PROTOZOA

INTRODUCTION: These micro organisms were discovered by Antony Won Leuven Hock. In 1820 Goldfus named these organisms as protozoa which can be defined as first animals. Proto = First, Zoon = Animal. In 1845, Von Sibold identified Protozoans as single cellular organisms. All activities will be carried by this single cell.

SPECIAL CHARACTERS:

1) Responses to stimuli can be correlated to the beginning of nervous system

2) Division of the labor is found in organelles.

3) Appearances of conjugants indicate the beginning of sexual dimorphism.

GENERAL CHARACTERS:

1 Most Protozoans' are microscopic, primitive, and unicellular with protoplasmic grade of organization

2. Worldwide in distribution. Lives in water, soil in air. Most organisms are in fresh water. Solitary or colonial, free living or parasites

A) Shape: Round, Spherical or Flat in shape.

B) Symmetry: Bilateral, radial or spherical, same are asymmetrical.

C) Size: Measures 0.002 mm to 16mm in size. Fossil Nummulite is the largest protozoan and measured about 19cms.

3 **Body** is naked or bounded by a pellicle while some have shells made up of $caco_3$ or silicon

4 Single cell performes all activities physiological division of labor is occurred among the cell organells.

5. **Locomation and Nutrion** is by means of pseudopodia, flagella, and cilia.

6. Cell contains one or two or more nuclei. Macronucleus is useful for metabolic activities and micro nucleus is for reproduction.

7. **Nutrion** may be holozoic, holophytic or saprozoic

8. **Digestion** is intracellular, occurs inside of the food vacuoles. Food vacuoles act as temporary stomach.

9. **Respiration** is by simple diffusion. In parasites it is anaerobic.

10. **Excretion** is through general body surface, contractile vacuole helps in osmoregulation.

11. **A sexual reproduction** is by means of binary fission, multiple fission, plasmotany, and budding.

12. **Sexual reproduction** is by means of conjugation

13. **Encystment** (formation of cyst) occurs for dispersal of spores and for resistance to unfavorable conditions.

Amoeba, Euglena, Paramecium, Elphidium, Plasmodium etc.,

Classification of Protozoa: The phylum protozoa has been divided into four classes. The classification is based principally on their mode of locomotion and the basis of locomotary organs. The classification followed here is based on Hyman's classification. Phylum Protozoa is divided into two subphyla namely

1. Sub-phylum Plasmodroma
2. Subphylum - Ciliophora

The sub-phylum Plasmodroma is classified into three classes and classification is based on the locomotor organelles where as the sub phylum Ciliophora consits of one class. Accordingly the phylum protozoa consists of 4 classes

Class 1 : Mastigophora

Class II : Rhizopoda

Class III : Sporozoa

Class IV: Ciliata

Class 1 Rhizopoda

- Rhizopoda (Rhiza= root; podus = foot). Protozoa having peculiar temporary organelles for locomotion, called pseudopodia or false feet.
- Mostly free living, some are parasitic
- Asexual reproduction by binary fission and sexual by syngamy.
- No conjugation.
- Examples: *Amoeba, Entamoeba*

Class 2 Mastigophora/ Flagellata

- Mastigophora (Mastix =whip; phoros=bearer) or Flagellata (flagellum = whip). Protozoa that move by the lashing of whip-like organelles called flagella
- Free living or parasite.
- Body covered with cellulose, chitin or silica.
- A sexual reproduction by longitudinal fission. 2

- No conjugation.
- Examples: *Euglena, Trypanosoma*

Class 3 Sporozoa

- Sporozoa (Spora —seed; animal). Parasitic protozoa possessing no locomotor organelles and reproducing by means of spores.
- Exclusively endoparasites
- Contractile vacuoles is absent
- Body covered with pellicle.
- Reproduction: Asexual reproduction by fission and Sexual reproduction by spores
- Examples: *Plasmodium, Monocystis*

Class 4 Ciliata

- Ciliophora (Cilium— eyelash). Protozoa that move by hair-like cilia.
- Body covered by pellicle.
- Reproduction: Asexual reproduction by binary fission. Sexual reproduction by conjugation.
- Nuclei two types i.e. macronucleus and micronucleus.
- Examples: *Paramecium, Vorticella,*

ELPHIDIUM

Phylum: Protozoa

Class : Rhizopoda

Order: Foraminifera

Not all protozoans are naked; some are enclosed in shells namely the foraminiferans. Their shells are many chambered and perforated all over with small pores, through which long and fine pseudopodia are extended. When they die their shells fall in a steady rain to the ocean floor and contribute to the formation of bottom sediments called ooze.

Structure:

Habit and Habitat: is a marine form. It is found in littoral zones of the sea, creeping on Sea weeds to a depth of 300fathoms. **Elphidium** is also called 'Polystomella is a 'dimorphic rhizopod'. It is a unicellular microscopic protozoan, and" 1 mm in diameter. It is pale yellow in colour.

Dimorphism: Elphidium exhibits dimorphism.The individual occurs in two distinct forms

1.Megalosperic form. 2. Microspheric form.

1. Megalospheric form: Its proloculum is big in size. A single large nucleus is present in one of the chambers. It takes up sexual reproduction.

2. Microspheric form: Its proloculum is small in size. Many nuclei are present in the cytoplasm. This

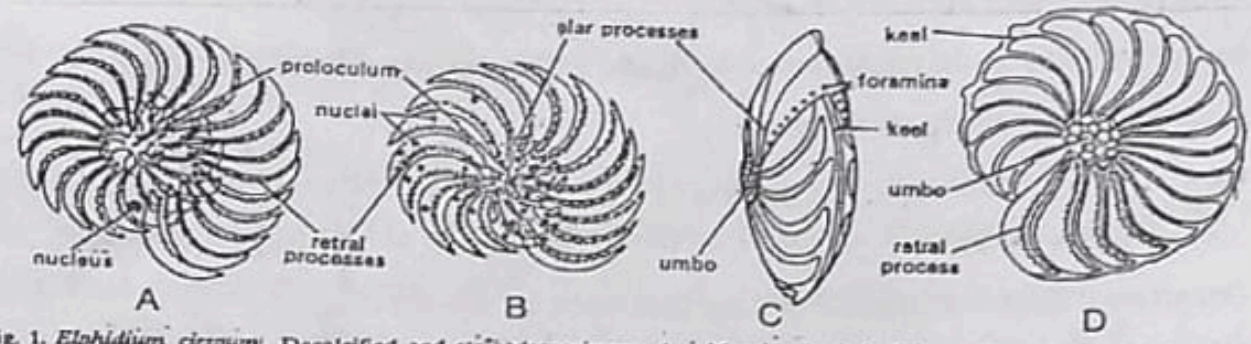

Fig. 1. *Elphidium circpum*, Decalcified and stained specimens. A— Megalospheric individual. B— Microsperic individual. C— Endon view of the shell. D— Lateral view of the shell.

form reproduces by asexual reproduction.

Shell: The body is covered by a shell. Shell is small, translucent, pale yellow in color, spherical and measures about 1mm in diameter. It is made-up of more with calcium carbonate and with small amounts of silica and magnesium sulphate. The shell contains spirally arranged V shaped chambers. The spiral coiling is in a planospiral manner i.e all the coils lay in the same plane. The chambers are filled with the cytoplasm. These chambers are perforated, through this opening cytoplasm will come out. The cytoplasm is produced into a number reticulopodia which will form a network. From hinder end of each chamber cytoplasmic processes will develop as folding like structures called retral processes. Each chamber of shell is elongated laterally with convex anterior surface and concave posterior surface. The peripheral part of shell is rigid and consists of continous rim called keel, where as the central rounded part is called umbo. Formation of shell begins with an initial single chamber called proloculum. As the animal grows in size, successive chambers are laid down in a spiral manner. Thus the last chamber is the largest and most recently formed is visible outside.

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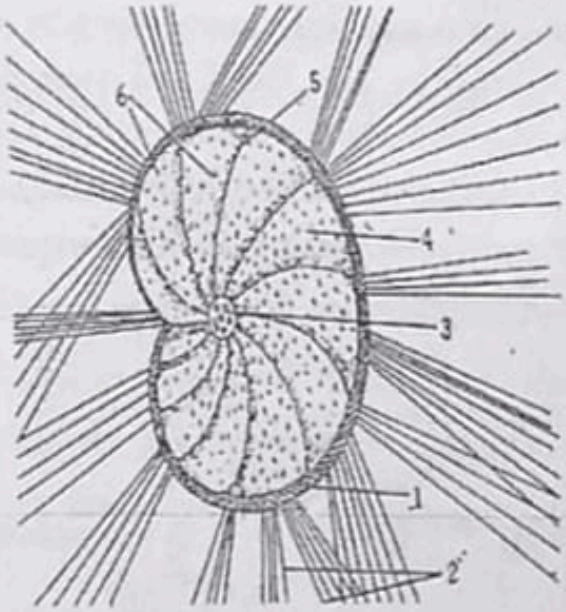

1.Shell
2. Reticulopodia
3. Proloculum
4. Chamber
5. Retral Processes
6. Pores

ELPHIDIUM

Cytoplasm: All the chambers are filled with cytoplasm, which is divided into outer thin **ectoplasm** and inner thick **endoplasm**. Endoplasm contains one or many nuclei, food vacuoles, golgi bodies, mitochondria, endoplasmic reticulum, ribosomes and color granules.

Reticulopodia: Pseudopodia are thread like, branching and an atomizing nature. Such pseudopodia are called reticulopodia. Each consists of two regions inner fibrillar axis and outer fluid like cortex. In the network of pseudopodia cytoplasm shows streaming circulation i.e the movement of granules is in opposite direction s along the two sides of axis. Reticulopodia helps in locomotion, nutrition and in the construction of shell and cyst wall.

Locomotion and Nutrition: Polystomella show slow creeping movements over the substratum on the sea bottom with the help of reticulopodia. It is a holozoic feeder it feeds minute organisms like diatoms, small protozoans and crustacean larvae. The reticulopodia secrete ans external mucous layer to capture the prey. This layer contains the proteolytic enzymes which paralyses the pray and initiates the digestion even during capture. The captured food is enclosed in a food vacuole. The prey is digested in the food vacuole the digested food is absorbed by the cytoplasm.

Respiration and Excretion: Is in the form of simple diffusion. The dissolved oxygen in the water is simply diffused to all parts of the cell through water circulation, in the same way the excretory products will be sent out by simple diffusion.

Life cycle of Elphidium: *Elphidium* shows dimorphism, the two different forms are Megalospheric form (sexual form) and Microsperic form (asexual form). *Elphidium* exhibits an alternation of generation in its life cycle. The Megalosperic forms alternates with Microspheric forms. The complete cycle takes two years in the shallower marine water. Asexual reproduction reaches a peak in spring of first year. Sexual reproduction begins early in the second spring as temperatures begin to rise.

Asexual Reproduction: The microspheric form takes up asexual reproduction by multiple f... The nuclei break into many Chromatin bits. They become round. The inner cytoplasm mass containing several nuclei creeps out of the shell and remains as a lump around it. A small amount of cytoplasm collects around each nucleus. As a result, a large number of amoeboid cells are formed. Each amoebulae secretes the proloculum, forms rhizopodia, then it grows and forms other chambers of the shell to become a megalospheric forms.

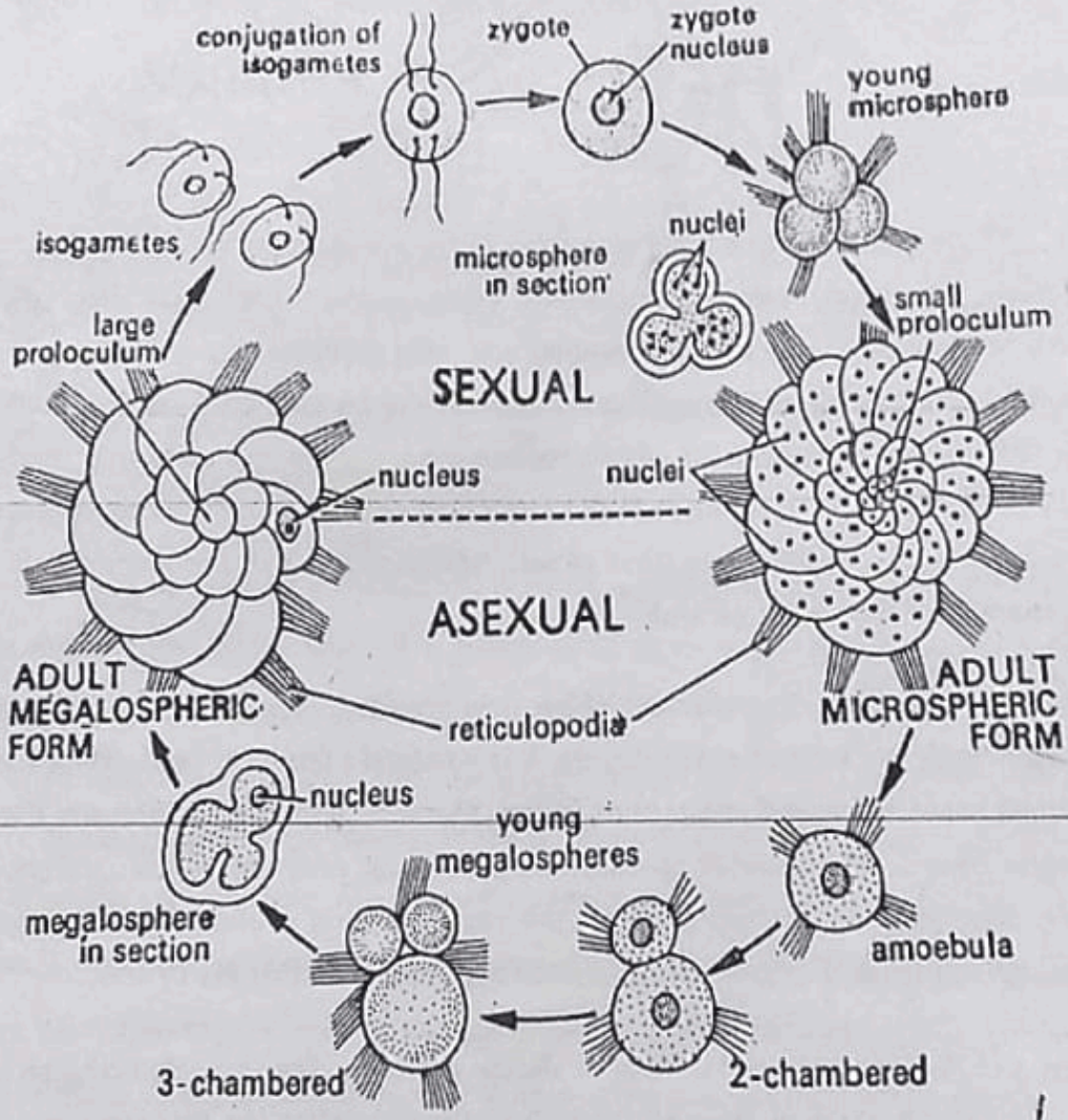

Fig. 4. *Elphidium*. Reproduction and life cycle.

Sexual Reproduction: The Megalospheric form produces numerous identical gamates (isogamat... sexually by syngamy. During sexual reproduction the nucleus breaks up into many small nuclie a... the cytoplasm collects around each of these nuclei. The nuclei divide twice giving rice to a la... haploids known as isogamates. Each gamate is with two flagella, a nucleus and fat globule. ... gamates are released in to water, they swim freely for some time and become conical in sha...

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Isogametes of two different individuals fuse in pairs to form zygotes. The zygote secretes the
around the proloculum and develops into microspheric forms.

Alternation of generation: The life cycle of *Elphidium* may be summarised as, the microsph
forms produce amoebulae by asexual fission which develops into megalospheric forms.
megalospheric forms produce flagellated isogametes which after syngamy produce zygotes
develop into microspheric forms. Thus, its life cycle clearly exhibits the phenomenon of alternat
of asexual microspheric generation with sexual megalospheric generatin