

UNIT -4

ULTRA STRUCTURE OF EUKARYOTIC CELLS

FUNGI :

- Fungi are eukaryotic organisms that include microorganisms such as yeasts, molds and mushrooms. These organisms are classified under kingdom fungi.
- The organisms found in Kingdom fungi contain a cell wall and are omnipresent. They are classified as heterotrophs among the living organisms.



- Fungi is derived from “**Mykos**”. Fungi are **eukaryotes**. They occur in both unicellular and multicellular forms.
- It is a group of **heterotrophs** (chemoheterotrophs) and placed in the phylum Thallophyta.
- It is measured in micrometre and size was ranged from **2μm -200μm**.
- It is a **non-motile** and consist of **well-developed membrane bound organelles**.
- Types of fungi – **Mold, Yeast & Mushroom**.



The FUNGI

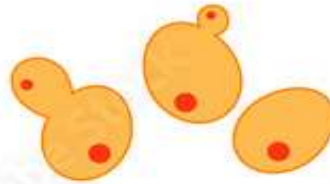
Fungi : Group of EUKARYOTE include Mold, Yeast and Mushroom

Mold



Molds are fungi form in
Multicellular
called hyphae

Yeast



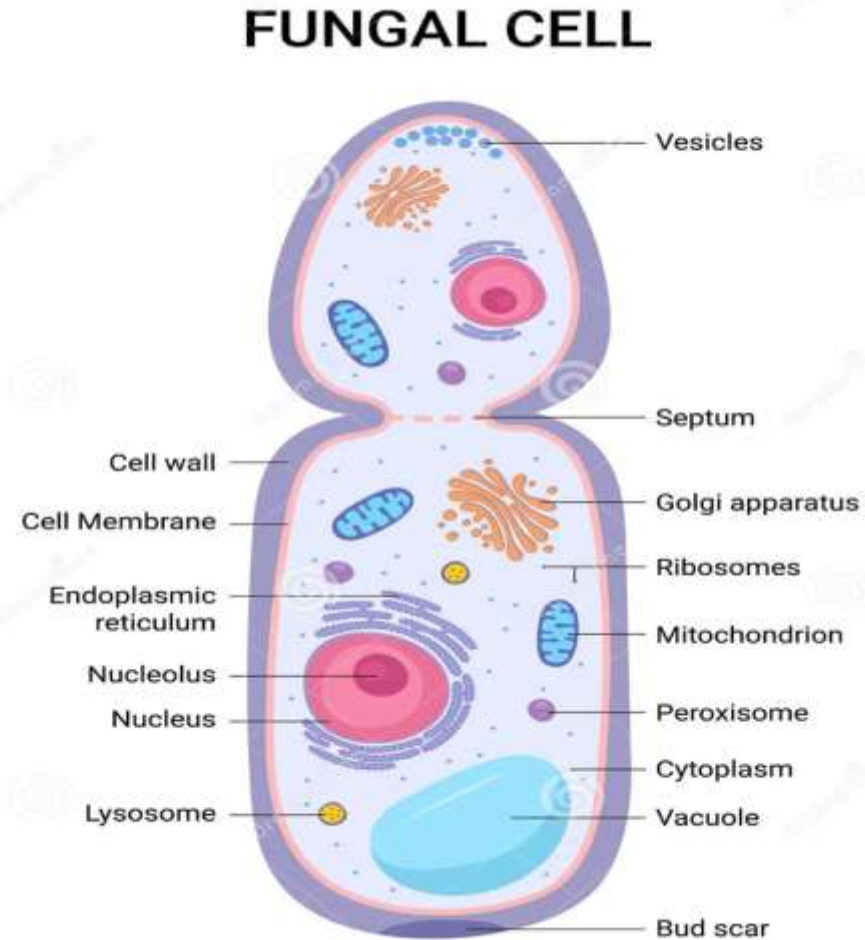
Yeast are fungi form in
Unicellular

Mushroom

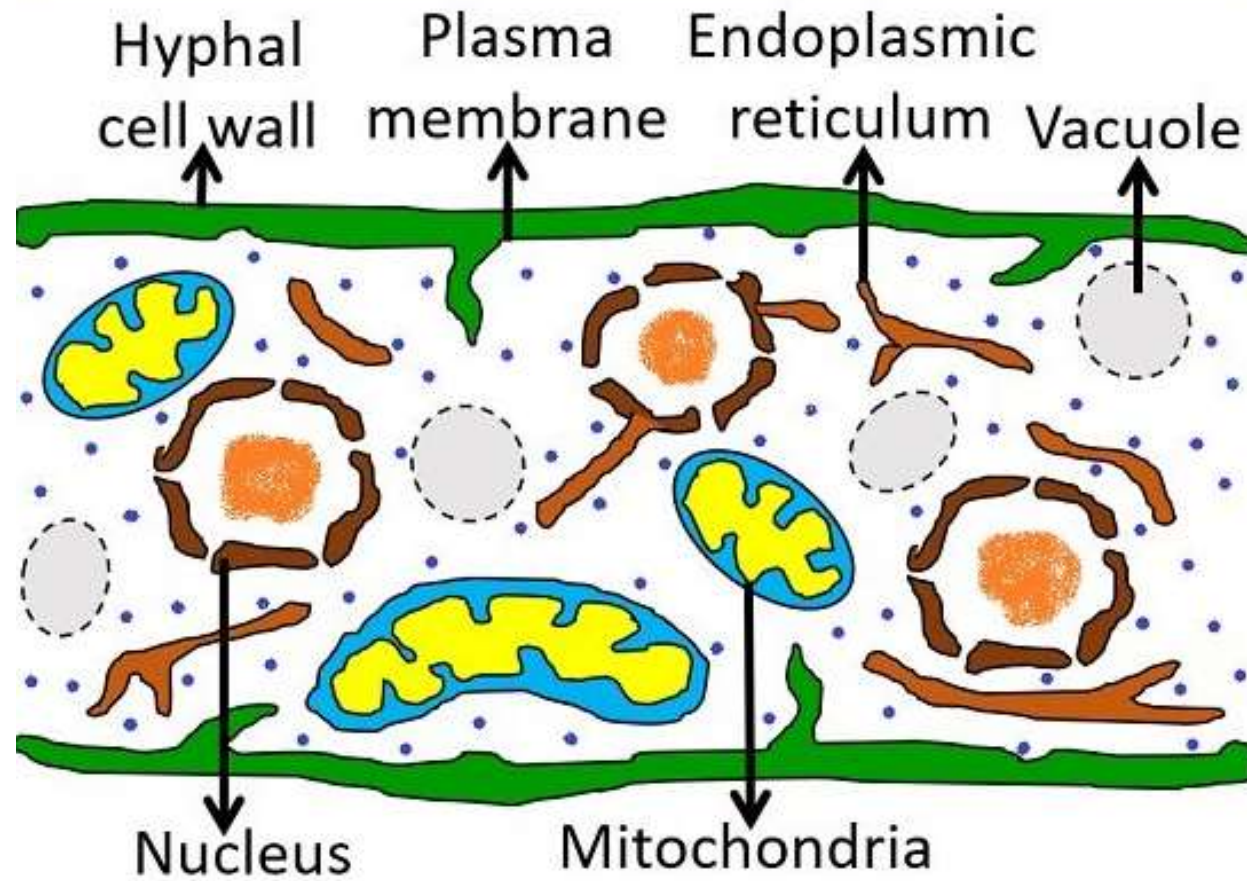


Mushroom or Toadstool
are spore-bearing
fruiting body of fungi

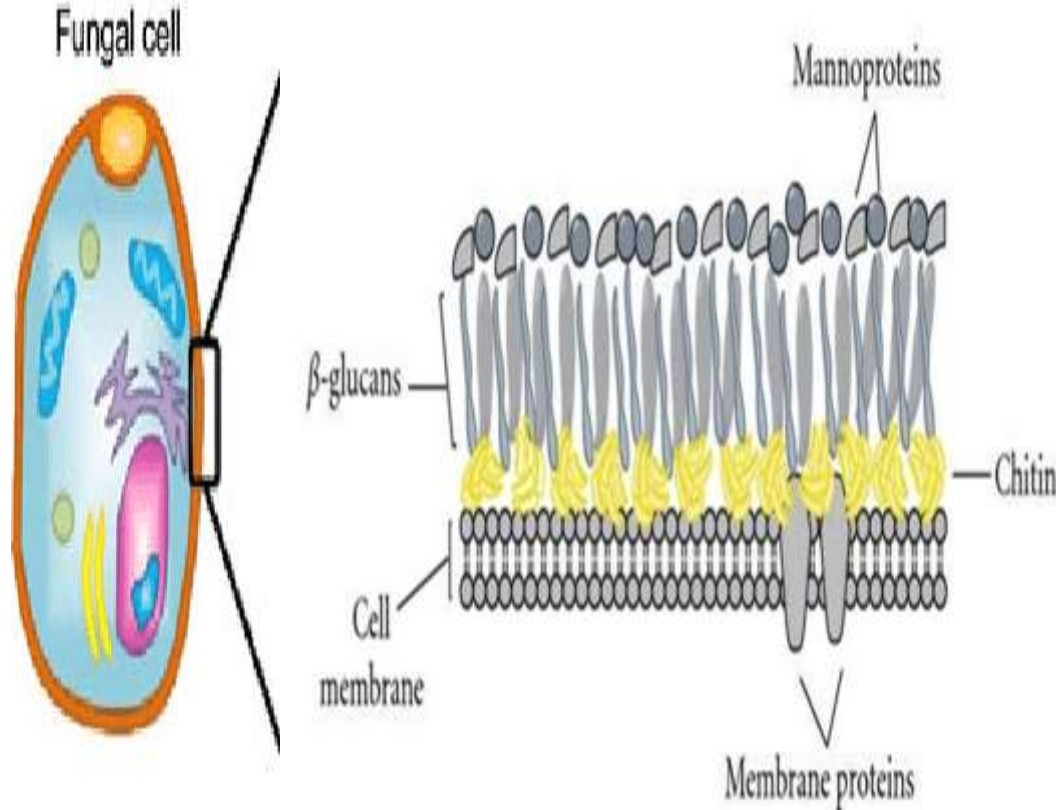
ULTRASTRUCTURE OF FUNGI:



FUNGAL MOLD



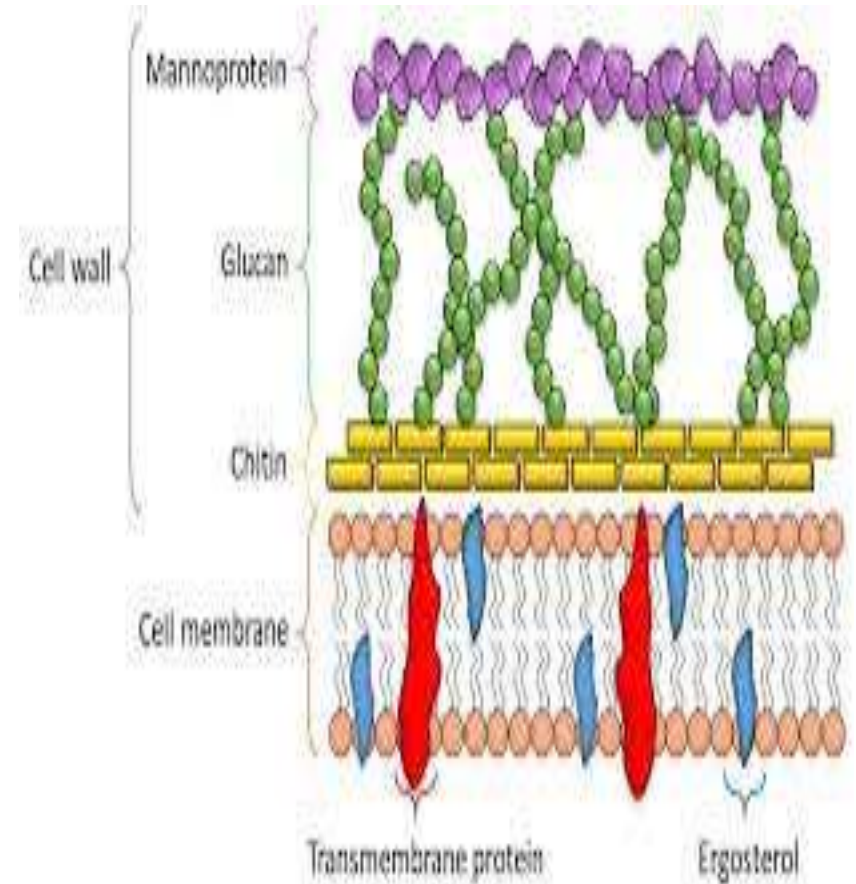
CELL WALL:



- The fungal cell consists of a **rigid and dynamic** structure of cell wall. Composition of cell wall of different fungal groups differs.
- Chemical analysis of cell wall reveals that it contains **80-90% polysaccharides**, and remaining **proteins and lipids or other glucans**.
- Chitin or cellulose or other glucans are present in cell walls in the form of **fibrils forming layers**. It is followed by Plasma or Cell membrane.
 - It gives **shape** to the cell and also **protects** the cell from changes in osmotic pressure and other environmental changes.
 - It enables **reproduction**, recognition and reception.

CELL MEMBRANE:

- ✓ In cell, the cell membrane is present **inner side** of cell wall that **encloses the cytoplasm**.
- ✓ It is a **semipermeable membrane** and also called as Plasma membrane.
- ✓ It is a **delicate**, extremely thin and living membrane.
- ✓ Made mostly of **phospholipid molecule**.
- ✓ It is a **complex barrier** separating the cell from its external environment.
- ✓ To control selectively the **entrance and exit of materials or water molecules** by endocytosis(entry) and exocytosis (exit).



1.Fungal Body (Thallus)

- The fungal body is collectively referred to as the "thallus," which is the vegetative structure that sustains the organism. In multicellular fungi, the thallus is typically made up of a network of filaments called **hyphae**. There are two general types of fungal thalli:
- **Yeasts**: Unicellular, typically oval or spherical, and reproduce by budding.
- **Molds**: Multicellular, composed of hyphae that form a mycelium.

2.Fungal Cells

- Fungal cells are eukaryotic, meaning they have a defined nucleus and organelles. They are enclosed by a cell wall made of **chitin**, unlike plant cells which contain cellulose.
- **Nucleus**: Contains genetic material (DNA) in the form of chromosomes.
- **Cytoplasm**: The gel-like substance that houses the cell's organelles.
- **Vacuoles**: Storage structures within the cell, often involved in maintaining osmotic pressure.
- **3. Hyphae**
- Hyphae are the thread-like structures that form the body of multicellular fungi. They can vary in structure and function:

- **Septate Hyphae:** Hyphae that are divided by septa (cross walls), which may have pores allowing cytoplasm to flow between cells.
- **Coenocytic Hyphae:** Hyphae that lack septa, resulting in continuous multinucleate cells.
- The growth of hyphae occurs through the extension of the tip, which allows fungi to spread over a surface and absorb nutrients. Hyphae can form:
- **Mycelium:** A dense network of hyphae that forms the main body of the fungus.
- **Rhizoids:** Specialized hyphae that anchor the fungus to a substrate.

4. Reproductive Structures

- Fungi reproduce both sexually and asexually. Their reproductive structures are often highly specialized and can vary significantly between fungal species.

A. Asexual Reproduction

B. Sexual Reproduction

- **A. Asexual Reproduction**

- Asexual reproduction allows fungi to reproduce rapidly under favorable conditions. Common methods include:
- **Conidia:** Asexual spores that are produced on specialized hyphae called conidiophores. These spores are dispersed by the wind.
- **Sporangia:** Structures that contain spores, formed by mitosis, and released when the sporangium breaks open.
- **Budding:** In yeasts, a small bud forms on the parent cell, grows, and eventually detaches to form a new individual.

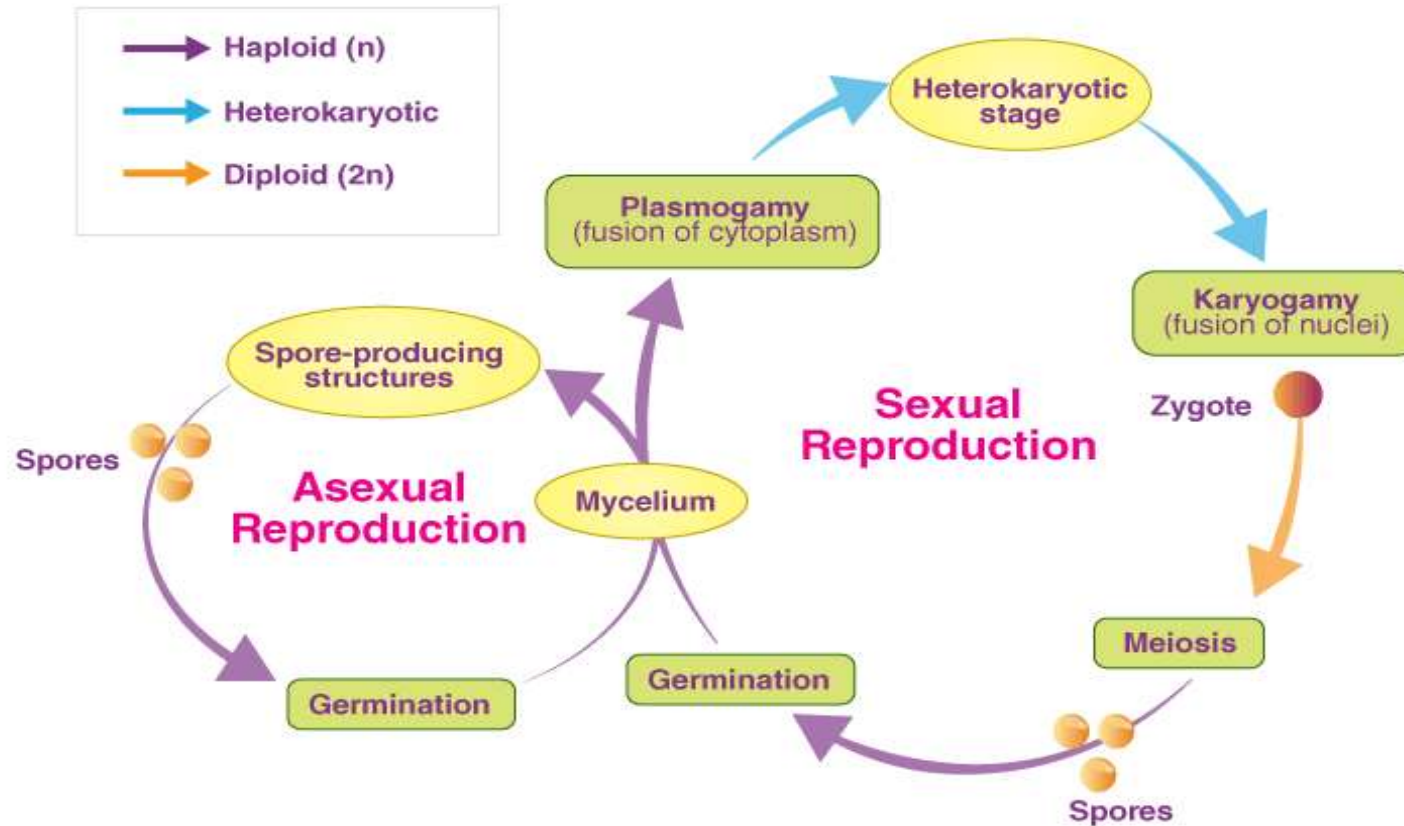
B. Sexual Reproduction

- Sexual reproduction in fungi involves the fusion of specialized sexual structures, leading to the formation of new genetic combinations.
- **Gametes:** In some fungi, the male and female gametes fuse in a process called plasmogamy, followed by karyogamy (fusion of nuclei).
- **Ascospores:** Produced in a sac-like structure called an ascus, characteristic of Ascomycota.
- **Basidiospores:** Produced on the surface of a structure called a basidium, characteristic of Basidiomycota.
- **Zygosporoes:** Formed after the fusion of two gametes in Zygomycota

Types of Reproductive Structures (based on Phyla)

- **Ascomycota** (Sac fungi): Produce sexual spores called **ascospores** in a sac-like structure (ascus) and asexual spores called **conidia**.
- **Basidiomycota** (Club fungi): Produce sexual spores called **basidiospores** on club-shaped structures called basidia (e.g., mushrooms, toadstools).
- **Zygomycota** (Conjugation fungi): Produce sexual spores called **zygospores** after the fusion of specialized sexual structures called gametangia (e.g., Rhizopus).
- **Chytridiomycota**: Produce zoospores with flagella, which are motile.

REPRODUCTION OF FUNGI :



ALGAE :

- Algae exist in environments ranging from oceans, rivers, and lakes to ponds, brackish waters and even snow. Algae are usually green, but they can be found in a variety of different colors.
- Algae living in snow contain carotenoid pigments in addition to chlorophyll
- Multicellular examples of algae include the giant kelp and brown algae. Unicellular examples include diatoms, Euglenophyta and Dinoflagellates.
- Most algae require a moist or watery environment; hence, they are ubiquitous near or inside water bodies.
- they also do not have vascular tissues to circulate essential nutrients and water throughout their body.
- Alga is a term that describes a large and incredibly diverse group of eukaryotic, photosynthetic lifeforms. These organisms do not share a common ancestor and hence, are not related to each other (polyphyletic).



1. Forms of Algae

- Algae exhibit a wide variety of forms based on their body organization:

a. Unicellular Forms

- Composed of a single cell.
- Examples: *Chlamydomonas*, *Euglena*, *Chlorella*.
- Found in freshwater and marine environments.
- These algae may move using flagella (motile forms) or remain stationary (non-motile forms).

b. Multicellular Forms

- Made up of many cells arranged in complex structures.
- Examples: *Ulva* (sea lettuce), *Sargassum*.
- Often found in marine habitats and can grow to significant sizes.

c. Filamentous Forms

- Cells are arranged in long, thread-like filaments.
- May be unbranched (e.g., *Spirogyra*) or branched (e.g., *Cladophora*).
- Filaments can be free-floating or attached to a substrate.

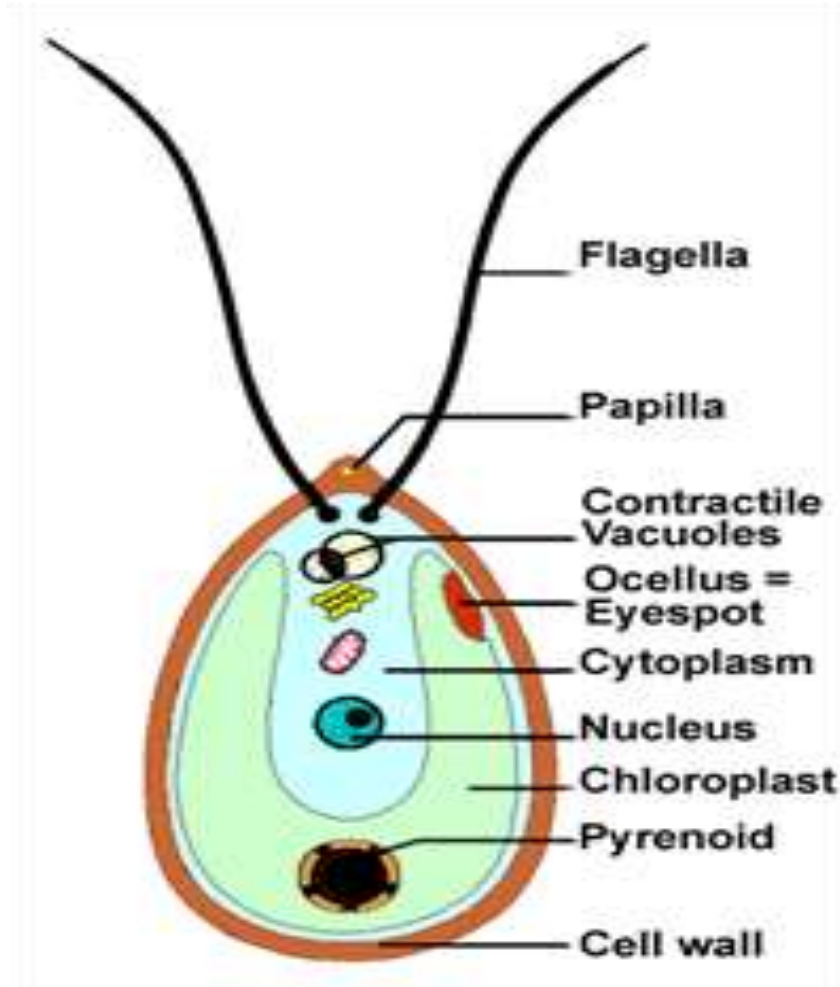
d. Tubular Forms

- Cylindrical, hollow structures with cells arranged around a central cavity.
- Example: *Vaucheria* (a genus of yellow-green algae).

e. Membranous Forms

- Flat, leaf-like structures or sheet-like thalli formed by cells arranged in two layers.
- Example: *Ulva* (sea lettuce), which has a thin, sheet-like appearance.

2.STRUCTURE OF ALGAE :



1.Cell Wall:

- Composed of cellulose, polysaccharides, or other materials.
- Diatoms have walls made of silica, forming intricate patterns.

2.Chloroplasts:

- Contain photosynthetic pigments such as chlorophyll (a, b, c, d, or f) and accessory pigments (e.g., carotenoids, phycobilin).
- Chloroplast shapes vary (e.g., spiral, cup-shaped).

3.Cytoplasm:

- Contains organelles like the nucleus, mitochondria, vacuoles, and ribosomes.

4.Nucleus:

- Present in eukaryotic algae, containing the genetic material.

5.Flagella:

- Some algae (e.g., *Chlamydomonas*) have flagella for motility.

3. Reproduction in Algae :

a. Asexual Reproduction

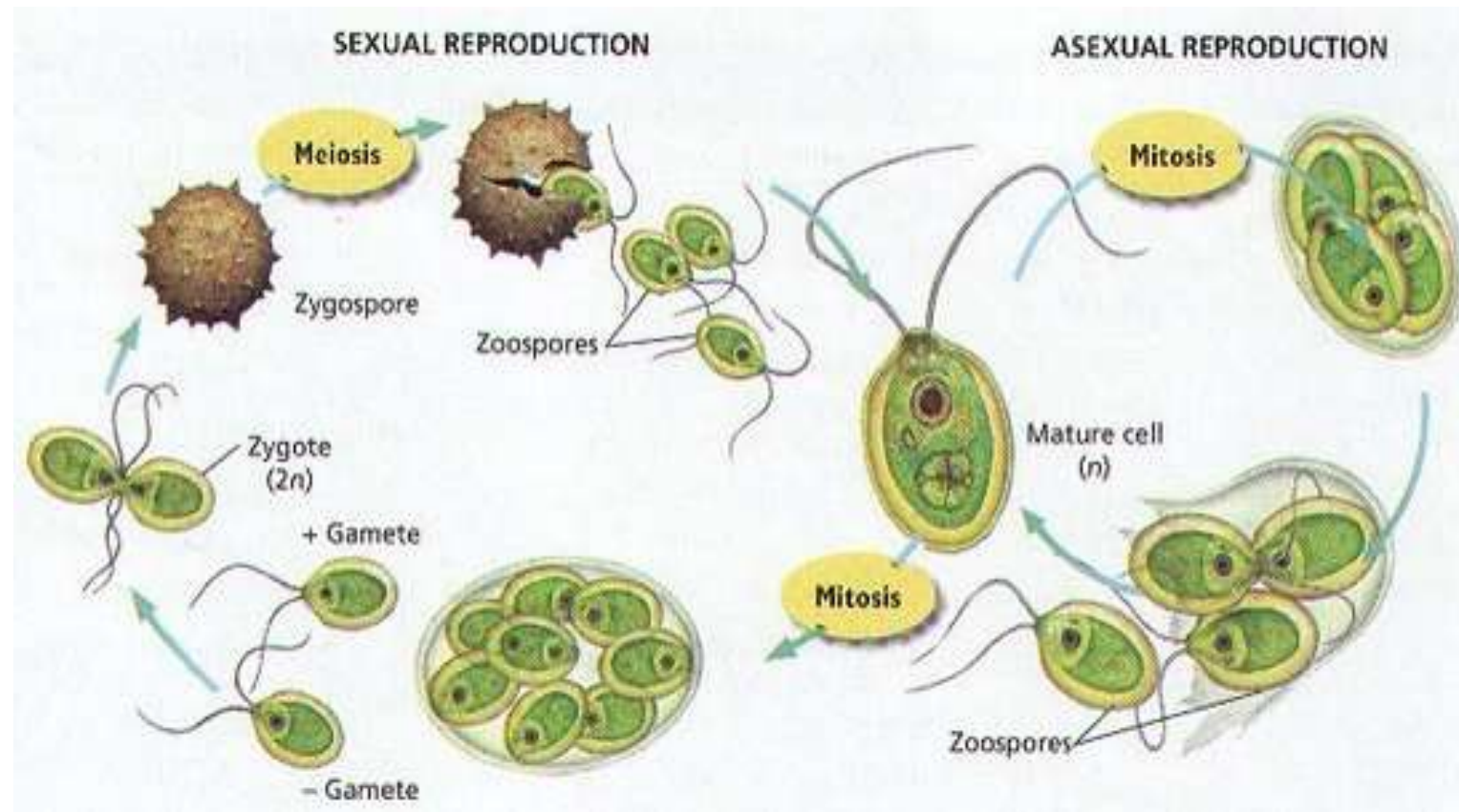
- Occurs without the involvement of gametes and is common in algae. Methods include:
- **Binary Fission:** A parent cell divides into two identical cells (e.g., *Chlamydomonas*).
- **Fragmentation:** The thallus breaks into pieces, and each piece grows into a new individual (e.g., *Spirogyra*).
- **Spore Formation:**
 - **Zoospores:** Motile spores with flagella.
 - **Aplanospores:** Non-motile spores.
 - **Autospores:** Non-motile spores formed inside the parent cell

b. Sexual Reproduction

- Involves the fusion of gametes, leading to genetic recombination. Types include:
- **Isogamy**: Fusion of morphologically similar gametes (e.g., *Spirogyra*).
- **Anisogamy**: Fusion of dissimilar gametes in size and/or form (e.g., *Eudorina*).
- **Oogamy**: Fusion of a large, non-motile egg with a smaller, motile sperm (e.g., *Volvox*, *Fucus*).

c. Vegetative Reproduction

- Involves the growth and division of vegetative parts:
- **Cell Division**: In unicellular algae, cell division produces new individuals.
- **Fragmentation**: Multicellular forms like *Spirogyra* regenerate new filaments from fragments.

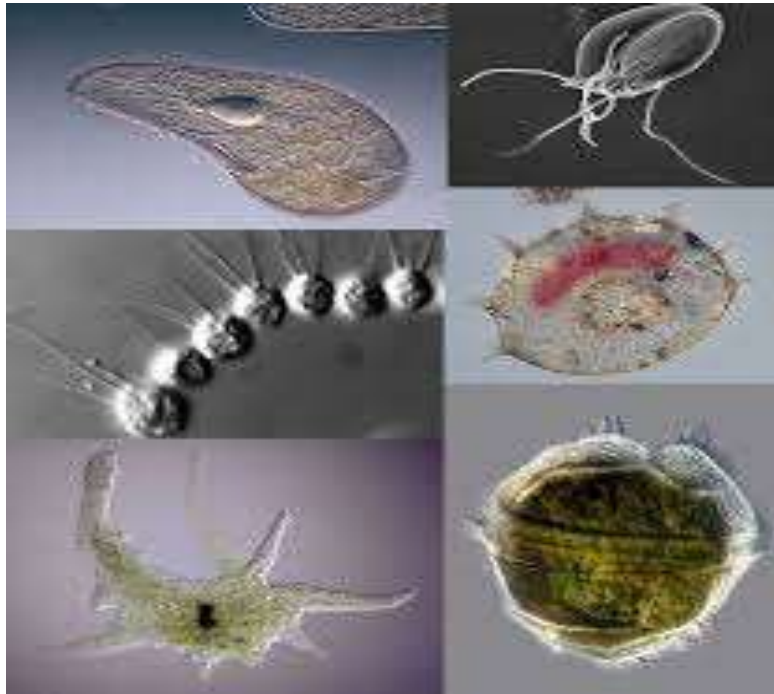


Examples by Algal Group

- 1.Chlorophyta (Green Algae):** Includes unicellular (*Chlamydomonas*), filamentous (*Spirogyra*), and membranous (*Ulva*) forms.
- 2.Phaeophyta (Brown Algae):** Mostly multicellular, includes *Sargassum* and *Laminaria*.
- 3.Rhodophyta (Red Algae):** Multicellular, includes *Porphyra* and *Gracilaria*.
- 4.Bacillariophyta (Diatoms):** Unicellular algae with silica cell walls.
- 5.Cyanobacteria (Blue-Green Algae):** Prokaryotic forms, includes *Nostoc* and *Anabaena*.

PROTOZOA :

- ❖ Protozoa are single-celled, eukaryotic organisms belonging to the kingdom Protista. They are highly diverse and exhibit various forms, structural adaptations, and reproductive strategies.



1. Organization of Protozoa :

Protozoa are unicellular organisms, but their cellular structure is complex and performs all the essential functions of life, such as feeding, movement, excretion, and reproduction.

Unicellular Nature: The entire organism is a single cell that functions independently.

Eukaryotic Cells: Protozoa have a true nucleus and membrane-bound organelles.

Microscopic Size: Protozoa are typically microscopic, ranging in size from 2–200 micrometers.

2. Forms of Protozoa

- Protozoa exhibit a wide range of forms based on their morphology and modes of locomotion:
- **a. Amoeboid Forms**
- Move using **pseudopodia** (temporary cytoplasmic projections).
- Example: *Amoeba proteus*.
- **b. Flagellated Forms**
- Use one or more whip-like structures called **flagella** for movement.
- Example: *Trypanosoma*, *Euglena*.
- **c. Ciliated Forms**
- Covered with numerous short hair-like structures called **cilia** for movement and feeding.
- Example: *Paramecium*.
- **d. Sporozoan Forms**
- Non-motile forms that rely on a host for movement and reproduction.
- Example: *Plasmodium* (causes malaria).

Reproduction in Protozoa :

- Protozoa reproduce by both **asexual** and **sexual** methods. The mode of reproduction often depends on environmental conditions.
- **a. Asexual Reproduction**
- **Binary Fission:** The cell divides into two identical daughter cells. Common in amoeboid, ciliated, and flagellated protozoa (e.g., *Amoeba*, *Paramecium*).
- **Multiple Fission (Schizogony):** The nucleus divides repeatedly before the cytoplasm divides, producing many daughter cells. Seen in sporozoans like *Plasmodium*.
- **Budding:** A smaller daughter cell forms on the parent, eventually detaching (e.g., *Trypanosoma*).

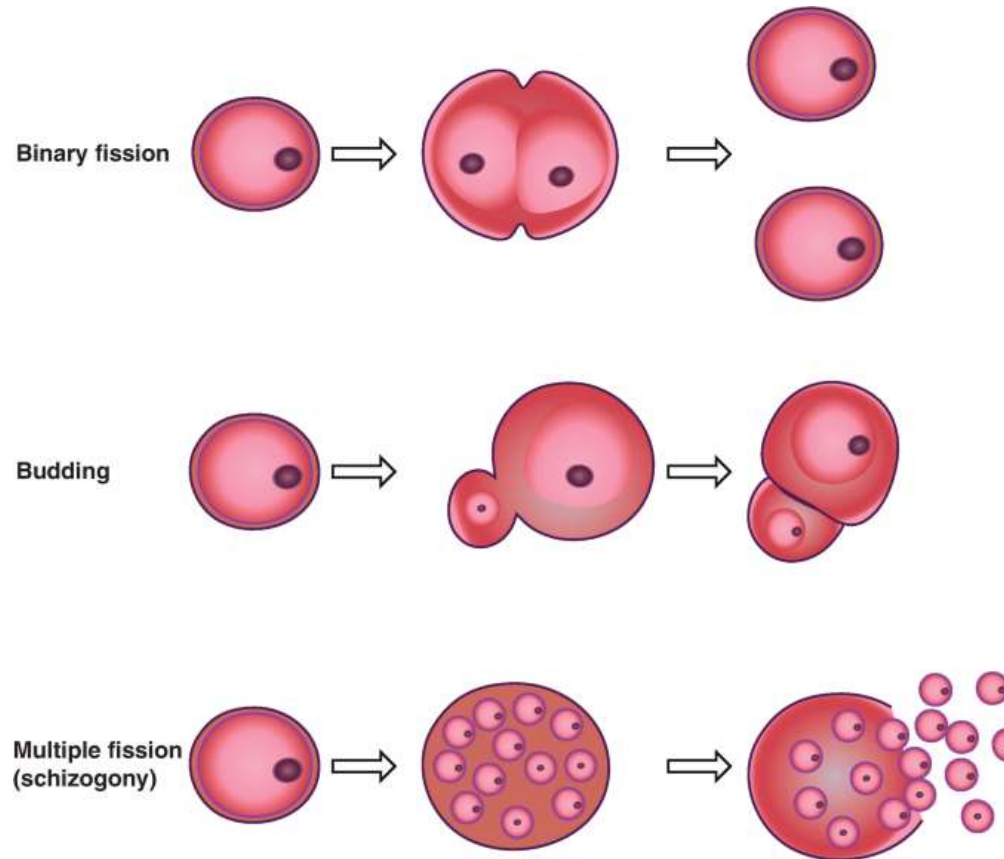
b. Sexual Reproduction

- **Conjugation:** Temporary union of two cells for the exchange of genetic material. Seen in ciliates like *Paramecium*.
- **Syngamy:** Fusion of male and female gametes to form a zygote, common in sporozoans like *Plasmodium*.

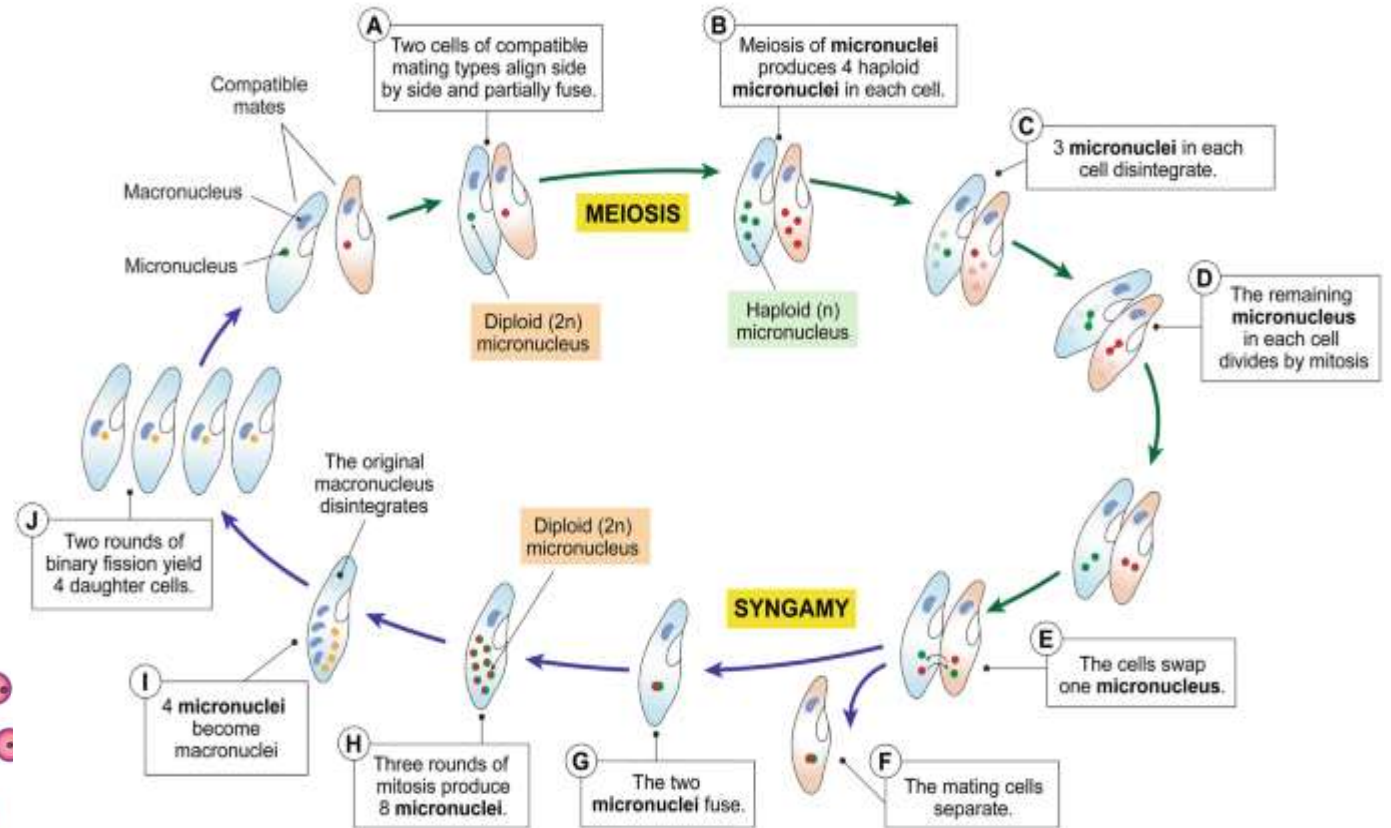
c. Encystment

- In harsh environmental conditions, some protozoa form a protective structure called a **cyst**.
- The cyst allows survival during unfavorable conditions, and the organism reactivates when conditions improve.

Reproduction in Protozoa :



Conjugation of Paramecium

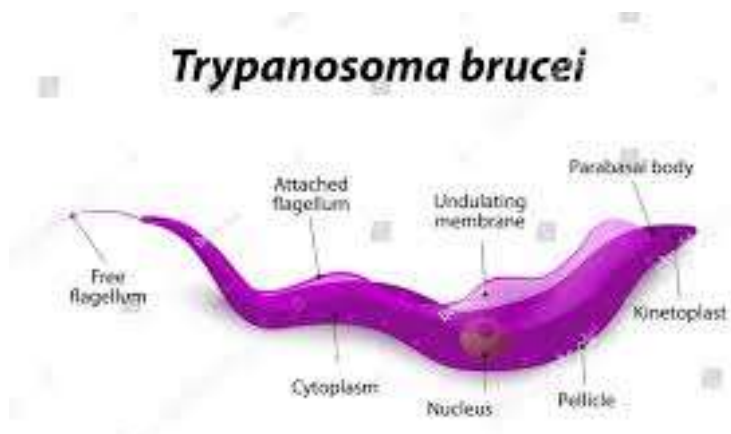


Examples of Protozoa

1. **Amoeboid Protozoa:** *Amoeba*, *Entamoeba*.
2. **Flagellated Protozoa:** *Euglena*, *Trypanosoma*, *Giardia*.
3. **Ciliated Protozoa:** *Paramecium*, *Stentor*, *Vorticella*.
4. **Sporozoans:** *Plasmodium*, *Toxoplasma*



Amoeba



Vorticella.

