Chapter = 07

Protoctists and Fungi

KINGDOM PROTOCTISTA:

Kingdom protoctista includes unicellular as well as multicellular organisms. These organisms may be photosynthetic, parasitic, predatory or absorptive. Examples include amoeba, paramecium both are hetero trophic and algae, euglena both are autotrophic while plasmodium and Trypanaosoma both are parasitic.

EVOLUTIONARY RELATIONSHIP:

Kingdom Protista is a polyphyletic group, includes

- Plants like (algae),
- Animals like (protozoa) and
- Fungus like (oomycote) organisms

They are actually ancestors of the plants, animals and fun The member of the kingdom Protista is actually a link between prokaryotes and eukaryotes.

MAJOR GROUPS OF PROTISTS:

Plantlike Protists - also called algae – autotrophs.
Animal like Protists - also called protozoa (means "first animal") - heterotrophs.
Fungus like Protists - heterotrophs, decomposers, external digestion.

PLANT LIKE PROTIST- ALGAE:

Characteristics:

i. Plant like protist are commonly called as Algae.
ii. Plant like protist are mostly aquatic.
iii. Plant like protist contain chlorophyll and can carry out photosynthesis.
iv. They possess a cell wall made up of cellulose like plant cell.
v. The size of plant like protist ranges from unicellular to multicellular.
vi. They bear some other pigments such as fucoxanthin (brownish), xanthophylls (golden), phycocynin (bluish) and phycoerythrin (reddish).
vii. The accessory pigments in plant like protist help in to absorb light and to give a variety of colors to algae.

On the basis of photosynthetic pigments plant like protists classified into following groups.

Phylum	Common Name	Major pigments	Example
Chlorophyta	Green algae	Chlorophyll a and b	Chlamydomonas, Ulva, Volvox
ii. Phaeophyta	Brown algae	Chlorophyl a and c	Fucus, Laminaria
iii. Rhodophyta	Red algae	Chlorophyl a, phycobilin, pigments, phycocyanin and phycoerythrin	Porphyra

Division Chlorophyta (GREEN ALGAE):

- Green algae are either unicellular or multicellular.
- Unicellular includes chlamydomonas, volvox (colonial), and chlorella while
- Multicellular includes spirogyra and ulva.

Ulva lactuca:

Ulva is a small genus of multicellular marine and brackish water green algae. It is edible green algae and often called as 'Sea Lettuce'.

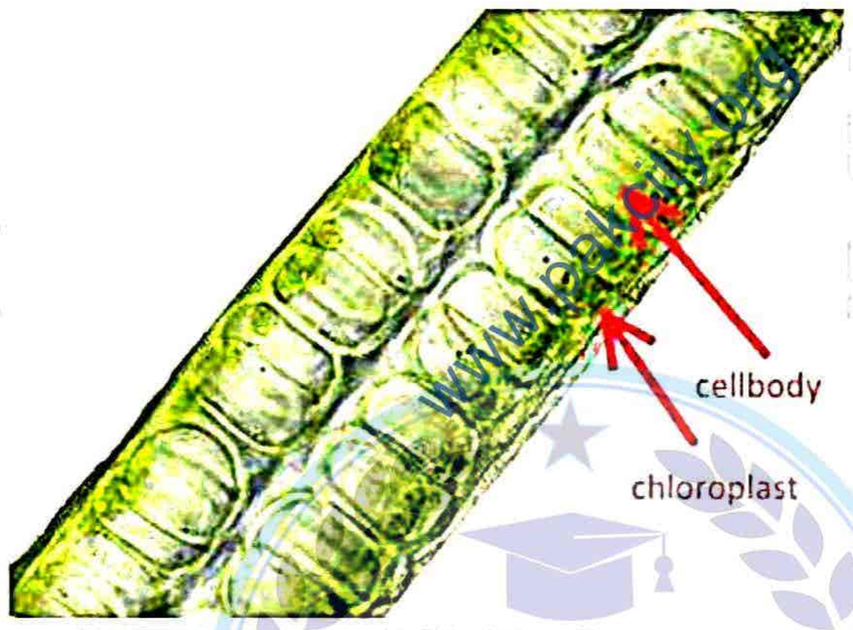
Occurrence of Ulva:

Ulva found attach to rocks by means of its hold fast at sea coasts.

Structure of Ulva:

- The body of Ulva is called thallus which is flat, elongated and blade-like and composed of two layers of cells.
- There is no differentiation into tissues i.e. all the cells of the ulva are identical except the basal cells that form the hold fast.
- The thallus of Ulva is very thin.
- Each cell contains one nucleus and has a cup-shaped chloroplast with a single pyrenoid.
- The thallus of Ulya is of two types i.e. sporophyte and gametophyte.

The thallus of ulva is made of 2 years cells.



A) Sporophyte:

Sporophyte thallus has 26 chromosomes and it is known as asexual plant of ulva.

B) Gametophyte:

The gametophyte has 13 chromosomes and it is known as sexual plant of ulva. Thus, Ulva plant exhibits heterothallism i.e. there are two types of plant body, the gametophyte (n) and sporophyte (2n). Morphologically both sporophytes and gametophytes are same hence called isomorphic thallus of Ulva.

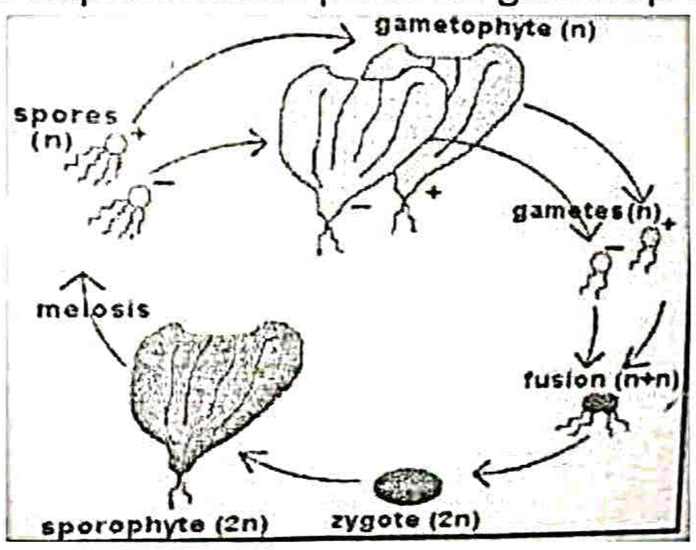
REPRODUCTION IN ULVA:

Ulva can reproduce sexually and as well as asexually.

(1) Asexual Reproduction in Ulva:

- Asexual reproduction takes place by formation of quadri flagellate zoospores in diploid asexual plant or sporophyte.
- Each cell except the basal cells of the sporophyte (2n) undergoes meiosis or reduction division and forms 8 to 16 zoospores, which are then released in water.

• Zoospore swims for some time in water, then lose flagella and undergo a period of Each zoospore now ultimately develops into haploid sexual plant i.e. gametophyt.



2) Sexual Reproduction in Ulva:

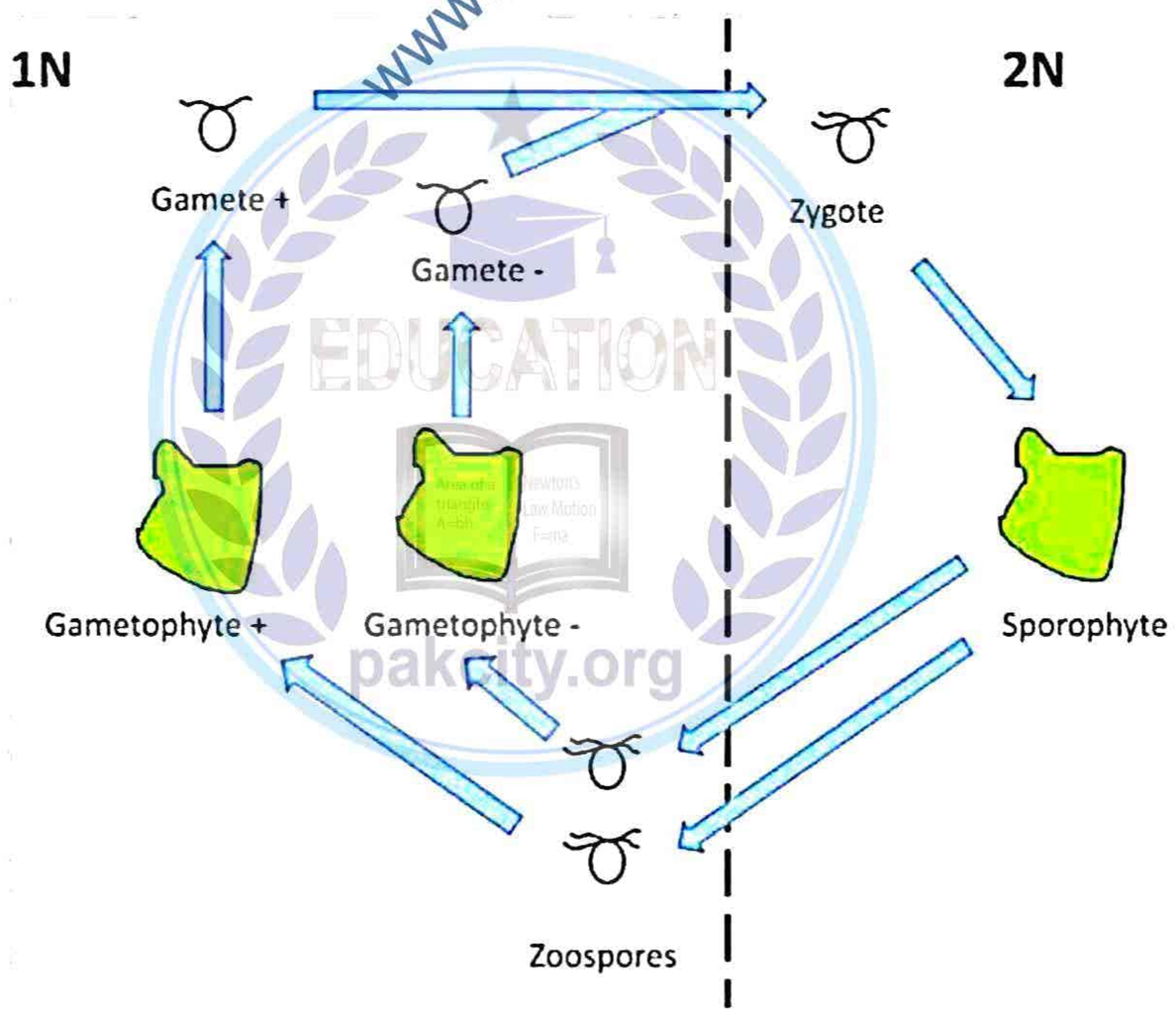
• Sexual reproduction in Ulva is isogamous and takes place in sexual plants or gametophyte, which is haploid (n).

• Each cell of the gametophyte produces many biflagellate gametes, which are then released in sea water.

• The gametes are morphologically similar and known as isogametes, but the fusion takes place between the gametes produce by two different gametophyte plants, which are termed as positive strain and the negative strain.

• After the fusion of gametes, a diploid quadri flagellate zygote is formed. Zygote swims for some time, then loses its flagella, secretes a wall around itself and undergoes a period of rest.

• Finally, the zygote develops into a new diploid sporophyte Ulva plant, which is called asexual plant.

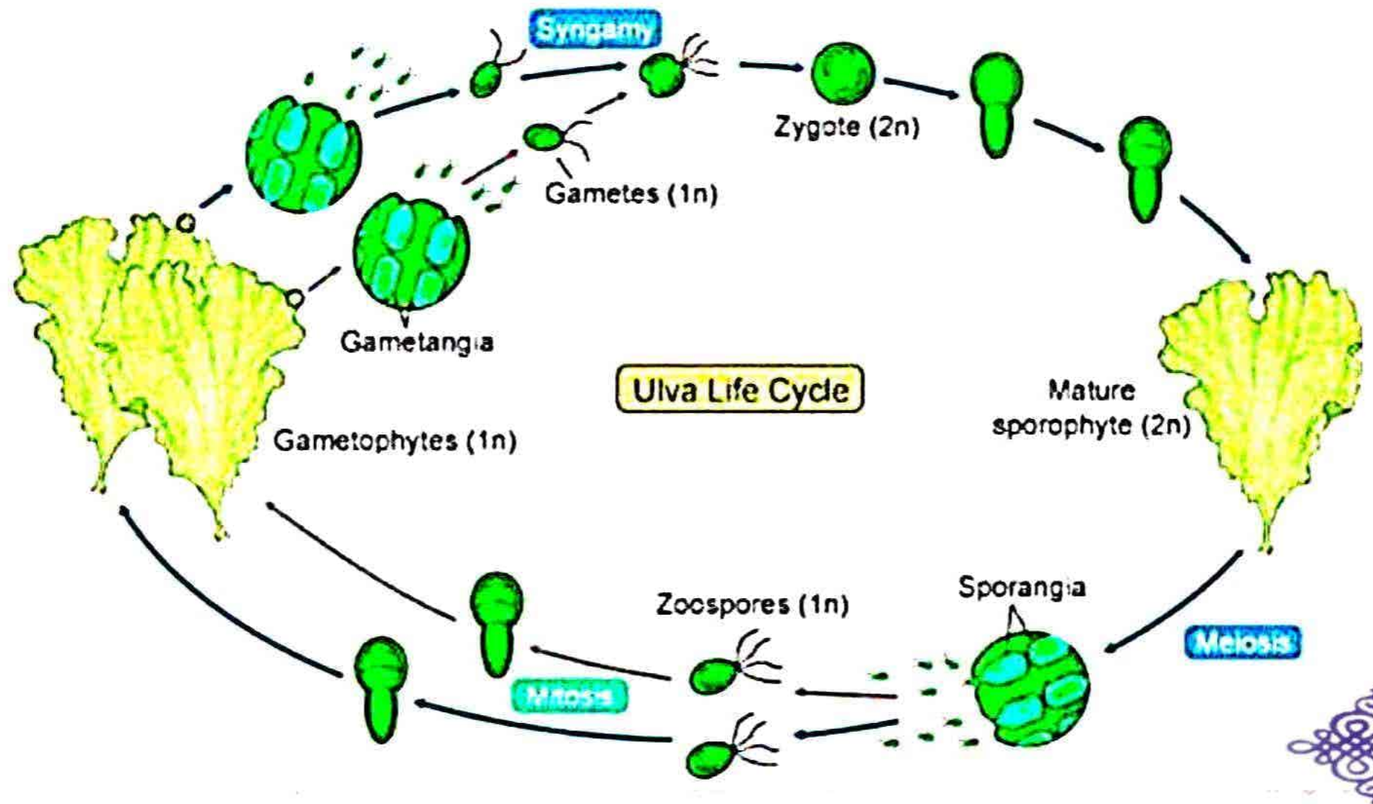


Alternation of Generation in Ulva:

• A distinct regular alternation of generations between the haploid gametophytes (sexual plant) and diploid sporophyte (asexual plant) is present in the life cycle of Ulva i.e. sporophyte by asexual reproduction produce gametophyte and gametophyte by sexual reproduction produce sporophyte.

• This is known as alternation of generation in Ulva.

• Since the two plants are morphologically similar so this process is known as "Isomorphic Alternation of generation.



FUNGI LIKE PROTISTA:

- Fungus like protist are heterotrophs and decomposers in nature having cell wall made up of cellulose.
- Its body is called mycelium made up of hyphae.
- They are non-motile but some show movement.
- They include slime molds and water molds.
- Water molds responsible for the "Late blight of potato".

SLIME MOLD (MYXOMYCOTA):

- Slime molds were once thought to be fungi because they produce spores but it is different from fungi because their vegetative body consists of only protoplast bounded by membrane and devoid of cell wall and for their phagtropic mode of nutrition.
- Slime mold is a haploid amoeba like cell.
- Its common name is plasmodial slime mold.
- Its habitat is terrestrial and moist decaying vegetation.
- In initial stages of life cycle, slime molds are creeping masses of living substances and look like egg's white and yolk.
- At this stage it is called plasmodium which can move along the forest floor, on to the dead leaves.
- Plasmodium is single cell with many nuclei and food vacuole and undigested food particles.
- Plasmodium undergoes metamorphosis during unfavorable condition and develop into fruiting bodies.
- Fruiting bodies are finger like, worm like, golf ball like or birds cage like structures and are of different colors.
- In fruiting bodies spores are formed.
- Cell wall is absent in slime mold.
- Mode of nutrition is phagtropic by means of protoplasmic arms (pseudopodia) from the rotten leaves.
- Reproduction in slime mold takes place by producing spores in sporangia.

WATER MOLD (OOMYCETE):

The oomycetes are also often referred to as water molds, although the water-preferring nature which directed the name is not true for most species, which are terrestrial pathogens. They are also named Oomycete because of female reproductive structure Oogonium.

PHYTOPTHORA INFESTANS:

Water mold is a fungus like Protist belongs to family Oomycetes. Water molds are filamentous, microscopic, absorptive organisms that reproduce both sexually and asexually.
Water mold is a pathogenic organism, causing "Late blight of potato".

Structure of water molds:

Its body is called mycellium which is the vegetative part of a fungus, consisting of a network of fine white threadlike filaments known as hyphae, which are endophytic aseptate, coenocytic, and hyaline.

A-ASEXUAL REPRODUCTION:

- Asexual reproduction takes place by means of biflagellate zoospores produce inside the reproductive structure Sporangia.
- The sporangia are produced on the branches of sporangiophore. Sporangiophores are those hyphae on which sporangia are produced.
- When sporangium mature then burst and the zoospores are liberated out in the film of water.

B- SEXUAL REPRODUCTION:

- Sexual reproduction is zoogamous.
- The female sex organ is oogonium while the male sex organ is antheridium.
- Both sex organs may develop on the same Hyphae or on two adjacent Hyphae lying side by side.
- The oogonium contains a single female nucleus in it.

- The fertilization takes place when the male and the female nuclei fuse together.
- After fertilization, the thick walled "oospore" is developed, which is present inside the oogonium.
- The oospore germinates in favorable conditions and produce a new mycellium.

a. ANIMAL LIKE PROTISTS (PROTOZOANS):

CHARACTERS:

- Protozoans are unicellular, eukaryotic and ingestive or absorptive heterotroph.
- Protozoans have single nucleus or many nuclei.
- Protozoans are solitary or colonial.
- Protozoans are mostly aquatic, live in fresh water, brackish water (slightly salty as in river estuaries) and marine water.
- Some of them are parasitic in nature.
- In protozoans, asexual reproduction takes place by simple cell division (fission) and sexual reproduction takes place by mating.

CLASSIFICATION OF PROTOZOANS:

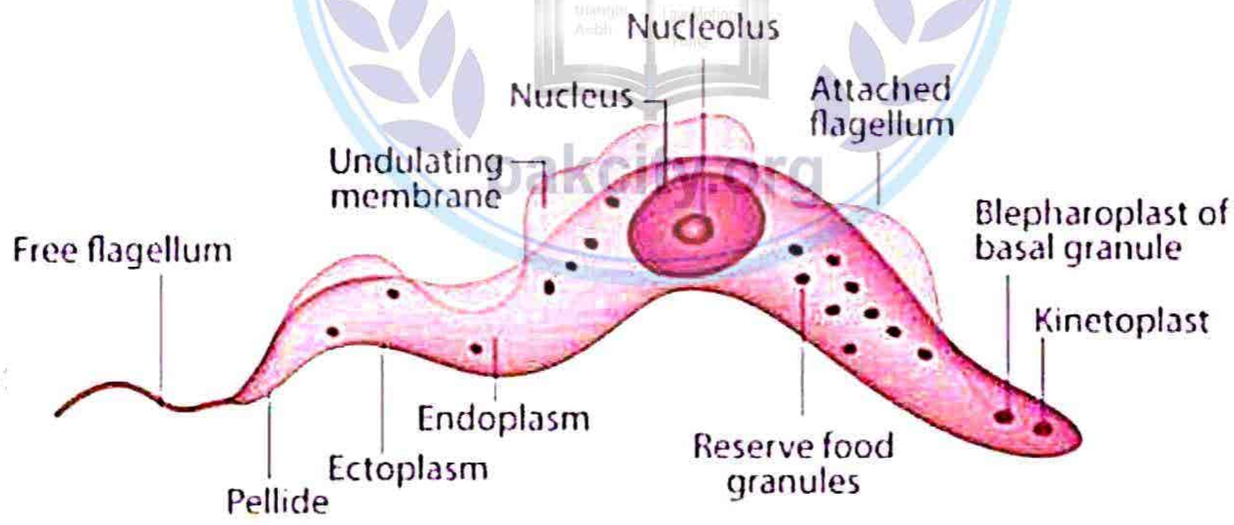
There are five classes of Animal like Protists that are usually classified based on how they move.

1. Class Zoo-flagellata.
2. Class Sarcodina.
3. Class Ciliata.
4. Class Suctoria.
5. Class Sporozoa.

1. CLASS ZOO-FLAGELLA

- Move by flagella ------ flagellary movement
- Two sub classes euglenophyta and zoomastigonia.
- Euglenophytes are aquatic, phototrophic, stored food as paramylon and reproduce asexually by binary fission.
- Zoomastigonia are parasitic, reproduce both sexually and asexually Have single nucleus.
- Causes diseases - African sleeping sickness caused by trypanosoma

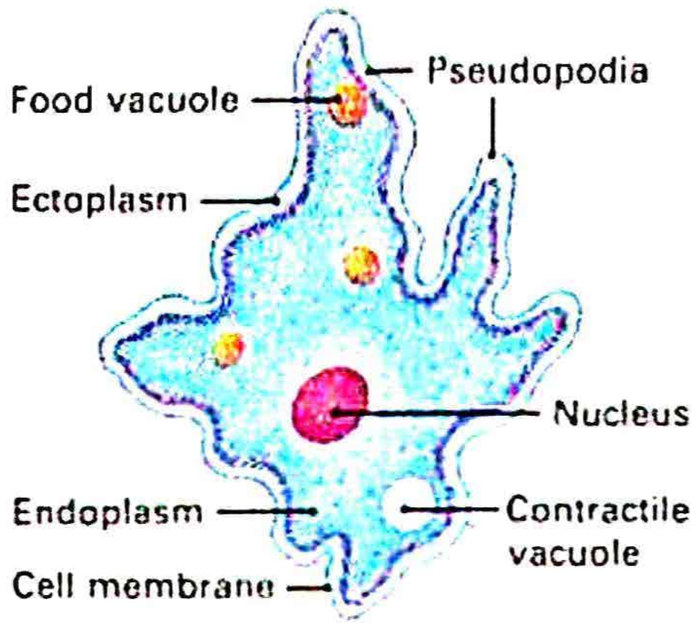
Examples: Trypanosoma, Leishmania and Euglena.



2. CLASS SARCODINA:

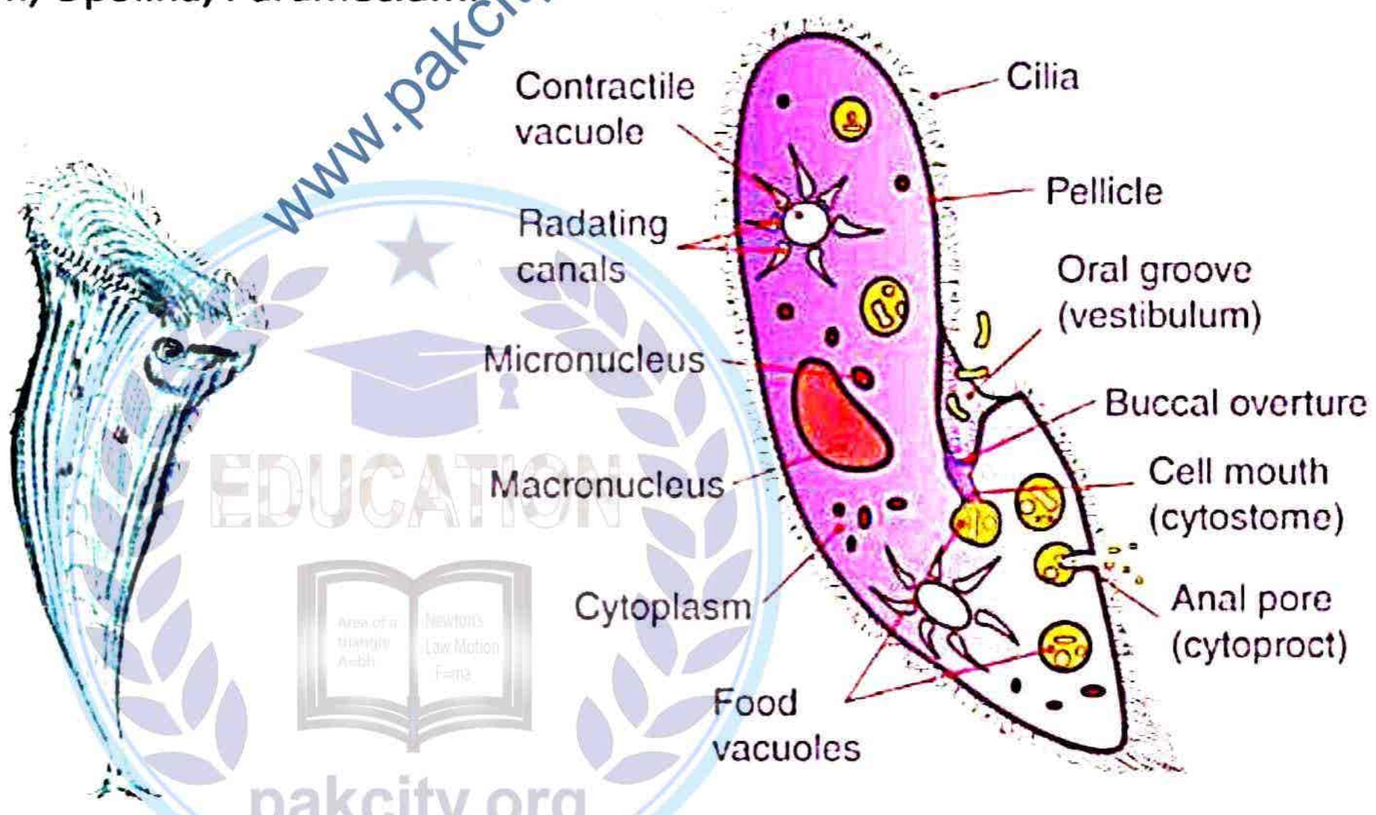
- Move by pseudopodia------- amoeboid movement,
- Irregular in shape.
- Parasitic or Holozoic nutrition.
- Single nucleus
- Contractile vacuole present.
- Reproduce asexually by binary fission and sexually by fusion of gametes.
- Causes dysentery, diarrhea.

• Shelled sarcodines form a layer on the sea bottom by deposition of their exo-skeleton.
Example- Amoeba, Antamoeba histolytica.



3) CLASS CILIATA:

• Move by cilia ----- ciliary movement
• They are heterotroph and predator.
• Two nuclei i.e. macronucleus and micronucleus.
• Contractile vacuole is present which removes excess water.
• Reproduces asexually by binary fission or sexually by conjugation.
• Outer membrane is called pellicle - is rigid due to which paramecia always have slipper or shoe-like shape. Examples - Balantidium, Opolina, Paramecium.



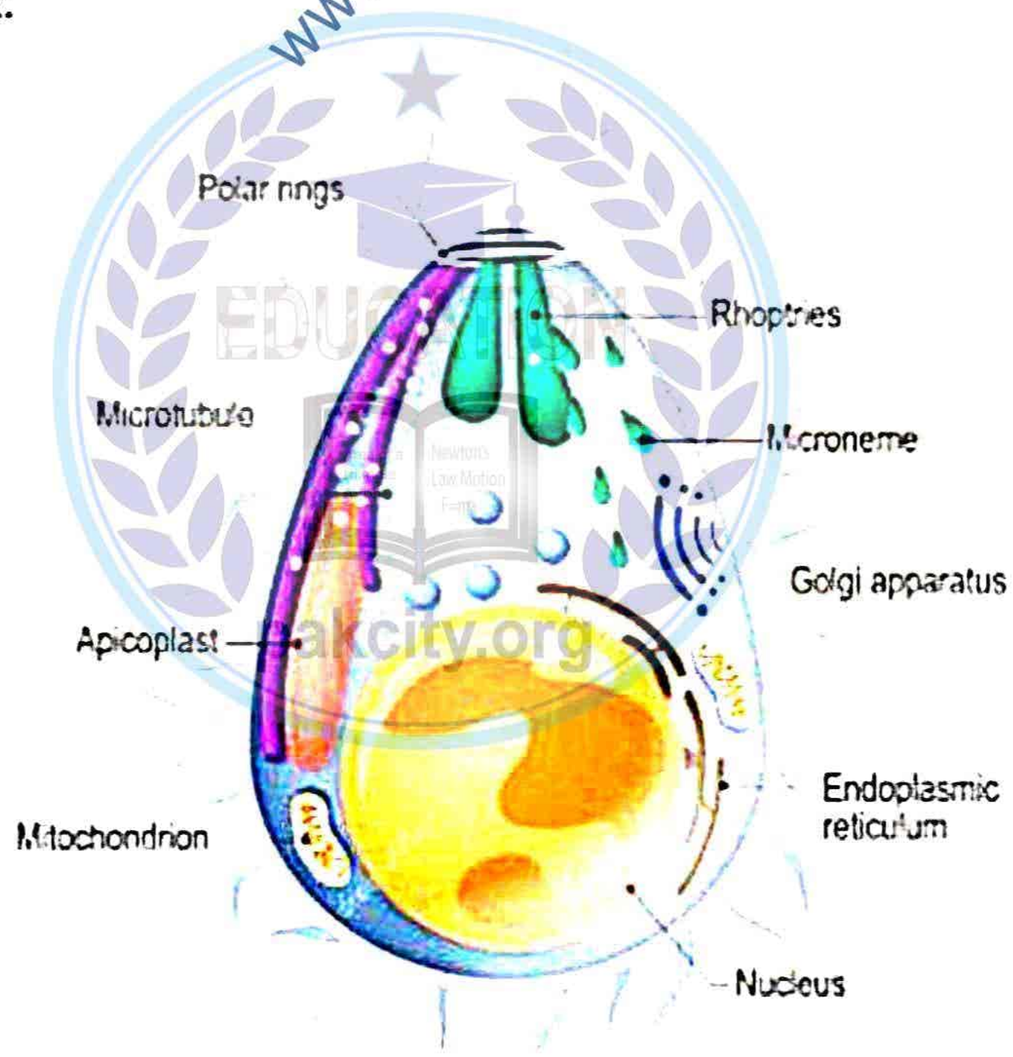
4) CLASS SUCTORIA:

• Young has cilia for swimming while adults are sedentary and attached to a substratum by stalk.
• Have delicate cytoplasmic tentacles, used for piercing, catching and holding the prey.
• Tentacles secrete a toxic substance for paralyzing the prey.
• Carnivores and heterotroph.
• Two nuclei the macronucleus and micronucleus.
• Reproduce asexually by binary-fission and sexually by conjugation.
Example - -----> Acineta.

5) CLASS SPOROZOA:

- Locomotory organ and alimentary canal is absent.
- No contractile vacuole and food vacuole.
- Parasitic causing serious diseases such as "coccidiasis" in poultry and malaria in man.
- Have single nucleus.
- Contractile vacuole absent.
- Reproduce asexually by multiple fission and sexually by syngamy.

Example - Plasmodium vivax.



IMPORTANCE OF PROTISTA :

PATHOGENIC PROTISTS:

- Pathogenic protists are parasites that infect other organisms, like animals and human beings, and cause harm to their hosts.

Trypanosoma: cause various diseases, including the fatal African sleeping sickness in humans.

Plasmodium: parasitic protozoa that must colonize a mosquito and a vertebrate, causes malaria.

Phytophthora infestans: causes late blight of potato.
Fertilizer: Sea weed contain potassium and other trace elements hence uses as fertilizer in the world.

Alternative Source Of Food:

Cholera: use as a food.
Algae: is a source of food for fishes.
Red sea weed: used to make bread.
Brown algae: harvested for food.

Environmental friend:

Algae consume about 80% CO_2 from the atmosphere and add O_2 in the atmosphere.

Biotechnology:

- Many microalgae species are genetically transformable.
- GM Dunaleilla salina contain orange red carotene which is used for color product in margarine, noodles and soft drink.
- Beta carotene is also used for lung cancer.
- Beta carotene is also used as vitamin supplement.
- GM green algae may use in fuel production.
- Botryococus braunii can use for crude oil production.

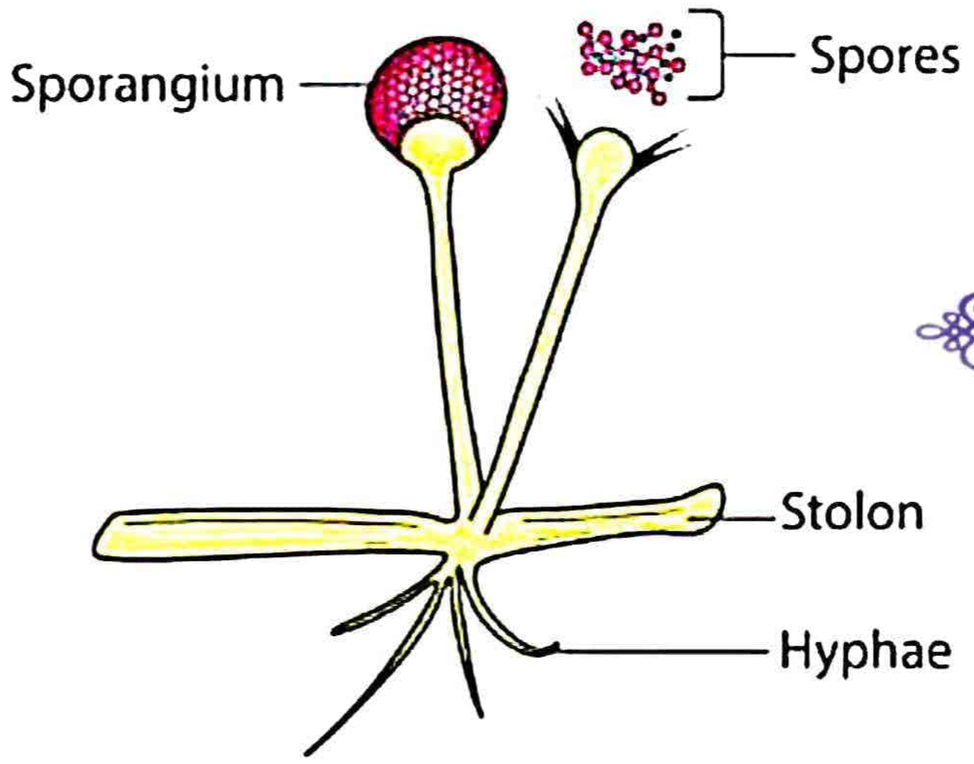
KINGDOM FUNGI:

- When we talk about fungus, negative thinking come into minds such as it attack plants, spoil food and affect human with athlete's foot.
- However, it is an important part of our ecosystem as it decomposed dead organisms, fallen leaves, feces and other organic materials.
- Fungus recycles the important chemical substances back to the environment.
- Fungus found in moist places.
- The study of fungi is called mycology.

CHARACTERISTICS OF FUNGI:

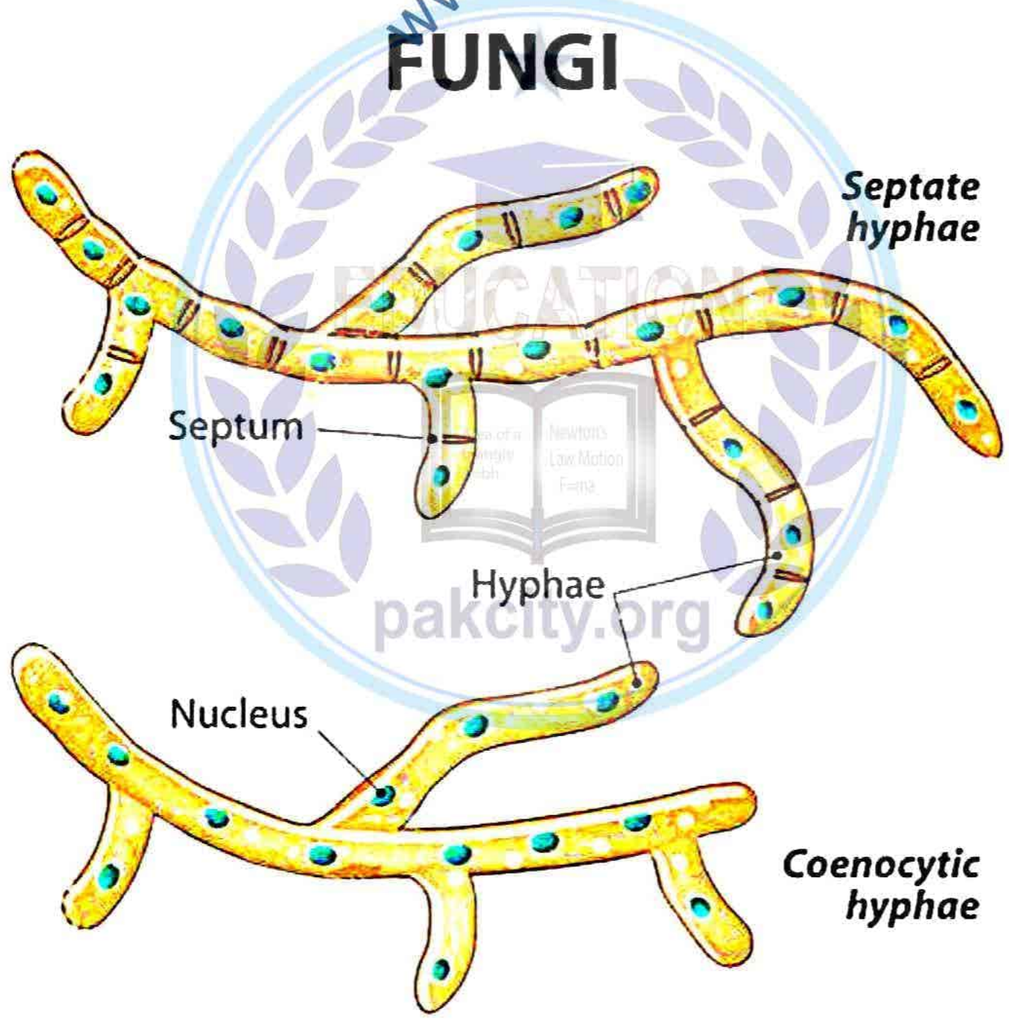
- Eukaryotic, non-vascular, non-motile and heterotrophic organisms.
- Multicellular filamentous except yeast.
- Reproduce by means of spores.
- Alternation of generation present.
- Lack chlorophyll, cannot perform.photosynthesis.
- Store their food in the form of glycogen.
- Reproduction is sexual or asexual.
- Some are parasitic and can infect the host.
- Produce a chemical called pheromone.

Examples include mushrooms, molds and yeast.



STRUCTURE OF FUNGI:

- Almost all have a filamentous structure except the yeast cells.
- Either single-celled or multicellular organisms.
- Consist of long thread-like structures known as hyphae.
- Hyphae together form a mesh-like structure called mycelium.
- Hyphae may be septate (Penicillium) or aseptae (Mucor).
- Cell wall- chitin and polysaccharides.
- Nucleus is dense, clear, with chromatin threads, surrounded by a nuclear membrane.



- Mostly fungal cellar haploid.
- Homok aryon cell nucleus.
- Heterokaryon: different nuclei.
- Dikaryon: observed during delayed karyogamy.
- Spores: haploid such as basidiospore and asco spore
- Diploid nuclei: formed during sexual reproduction

- Nuclear mitosis: observed, spindle formed inside the nulear membran
- Digestion: absorptive heterotroph, outside the body.

OVER VIEW OF FUNGI CHARACTERS:

1	**Cell Type**	Eukaryotic
2	**Cell Wall**	Present, made of chitin
3	**Centrioles**	Missing
4	**Plastids**	Missing
5	**Storage**	If carbohydrate is stored, it is usually as glycogen and not starch
6	**Nucleus**	• Some cells have single nucleus (monokaryotic). • Some have two nuclei (dikaryotic). • Other have multiple nuclei (multinucleate or coenocytic).
7	**Mitotic Division**	• Fungal cells show a unique mitotic division called nuclear mitosis.

MODE OF NUTRITION:

- Mode of nutrition is heterotrophic.
- Based upon ways of obtaining nutrient fungi may be saprotrophic, parasitic, predator and symbionts.

1. SAPROTROPHIC:

- Saprotrophic or decomposer directly obtained their food from dead organic Matters.
- Anchor or attach with substratum by modified hyphae the rhizoid.
- Secrete enzymes on dead organic matters and absorb the food.

Example: Mushroom, Yeast, Penicillium and Mucor.

2. PARASITIC:

- Absorb nutrients directly from the living host cytoplasm with the help of special hyphal tips called haustoria.
- May be obligate or facultative.

a- Obligate parasite:

- Can grow only on their living host and cannot be grow on available defined growth culture medium.

Example: Mildew, Rust.

b- Facultative parasite:

- Can grow partially on their host as well as by themselves on artificial media.

Example: Armillaria.

3. PREDATORY FUNGI

- Some are active predator such as Pleurotus.
- Some species trap soil nematodes by forming constricting ring, their hyphae invading and digesting other living organisms.

4. MUTUALISTIC FUNGI:

- Live together with other organisms such as Lichens and Mycorrhizae.

Lichens: association between fungus and green algae. Fungal partner helps alga in absorption of water and minerals while algal partner provides prepared food.

Mycorrhizae: relationship between soil fungi and roots of plants. Hyphae help in direct absorption of phosphorous, zinc, copper from soil while plants grow successfully and provide food.

REPRODUCTION IN FUNGI:

• Most fungi can reproduce asexually and sexually (except imperfect fungi in which sexual reproduction has no be observed).

1- ASEXUAL REPRODUCTION:

Asexual reproduction takes place by

a) Sporangiospore.

b) Conidiospore.

C) Budding.

d) Fragmentation.

a) Sporangiospore:

• Produced in spherical sac like structures, the sporangia.

• Sporangia are developed on the tips of special erectly growing hyphae, the sporangiophores e.g. Rhizopus.

b) Conidiospore:

Produced in the form of a cluster of chains on the tips of special erectly growing hyphae, the conidiophores. Eg.Penicillium

c) Budding:

• Only shown by yeast In budding.

• First, nucleus is divided into two daughter nuclei by nuclear mitosis.

• Then an out growth is formed which takes one of the daughter nuclei And subsequently separated from the parent cell.

d) Fragmentation:

• Breakdown of mycelium into different fragments.

• Segments regenerate into new mycellium.

2. SEXUAL REPRODUCTION IN FUNGI:

• In sexual reproduction, there are three steps;

I. Plasmogamy

• It is the fusion of cytoplasm of two hyphae of mating types.

• Hyphae of two genetically different but compatible mating types come together and fuses their cytoplasm.

• It also bring two haploid nuclei of fusing hyphae closer.

ii- Karyogamy:

• It is the fusion of two haploid nuclei, converting hyphal cell into zygote.

• Plasmogamy is followed by karyogamy.

iii- Meiosis:

• Meiosis is followed by karyogamy

- It converts diploid zygote into spores.
- Spores germinate into haploid hyphae.

DIFFERENCE BETWEEN FUNGI AND PLANTS:

Fungi	Plants
Chlorophyll absent	Chlorophyll present
No cell differentiation	Cell differentiate
Cell wall - chitin	Cell wall-cellulose
Decomposers	Producers
Reproduce by spores	Reproduce by seeds
Example--- yeast, mold, mushrom	Example--- moss, trees

DIVERSITY AMONG FUNGI:

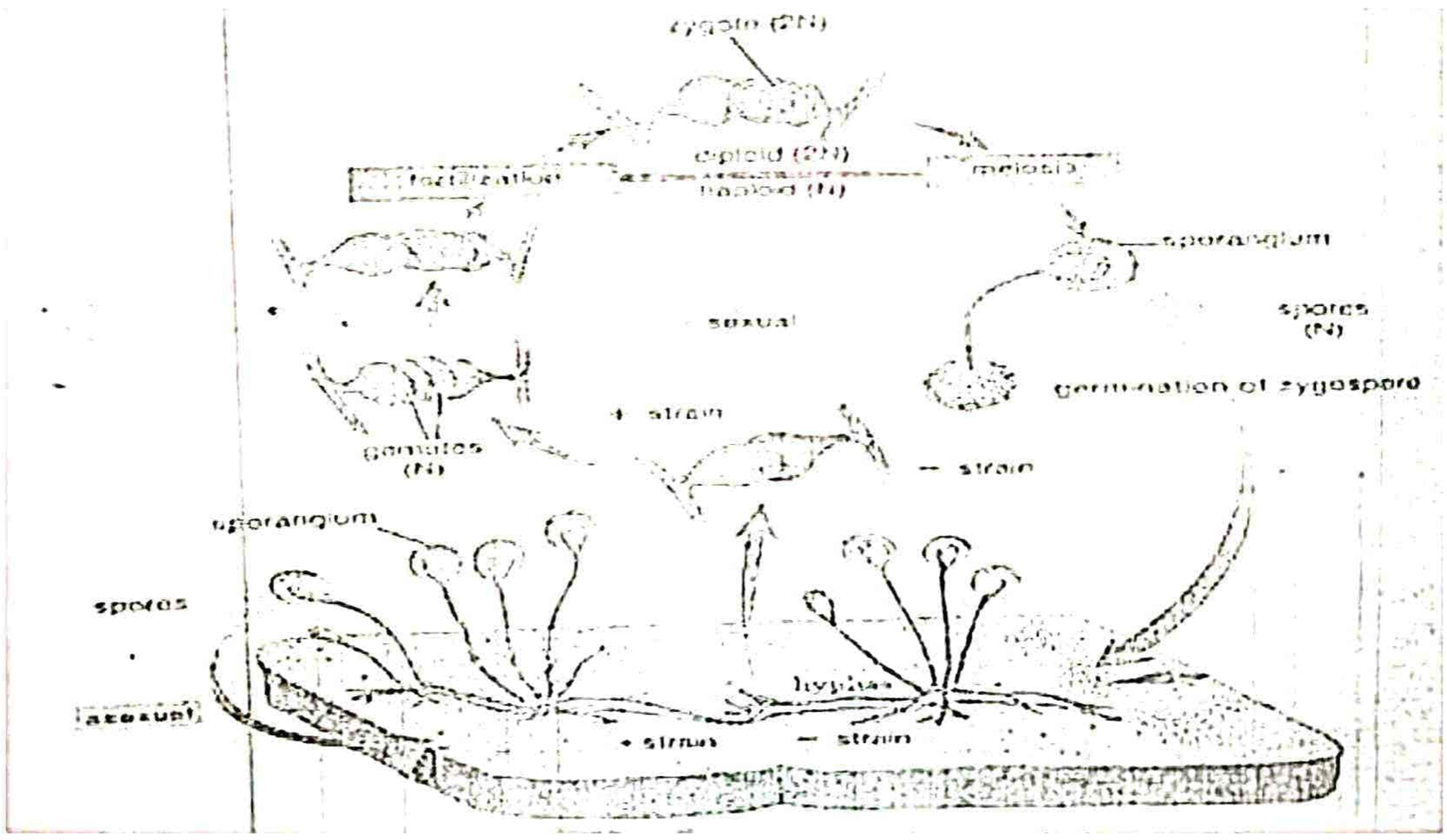
Four major divisions of fungi on the basis of sexual reproductive structures except deuteromycota.

1. Zygomycota.
2. Basidiomycota.
3. Ascomycota.
4. Deuteromycota.

1. ZYGOMYCOTA:

- Commonly called conjugating or zygote fungi.
- Spores-zygospores formed by the fusion of plus and minus nuclei i.e. coenocytic.
- Hyphae - aseptate Asexual reproduction - by sporangiospores and fragmentation.
- Sexual reproduction - by conjugation of plus and minus nuclei Zygote - formed by as a result of karyogamy.
- Zygospore - zygote develop into zygospore.
- Germination - zygospore germinate in favorable condition and undergo meiosis.
- Fruiting body – absent.
- Gametangia – improper, poorly developed.

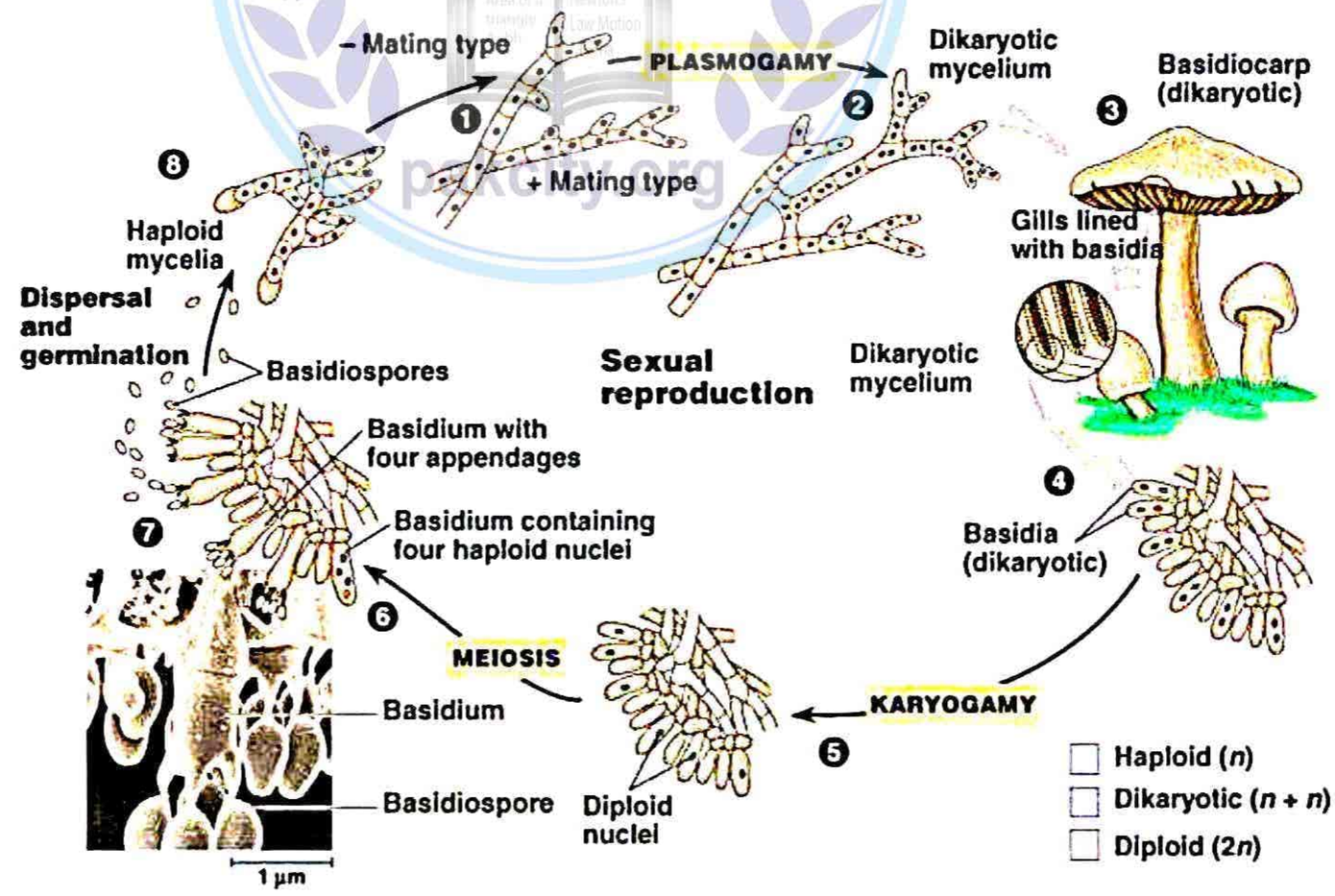
Examples: Mucor, Rhizopus.



2. BASIDIOMYCOTA:

- Commonly called club fungi.
- Spores-basidiospores formed in basidium.
- Hyphae Septate.
- Asexual reproduction - by conidiospores and fragmentation.
- Sexual reproduction - by fusion of hyphae i.e. plasmogamy.
- Secondary mycelium - formed by as a result of plasmogamy (n+n) having two haploid nuclei.
- Buttons - secondary mycelium grow and form a compact mass called button.
- Fruiting body - present, buttons grows into a fruiting body called mushroom (basidiocarp-consist of stalk and cap).
- Basidia and Zygote - formed by the fusion of haploid nuclei in basidia on cap of fruiting body.
- Basidiospore-in zygote meiosis occur, form 4 haploid basidiospores.
- Gametangia – proper.

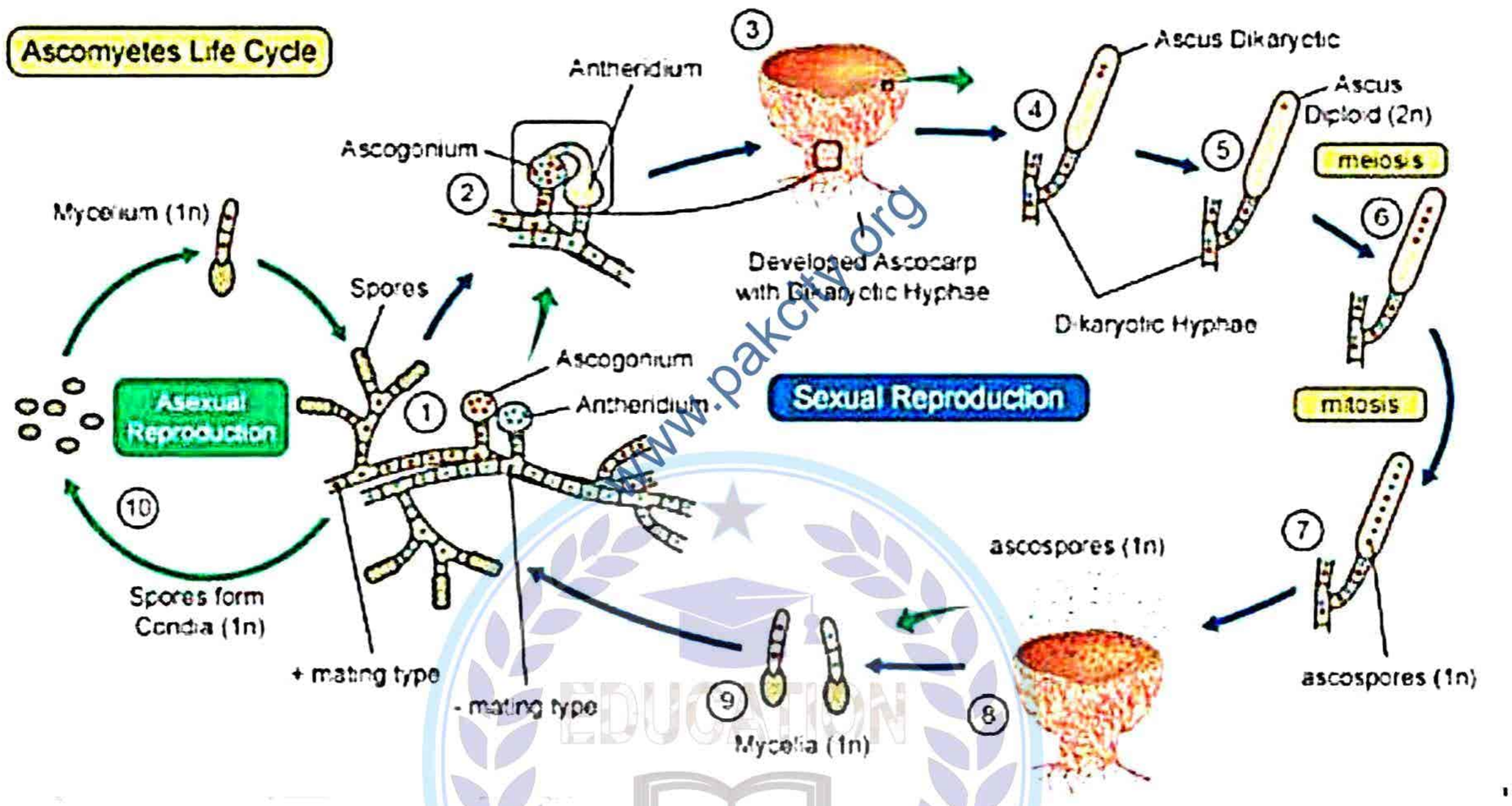
Example - Toad stool, Mushroom, Puff balls.



3. ASCOMYCOTA:

- Commonly called sac fungi.
- Spores - ascospores formed in ascus or asci.
- Hyphae – septate.
- Asexual reproduction - by conidiospores, fragmentation and budding.
- Sexual reproduction - by plasmogamy and karyogamy .
- Dikaryotic hyphae - nuclei pair but no fuse, karyogamy delayed.
- Secondary mycelium - formed from dikaryotic hyphae.
- Fruiting body - develop from 2ndry mycelium known as ascocarp (cup, flask, bell shaped).
- Zygote - within ascus nuclei fused and develop into zygote, undergo meiosis and formed 4-haploid nuclei followed mitosis resulting in 8 nuclei.
- Ascospores each haploid nuclei develop into ascospores.
- Germination-ascospore germinate in favorable condition.
- Gametangia – proper.

Examples; Yeast, Neurospora, Mildew.



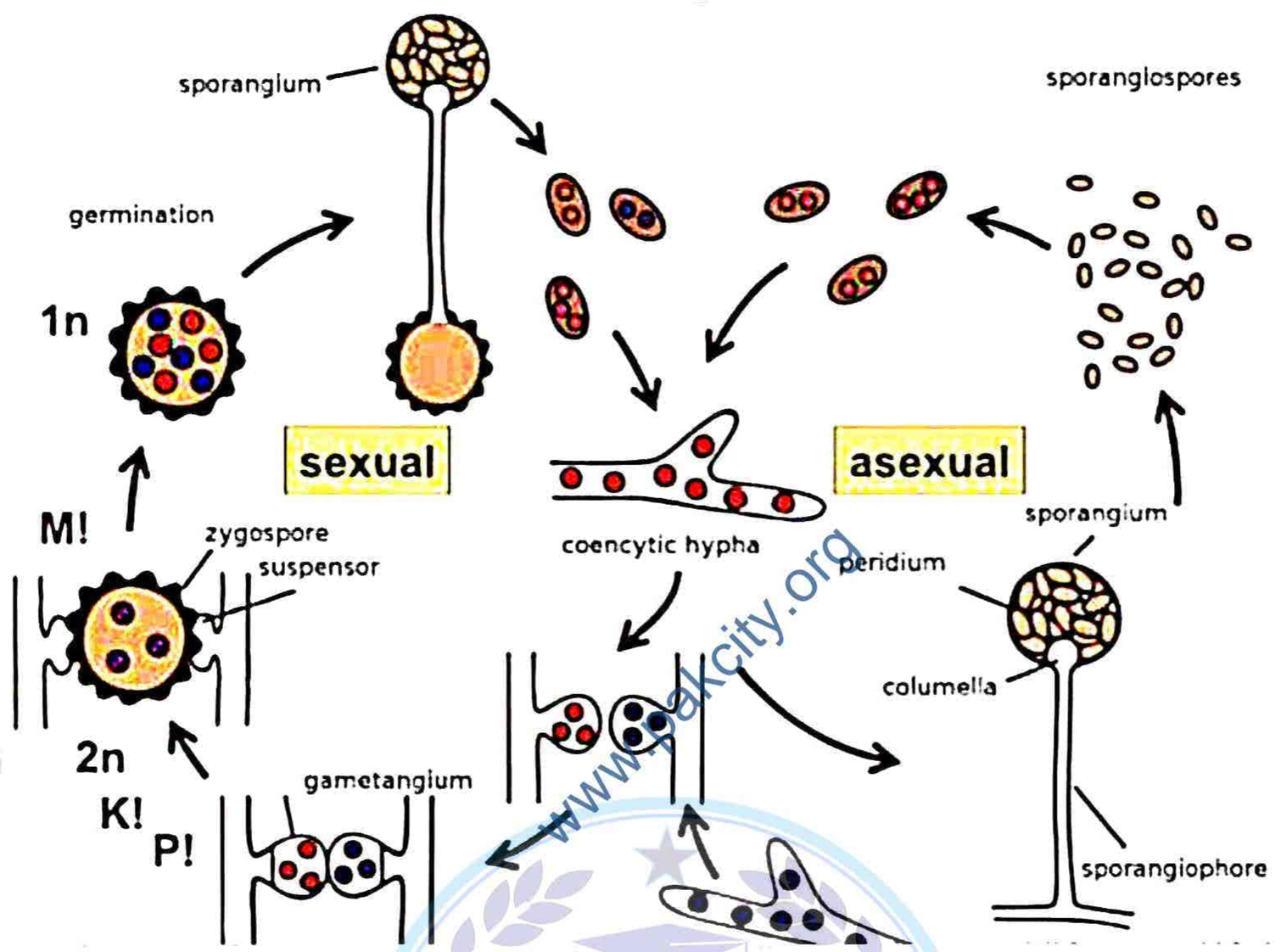
4. DEUTEROMYCOTA:

- Commonly called fungi imperfecti
- Spores - fail to produce spores
- Hyphae - septate or aseptate
- Asexual reproduction - by sporangiospore/conidiospores and fragmentation
- Sexual reproduction - NO
- Plasmogamy and karyogamy - NO
- Secondary mycelium - NO
- Fruiting body - NO
- Zygote -NO
- **Parasexuality** - results in recombination of genes from different individuals but does not involve meiosis and formation of a zygote.
- Gametangia – NO.

Examples; Penicillium, Aspergillus.

LIFE CYCLE OF MUCOR (ZYGOMYCOTA):

- Mucor commonly called – Mold.
- Mode of nutrition - Saprophytic on plants, vegetables, fruits and bakery goods.
- Coprophilous fungi - Growing or living on dung.
- Distribution-in humus (organic component of soil).
- Smell - musty or moldy smell.
- Hyphae - aseptate i.e. coenocytic.
- Mycellium aseptate hyphae forms network.
- Hyphae types sporangiphore and rhizoidal (penetrate into tissues of substratum).



IMPORTANCE OF FUNGI:

- Fungi are important for human as;
- Food.
- Decomposers.
- Pathogens.
- Medicines.
- Biological control.
- Biotechnology.

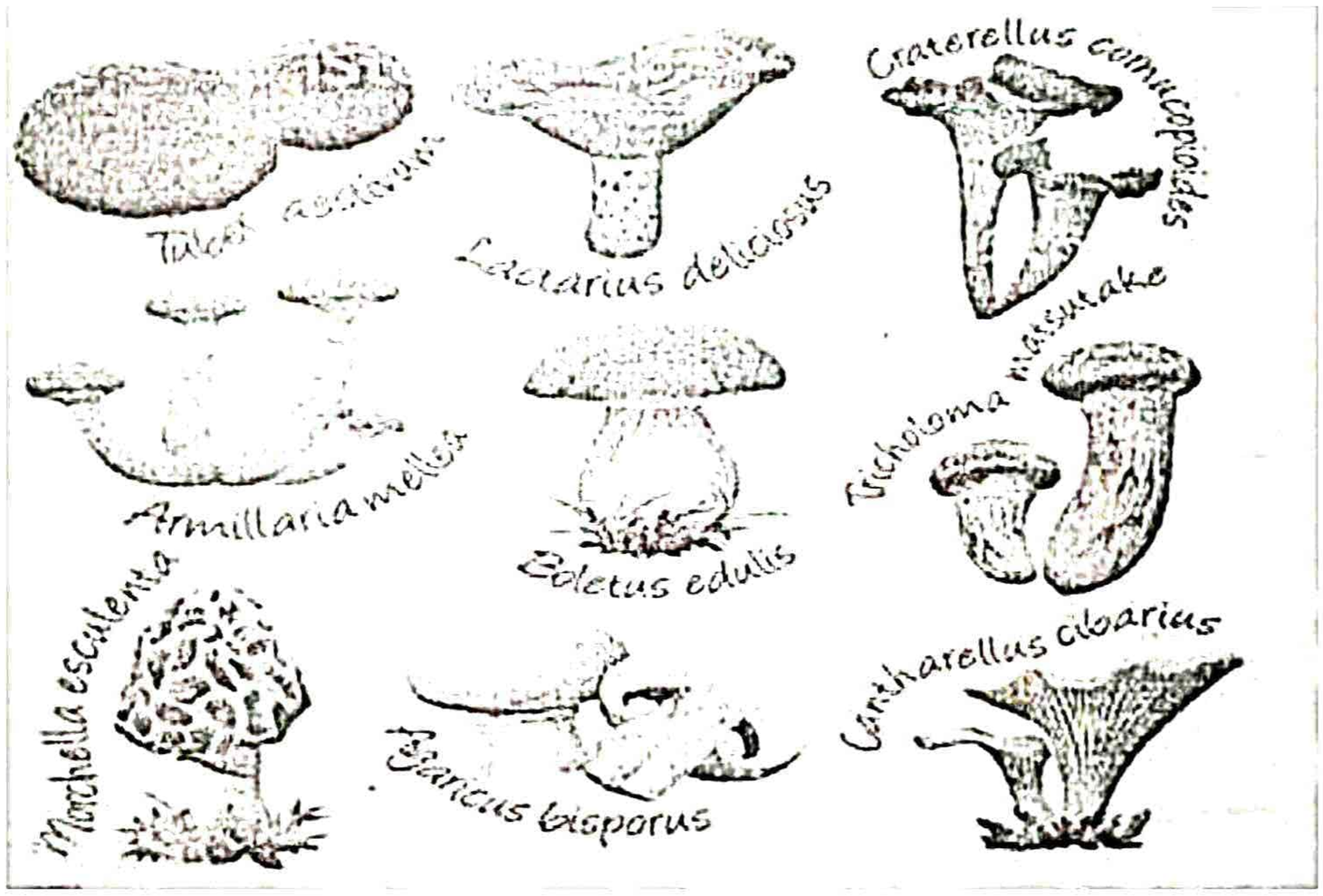
EATING AND DRINKING FUNGI:

Fungi are rich in high-quality proteins, carbohydrates, vitamins, and antioxidants. Mushroom such as Agaricus bisparous, Padistren, Truffles and Oyster mushroom are important source of food.

Another role of fungi is fermentation used in industries.

Aspergillus oryza: used in soybean fermentation to make soy sauce.

Saccharomyces cerevisiae: used in the fermentation of sugar into alcohol and CO_2 in wine, beer and bread industries.



FOOD SPOILAGE:

Saprophytic fungi spoil food such as Penicillium italicum causes citrus fruits spoilage, Botrytis allii causes onions spoilage.

POISONOUS:

Toadstools contain poison that may effect the human nervous system.

PATHOGENIC FUNGI:

ANIMALS PATHOGENS:

- Ring worm disease: caused by Microsporum canis such as tinea pedis or athletes foot disease.
- **Allergic disease:** caused by Alternaria or Aspergillus
- **Histoplasmolysis of lungs:** caused by Histoplasma
- **Lung disease/Aspergillosis:** caused by Aspergillus
- **Systemic bone infection:** caused by Candidal osteomyelitis.
- **Vaginal Thrush:** caused by Candida albicans
- **Moniliasis/Candidiasis:** skin and mouth disease caused by Candida albicans

PLANTS PATHOGENS:

- **Downy and powdery Mildew:** caused by ascomycete Golovinomyces orontii.
- **Smuts and Rust:** smut is caused by the Sporisorium scitamineum and rust is caused by Puccinia graminis.

DECOMPOSER:

Saprotrophic fungus decomposed dead organisms and recycled nutrients such as phosphate and sulphates.

SPOILAGE:

Fungi spoil leather, wool, books, timber and cotton.

ANTIBIOTICS:

- Antibiotics derived from fungus used against various bacterial diseases such as diphtheria, pneumonia, meningitis, syphilis and gonorrhea etc.

- Penicillin derived from fungus Penicillium.
- Chloromycetin- - derived from Acremonium vitellinum.
- Neomycin + not derived from fungus, it is derived from bacteria Streptomyces fradiae.
- Terramycin-not derived from fungus, it is derived from Streptomyces rimosus.
- Cyclosporin-derived from soil fungus Trichoderma polysporum, used in organ transplant.
- Griseofulvin - obtained from penicillium.

BIOLOGICAL CONTROL:

- Fungi used for weeds and pests control.
- Trichoderma used for controlling plant diseases.
- Soil fungi trap nematodes.

USE IN BIOTECHNOLOGY:

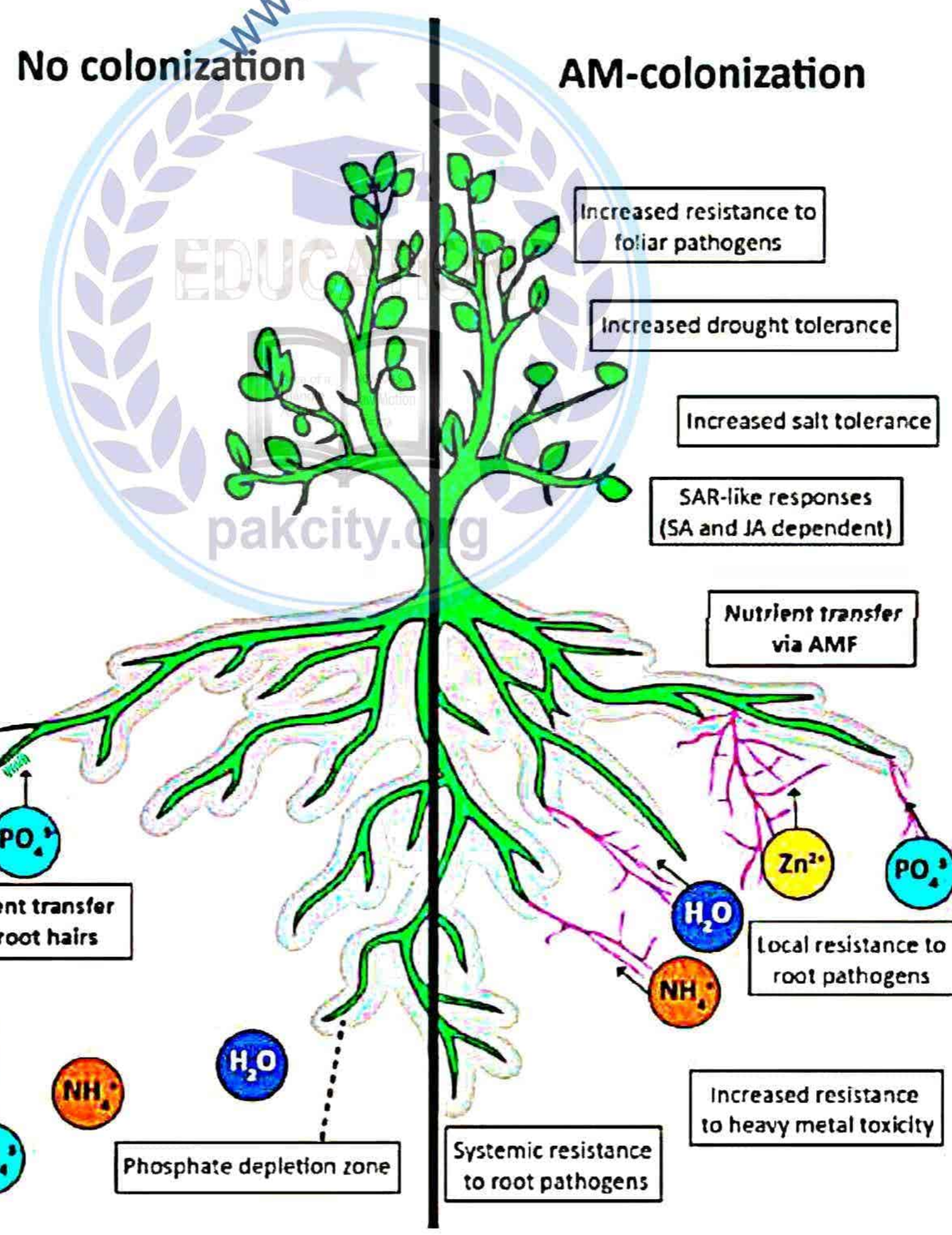
- Saccharomyces cerevisiae: used in insulin production by introducing human insulin gene.
- Fungi convert waste into vitamins, hormones and antibiotics.

GENETIC RESEARCH:

Fungus used in genetic research, include genetic recombination and gene regulation.

MUTUALISTIC FUNGI:

- **Mycorhizae:** Fungi with roots of plants - fungi absorb minerals (P, Zn, Cu) while plants provide food.
- **Lichens:** fungi with algae - fungus protect plants from strong light and desiccation while algae gives food to fungus.



DIFFERENCE BETWEEN FUNGI AND FUNGI LIKE PROTISTA:

FUNGI	FUNGI LIKE PROTISTA
Their cell wall is made up of chitin.	Their cell wall is made up of cellulose.
Their body is composed of hyphae (mycelium).	Their body may be a mycelium or plasmodium.
They lack centrioles	They have centrioles.
They have no flagellated sex cells.	They have flagellated sex cells.

DIFFERENCE BETWEEN ALGAE, FUNGI AND ANIMAL LIKE PROTISTS:

ALGAE	FUNGI	ANIMAL LIKE PROTISTS
These are photosynthetic protists. Chlorophyll and chloroplast is present in them.	Fungi are heterotrophic. They lack chlorophyll and chloroplast.	Heterotrophic and they lack chlorophyll and chloroplast.
Their cell wall is made up of cellulose.	Their cell wall is made up of chitin.	No cell.
Body may be unicellular, thallus or filamentous.	Their body is composed of hyphae.	Body may be unicellular, colonial or multicellular.
Their reserve food material is starch.	Their reserve food material is glycogen.	Reserve food material is glycogen/Fats.

DIFFERENCE BETWEEN SPORE AND CONIDIA:

SPORE	CONIDIA
These are small, haploid and non- motile structures covered by hard wall.	Conidia are naked non-motile asexual spores which are cut off at end of modified hyphae called conidiophores.
Spores are produced inside the sporangium	Conidia are not produced inside the sporangium.
The hyphae on which sporangium of spores is produced is called sporangiophore.	They hyphae on which conidia are cut off is called conidiophores.
These are produced in Zygomycota.	These are produced in Ascomycota, Zygomycota and Deuteromycota.

DIFFERENCE BETWEEN COENOCYTIC/NON-SEPTATE HYPHAE AND SEPTATE HYPHAE:

COENOCYTIC/NON-SEPTATE HYPHAE	SEPTATE HYPHAE
Coenocytic hyphae lack septa or cross walls.	Hyphae are divided by cross walls called septa.
Hyphae are in the form of an elongated multinucleated large cell.	Hyphae are separated into individual cells containing one or more nuclei.
In such hyphae cytoplasm moves effectively, distributing the materials throughout.	In such hyphae, septa has pores but cytoplasm does not move so effectively.

DIFFERENCE BETWEEN PLASMOGAMY AND KARYOGAMY:

PLASMOGAMY	KARYOGAMY
The fusion of cytoplasm is called plasmogamy.	The fusion of nuclei is called Karyogame.
It occurs first in sexual reproduction of fungi.	It occurs after plasmogamy in sexual reproduction of fungi.