Ashur university collage

Dept. of Biology

First-year

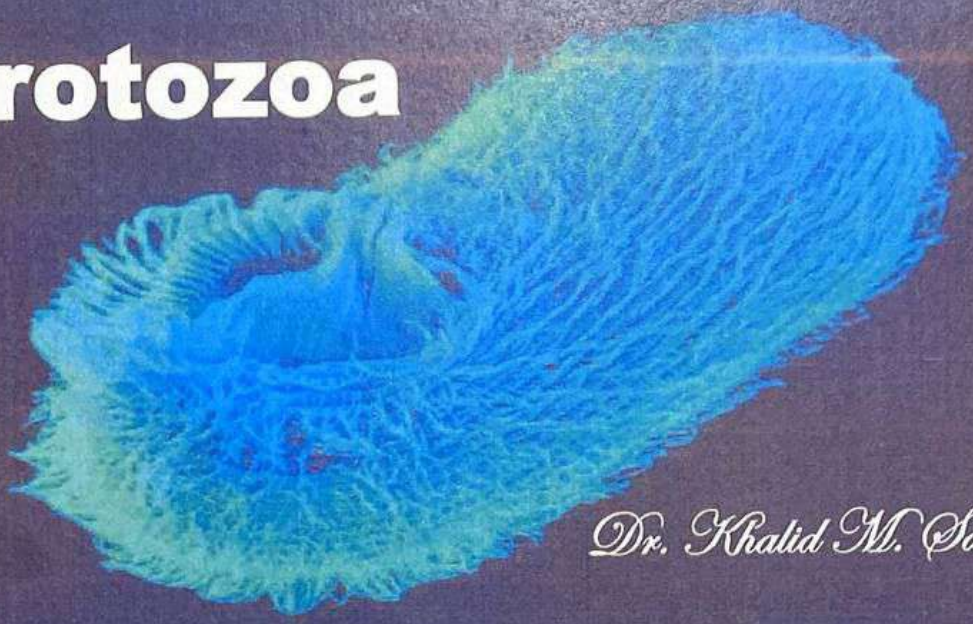
Lecture 4

Zoology

Assist. Lec. Al-Hassan talib

2022-2023

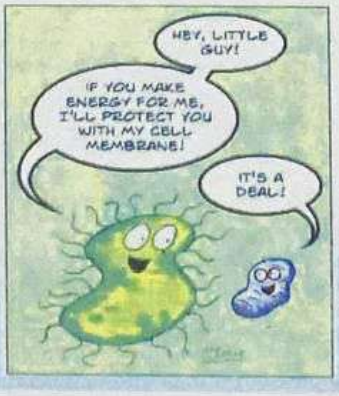
Protozoa



Dr. Khalid M. Salih

Definition

- ***Protozoa*** (first animals) are unicellular heterotrophs of Protista kingdom .
- Protozoans possible evolved from the 1st eukaryotes about 1.5 billion years ago by a process ***Endosymbiosis*** (one prokaryote lives inside another becoming dependent upon each other).



Characteristics of Protozoan

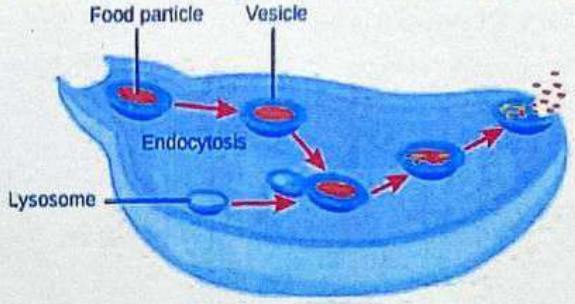
- Eukaryotes & unicellular.
- Most are heterotrophs ingest & digest small food particles inside food vacuoles.
- Microscopic (few to hundreds of micrometers) that live as single cells or in simple colonies that show no differentiation into tissues.
- Found everywhere (freshwater, marine, moist terrestrial habitats that make up part of the ***zooplankton*** (food for animals in marine & freshwater systems).
- There are 65,000 identified species most of them are ***free-living*** and eat bacteria, algae, or other protozoa, while other species are ***parasitic living*** inside their host & cause several diseases.
- Most are motile (able to move) which is one of the important characteristics used to divide them into major groups.

Cellular Structure & Function

- The various forms have a unicellular structure bounded by a thin cell membrane with one or more nuclei.
- Protozoans carry on all the metabolic functions of animals such as:
  - ***Digestion***
  - ***Respiration***
  - ***Reproduction***
  - ***Adaptations***

Digestion

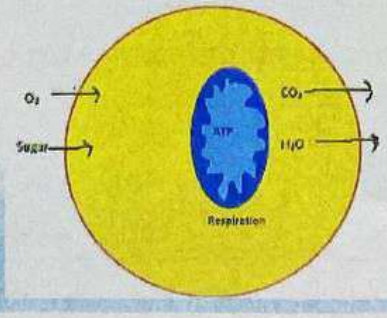
- Some protozoans have complex digestive systems and feed on large food particles, such as other microorganisms. The food is digested by means of enzymes and the wastes transported to the cell surface or stored in ***food vacuoles*** (bubble-like spaces).
- While others absorb dissolved organic matter through the ***cell membrane***.



Some unicellular organisms, such as the amoeba, ingest food by endocytosis. The food vesicle fuses with a lysosome, which digests the food. Waste is excreted by exocytosis.

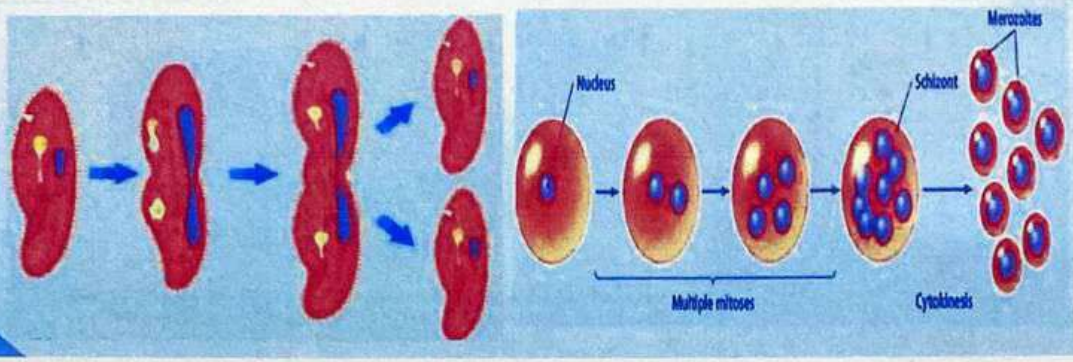
Respiration

- Diffusion of dissolved gases (oxygen) through the cell membrane.
- Oxygen used to oxidize food molecules, producing energy.
- Energy used to produce organic molecules for building and maintenance of cell.
- The waste products of this oxidation (CO_2 & H_2O) diffuse out of the cell.



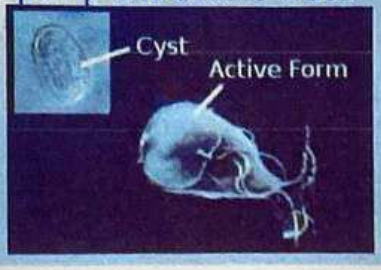
Reproduction

- Reproduction is usually ***asexual***, occurring mostly by **binary fission, budding** or by the **formation of spores** (multiple fission producing more than two individuals without fertilization).
- Some species reproduce ***sexually*** by conjugation (opposite mating strains join & exchange genetic material)



Adaptations

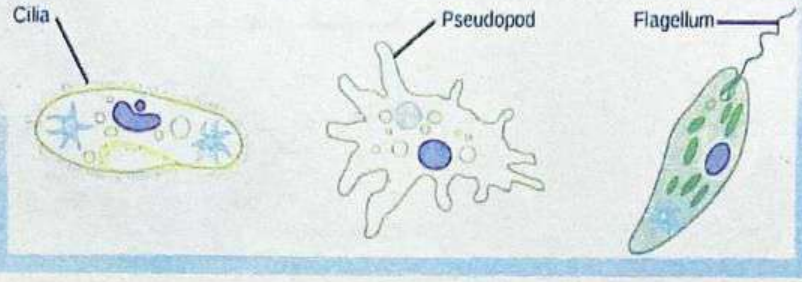
- Many protozoa secrete an amorphous material called ***extrusomes*** involved in formation of a **capsule** or **cyst** when conditions become unfavorable (no water, pH or temperature changes, nutrient deficiency, decreased oxygen supplies...), that may serve for protection or predation. Then metabolic activity of protozoans resumes when conditions become favorable again.
- Some protozoans can detect & avoid obstacles and harmful chemicals in their environment (ex. **Eyespots**).
- Freshwater protozoa have ***contractile vacuoles*** to pump out excess water that moves into the cells by osmosis.



Classification

Protozoan divided into 4 phyla based on their method of movement:

1. **Sarcodina** move by fingerlike projections of cytoplasm (*pseudopodia* - false foot) bulges outward from any edge of the cell.
2. **Zoomastigina** move by whip like structures (*flagella*) that usually occur one to a few per cell and have an undulating motion.
3. **Ciliophora** move by hair like structures (*cilia*) that are shorter & move like oars.
4. **Sporozoa** are either non-motile or very slow.

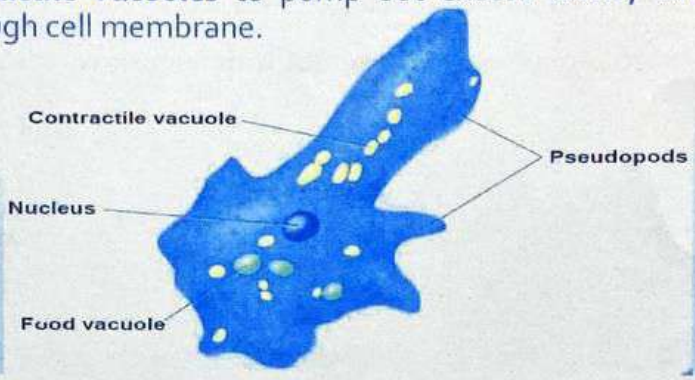


Classification

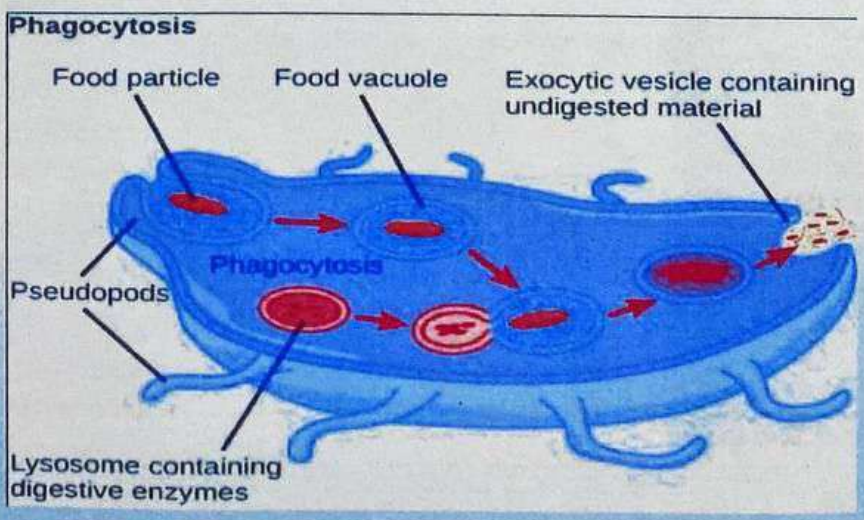
Phylum	Common Name	Locomotion	Nutrition	Examples
Sarcodina	Sarcodines	pseudopodia	heterotrophic; some parasitic	*Amoeba* *Radiolaria*
Ciliophora	Ciliates	cilia	heterotrophic; some parasitic	*Paramecium* *Balantidium*
Zoomastigina	Zoo flagellates	flagella	heterotrophic; some parasitic	*Trypanosoma* *Leishmania* *Giardia*
Sporozoa	Sporozoans	(None in adults)	heterotrophic; some parasitic	*Plasmodium* *Toxoplasma*

1. Phylum Sarcodina

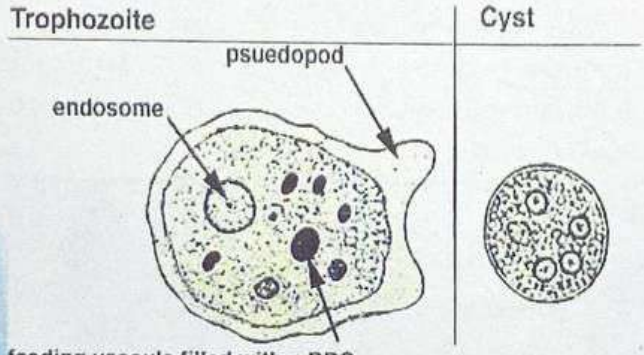
- ***Amoebas*** found in freshwater, marine, & moist soil habitats
- Reproduce ***asexually.***
- Cytoplasm consists of clear outer ***ectoplasm*** & granular inner ***endoplasm.***
- Move by ***pseudopodia*** in a process called ***amoeboid movement.***
- Most have ***contractile vacuoles*** to pump out excess water, while O2 & CO2 diffuse through cell membrane.



- Use their pseudopods for feeding by a process called ***phagocytosis,*** to form ***food vacuole,*** enzymes enter the food vacuole & digest the food, while undigested food & wastes leave by ***exocytosis.***

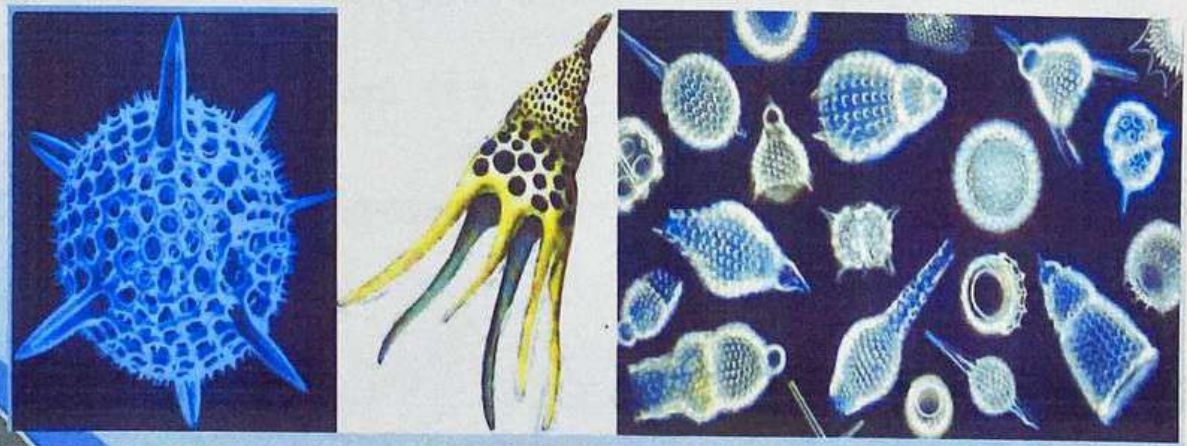


- Form hard, protective, inactive ***cysts*** when conditions become unfavorable (lack of nutrients, heat...), and can be react to stimuli such as light
- Some Sarcodines are parasitic for higher animals including human such as ***Entameba histolytica*** cysts in untreated water supplies cause ***amoebic dysentery*** which can be fatal



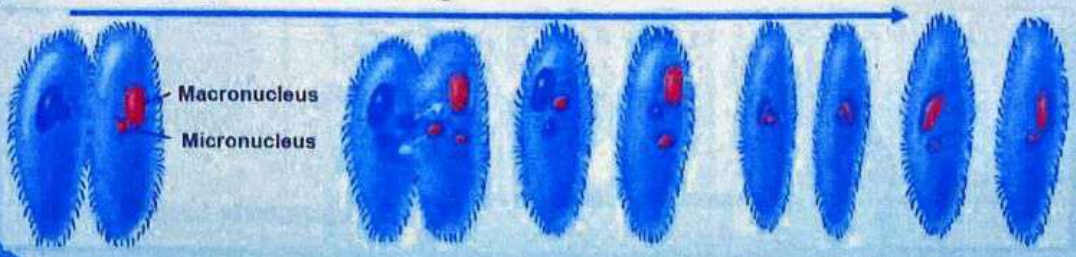
Entamoeba histolytica

- Some marine Sarcodines have **hard shells** made of:
  - *Silica* & have sticky pseudopodia to trap food called **(Radiolarians)**
  - *Calcium carbonate* form limestone or chalk with holes through which pseudopodia extend called **(Foraminiferans)**



2. Phylum Ciliophora

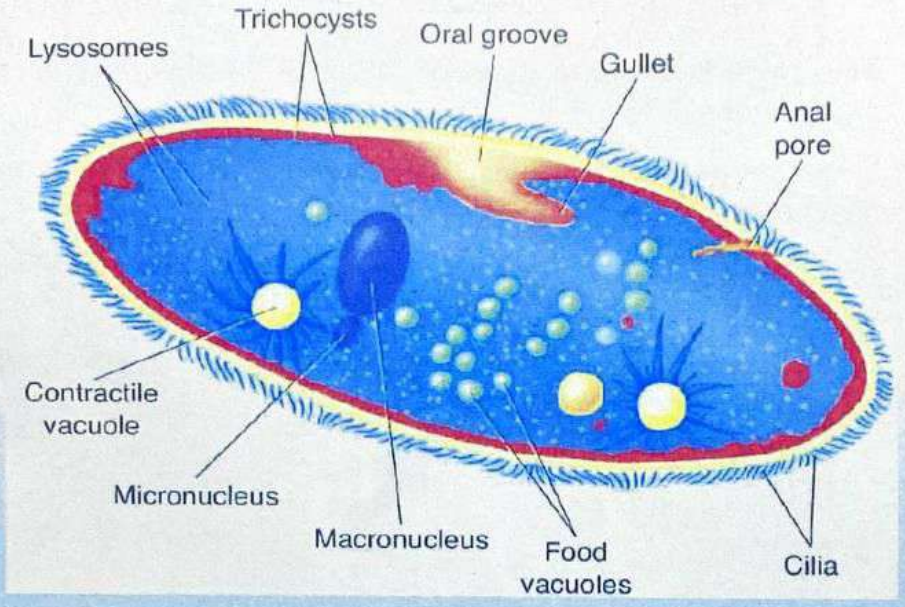
- ***Ciliates*** move by (**cilia**) and most are **freshwater**, but some are marine serve as a food source ***plankton***.
- They form protective **cysts** to survive unfavorable conditions.
- They have two types of nuclei; the larger ***(macronucleus)*** control all activities including asexual reproduction by mitosis, while smaller ***(micronucleus)*** control only sexual reproduction by conjugation when two organisms join together & exchange DNA.



Paramecium

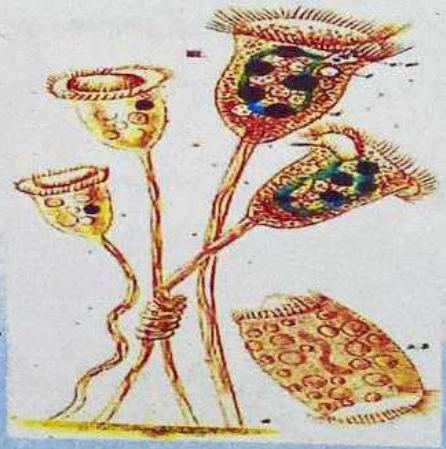
- ***Pellicle*** is elastic covering made of protein for protection.
- Reproduce asexually by mitosis & sexually by conjugation.
- Use cilia to swim & obtain food *(algae & bacteria)*.
- Cilia sweep food into ***oral groove, gullet, food vacuoles*** where it's digested, then wastes leave through ***anal pore.***
- Water excess pump out via 2 ***contractile vacuoles.***
- Respond to light & learn by trial & error.
- ***Trichocysts*** are tiny toxic darts to capture prey or anchor to a surface.

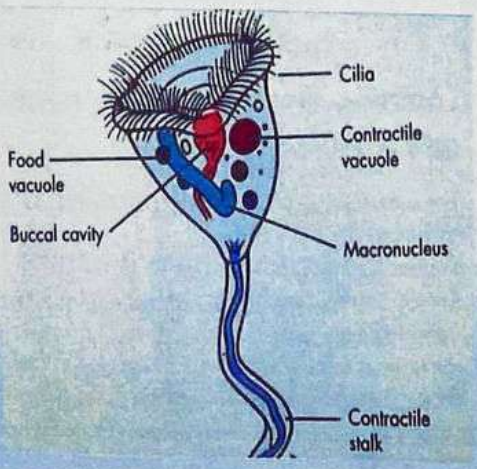
Paramecium



Vorticella

- Cup shaped with cilia at the top
- Has **coiled stalk** to raise & lower the organism for attachment to surfaces.
- They are mostly lived in colonies.

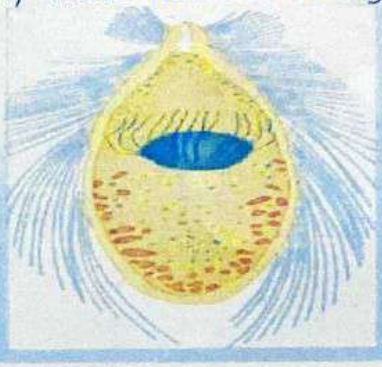




3. Phylum Zoomastigina

- ***Zoo flagellates*** have one or more whip-like ***flagella*** made of bundles of microtubules to move.
- Some are **parasites** such as ***Trypanosoma*** that infect humans and destroy red blood cells & causes fatal African **sleeping sickness**.
- Other such as ***Trichonympha*** lives symbiotically inside termites & digests cellulose.





4. Phylum Sporozoa

- Sporozoans are non-motile, commonly parasitic on vertebrate animals using one or more hosts such as ***Plasmodium spp.*** cause **malaria**.
- Immature sporozoans are called ***sporozoites*** transmitted by **mosquitoes**.
- enter the bloodstream, travel to the liver, divide & form spores called ***merozoites***
- invade red blood cells, multiply, escaping from the ruptured cells
- later form eggs & sperm that fertilize to form new sporozoites that migrate to the salivary glands of mosquitoes where they can be passed on to another person.
- Reproduce asexually by **spores** & sexually by fertilization of **egg** and **sperm**

Plasmodium spp. (malaria)

