



BIOL 160. INVERTEBRATE SYSTEMATICS

LESSON 2 & 3. PROTOZOA

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Introduction:

Kingdom Animalia has 3 sub-kingdoms;
Protozoa, Mesozoa & Metazoa.

Protista has 2 branch; **Protozoa** and **Protophyta**.

Protozoa has no chlorophyll but protophyta has chloroplast.

PROTOZOA

- The organisms are mostly single celled. Often, referred to as unicellular organisms.
- The organisms however, approach bi-nuclei in organisms under phylum Cilliophora.



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The organism, though single celled can feed, respire, excrete, reproduce, etc. as seen in simple and complex multi-cellular organisms.

All metabolic activities occur within an enclosed cell membrane.

They are thus;

- unicellular ,
- free-living (planktonic), benthic or
- parasitic (sporozoans), and
- commensals.



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Free-living types are aquatic; may be solitary or in colonies.

Microscopic

Heterotrophs and do not possess chlorophyll pigments.

Undergo metabolic activities; require energy for life.

Radiolaria and foraminefera have intricate structure.



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No germ cells.

No tissues nor organs.

Locomotion is by body wave movement, hairs or threads.

Reproduction from asexual and sexual means; asexual- fission, budding and cysts.

Sexual- conjugation, syngamy (union) of male n female to form gamete



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CLASSIFICATION OF SUBKINGDOM PROTOZOA.

This has 2 super phyla. Apicomplexa and Sarco-mastigophora.

A. SUPER PHYLUM APICOMPLEXA

The organisms are oval in shape.

Have no visible locomotive organelle.

They thus, flow along the current of the medium in which they find themselves.



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Are mostly parasites in higher organisms

Have intermediaries in invertebrates.

They exist in both sporozoites and merozoites stages in their hosts.

They have apical complex that enable them to penetrate into host tissues.

They may have simple life cycle as in monocystis or complex life cycle as in Plasmodium.



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The apical complex consists of the polar ring, two smaller conoids, two long rhoptries, spots called microneme, and an opening referred to as microspore.



CLASSIFICATION OF APICOMPLEXA.

Has 2 phyla; Sporozoa and
Teleospora.

Phylum SPORAZOA

These have complex life cycles.

May involve 1 or 2 hosts.

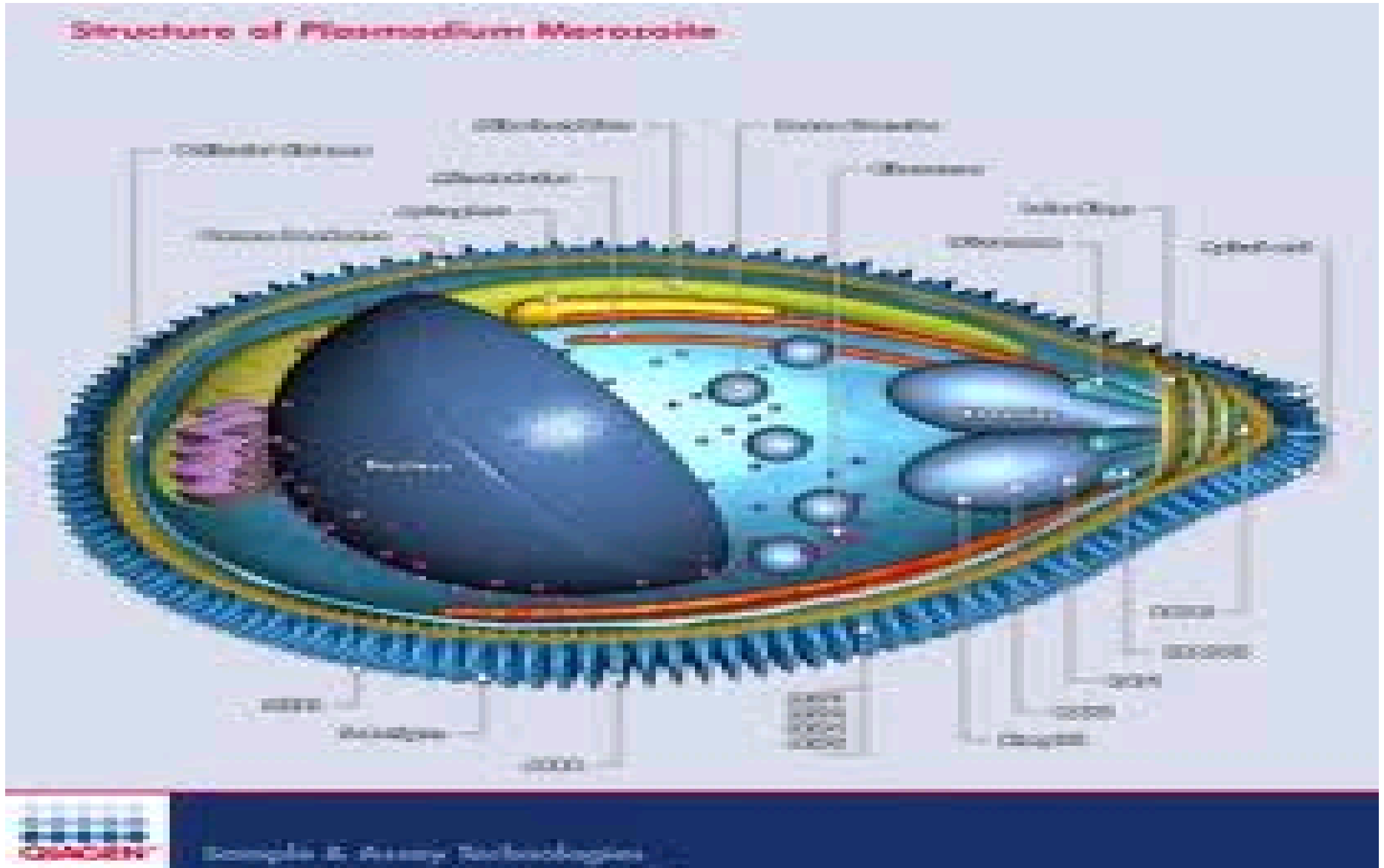
It has 2 Classes; **Coccidia &
Gregarina**

Eg. Coccidia are the *Plasmodium*,    www.knust.edu.gh

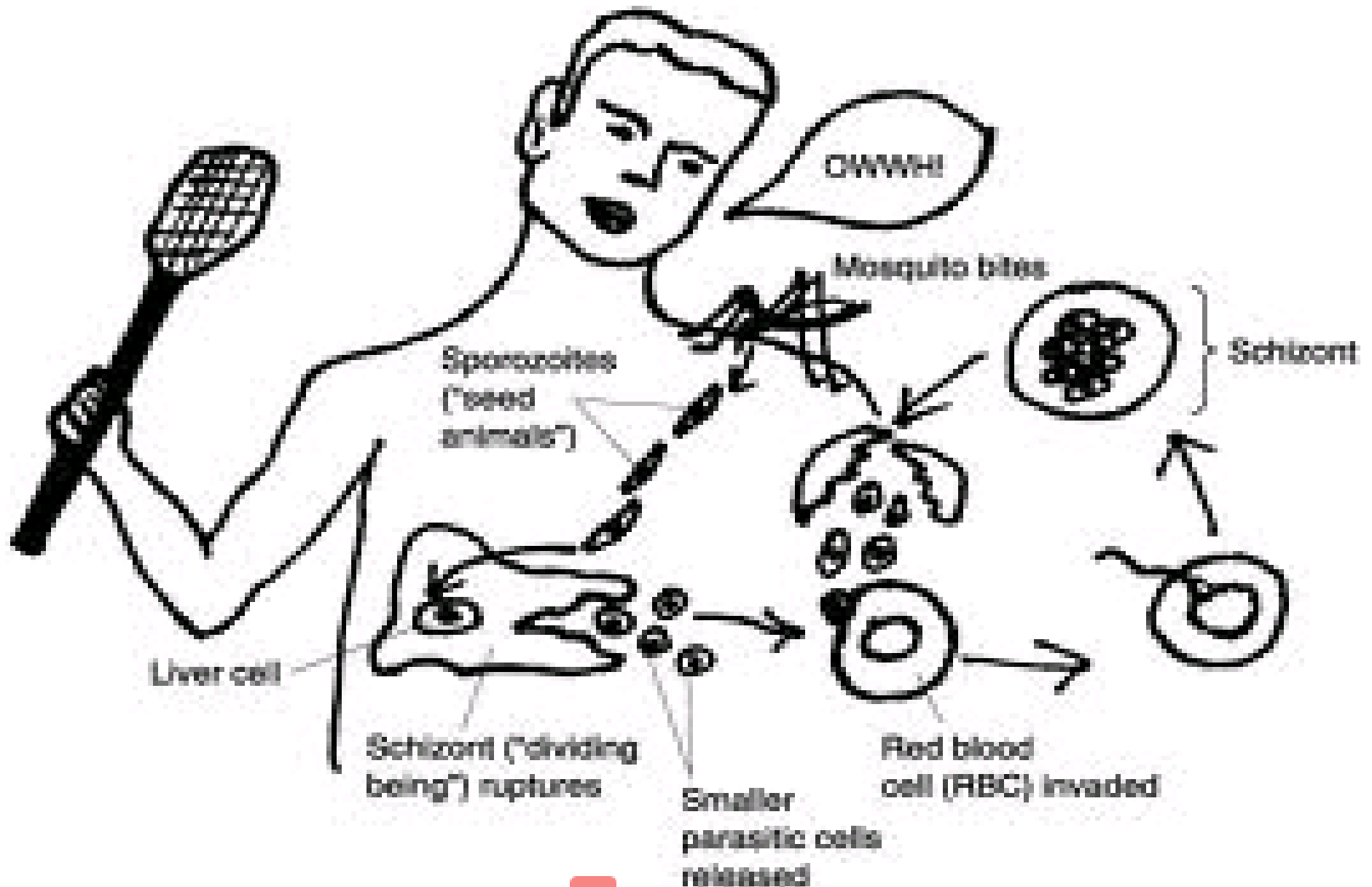
Toxoplasma, *Cryptosporidium*



Plasmodium



Life cycle of plasmodium



2. Phylum Teleospora;

This was formally known as **Myzozoa**.

This has one Class; **Perkinsida**

Order; **Perkinsidae**

-It causes a serious disease, and have examples like *Perkinsea*, *Babesia*, *Nassula*, *Stylonicchia*, etc.

-These have simple life cycles.

-They invade blood corpuscles of both humans and mollusks.



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Babesia sp.



Stylonicchia sp



B. Super-phylum Sarcomastigophora

Organisms are made up of single cell that has some means of locomotion .

This may be out of body fluid movements,
flicking of hair-like and tread-like structures found on their body.



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Sarco-mastigophora has 3 phyla;
Sarcodina, Mastigophora and
opalinata.

Phylum Cilliophora evolved from
Opalinata and forms a phylum of
itself.

It contains the most developed
organisms under protozoa.

Their nucleus is advanced into micro
and mega nuclei.



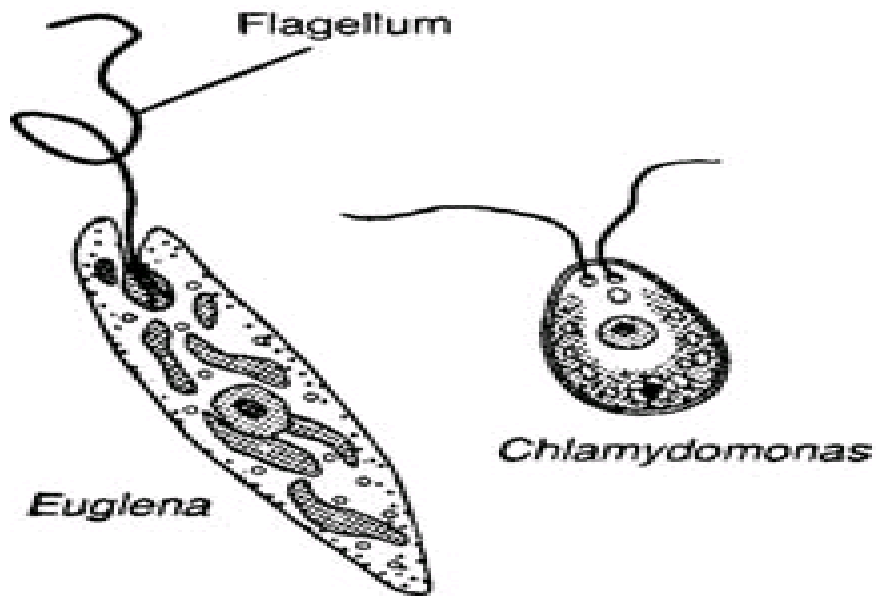
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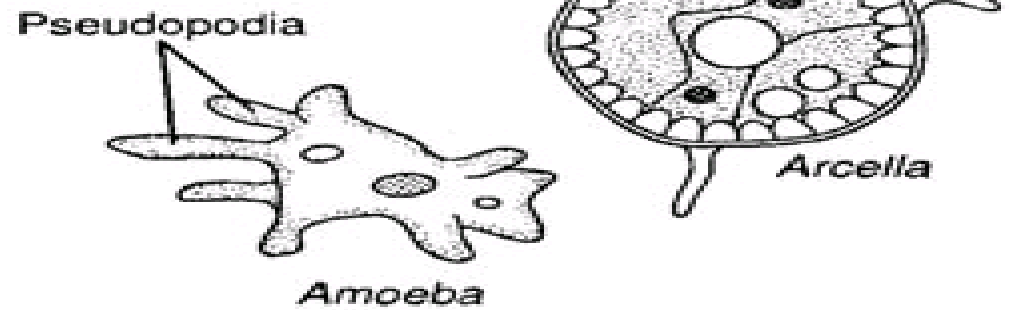
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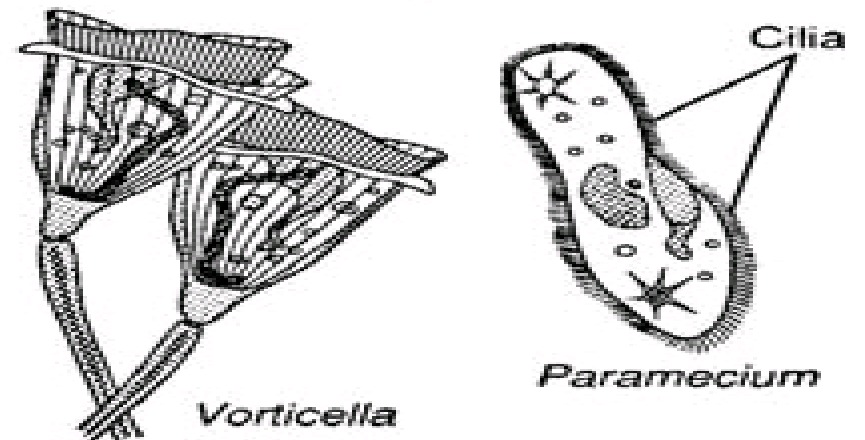
Mastigophora



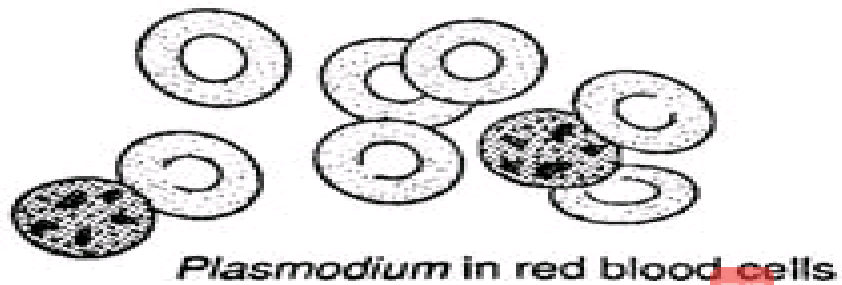
Sarcodina



Ciliophora



Apicomplexa



1. Phylum Opalinata

This has no classes.

The organisms have no smaller sub-units but have only two genera, *Opalina* and *Zelleriella* spp.

They are oval and covered with longitudinal rows of cillia.

They are extinct now.

Ciliates evolved from this.



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2. Phylum Sarcodina :

Unicellular organisms that move by propelling body movements.

Organisms have no specialized organelles but has the ability to move parts of their to enable them move.

Reproduction is by binary fission. The nucleus divide and the body mass then, divide along to form 2 daughter organisms.



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They are able to extend part of their body in the direction that they have to move.

Their body mass also, move in the extended portion to enable the organism move along (pseudopods)

.
They are free-living (aquatic) or parasitic.



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Types of pseudopods:

The body extensions are known as lobopodium in *Arcella*, *Amoeba*, *Diffugia*.

As reticulopodium in *Globigerina* & *Foraminifera* (*Vertebralima sp.*)



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As axopodium in Actinophrys
and *Clathrulina*,

and filopodium in
Chlamydophrys.

Though, most are found at any
portion of the organism, they
are fixed in advanced
sarcodinas.



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Sarcodina has 2 classes;
Rhizopoda & Actinopoda.
Rhizopods mostly have exposed
/naked body whilst actinopods
have some sort of cover at
some part of the body.
Some have fixed bodies wall in
actinopods.



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Eg. of **Rhizopods**; Amoeba,
Entamoeba, Arcella, Diffugia,
Chlamydophrys, etc.

Eg. of **Actinopods**; Sphaerezoum,
Acanthometra, Vampyrella,
Lithocircus, Actinospaeurium,
Actinophrys , Clathrulina, etc.

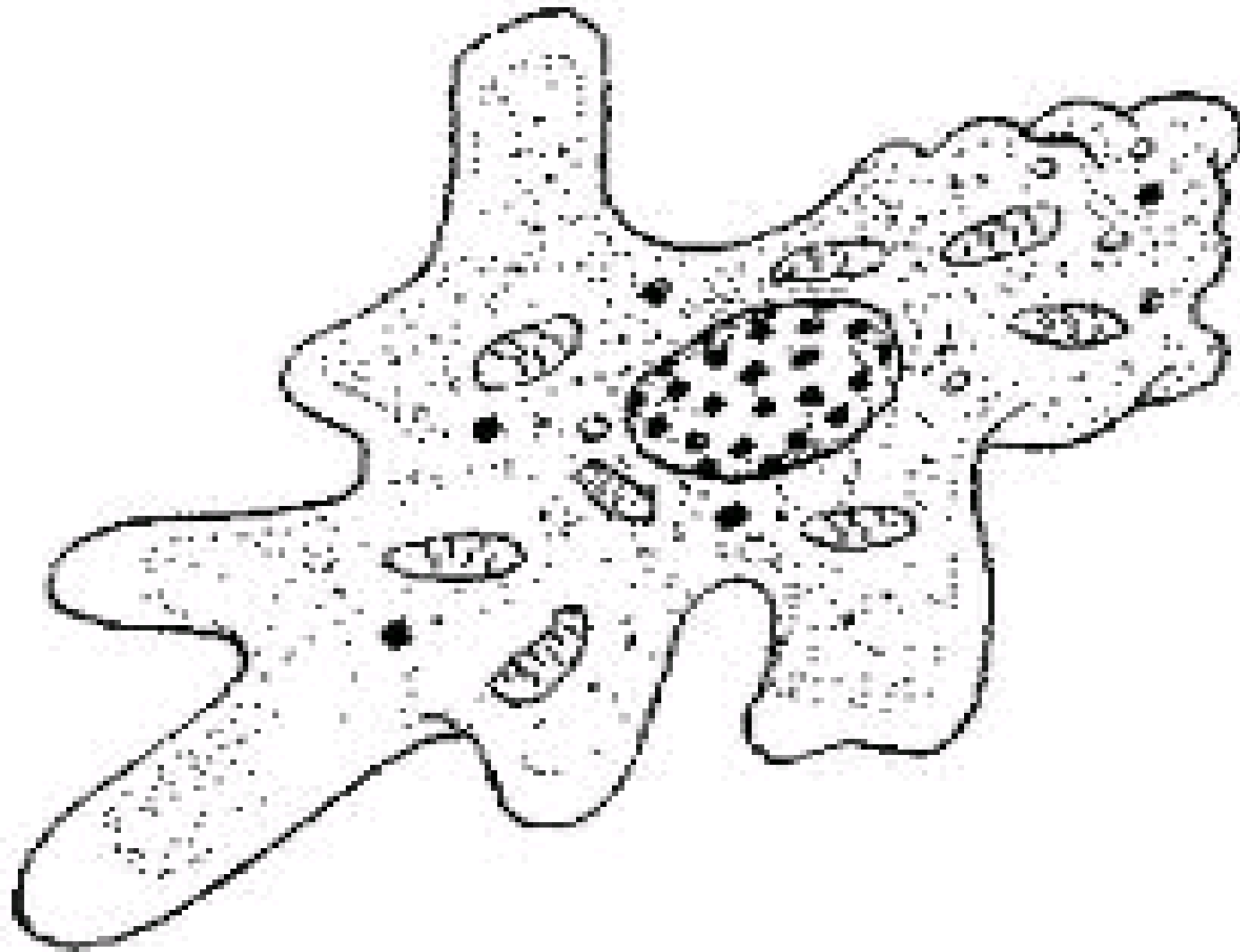


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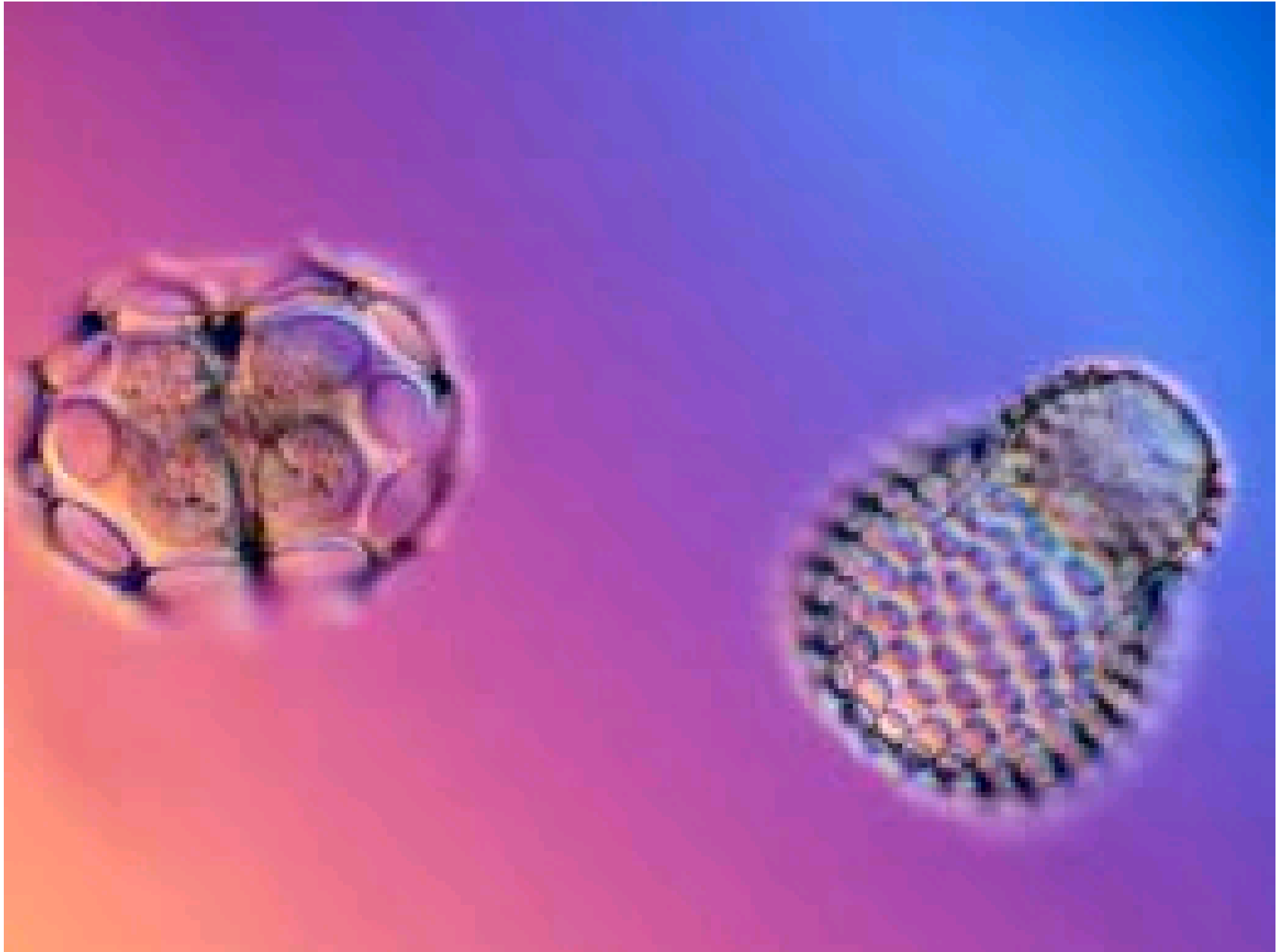


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Amoeba,



radiolarians



3. Mastigophora

This is also known as Flagellata

Organisms have an organelle used for locomotion.

It's a long whip/thread attached to the body.

It can be found at any part of the organisms.

They normally have fixed bodies.



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It has 2 sub-phyla : phyto- and zoo-mastigophora.

A. The Phyto-mastigophora consists of those that have some chlorophyll pigment in their body. Though they are animals, they can photosynthesis food because most at at the surface of waters.



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Phytomastigophora has 10 Classes.

Class Volvocida, Chlamonadida,
Eubriida, Chrysomonadida,
Silicoflagellida,
Coccolithophorida, Euglenida,
Dinoflagellida, Heteroclorida,
Cryptomonadida



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B. Zoomastigophora has the real animal like organisms. They are heterotrophs and parasites

It has 9 Classes.

Class Retortamonadida, Diplomonadida, Oxymonadida, Trichomonadida, Choanoflagellida, Bicosoecida, Rhizomastigida, Hypermastigida, Kinetoplastida



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A. Phytomastogophora

Class Volvocida- body with chlorophyll usually single cup-shaped, stigma, 2-4 apical flagella per cell. Many colonial species.

Largely freshwater forms.

Eg. Haematococcus, Polytomella, Chlamydomonas, Volvox, Gonium, Platydorina, etc.



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Class Euglenida :

Elongated, green or colourless .

Possess one or two flagella,
arise from anterior recess.

Stigma present. Mostly
freshwater forms.

Eg. **Euglena, Peranema,**

Haematococcus, Rhabdomonas,

Phacus, etc.



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Class Dinoflagellida-
possess equatorial and a
posterior longitudinal flagellum
located in grooves. Body either
naked or covered by cellulose
membrane. Brown or yellow
chromoplasts and stigma usually
present. Largely marine and
parasites.



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There are 2 types; armoured and unarmoured.

Armoured has hard material on their body and unarmoured has no real hardness.

Eg. of armoured: Ornithocircus, Ceratium, Noctiluca, Histiophysics, etc.



Eg of unarmoured: Oodinium
and Gymnodinium

Class Coccolithophorida

tiny marine flagellates. Covered
with calcareous platelets-
coccoliths.



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2 flagella and yellow to brown chromoplast present. Have no endogenous siliceous cysts.
Eg. **Coccolithus, Rhabdosphaera.**

Class heteroclorida
2 unequal flagella. Possess yellow-green chloroplast.



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Have siliceous cysts.

Eg. Heterocloris, Myxochloris.

Class Ebriida

They are biflagellate. No
chloroplasts, have internal
siliceous skeleton. Mainly
fossils.

Eg. Ebria



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Class Silicoflagellida

Flagelum single or absent. Have brown chromoplast. Have internal siliceous skeleton. Mostly in fossil forms. Eg. Dictyocha



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Continue to make notes for the rest of the remaining 7classes



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B. Zoomatigophora

Organisms are fully animals.

Heterotrophic in feeding.

Has 9 classes

Class Choanoflagellida-

mainly freshwater. **Single**

flagelum sorrounded by collar.

They are found in the body cells of



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higher organisms. Solitary or colonial.

Sessile forms or stalked.

Eg. Codosiga, Pretorospongia,

2. Class Kinetoplastida-

Single forms. Posses up to 4 flagella.

Mostly parasitic.

Eg. *Bodo*, *Trypanosoma*, *Leishmania*,



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3. Class Trichomonadida-
parasitic. 4-6 flagella with one
trailing,
Eg. Trichomonas



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Continue to make notes for the rest of the remaining 6 classes



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Flagella arrangement

Organisms have an organelle or attachment for locomotion.

It's a threadlike structure but has the same internal arrangement of micro-fibrils as that of the cillium; 9+2 arrangement.



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Though many have a single flagellum, others have double flagella.

The flagellum may be situated at the anterior or the posterior side of the organism.



Those with flagellum at posterior end is *Trypanosoma*.

- *Chlamydomonas* has bi-flagella,
- *Trypanosoma* has a uni-flagellum.
- *Trichomonas* has penta-flagella (5)
- .
- *Volvox* has many short flagella.

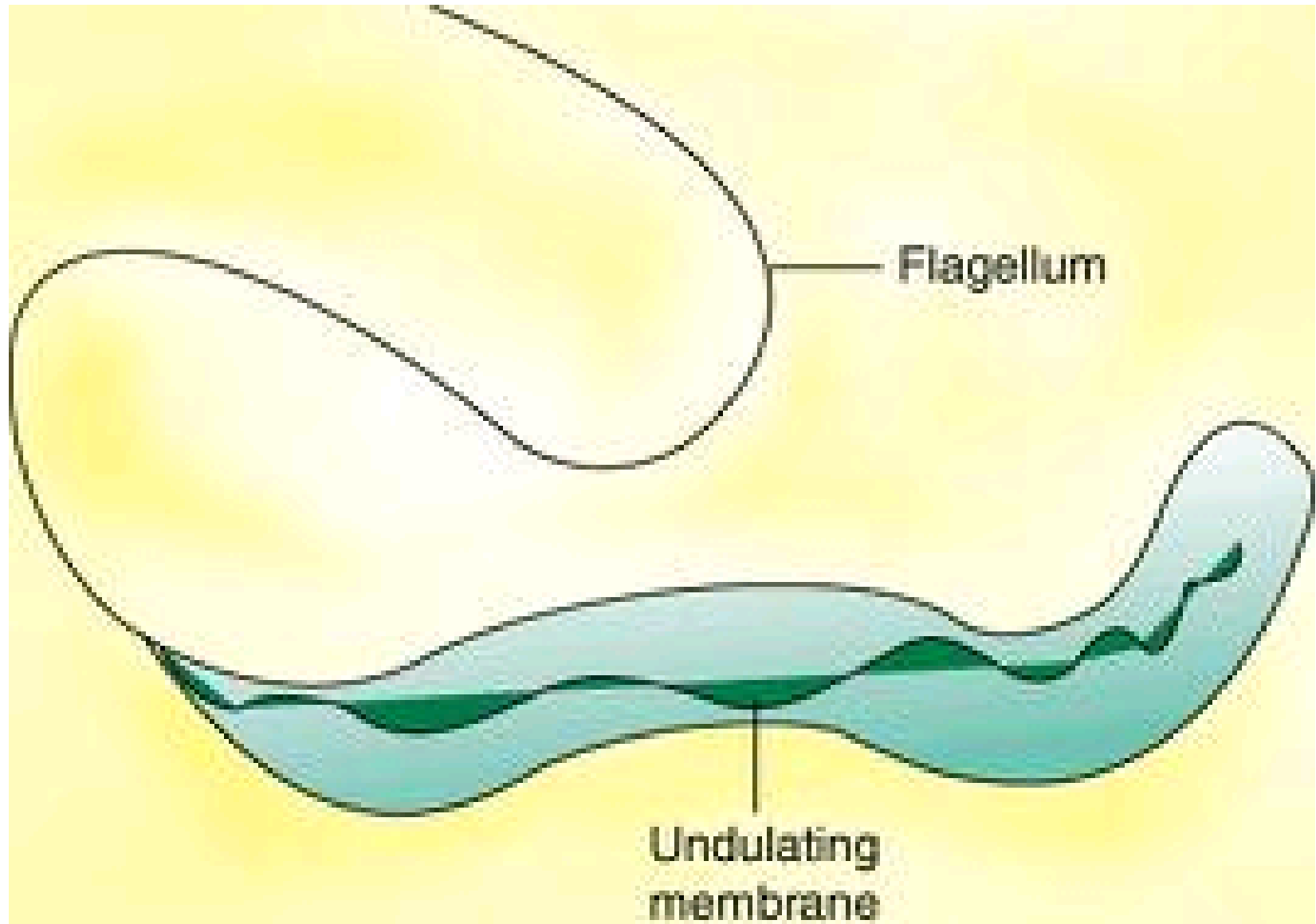


Eg. of organisms with flagellum at anterior ends are ;

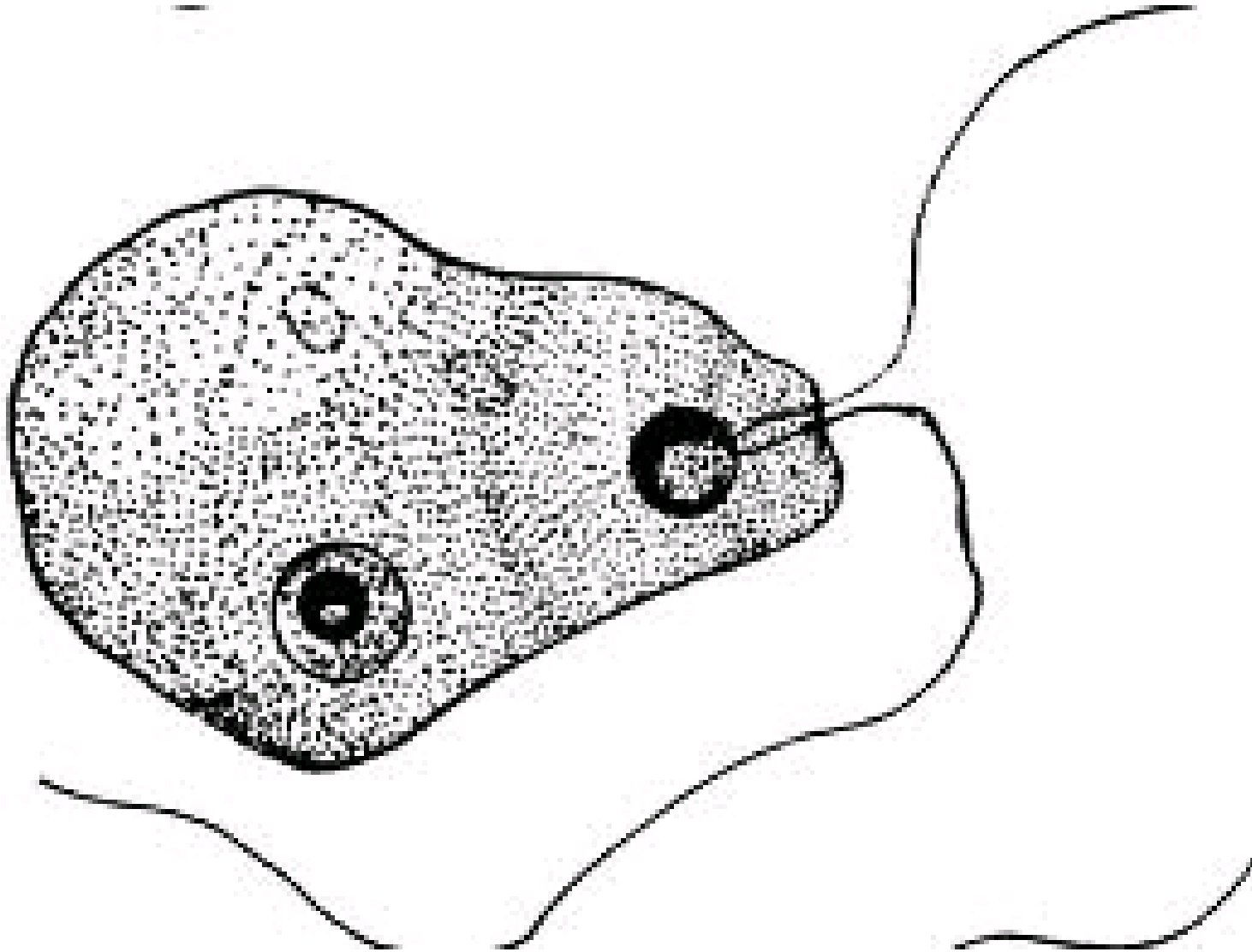
- *Euglena*
- *Chlamydomonas*.



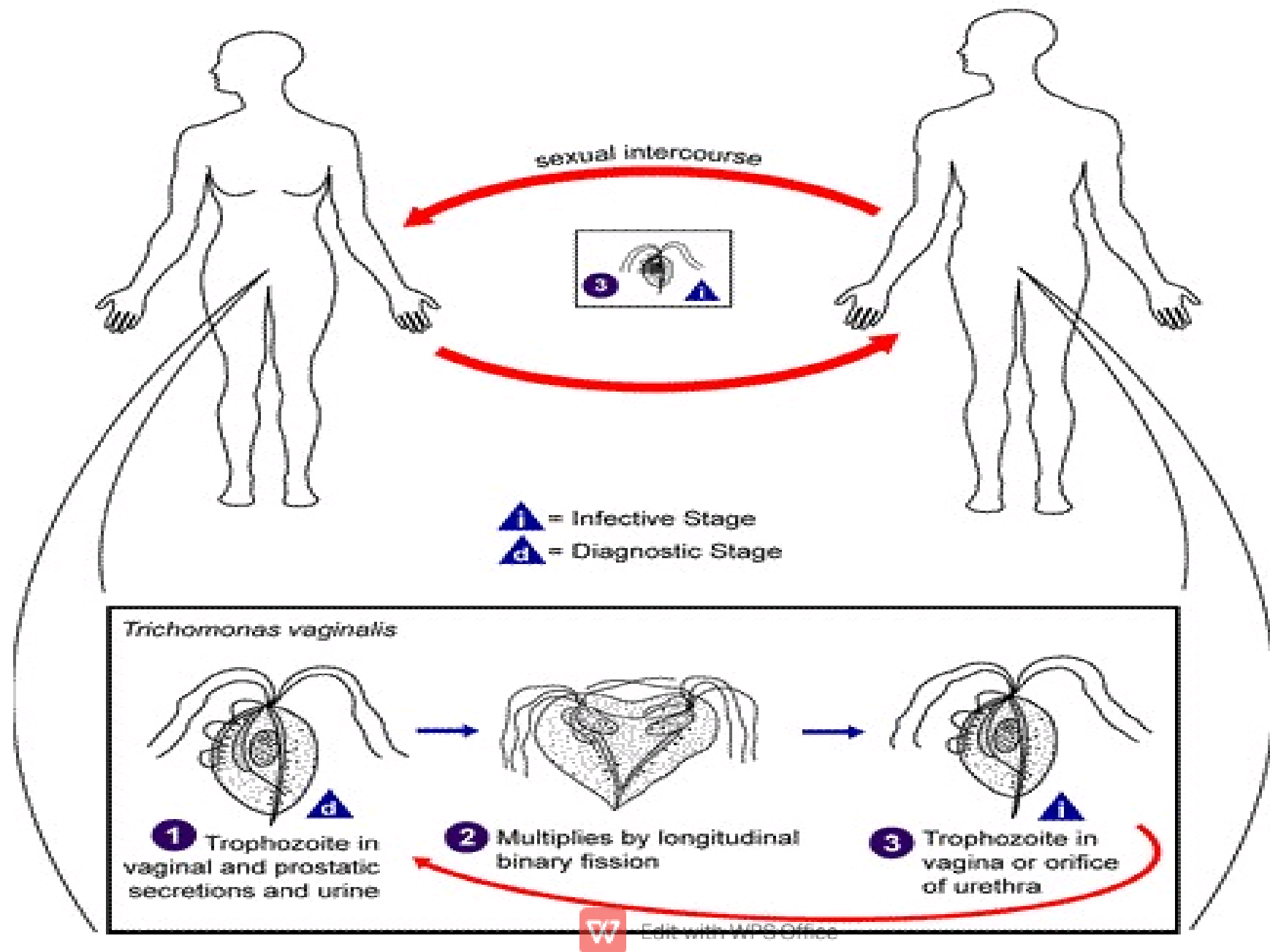
*Trypanosoma*_sp.



Gardia, Chlamydomonas



Life cycle of Gardia



PHYLUM CILLIOPHORA

These are also referred to as **Ciliata**. Organisms have fixed bodies with hair-like structures.

The cillium has a 9+2 internal structure.

The structure of the cilia and their arrangement gives classification to the organisms.



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This is the most developed group under Protozoa. The nucleus in some are bi-nucleated (micro- and mega-).

It has 2 Superclass: Holotrichia and Spirotrichia

S.Class Holotrichia has 9 classes while S.Class Spirotrichia has 6 classes.



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Superclass Holotrichia

Has simple or uniform body cilia. Buccal ciliation is small and inconspicuous or/ absent. 9 classes

Class Trichostomatida; they have feeding ciliation around the mouth. Eg. *Balantidium*, *Colpoda*, *Isotrichia*, etc



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Class Gymnostomatida

Large ciliates with oral ciliature.

Cilia are around the **cytopharynx**.

Eg. *Loxophylum*, *Amphileptus*,
Dileptus, *Prorodon*, *Didinium*, etc.

Class Peritrichida

Adult lack cilia. Apical end of body bear conspicuous buccal ciliature.



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They are mostly attached to/form stalks.

Eg. Vorticella, Zoothamnium, Trichodina

Class Hymnostomatida

Small ciliates. Possess uniform body ciliature. Body consists of undulating membrane. the buccal cavity contain pellicular ribs which are fed by rows of microtubules.



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Eg. Paramecium, Tetrahymena,
Blepharostoma, Colpodium, etc.

Class Thigmatrachida; cirri
adher to one side of the body,
and referred to as **thigmotatics.**

Eg. *Gagarius*, *Ancistrocoma*,
Ancistrum, etc.



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Add the other 4 classes

Class Astomatida, Suctorida;
Apostomatida and Chonotrichida



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Class Astomatida; Eg.

Anopiophyra, Metaradiophyra,
etc.

**Class Suctorida; Eg. Podophyra,
Acineta, etc.**

Class Apostomatida; Eg.

Foettiingeria, Polyspira, etc.

Class Chonotrichida: eg.



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2. Super Class Spirotrichia

organisms have reduced body cilia.
But well developed buccal ciliature.

Has 6 classes

***Class Hypotrichida;** Dorso-ventrally flattened ciliates. Body cilia is restricted into **tufts** (cirri). It located at the ventral part of body.

Eg. *Vorticella*, *spirochona*, etc.



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***Class Odontostomatida**

a small group of compressed and wedge shaped ciliates, with reduce body. Possess **carapace** and buccal cilia. Eg. Saprodinium.

***Class Heterotrichida**

protozoons have body cilia, or have body encased in a **lorica** without cilia.

Eg. Stentor, Blapharisma, Bursaria,
etc



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Class Entodiniomorphida

These are endo-commensal ciliate in the gut of herbivores. Cilia is reduced or absent. Have buccal ciliature that are often in separate anterior clumps. Posterior end may be drawn into spines.

Eg. Entodinium, elephantophilus, Cycloposthium



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Add that of Class Tintinnida and Oligotrichida.

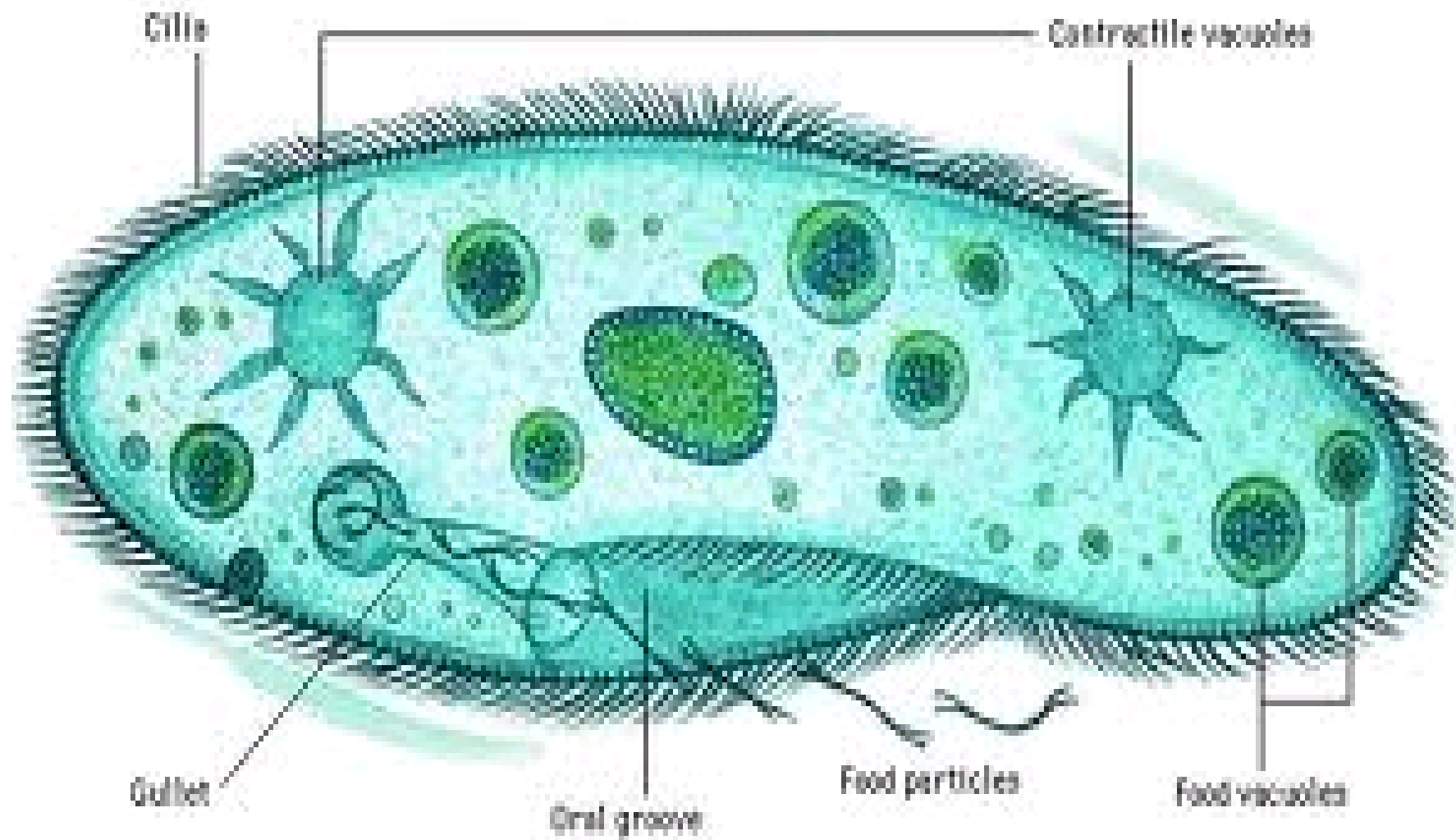


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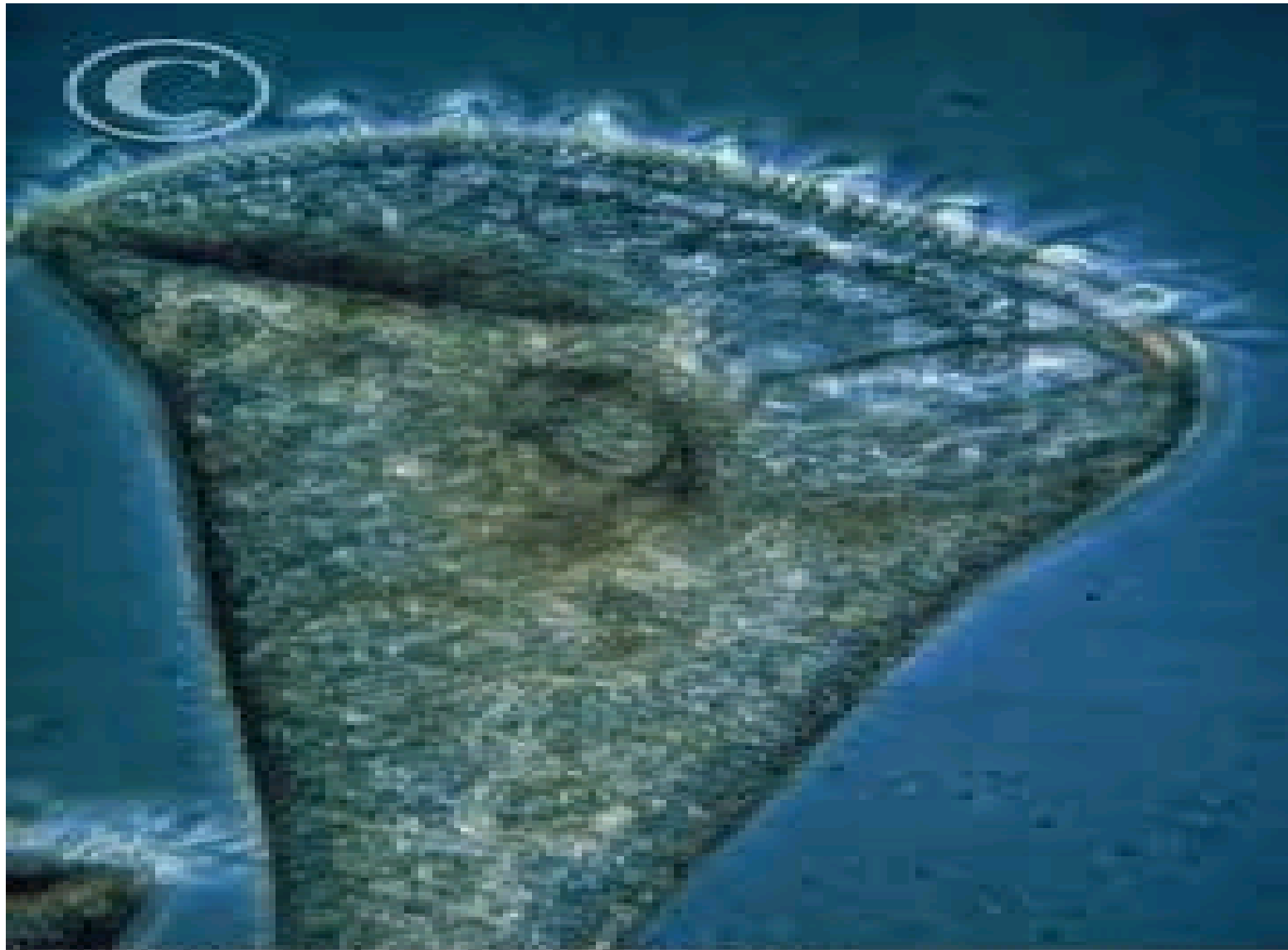


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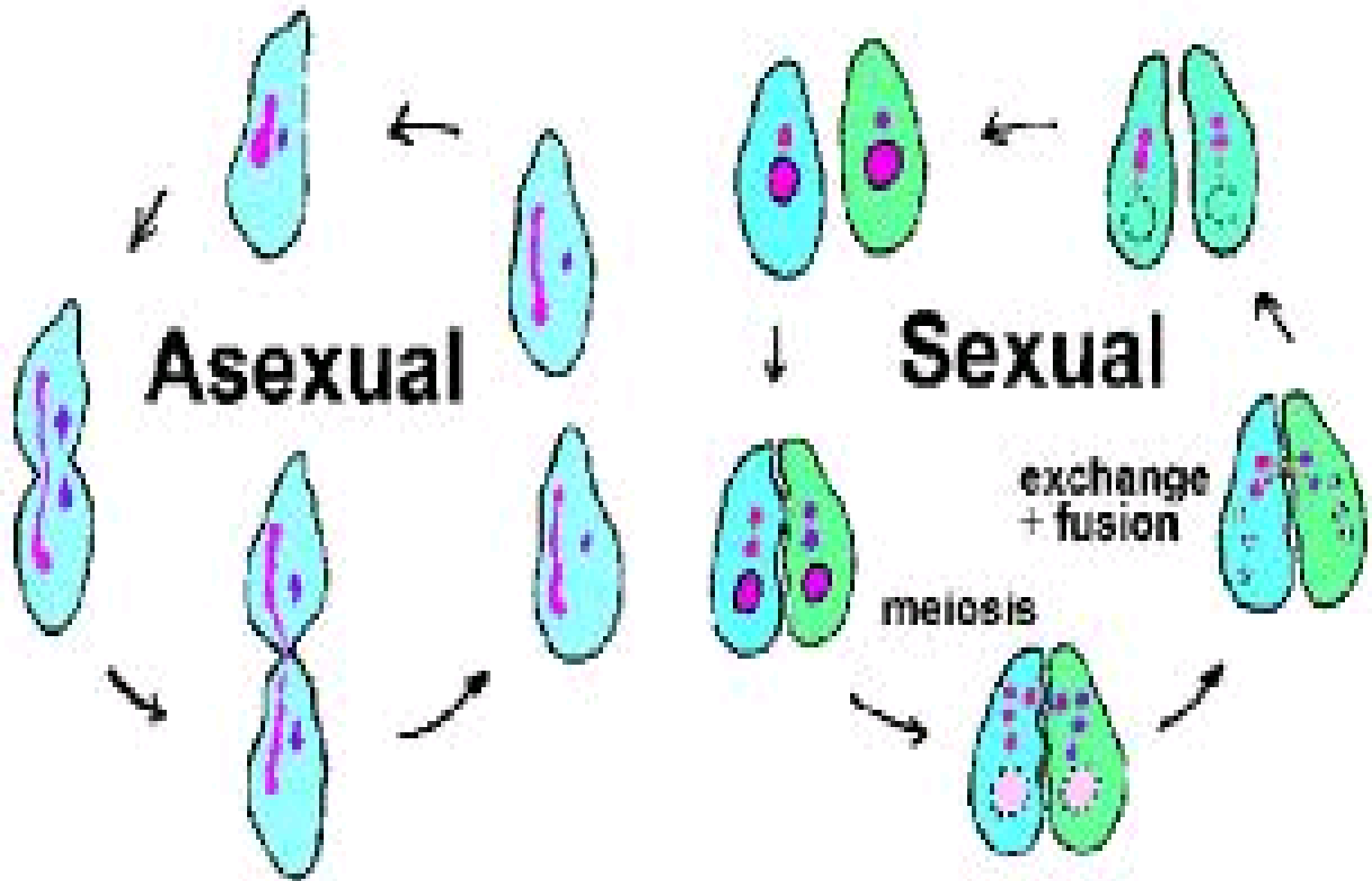


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Reproduction in ciliates



End of Lesson.

Thanks



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