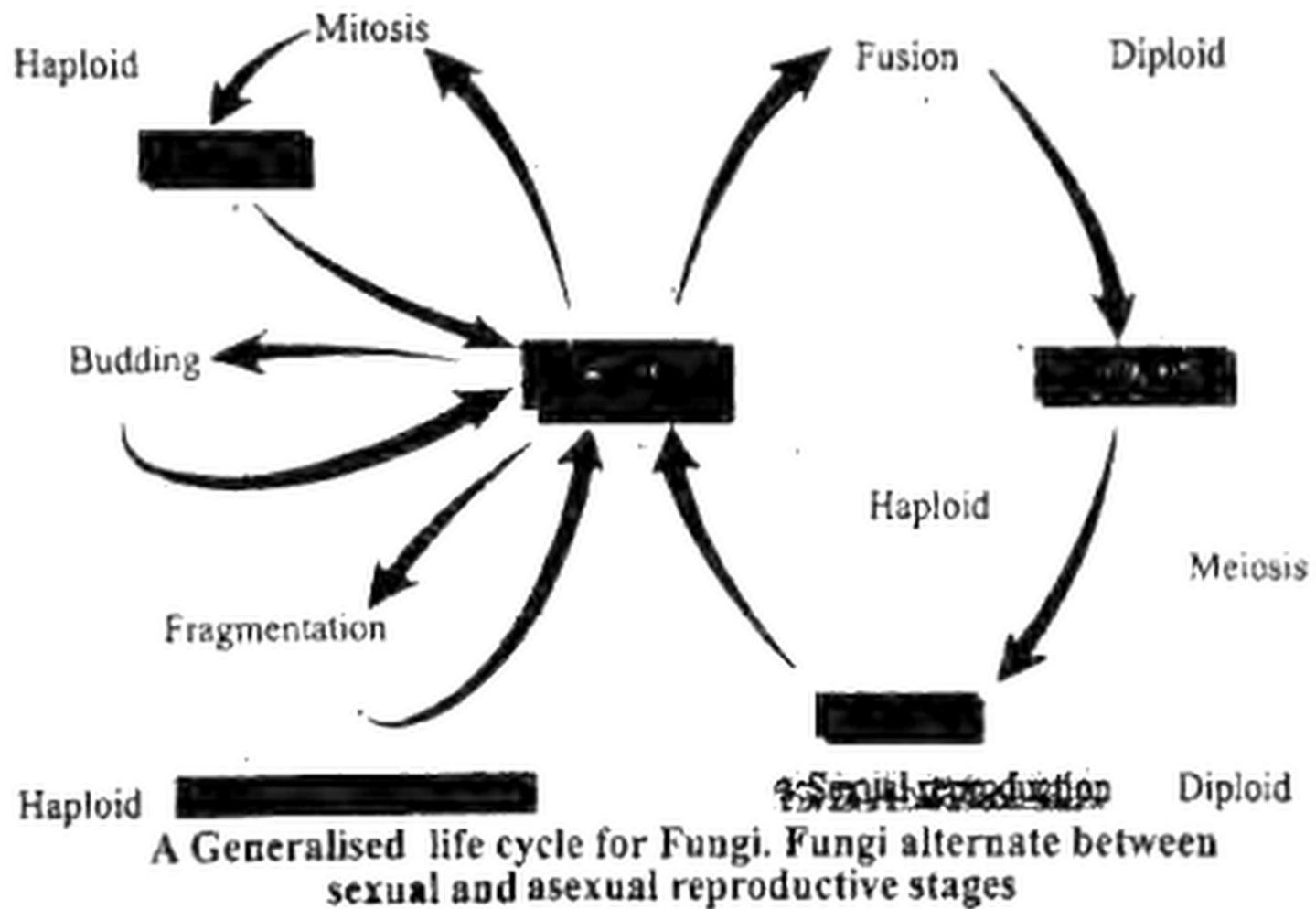
- (i) Fungi have no chlorophyll
- (ii) Fungi never have flagella
- (iii) Fungi are saprotrophs

Fungi are different from animals:

- (i) Fungi have cell wall.
- (ii) Fungi are absorptive heterotrophs.
- (iii) Fungi are non-motile.

Conclusion:

So, fungi are neither plants nor animals. They show "nuclear mitosis". Because fungi are distinct from plants, animals and other eukaryotes in many ways, they are assigned to separate kingdom-fungi.



21. Give reasons why fungi are classified in a separate kingdom.

Ans: Fungi are separate kingdom:

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22. Give the diagnostic features and examples of the fungi Zygomycota.

Ans: Zygomycota (Conjugating Fungi):

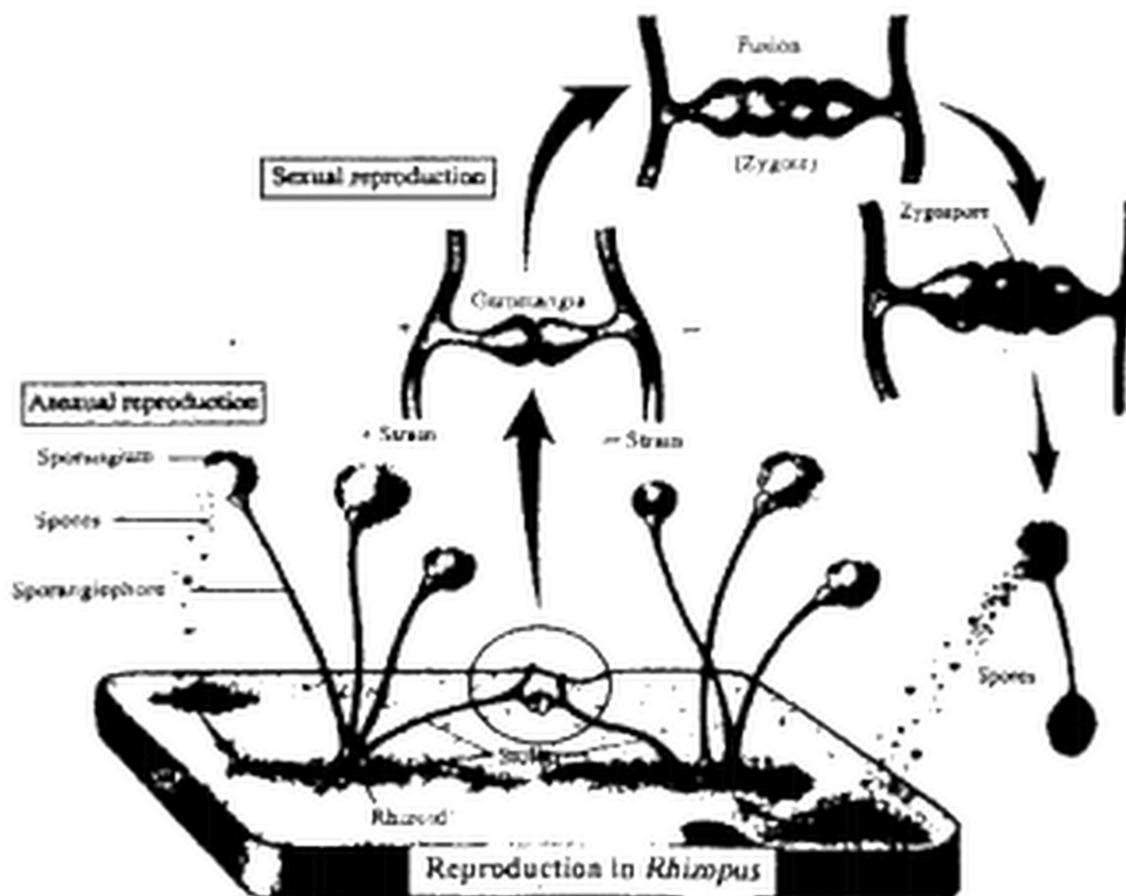
The phylum zygomycota is called conjugating fungi.

Characteristics:

They are mainly saprotrophs living on plant remains, on bakery good, on vegetables and fruits. Some are parasites of small soil protists. Hyphae are nonseptate, mycelium well developed and branching.

Asexual reproduction:

Asexual reproduction takes place by conidia or spores, e.g., *Rhizopus nigricans*.



Sexual reproduction:

Sexual reproduction takes place by conjugation. When hyphae (stolon) of opposite mating types meet, hormones are produced that cause the tips of the hyphae to come together and to form gametangia, structures that produce gametes. These structures become separated from rest of the mycelium by the formation of septa. Plus and minus nuclei then fuse to form a diploid nucleus, the **zygote**.

The Zygote develop into a **zygospore**. The division or phylum name refers to the **zygospore**. Zygospores **germinate** under favourable conditions and divide by **meiosis**. The wall of the zygospore shifts and hypha grows upward. The tip of walls of the hypha develops into a sporangium. The sporangium contains many nuclei. The wall of the sporangium ruptures and the spores are liberated. Each spore grows into a new plus or minus strain of mycelium.

23. Draw and explain a diagram of the life cycle of *Rhizopus nigricans*.

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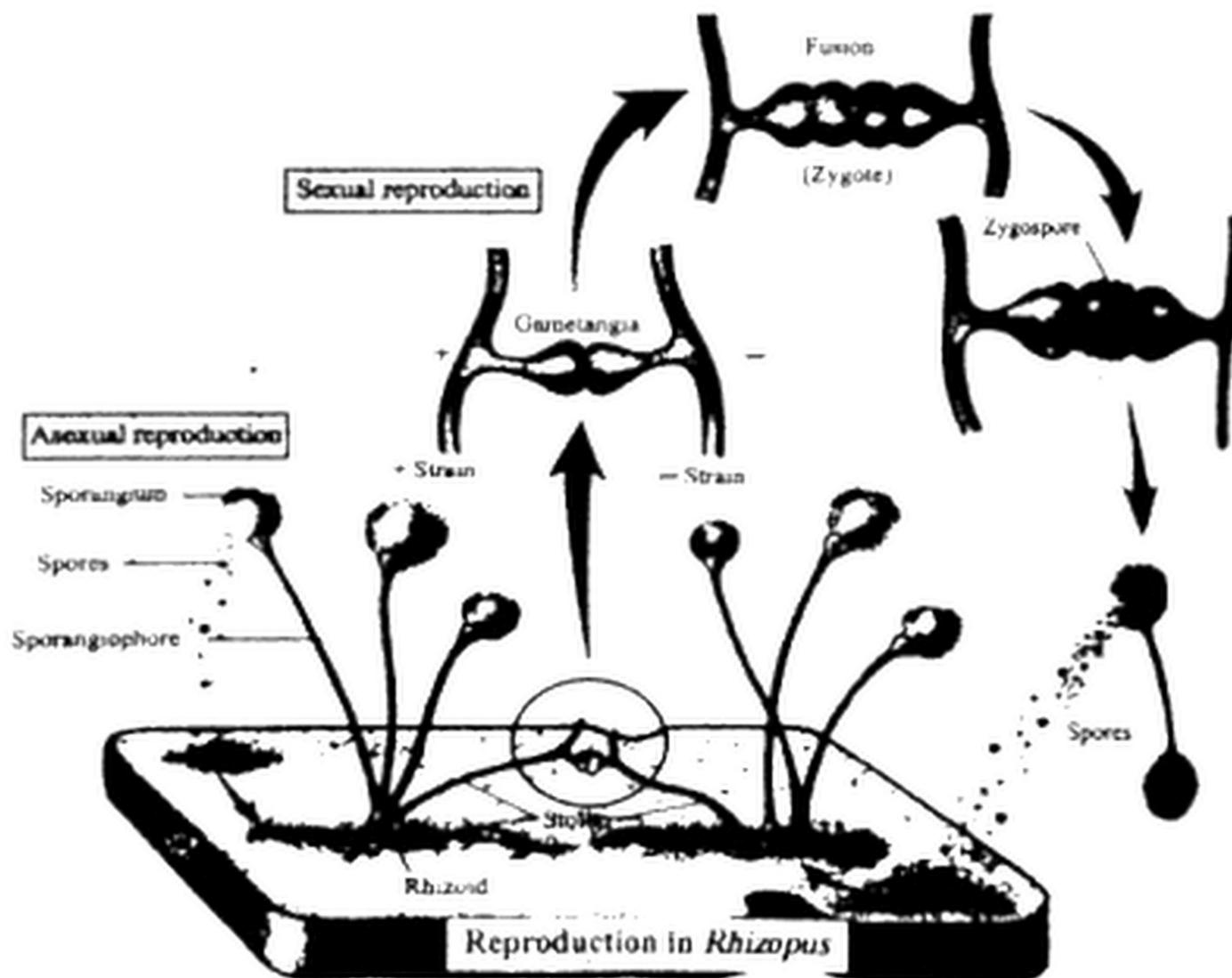
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24. Give the diagnostic features and examples of fungi Ascomycota.

Ans: Ascomycota (sac fungi):

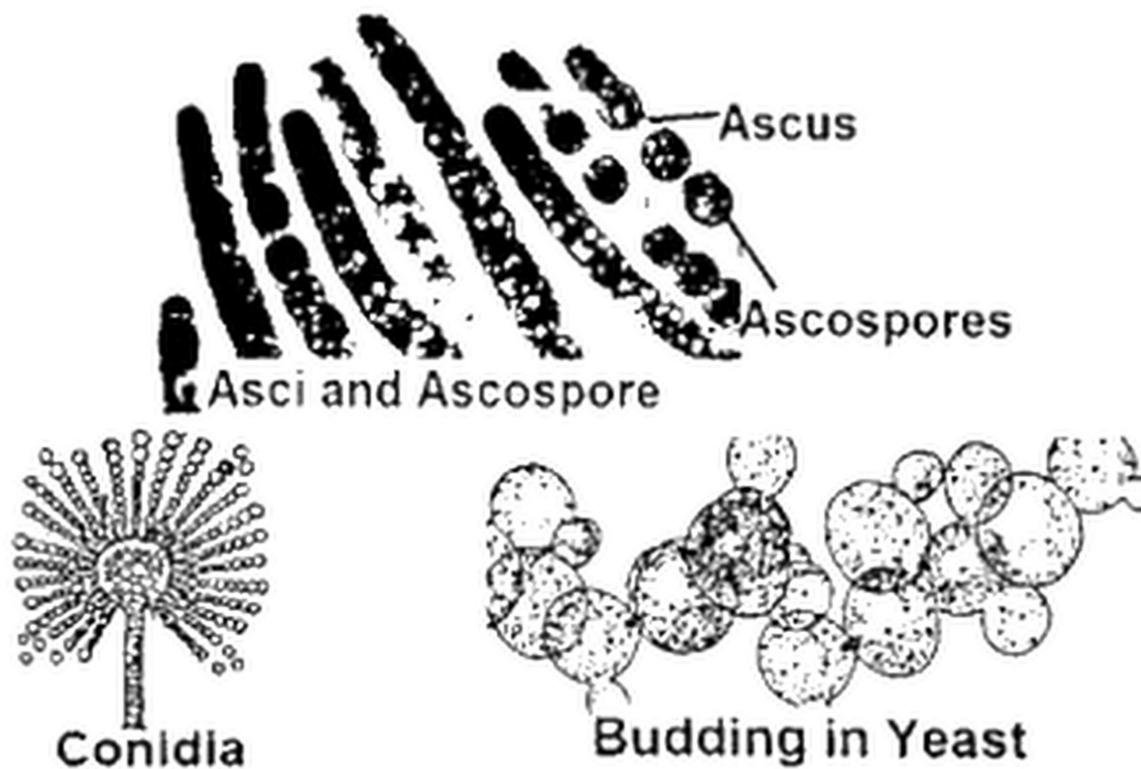
Ascomycotes are the members of phylum ascomycota. It is a large group. Ascomycotes are also known as **sac fungi** because their sexual spores are produced in little sacs called asci (sing, ascus).

Hyphae of sac fungi:

Their hyphae usually have septa but the cross walls are perforated so that cytoplasm can move from one compartment to other.

Asexual reproduction:

Asexual reproduction involves production of spores called conidia (singular: conidium) or **conidiospores** (Gk. Konis, dust, and spora, seed). Conidia vary in shape, size and may be multicellular. There are no sporangia in Ascomycotes. The conidia develop directly on the tips of modified aerial hyphae called **conidiophores**. The colour of conidia is what gives the characteristic brown, blue, pink or other tint to **many** of these molds. In unicellular **yeasts**, asexual reproduction takes place by **budding**. Yeast also reproduces asexually by fission.

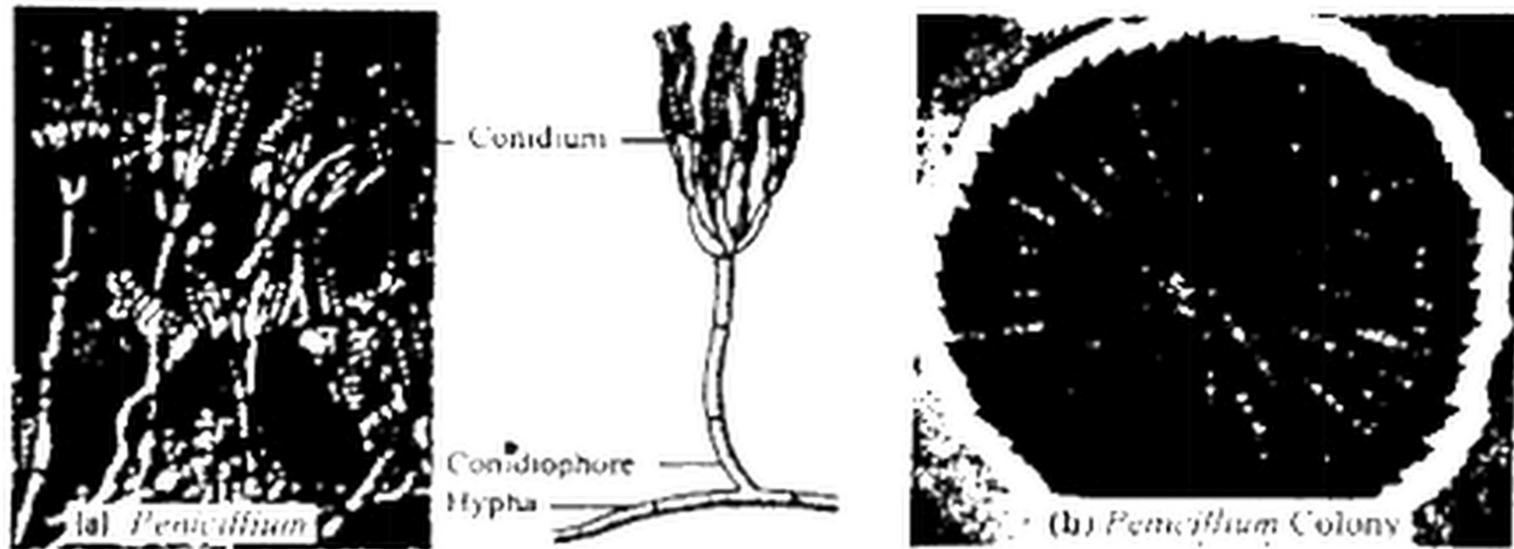


Sexual reproduction:

Sexual reproduction takes place after two hyphae grow together and their cytoplasm mingles. Within these fused structures, nuclei from the parent hyphae pair but don't fuse. New hyphae develop from the fused structure and the cell of these hyphae are **dikaryotic**. The $n + n$ hyphae form a fruiting body known as **ascocarp**. The asci develop in the ascocarp. The asci are usually surrounded by sterile hyphae. An ascocarp is a **fruiting body**. It is reproductive structure where spores are produced and released. An ascocarp can have different shapes. In cup fungi they are cup shaped, in molds they are flask shaped and, in the morals, they are stalked and crowned by bell shaped structure.

Within an ascus the two nuclei fuse and form a **diploid** nucleus the **zygote** which undergoes **meiosis** to form four haploid nuclei. This process is usually followed by one mitotic division of each of the four nuclei, resulting in eight haploid nuclei. Each haploid nucleus develops into an **ascospore**. The ascospores are then windblown if they land on suitable location and germinate to form a new mycelium, e.g. in yeasts.

During sexual reproduction, asci within a fruiting body produce ascospores. The examples of sac fungi are yeasts (*Saccharomyces*) *Neurospora*, Morels, Truffles, *Penicillium*.



25. Give the diagnostic features and examples of the fungi Basidiomycota.

Ans: Basidiomycota (club-fungi):

Basidiomycotes are included in the phylum Basidiomycota.

Example:

Included in these phyla are mushrooms, bracket fungi, rust, smut, and puffballs. These structures are all fruiting bodies called basidiocarps.

Characteristics:

Basidiocarp contains the basidia. Each basidium is club shaped structure. It is hyphal cell on the tip of which develops four basidiospores, from which these phylum takes its name.

Each individual fungus produces millions of basidiospores and each basidiospore has the potential to give rise to a new primary mycelium. Hyphae of primary mycelium are composed of monokaryotic (n) cells.

The mycelium of a basidiomycote, e.g. *Agaricus* (mushroom) consists of mass of white branched, thread like hyphae that occur mostly

below ground. The hyphae are divided into cells by septa. The septa are perforated and allow cytoplasmic streaming between cells.

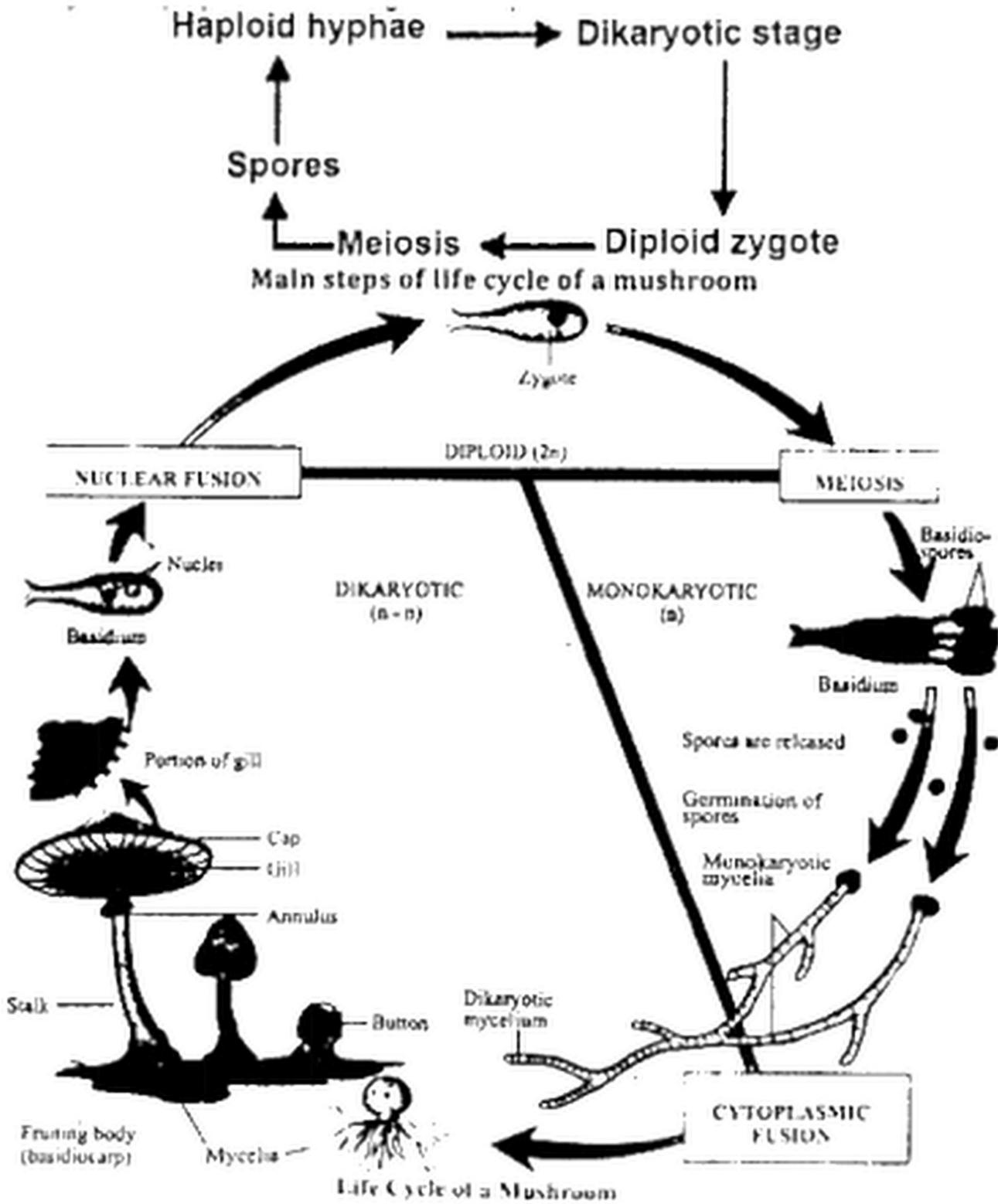
Reproduction:

Although club fungi occasionally do produce conidiospores asexually, they usually reproduce sexually. A hypha of a primary mycelium encounters another monokaryotic (n) hyphae of a different mating type and the two hyphae fuse. However, the two haploid nuclei remain separated from each other. In this way a secondary mycelium with a dikaryotic ($n + n$) hyphae is produced, in which each cell contains two haploid nuclei. The $n + n$ hyphae of the secondary mycelium grow and form compact mass called buttons, along the mycelium. Each button grows into a fruiting body known as mushroom.

A mushroom consists of a stalk and a cap, is more formally referred to as basidiocarp. Each basidiocarp actually consists of intertwined hyphae that are matted together. The walled ends of the tightly packed hyphae become the club shaped basidia.

The lower surface of the cap usually consists of many thin perpendicular plates called gills that radiate from the stalk to edge of the cap.

On the gills of the mushroom haploid nuclei of the dikaryotic cells fuse to form diploid zygotes. Meiosis then takes place forming four haploid nuclei that move into finger like projections forming basidiospore, which are released later.



26. Explain the term club fungi. Draw and explain a diagram of the life cycle of a typical mushroom.

Ans: Basidiomycota (Club-Fungi):

Basidiomycotes are included in the phylum Basidiomycota.

Example:

Included in the phylum are mushrooms, bracket fungi, rust, smut and puffballs. These structures are all fruiting bodies called **basidiocarps**.

Characteristics:

Basidiocarp contain the basidia. Each basidium is club shaped structure. It is a hyphal cell on the tip of which develops four **basidiospores**, from which this phylum takes its name.

Each individual fungus produces millions of basidiospores and each basidiospore has the potential to give rise to a new primary mycelium. Hyphae of primary mycelium are composed of monokaryotic (n) cells.

The mycelium of a basidiomycote, e.g. *Agaricus* (mushroom), consists of mass of white branched, thread like hyphae that occur mostly below ground. The hyphae are divided into cells by septa. The septa are perforated and allow cytoplasmic streaming between cells.

Reproduction:

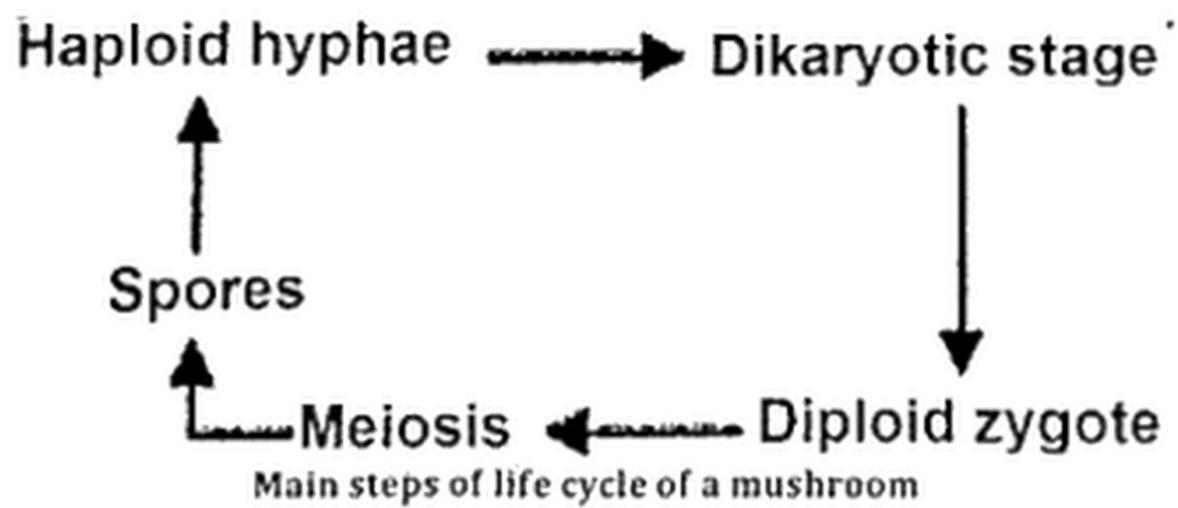
Although club fungi occasionally do produce conidiospores asexually, they usually **reproduce** sexually. A hypha of a primary mycelium encounters another monokaryotic (n) hyphae of different mating type and the two hyphae fuse. However, the two haploid nuclei remain separated from each other.

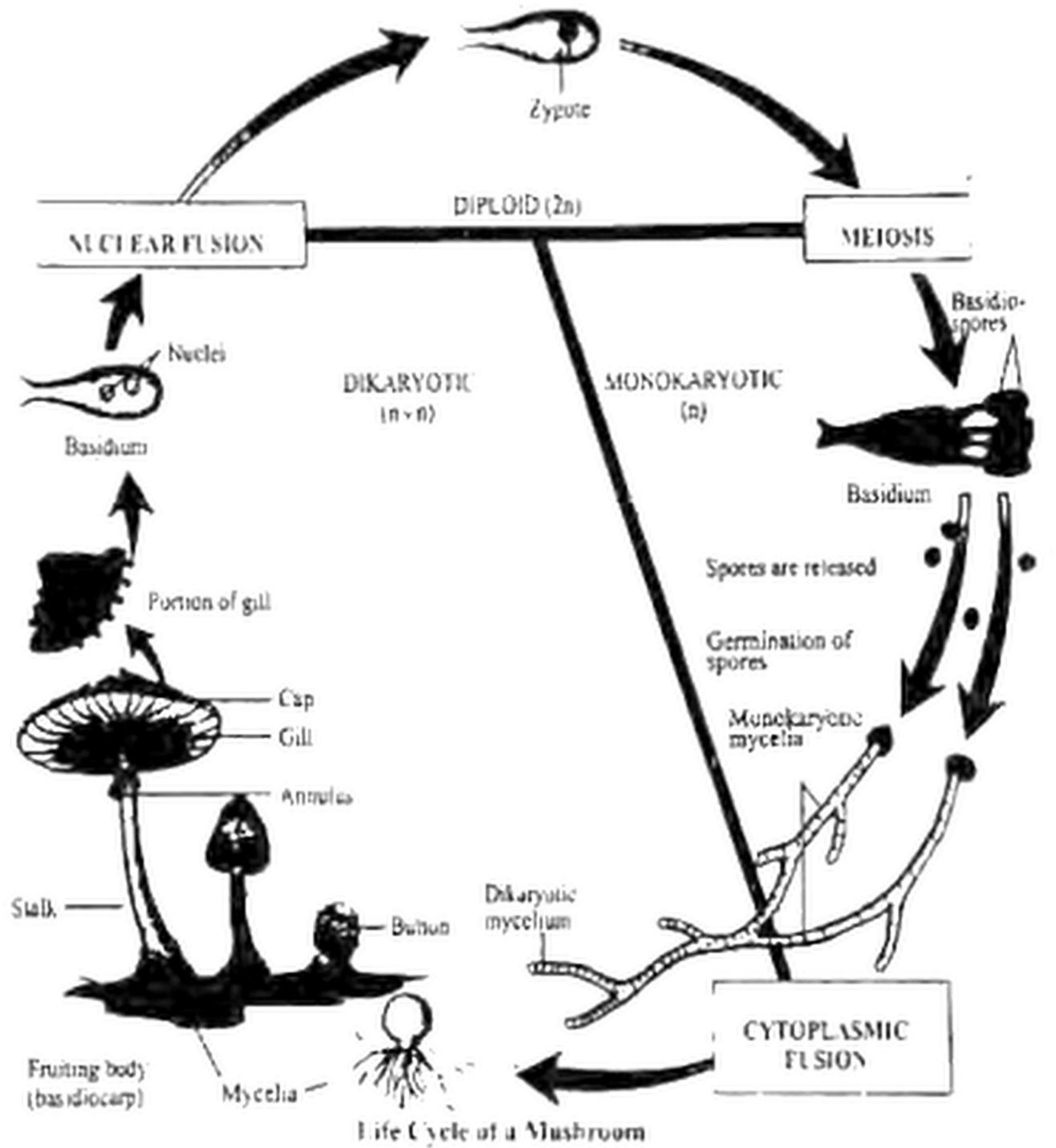
In this way a secondary mycelium with a **dikaryotic** (n+n) hyphae is produced, in which each contains two haploid nuclei. The n+n hyphae of the **secondary mycelium** grow and form compact mass, called **buttons**, along the mycelium. Each button grows into a **fruiting body** known as **mushroom**.

A mushroom, which consists of a stalk and a cap is more formally referred to as basidiocarp. Each basidiocarp actually consists of intertwined hyphae that

are matted together. The walled of ends of the tightly packed hyphae become the club shaped basidia.

The lower surface of the cap usually consists of many thin perpendicular plates called gills that radiate from the stalk to the edge of the cap. On the gills of the mushroom haploid nuclei of the dikaryotic cells fuse to form diploid zygotes. Meiosis then takes place forming four haploid nuclei that move into finger like projections forming basidiospore, which are released later.





27. Write the importance of the unicellular fungi yeast.

Ans: Importance of fungi:

Fungi are useful and also harmful to human being. Fungi economic gains as well as losses.

People eat fungi and grow them to make various chemicals. Fungi cause diseases in humans, other animals and plants.

Here we will discuss use of fungi, antibiotics obtained from fungi, mutualism, edible fungi, ecological role of fungi and pathological role of fungi.

Uses of Fungi:

Fungi are used in baking, brewing and genetic research.

(a) Use of Fungi in baking:

In making bread Amylase from fungi. Which digest starch, can be added to increase the sugar contents. Yeast uses sugars as a source of energy in respiration. Both aerobic and anaerobic respiration result in production of carbon dioxide gas. When making bread, bubbles of the gas are trapped inside the warm dough causing it to rise.

Strains of the yeast *Saccharomyces cerevisiae* are selected for their high production of carbon dioxide gas.

(b) Use of Fungi in brewing:

Wine production is called brewing. Two commonly species, *Saccharomyces cerevisiae* and *Saccharomyces carsbergensis* are used in brewing.

(c) Use of Fungi genetic research:

Yeast are used in biological research especially in genetic research. Researchers use *Saccharomyces* to study molecular genetics of eukaryotes, because its cells are easy to culture and manipulate. Scientists are gaining insight into the genes involved in human diseases such as Parkinson's disease and Huntington's disease by examining in *Saccharomyces*.

Antibiotics are obtained from fungi:

Penicillin:

The first antibiotic discovered was **penicillin**, made by the mold *Penicillium chrysogenum*.

Cyclosporins:

Cyclosporins are obtained from soil fungus (*Tolypocadium inflatum*) is used in organ transplantation of preventing transplant rejection.

Griseofulvin:

Griseofulvin obtained from a fungus (*Penicillium nigricans*) is used to inhibit fungal growth.

Neurospora:

Pink mold *Neurospora* has also been used for genetic research.

Saccharomyces cerevisiae:

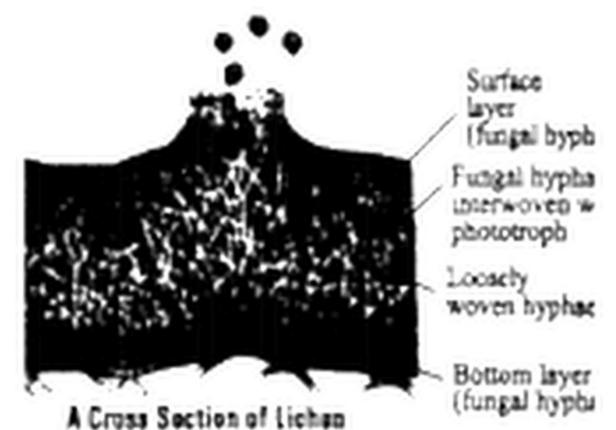
Yeast was the first eukaryotes to be used in genetic engineering. In 1983, a functional artificial chromosome was made in *Saccharomyces cerevisiae*. It was also the first eukaryotes whose genomic sequence was completely studied in 1996.

28. Explain the mutualism established in mycorrhizae and lichen associations.

Ans: Mutualism: Lichen and Mycorrhizae.

Mutualism is the association in which both the partners are benefitted. The two key mutualistic symbiotic association formed by the fungi are lichens and mycorrhizae.

Lichens: Lichens are an association between a fungus (mostly Ascomycotes and a few Basidiomycotes), a cyanobacterium or green alga. The body of lichen has



three layers. The upper layer is thin and tough which consists of fungal hyphae. The middle layer consists of fungal hyphae interwoven with photosynthetic cell. Bottom layer consists of loosely packed fungal hyphae. Specialized fungal hyphae which penetrate or envelope the photosynthetic cells, transfer nutrients directly to the rest of the fungus.

Mycorrhizae:

Mycorrhizae are mutualistic relationships between soil fungi and the roots of most plants. The hyphae help in the direct absorption of phosphorous, zinc, copper and other nutrients from the soil into the roots. Plants whose roots are invaded by mycorrhizae grow more successfully than do plants without mycorrhizae. There are two main types of mycorrhizae in which mycelia extend far out into the soil.

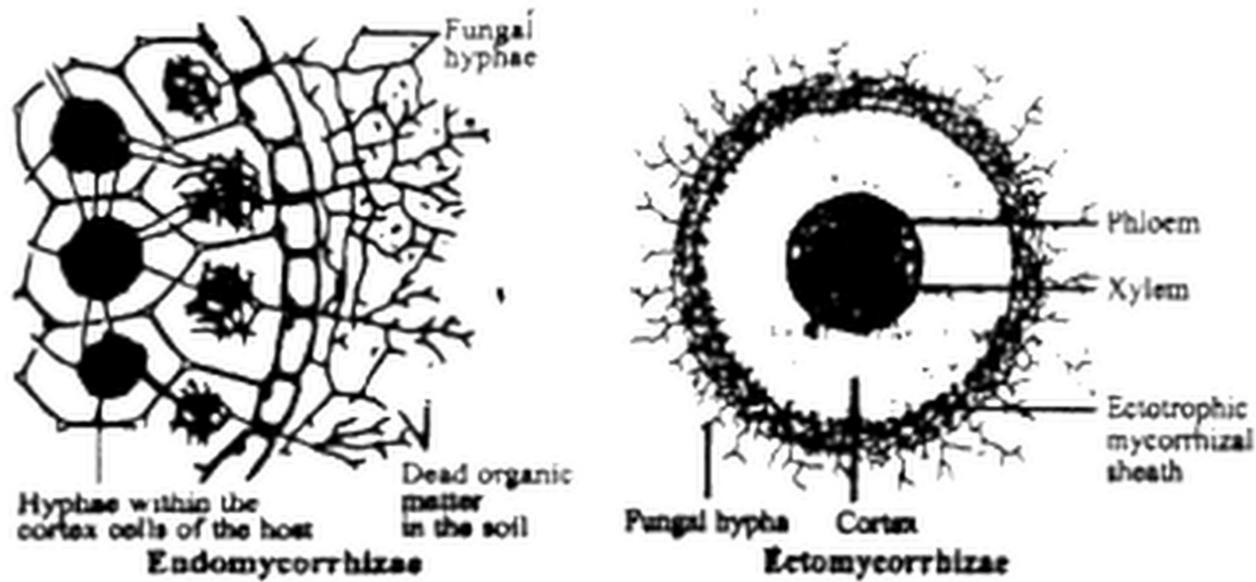


Endomycorrhizae:

Endomycorrhizae penetrate only into the outer cells of plant root forming coils, swellings and minute branches and also extend out into surrounding soil.

Ectomycorrhizae:

Ectomycorrhizae form a mantle that is exterior to the root, and they grow between cell walls. These are mostly formed with pines, firs etc.



29. Write a brief note on edible fungi.

Ans: Edible Fungi: *Aspergillus tamari* is used to produce soya sauce. There are some 200 kinds of edible mushrooms e.g. *Agaricus*. Some edible mushrooms are cultivated commercially. Morels, which superficially resemble mushrooms and truffles, produce undergrounded fruiting bodies are ascomycetes. The edible part of yellow morels (*Morchella esculenta*) is an ascocarp.



30. Describe the ecological impact of fungi.

Ans: Ecological impacts of fungi:

Saprotrophs: Fungi make important contributions to the ecological balance of our world like bacteria, most fungi are saprotrophs, decompose and absorb nutrients from organic wastes and dead organisms. In this way fungi help in maintaining the nutrient balance in nature. The organic waste is removed from the environment by the activity of saprotrophic and bacteria.

Humus: The fungi and bacteria liberate huge amounts of CO₂ in the air by decomposing dead bodies of animals and plants. The green plants for the synthesis of organic food use this carbon dioxide. Thus, fungi help in recycling of materials. **Humus** is an important constituent of soil and essential for the proper growth of plants. It is formed from the organic waste material through the activities of fungi and bacteria.

31. Explain the pathogenic role of fungi.

Ans: Pathogenic Role of fungi:

Fungi cause many important diseases in plants and also in animals including human beings.

Plant diseases: Fungi are responsible for many serious **plant diseases**, including epidemic diseases that spread rapidly and often result in complete crop failure. All plants are apparently susceptible to some fungal infection.

Some important plant diseases caused by **ascomycotes** are powdery mildews, chestnut blight, Dutch elm disease, apple scab, and brown rot, which attack cherries, peaches, plums and apricots. Diseases caused by Basidiomycotes include smuts and rusts that attack various plants – for example the cereal crops of corn, wheat, oats etc.

Animal diseases: Some fungi cause superficial infections in which only the skin, hair, or nails are infected. Ringworm (*Microsporium audouini*) and athlete's foot

(*Tinea pedis*) are examples of fungal infection of the skin. Candidiasis is a yeast infection of mucous membrane of the mouth or vagina.

Histoplasmosis is a serious infection of the lungs caused by inhaling spores of a soil fungus.

Ergotism is caused by purple ergot rye. It causes nervous spasm, convulsion, psychotic delusion and even gangrene.

