



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 Ciliophora.



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.



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.

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



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.



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.



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

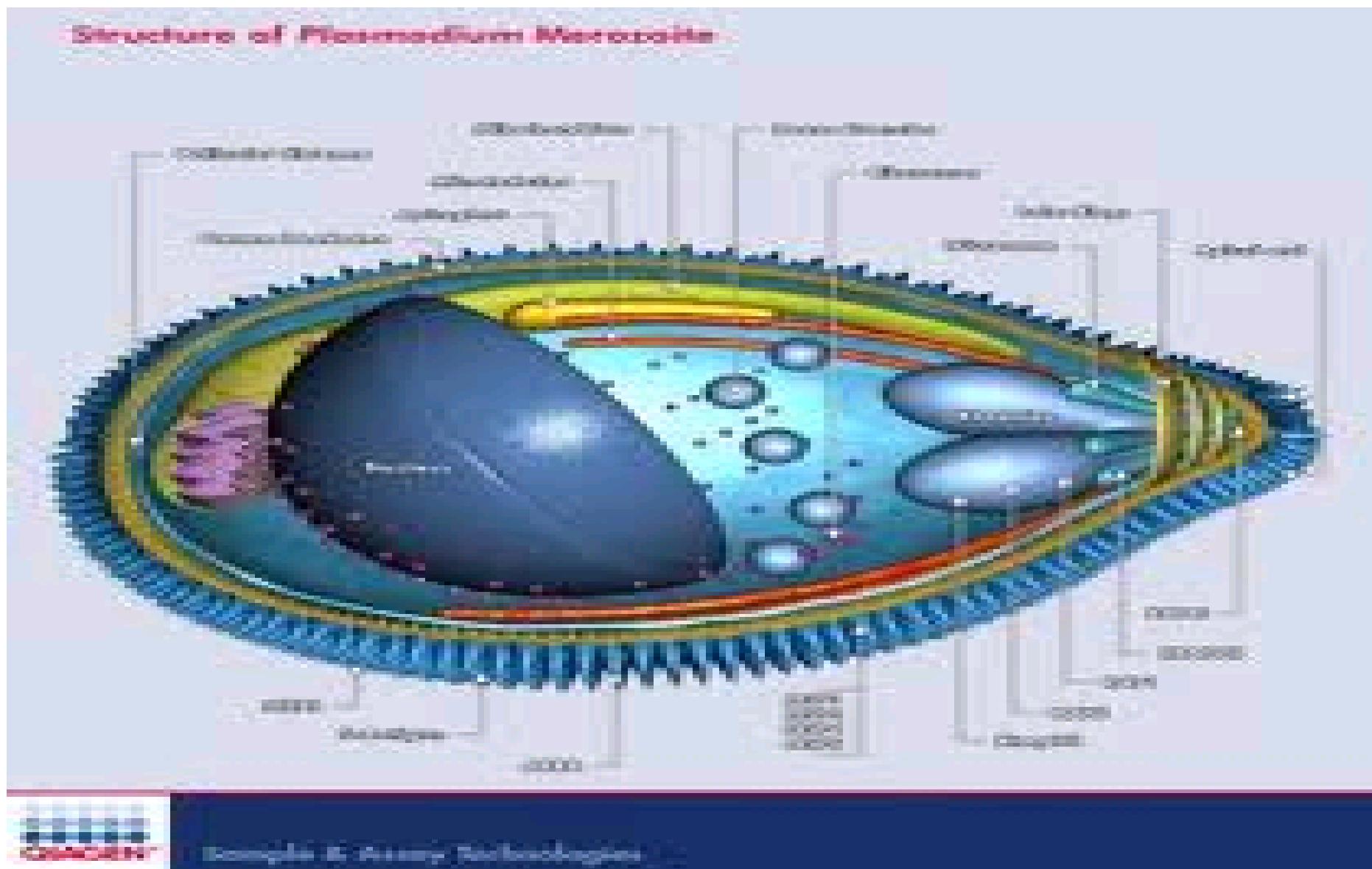
These have complex life cycles.
May involve 1 or 2 hosts.

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

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

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Toxoplasma, *Cryptosporidium*

Plasmodium

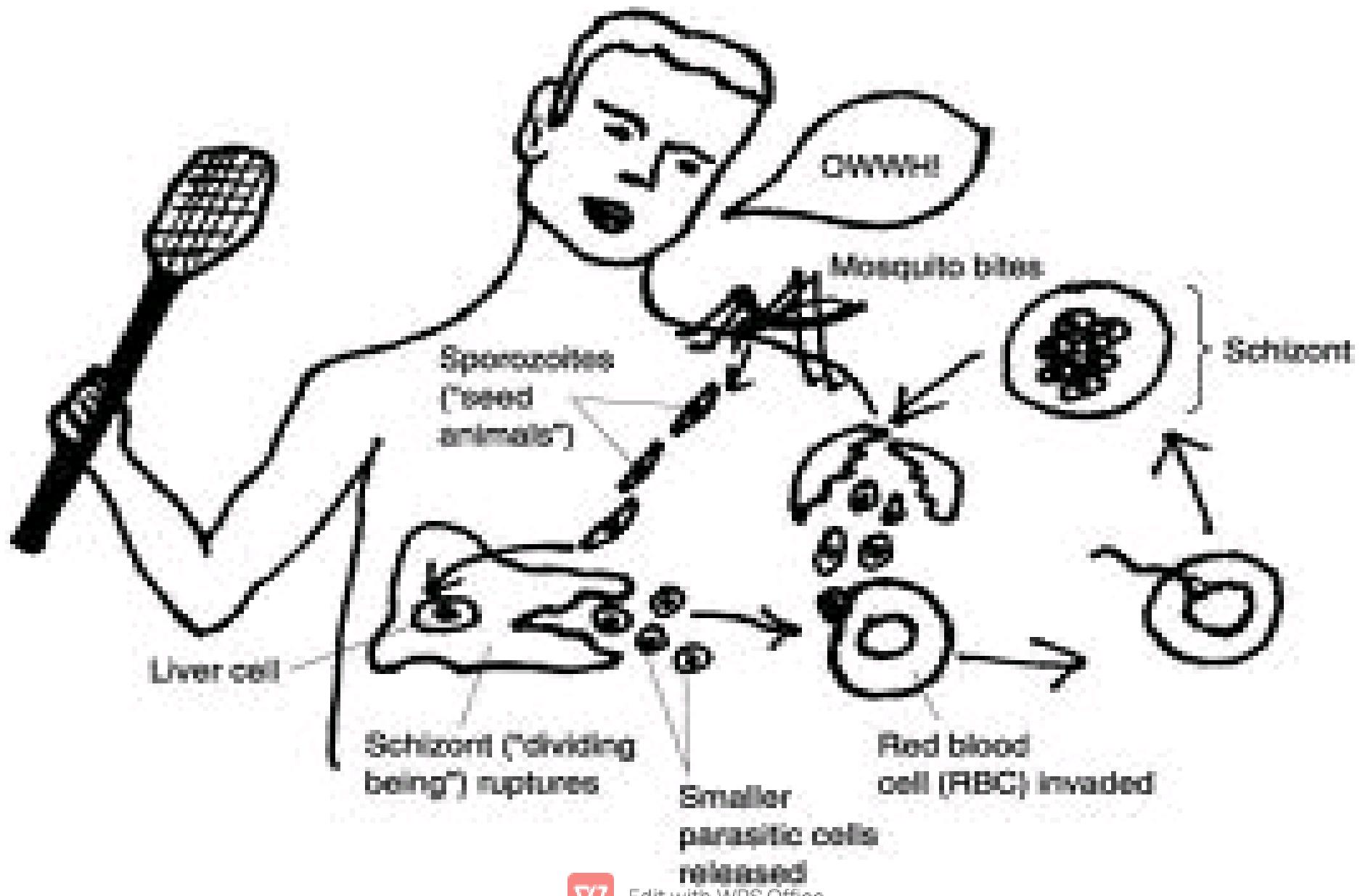


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Life cycle of plasmodium



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*, *Styloonicchia*, etc.

-These have simple life cycles.

-They invade blood corpuscles of both humans and mollusks.

Babesia sp.



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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.

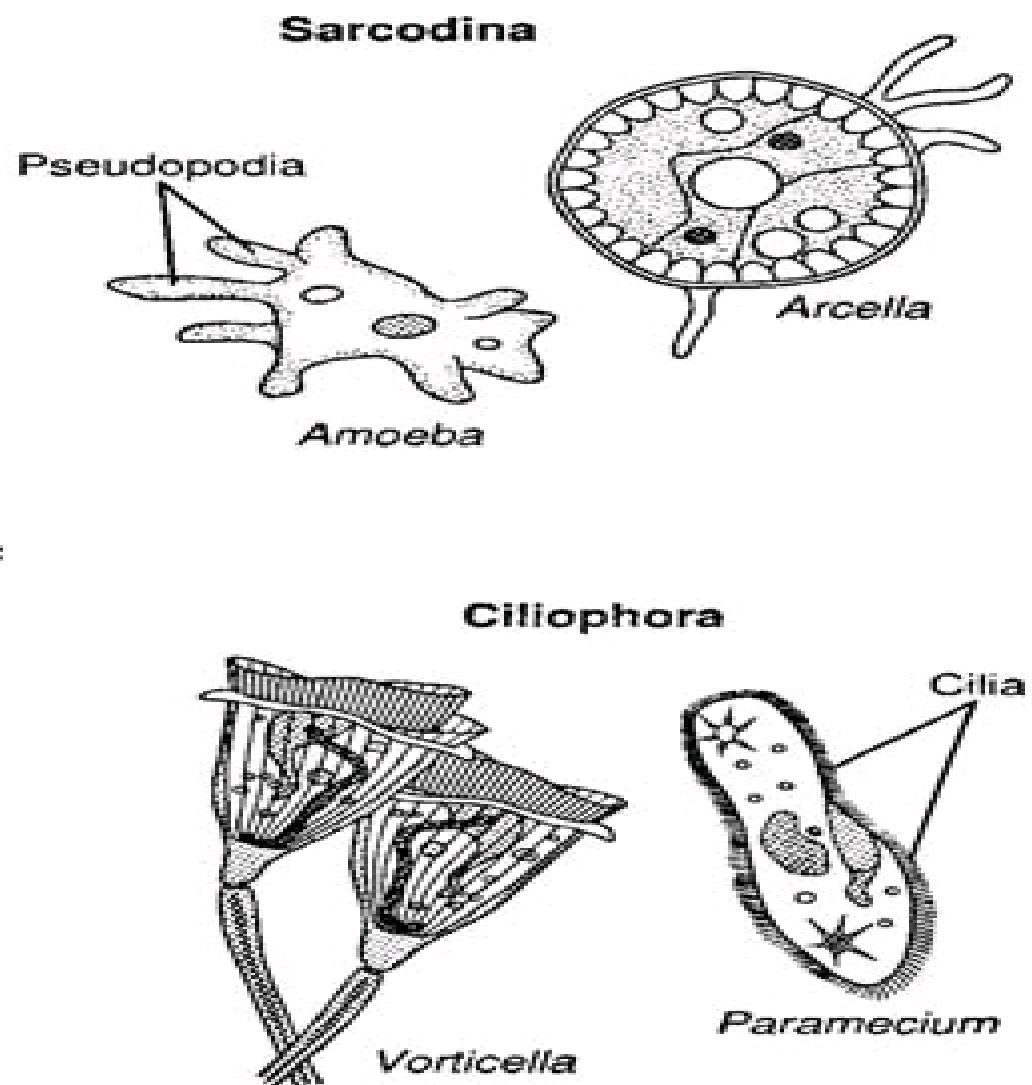
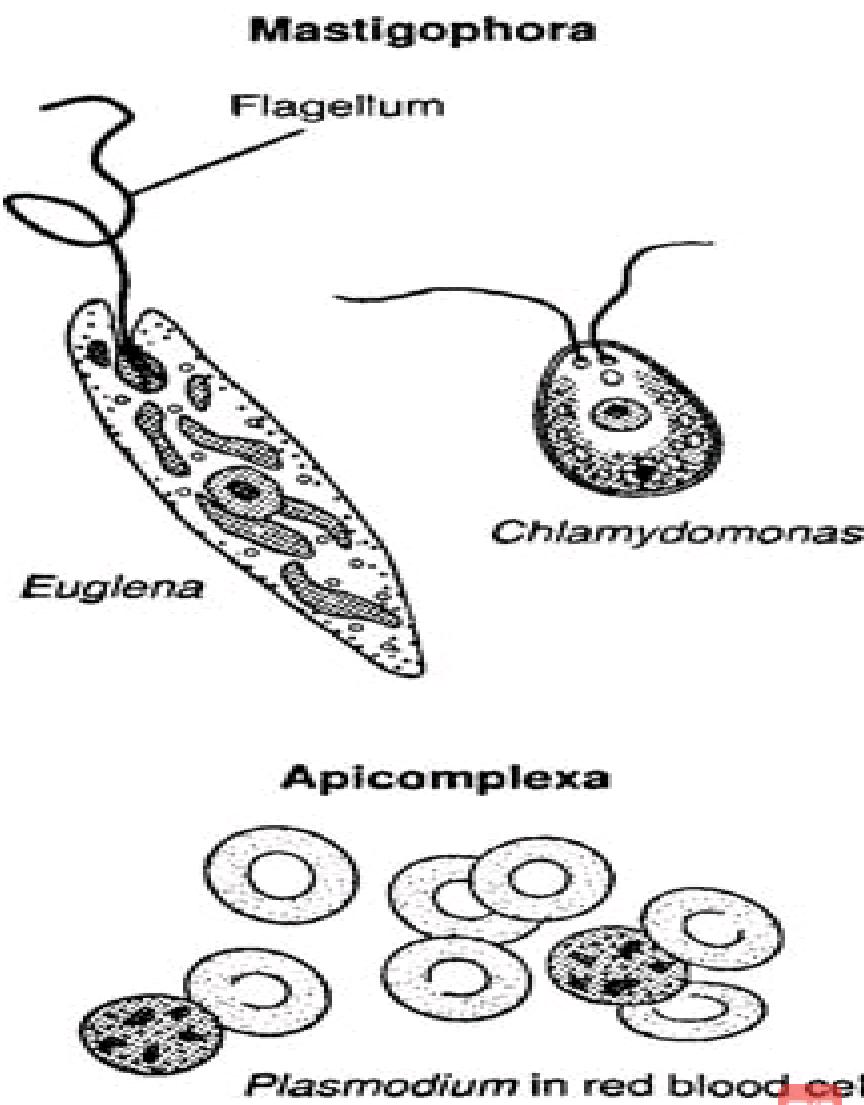


Sarco-mastigophora has 3 phyla;
Sarcodina, Mastigophora and
opalinata.

Phylum Ciliophora 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.





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.



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.



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.



Types of pseudopods:

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

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

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.



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

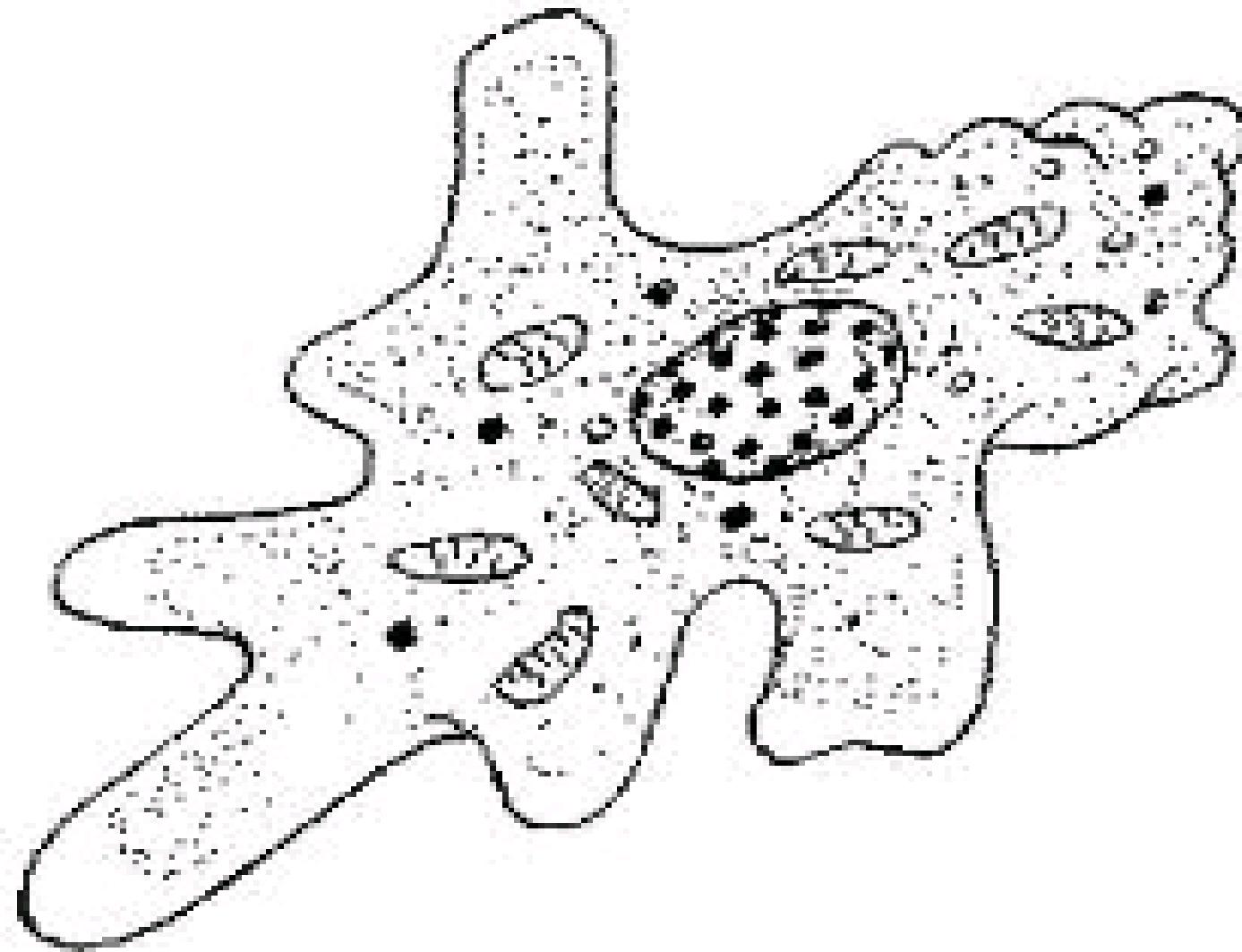
actinopods.

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

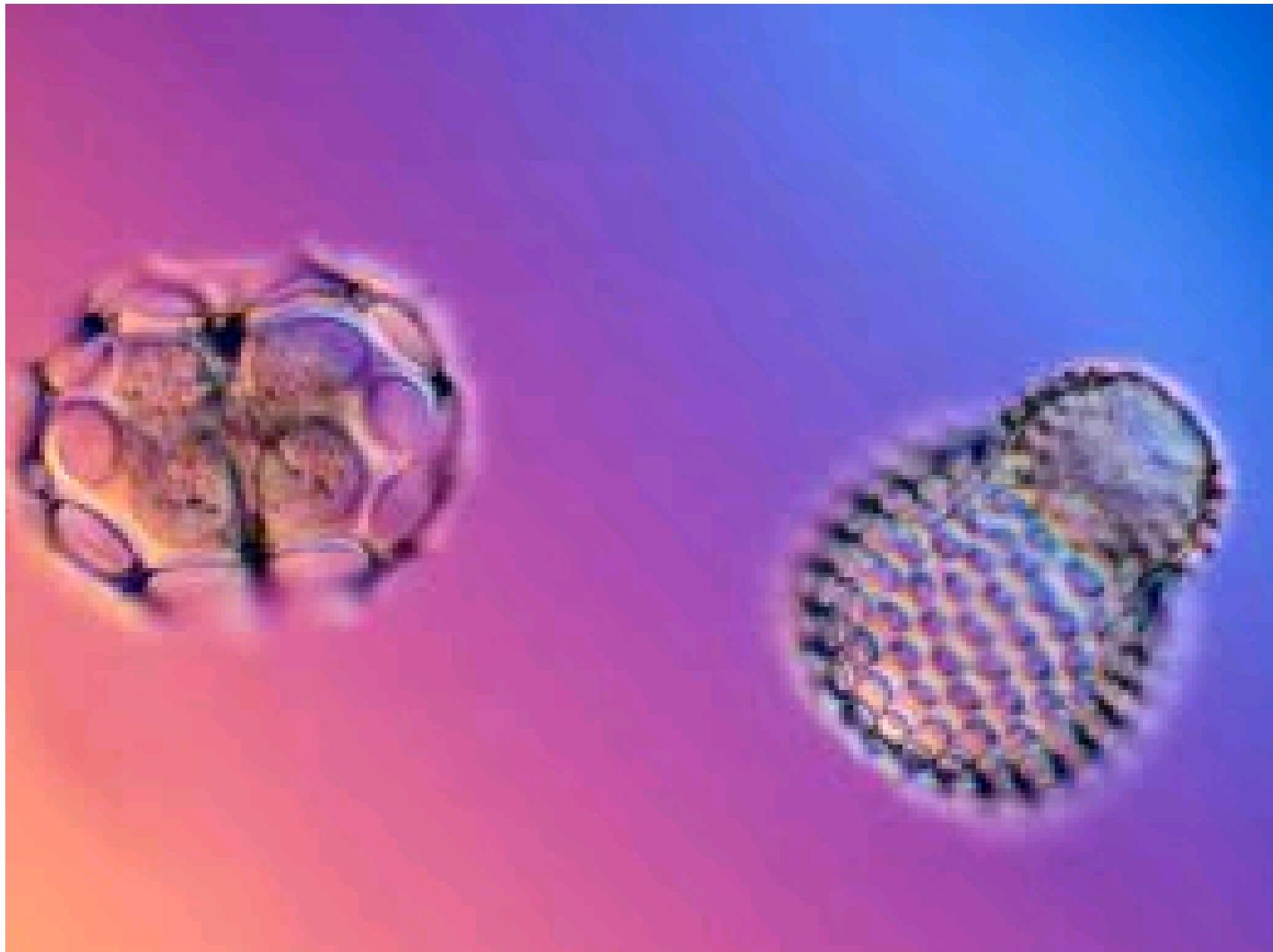
Eg. of Actinopods; Sphaerezoum, Acanthometra, Vampyrella, Lithocircus, Actinosphaerium, Actinophrys , Clathrulina, etc.



Amoeba,



radiolarians



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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 zoomastigophora.

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

Phytomastigophora has 10 Classes.

Class Volvocida, Chlomonadida,
Ebriida, Chrysomonadida,
Silicoflagellida,
Coccolithophorida, Euglenida,
Dinoflagellida, Heteroclorida,
Cryptomonadida



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**

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.



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.



Class Dinoflagellida-

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

There are 2 types; armoured and unarmoured.

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

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

Eg of unarmoured: Oodinium and Gymnodinium

Class Cocciliophorida

tiny marine flagellates. Covered with calcareous platelets-coccoliths.



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.



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

Flagellum single or absent. Have brown chromatophore. Have internal siliceous skeleton. Mostly in fossil forms.
Eg. Dictyocha



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



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B. Zoomatigophora

Organisms are fully animals.

Heterotrophic in feeding.

Has 9 classes

Class Choanoflagellida-

mainly freshwater. Single

flagellum surrounded by collar.

They are found in the body cells
of



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*,

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.

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)

.

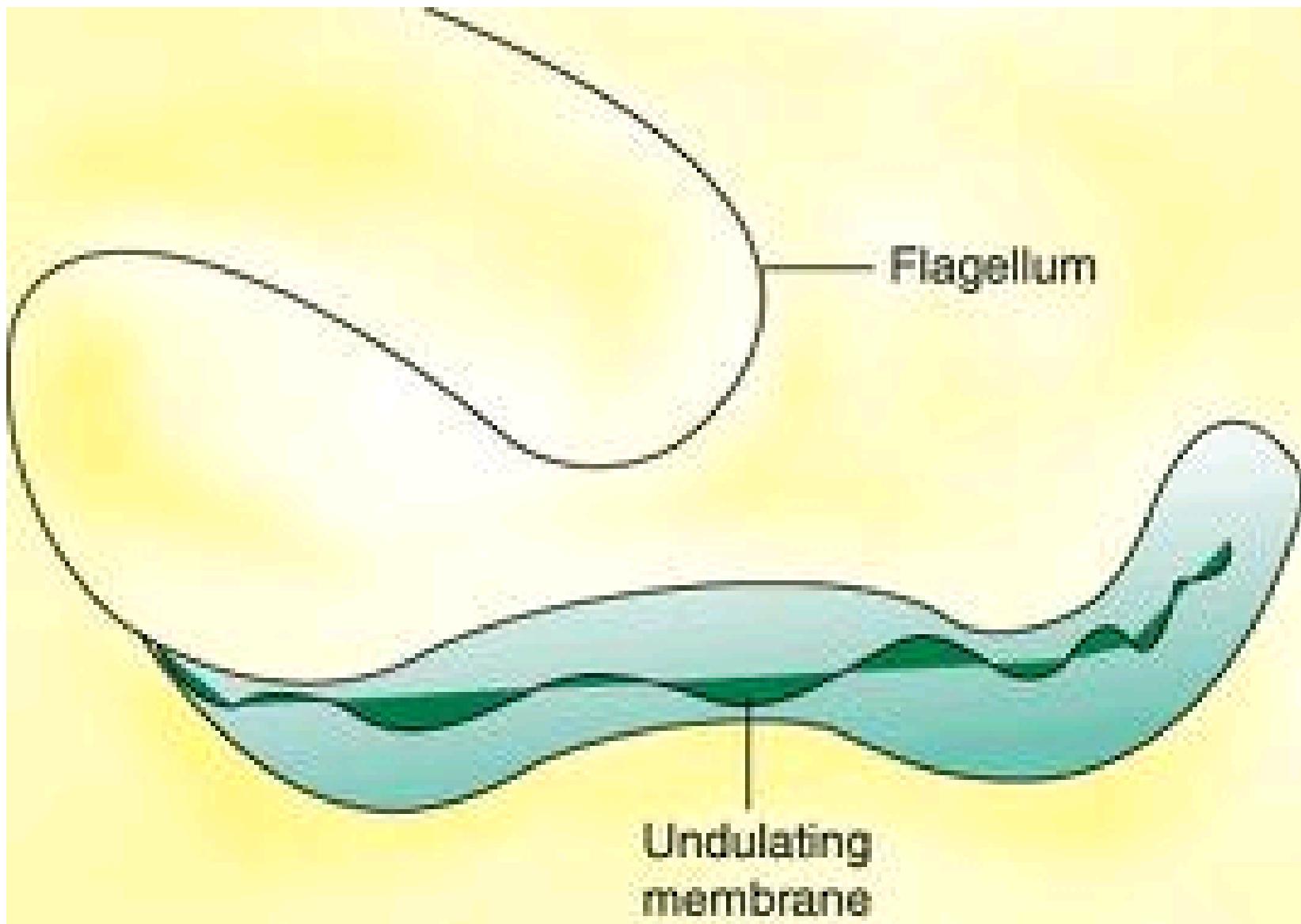
-*Volvox* has many short flagella.

Eg. of organisms with flagellum at anterior ends are ;

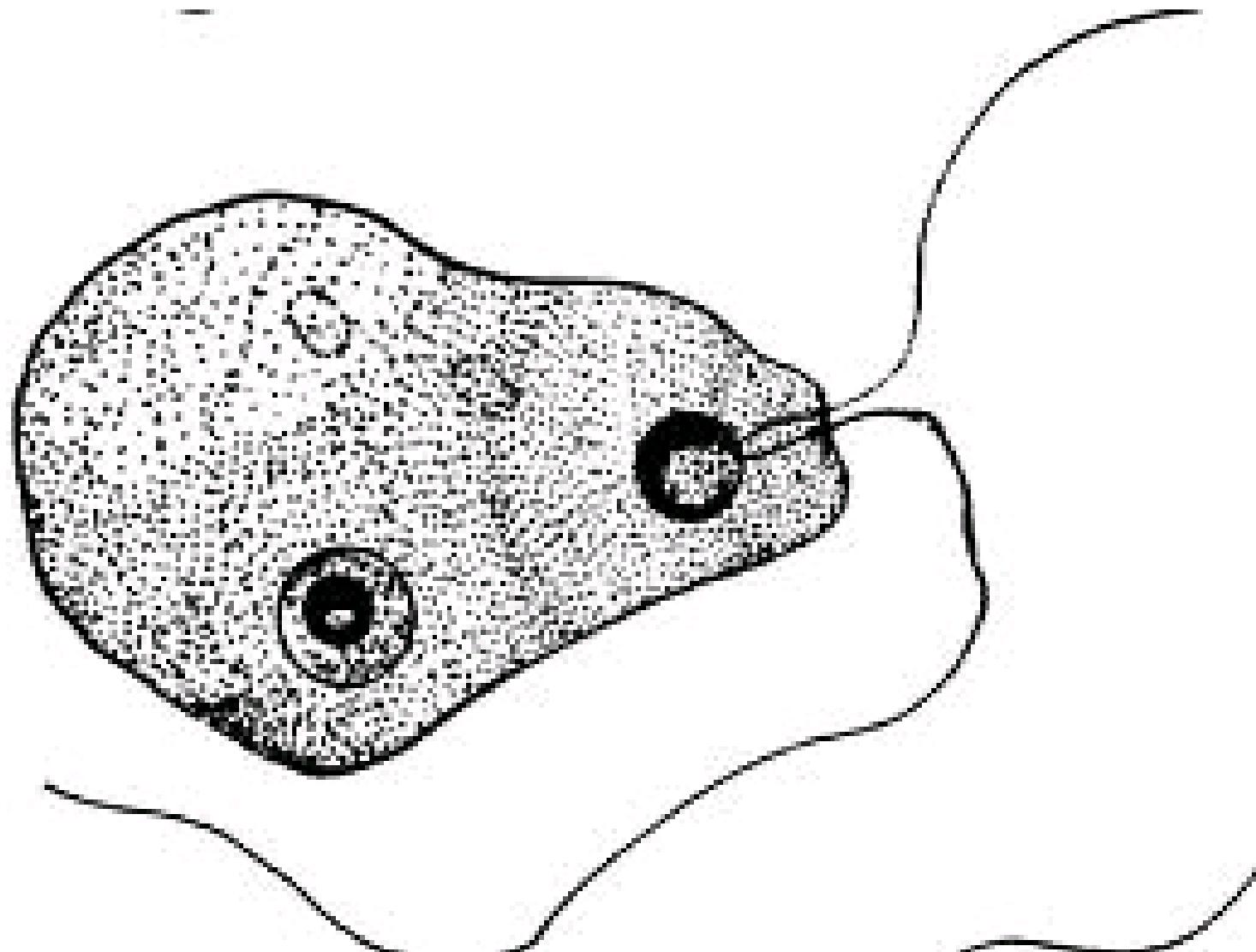
- *Euglena*
- *Chlamydomonas.*



Trypanosoma sp.

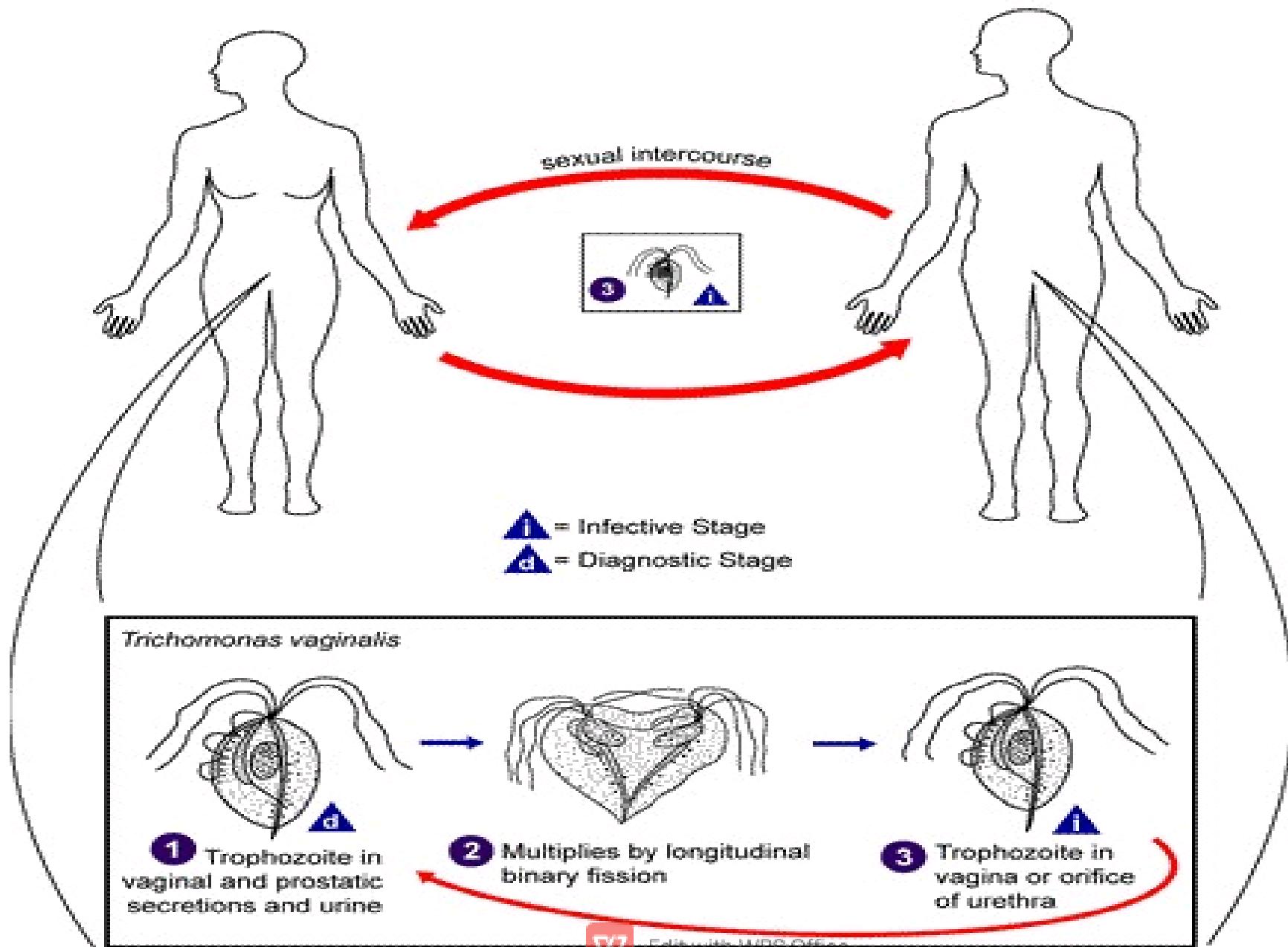


Gardia, Chlamydomonas



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Life cycle of Gardia



PHYLUM CILLIOPHORA

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

The cillum has a 9+2 internal
structure.

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



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.



Superclass Holotrichia

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

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



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.



They are mostly attached to/form stalks.

Eg. Vorticella, Zoothamnium, Trichodina

Class Hymnóstomatida

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



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

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

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

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.



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. *Vorticela*, *spirochona*, etc.

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

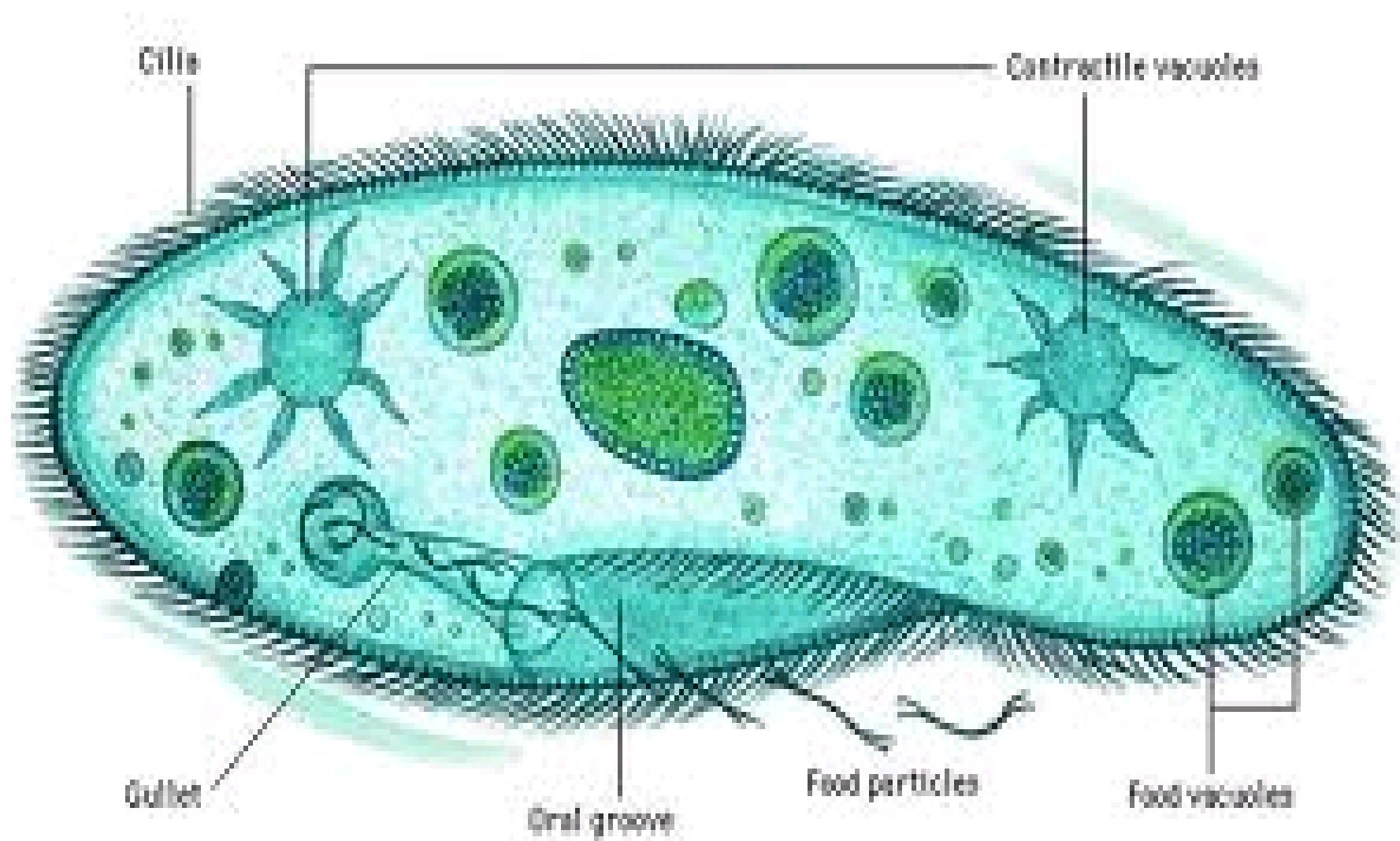
Add that of Class Tintinnida and Oligotrichida.

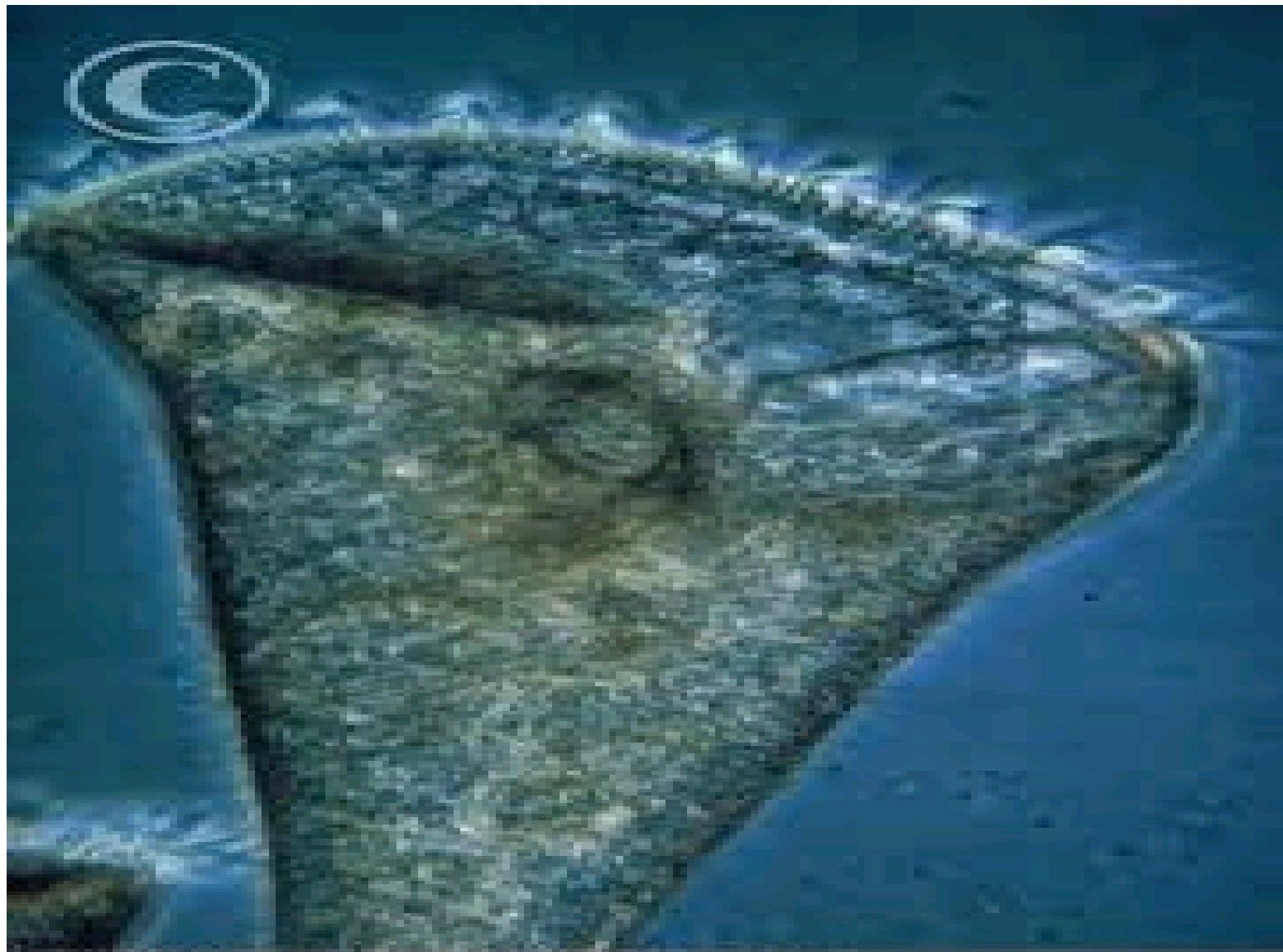


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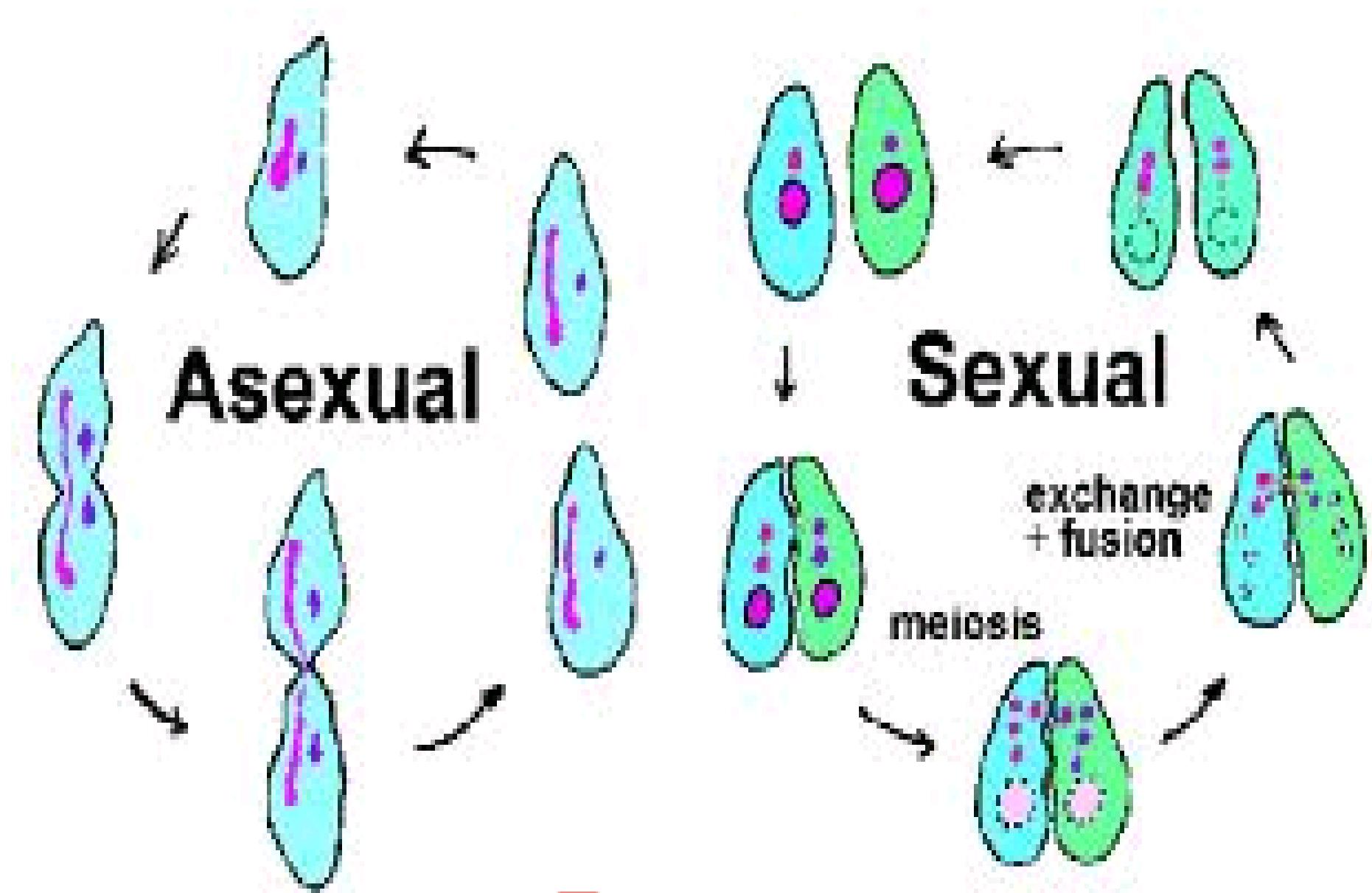


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End of Lesson.

Thanks



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