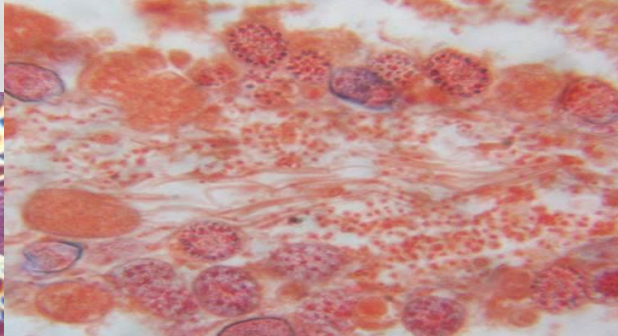
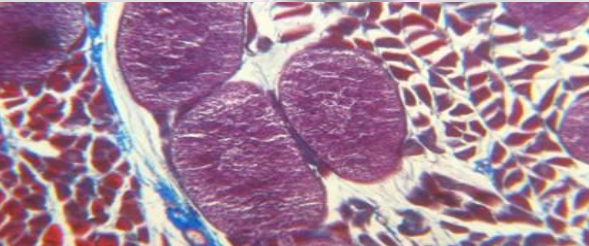
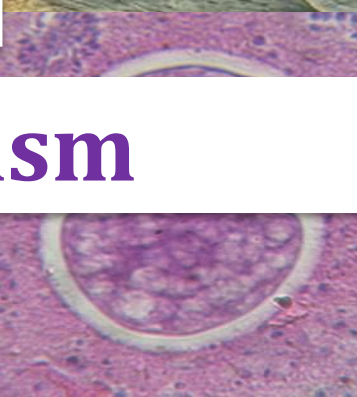
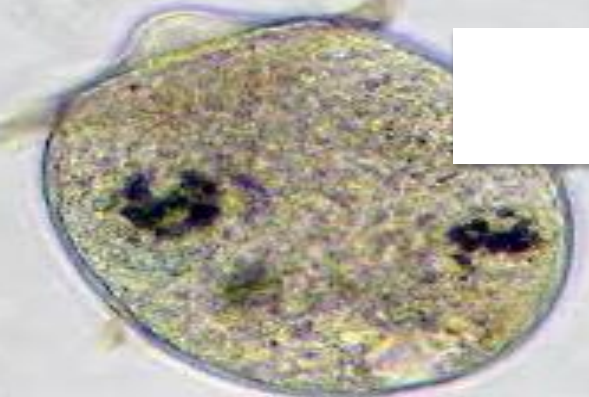


Lecture (2)

Parasitology and parasitism



Times of the exams

First mid- term exam: Tuesday 3/4/2018

Time: 9 - 10 am

Final exam: Tuesday 24/4/2018 - 26/4/2018

Time: 9 - 11 am

Phylum Euglenozoa

Flagellates with 1-2 flagella, with mitochondria

Class Kinetoplastea

Order Kinetoplastida

...Kinetoplastids were named for the presence of a **kinetoplast** which is a distinct region of single, long mitochondrion containing coiled DNA filaments.

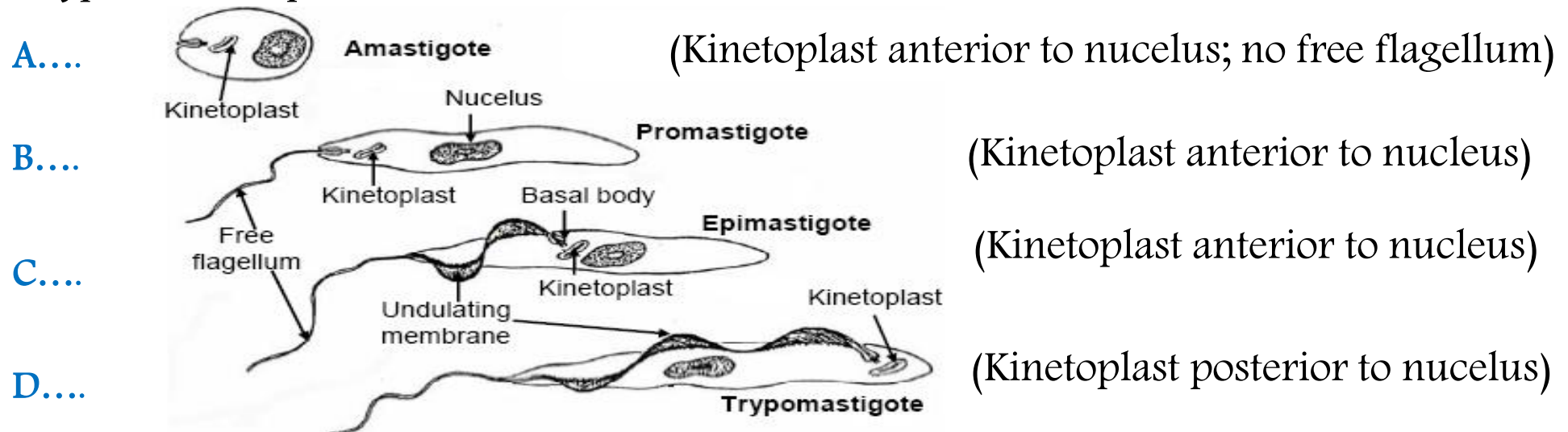
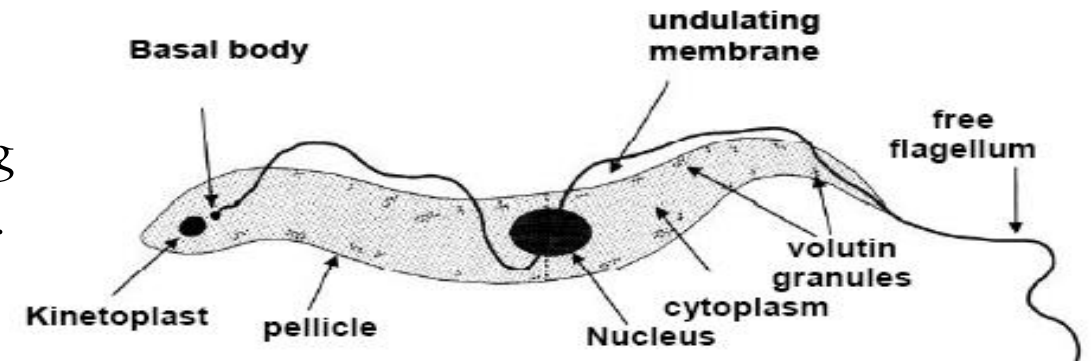
Suborder Trypanosomatina (with a single flagellum):

...One flagellum, Single mitochondrion, usually extending length of body (in a few, mitochondrion is non-functional).

...Pleiomorphic (variation in body shapes):

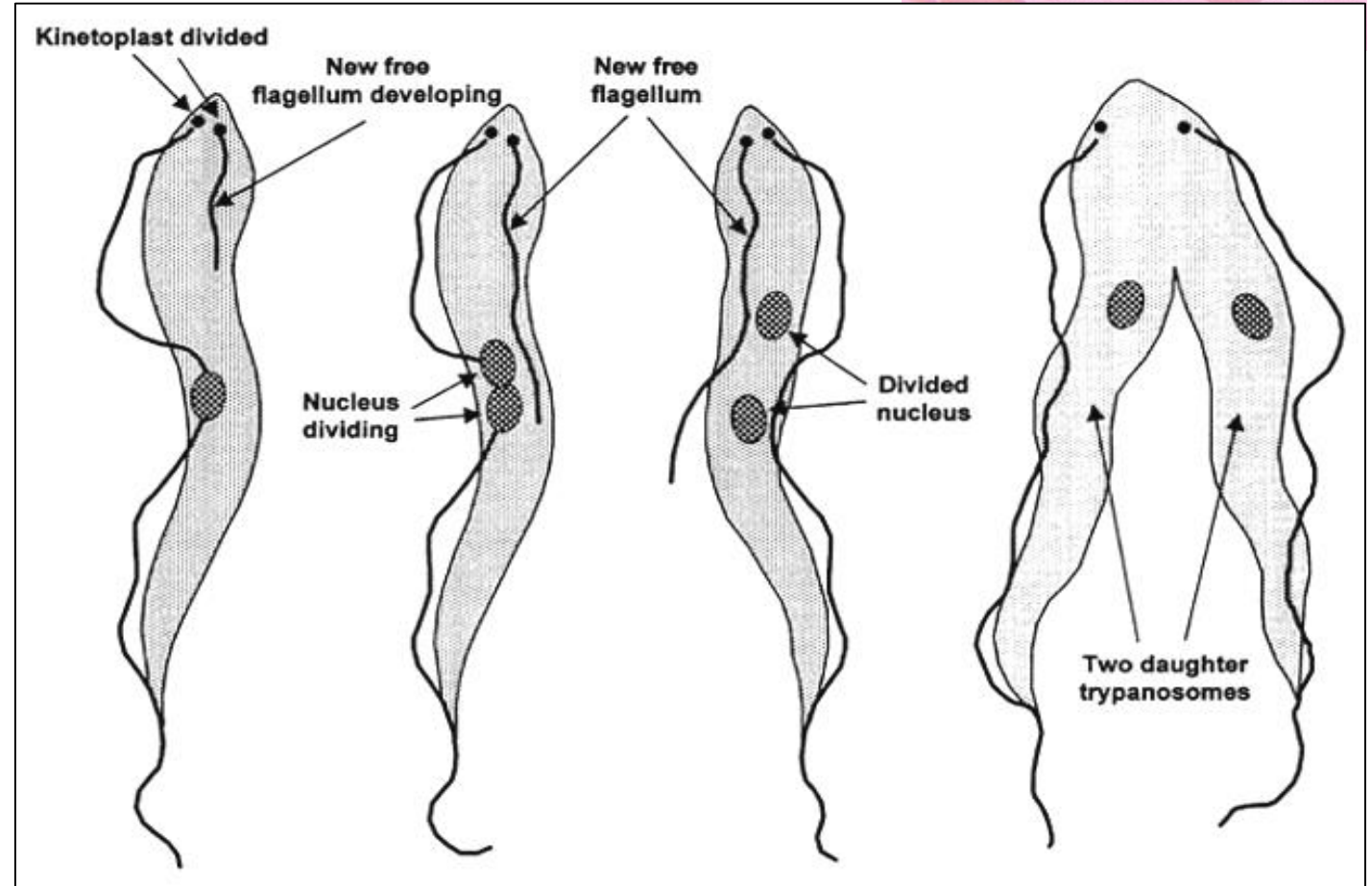
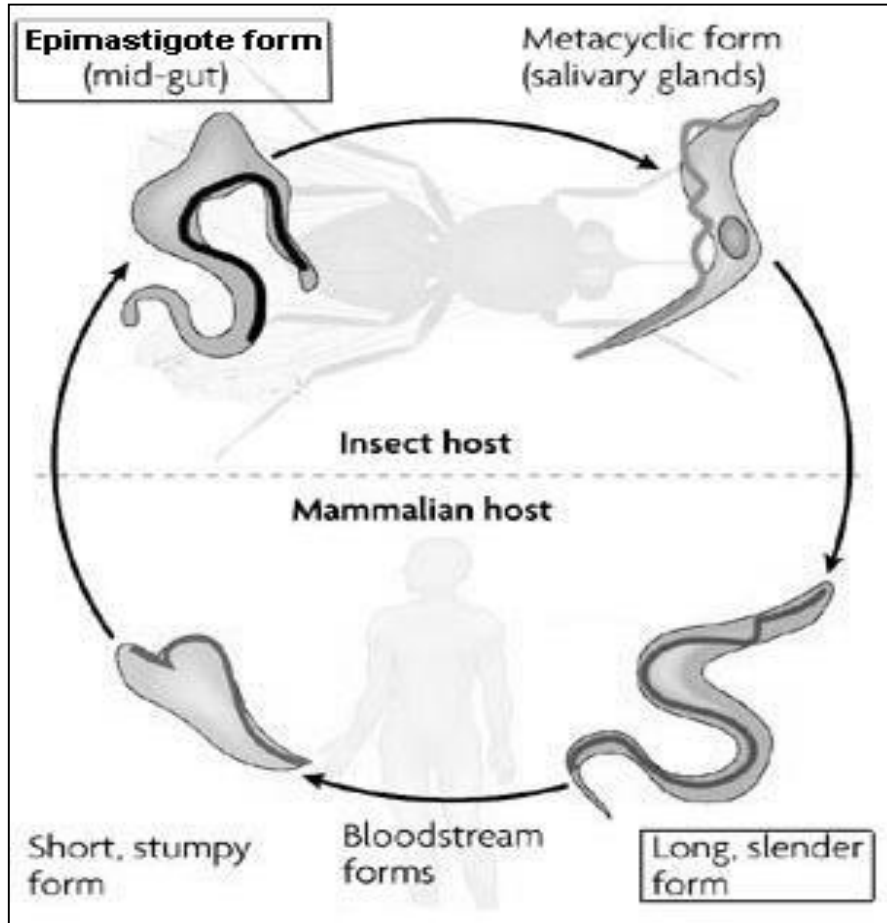
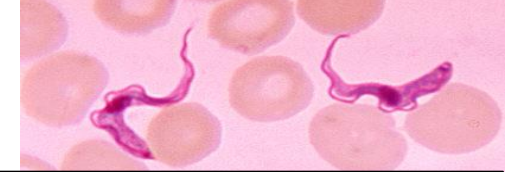
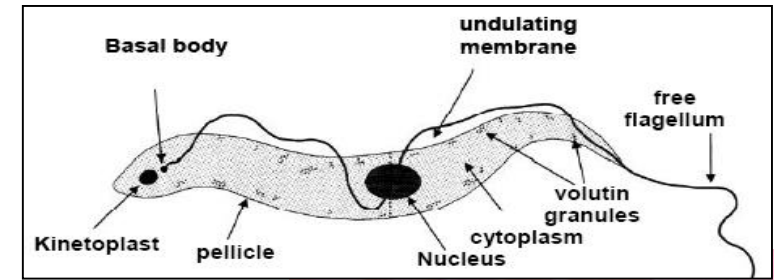
-When the organism progress through their life cycle in a series of morphological changes.

-Example: *Trypanosoma* sp.



Trypanosoma sp.

- ...Extracellular endoparasite, as live between blood cells of man.
- ...Heteroxenous with more than one host [man and tse tse fly (vector)].
- ...Trypomastigotes found in vertebrate host and epimastigotes in invertebrate vector.
- ...*Trypanosoma* sp. reproduce only asexually by Binary fission.



...Often Trypanosomes are divided into 2 traditional groups according to the mode of transmission (by biting or feces) and the site of infection in the insect gut:

A...Salivaria (or anterior station)

...They are *Trypanosoma* species develop in the anterior portion of the insect gut. When the infective stages enter the salivary glands they will be Transmitted by bite of an insect.

Examples

Trypanosoma brucei brucei

Vertebrate host or final hosts are ruminants and horses while the vector is the tsetse flies; disease in animals termed **nagana disease**...symptoms fever, weakness, which lead to weight loss and anemia



Trypanosoma brucei gambiense

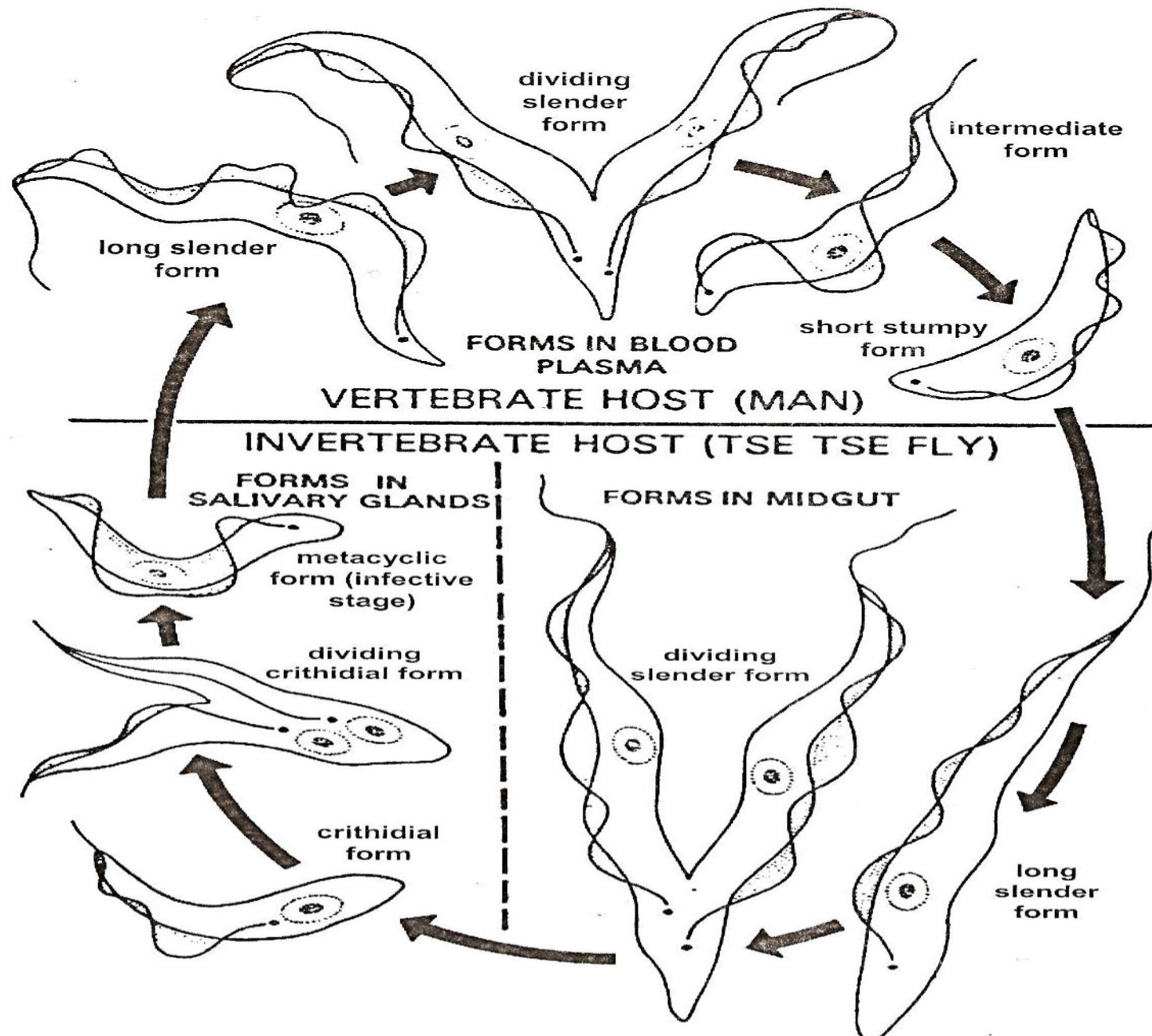
Humans are the main vertebrate host; vectors are the tsetse flies, they cause **sleeping sickness** or **West African trypanosomiasis**



Trypanosoma brucei rhodesiense

Humans are vertebrate hosts; vectors are tsetse flies, they cause **sleeping sickness** or **East African trypanosomiasis**





Life cycle of *T. gambiense*

Pathogenesis:

...As the infection progresses, the parasites cross the blood brain barrier and enter the central nervous system and the disease takes a dramatic turn.

...The patient is unable to concentrate and may show moods of irritation, aggressiveness.

...The patient is overcome by extreme tiredness, and sleep-like unconsciousness as the infection progresses. Because he is unable to eat food, he becomes wasted and eventually falls into a deep coma and dies.

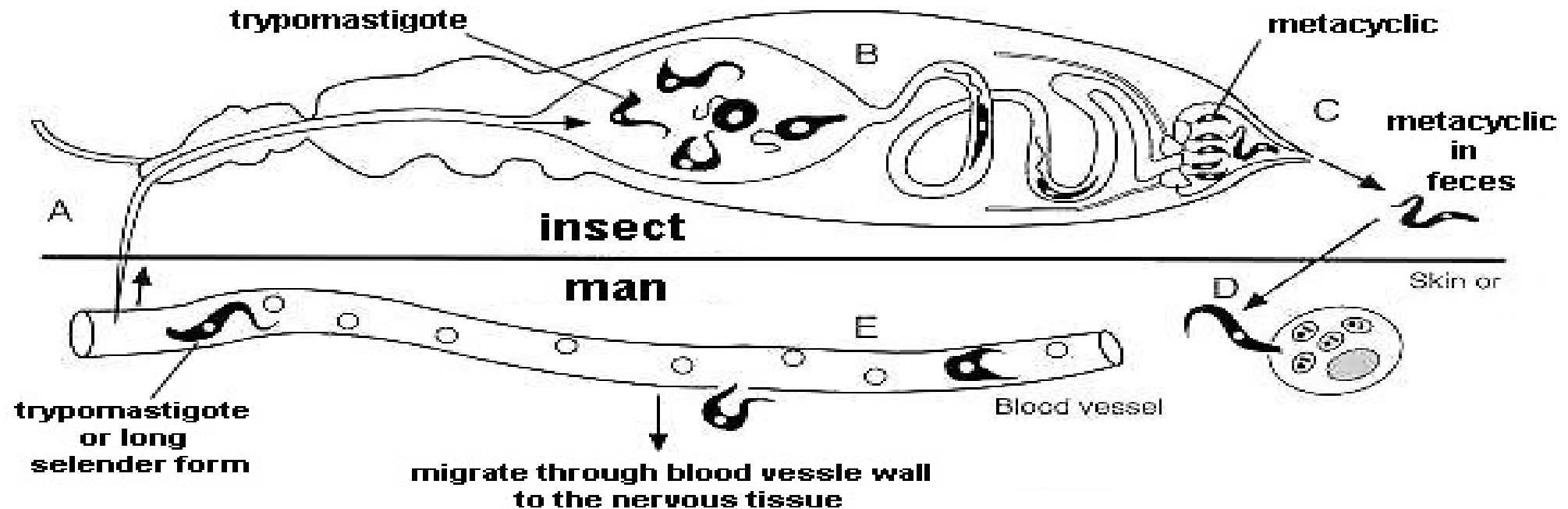


B... Stercoraria (Posterior station)... *Trypanosoma cruzi*... "Chagas' disease".

...They are *Trypanosoma* species develop in the posterior portion of the insect gut (hind gut).

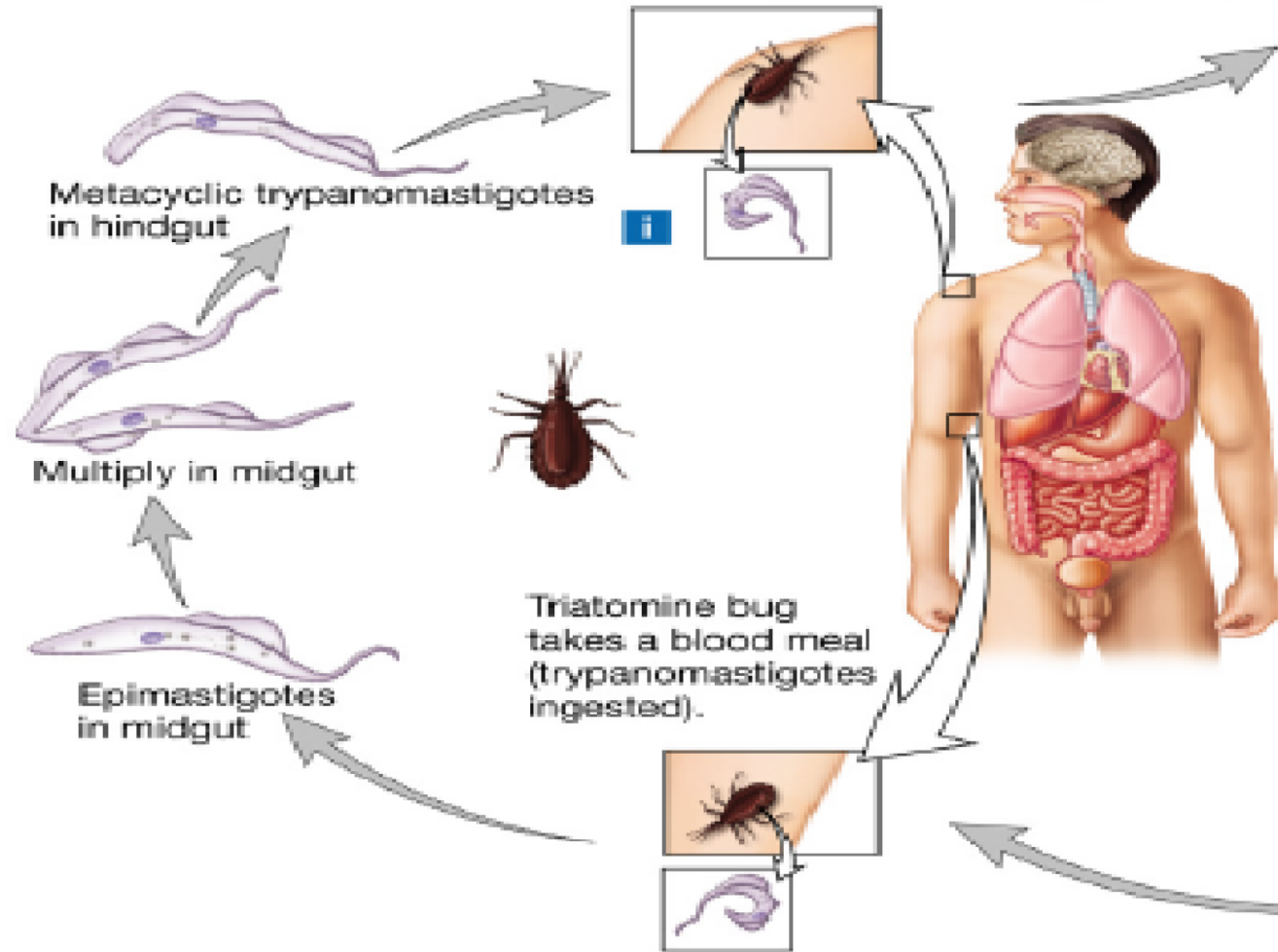
...The infective stages transmitted in the feces of insects.

...Metacyclic (= infectious) stage inside the rectum of bugs. These stages are set free in fecal droplets during blood meal on their hosts. They enter the skin after the blood meal through a bite channel, scratched skin or via mucous membranes. Inside the mammalian host they penetrate into various cells.



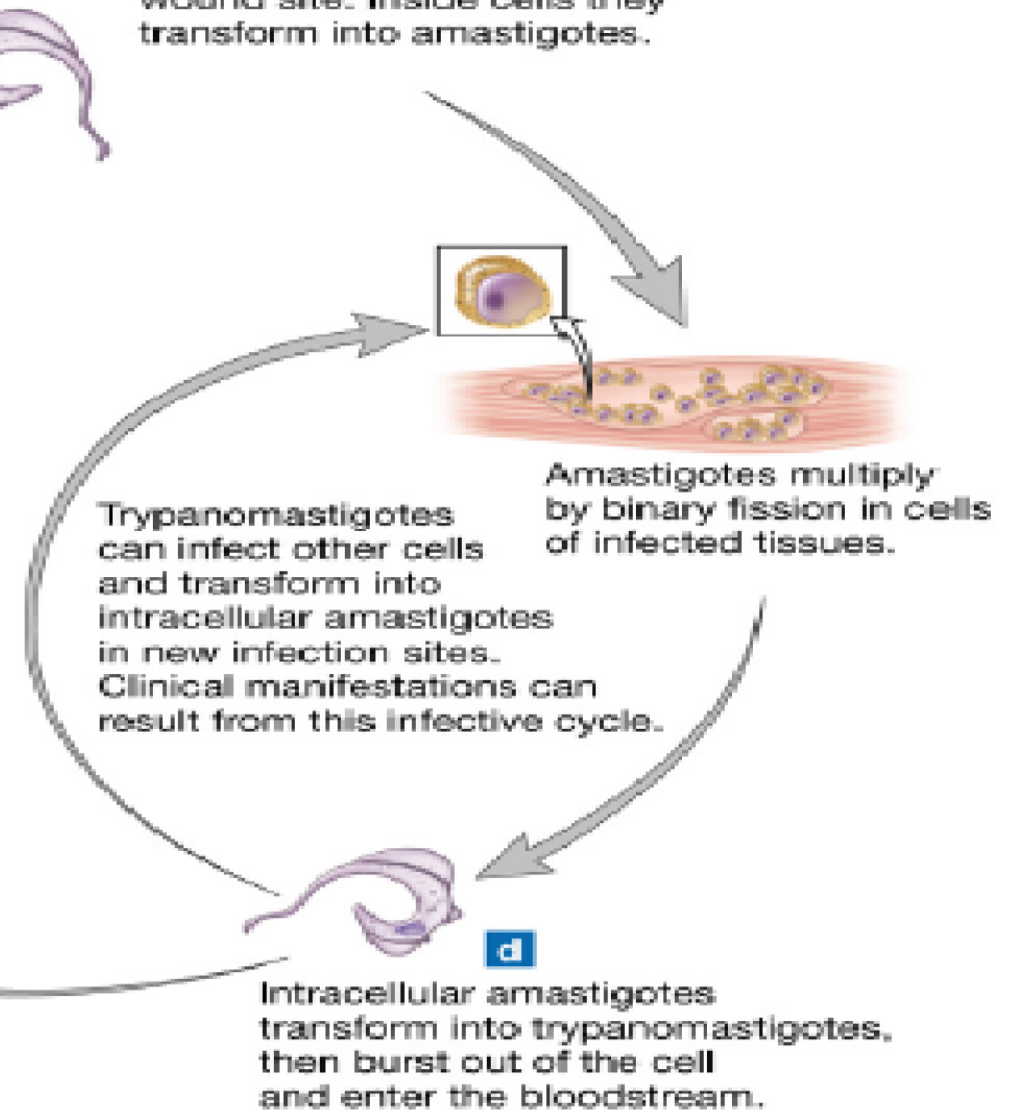
Triatomine Bug Stages

Triatomine bug takes a blood meal (passes metacyclic trypanomastigotes in feces, trypanomastigotes enter bite wound or mucosal membranes, such as the conjunctiva).



Human Stages

Metacyclic trypanomastigotes penetrate various cells at bite wound site. Inside cells they transform into amastigotes.



Life cycle of *T. Cruzi*

- i** - Infective stage
- d** - Diagnostic stage

Pathogenesis:

a....Local acute inflammation at bite site (chagoma); if this occurs near eye and swelling of eyelid area, termed **Romana's sign**.

b....Gradual degeneration of tissues throughout body, the most severe of which are muscle cells which cannot be replaced.

c....Edema, chills, fever, muscle pain and weakness, megaesophagus, megacolon, heart failure, death.

d....The disease manifestations of this parasite are collectively termed "**Chagas' disease**".



Romana's sign



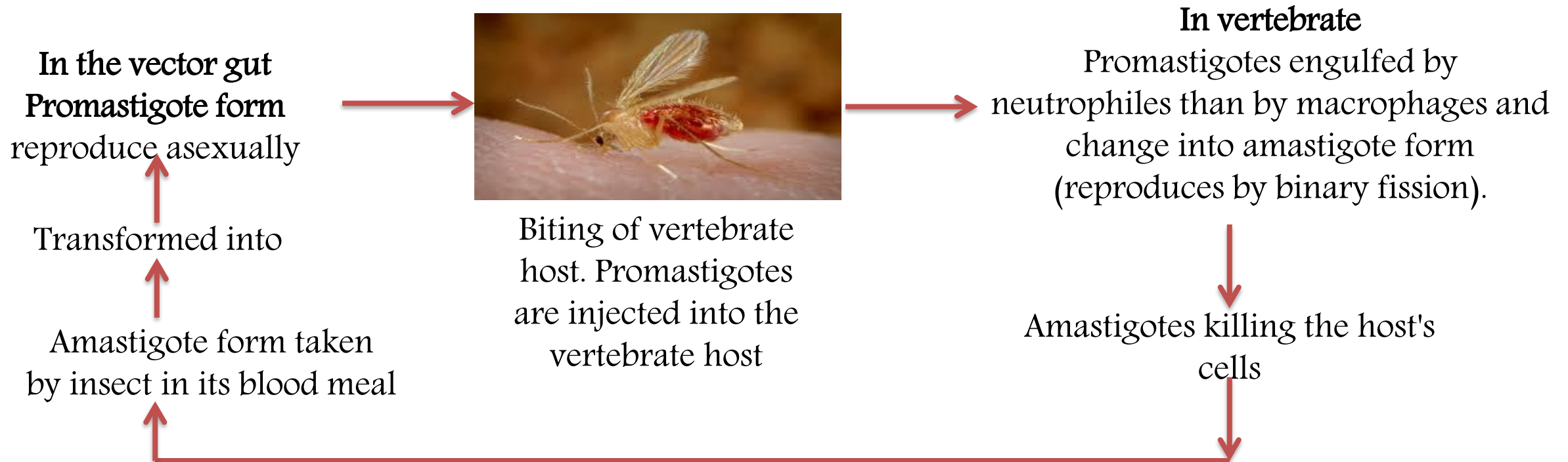
Chagas' disease

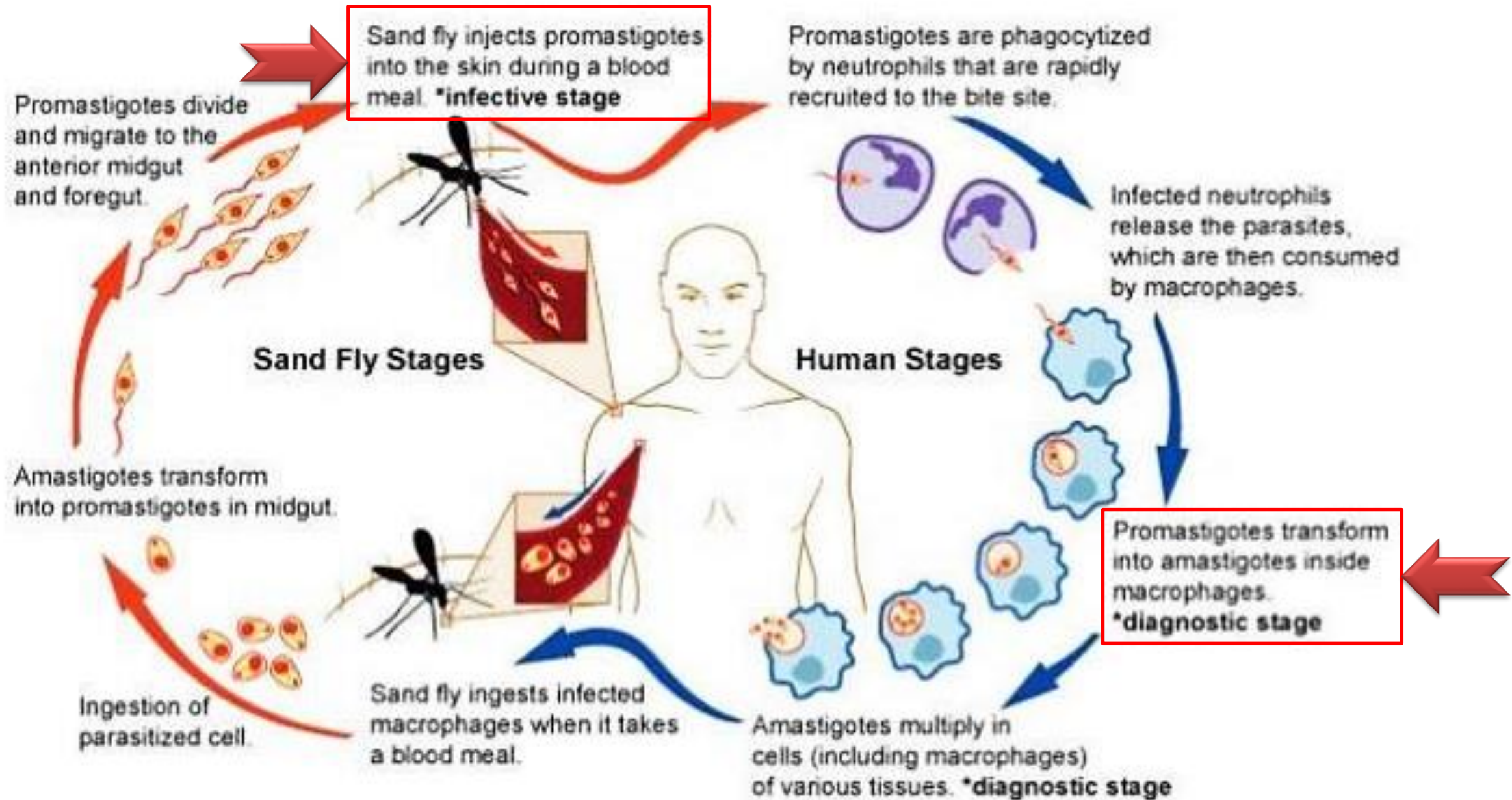
Leishmania sp.

...Members of genus *Leishmania* infect many vertebrates, including **humans, dogs, and rodents.**

...Heteroxenous with more than one host .. man and vectors (sandflies) causing **leishmaniasis.**

...The **amastigote (leishmania)** form is the predominant form in vertebrate host and **promastigotes (leptomonad)** in invertebrate.





There are 3 species of *Leishmania* found in humans.

Leishmania donovani

...It causes visceral leishmaniasis or Kala azar Disease.

...It affects the visceral organs, most notably the liver, spleen and bone marrow.



Leishmania tropica

...It causes cutaneous leishmaniasis or oriental sore disease



Leishmania braziliensis

...It causes mucocutaneous leishmaniasis disease....
...It affects nose, throat, and mouth. This can lead to partial or complete destruction of the mucous membranes in those areas



What are the treatments for leishmaniasis?

Visceral leishmaniasis

It requires treatment. Several medications are available. Commonly used medicines include **Pentostam and miltefosine**.

Cutaneous leishmaniasis

Cutaneous ulcers will often heal without treatment. However, treatment can speed healing, reduce scarring, and decrease risk of further disease.

Mucocutaneous leishmaniasis

These lesions don't heal naturally. They always require treatment. **Amphotericin B and paromomycin** .

Infrakingdom Alveolata

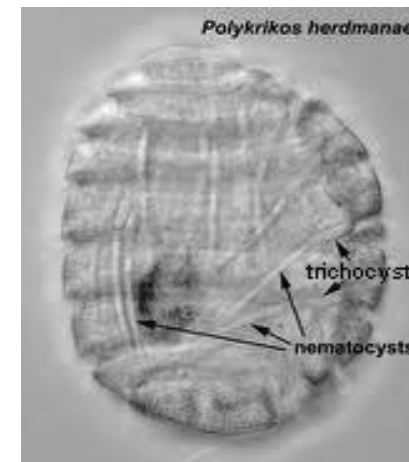
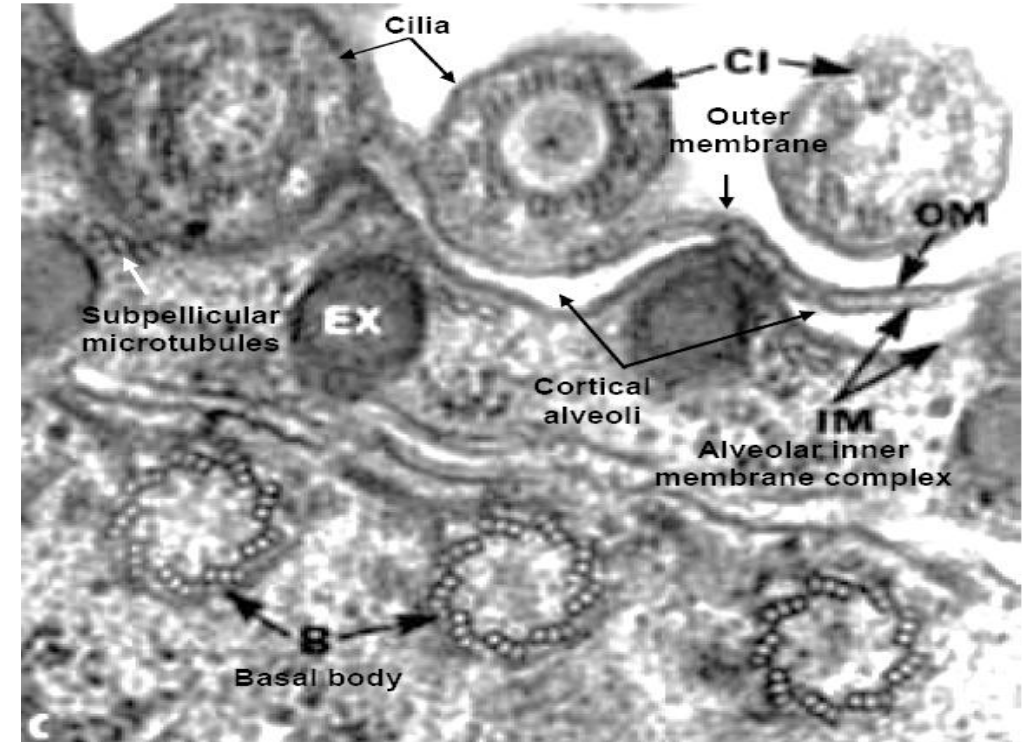
General characteristics of Alveolata:

...Animals with membrane - bound sacs called cortical alveoli (apheisma) lie beneath the outer plasma membrane.

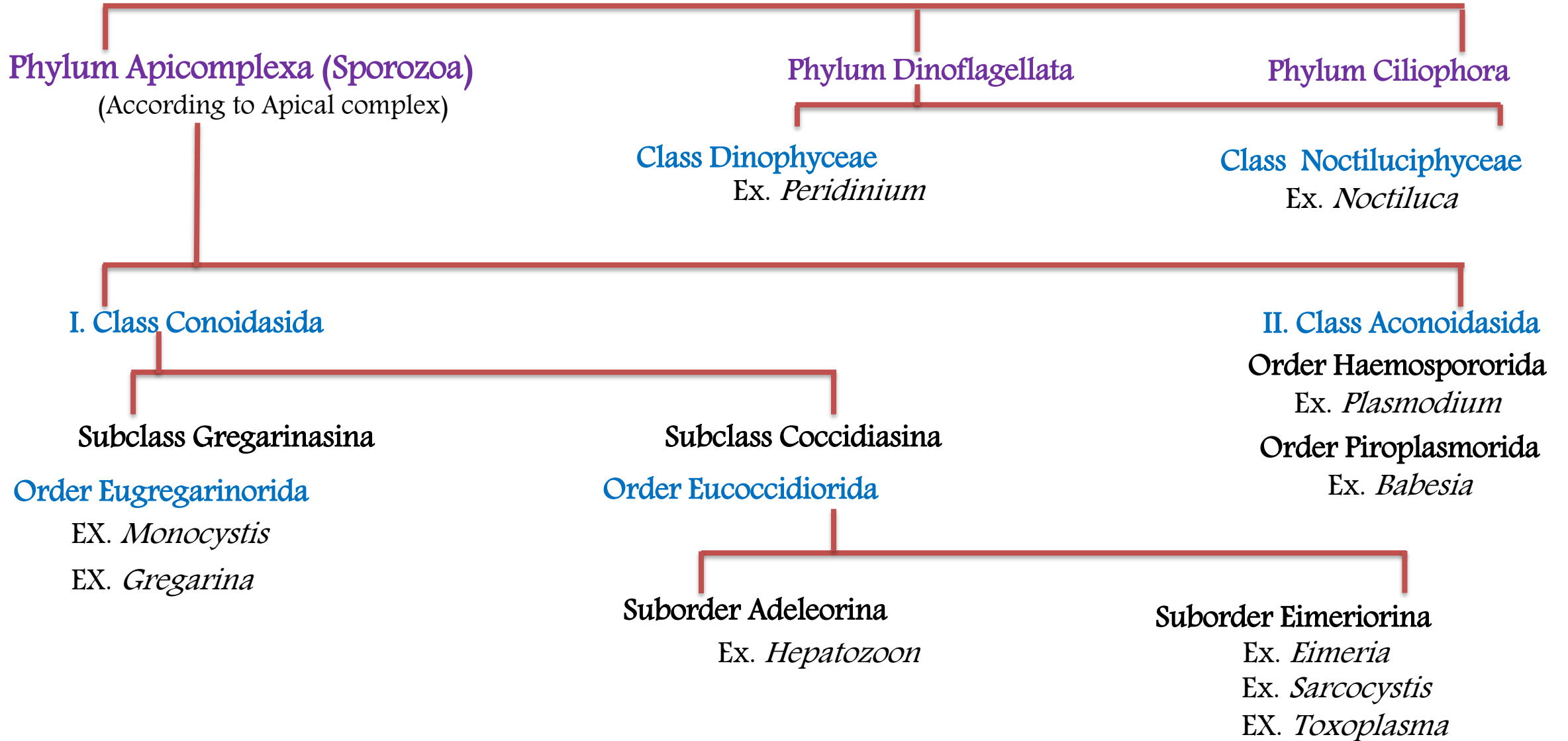
...With **extrusomes** a group of organelles used to secrete material to the exterior which:

A...used in ciliates and dinoflagellates for prey capture.

B...used in apicomplexans for formation of parasitophorous vacuole.



Infrakindgom Alveolata



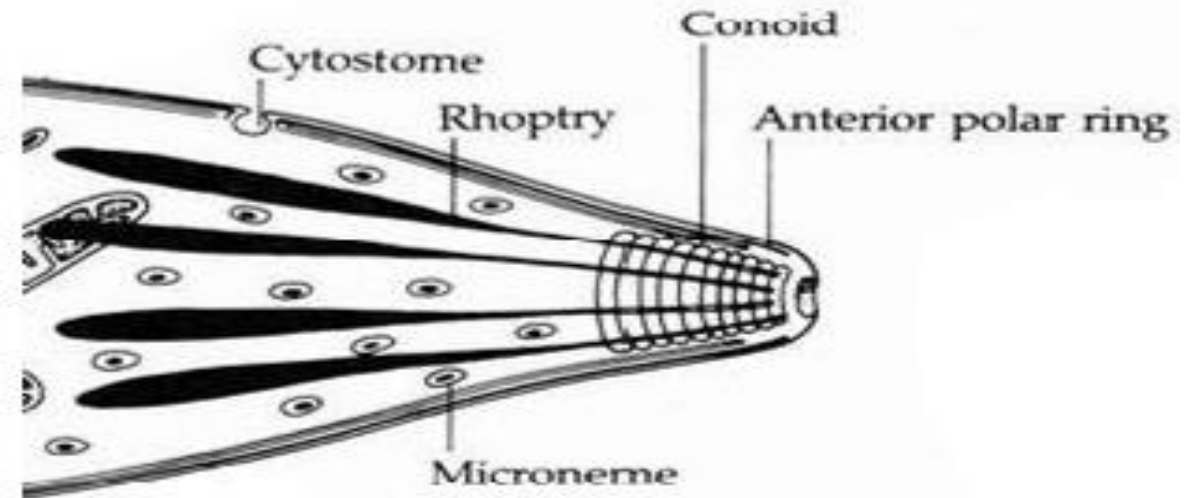
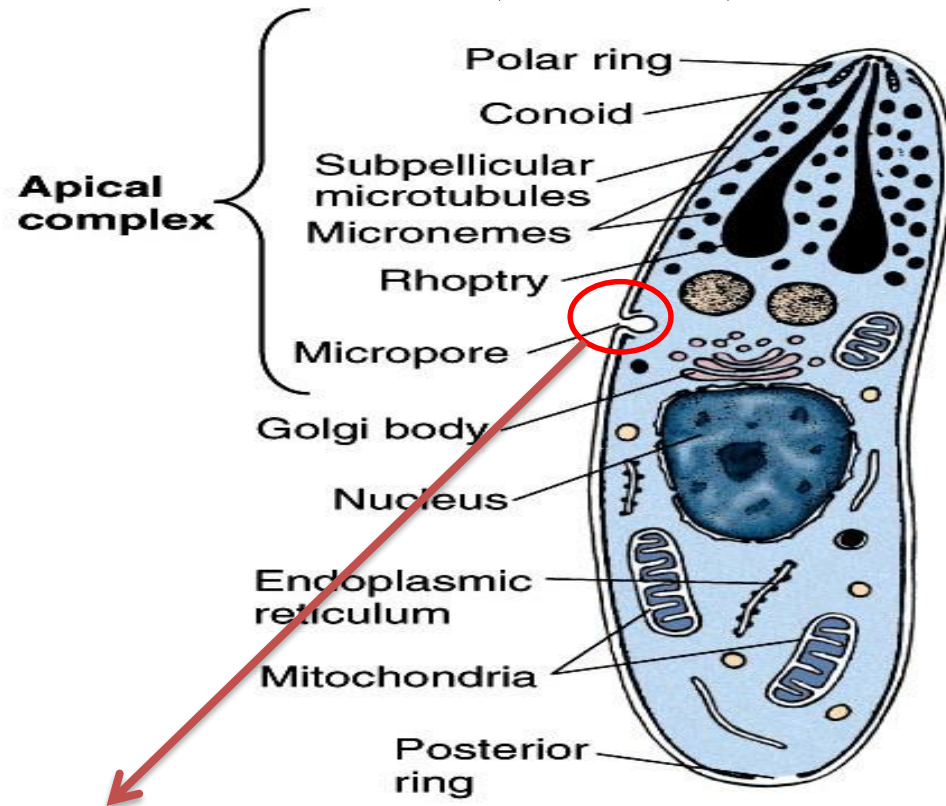
...The name is derived from *Api* means apex. *Complexa* means complex (apical complex).

...So it is mean that there is a complex structure present in the apical part of an organism.

...Apical complex consists of:

1- Cytoskeletal elements (conoid, polar rings, subpellicular microtubules)

2- Secretory organelles (rhoptries (for cell penetration), micronemes, dense bodies)



Micropore is a simple cytostome consisting of an invagination of the plasma membrane.

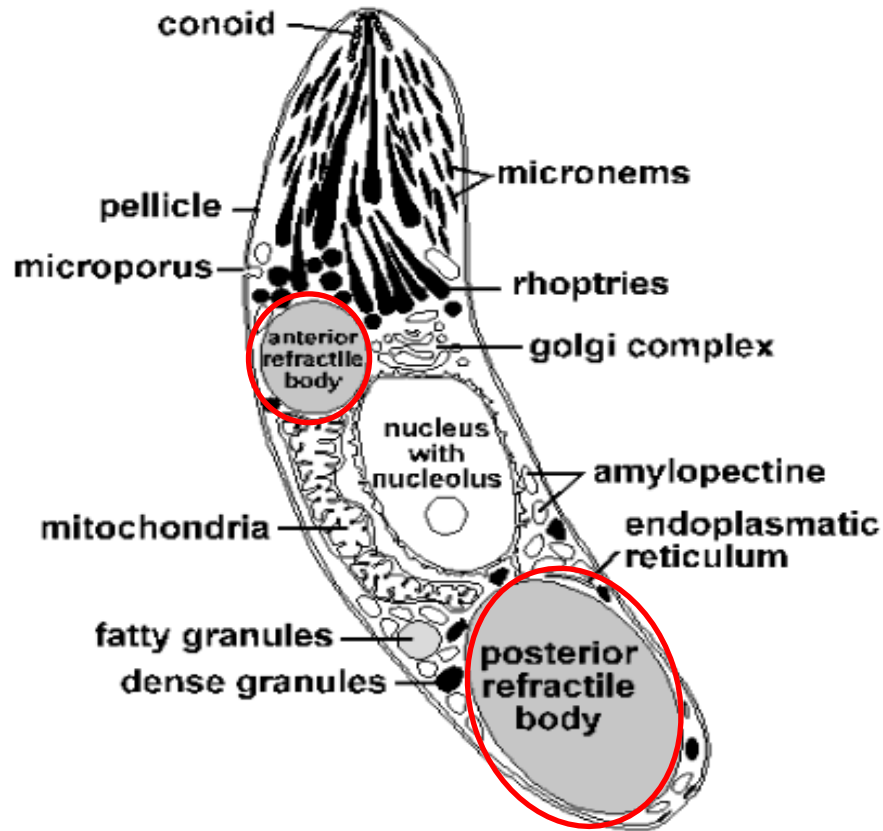
Motile stages in Phylum Apicomplexa



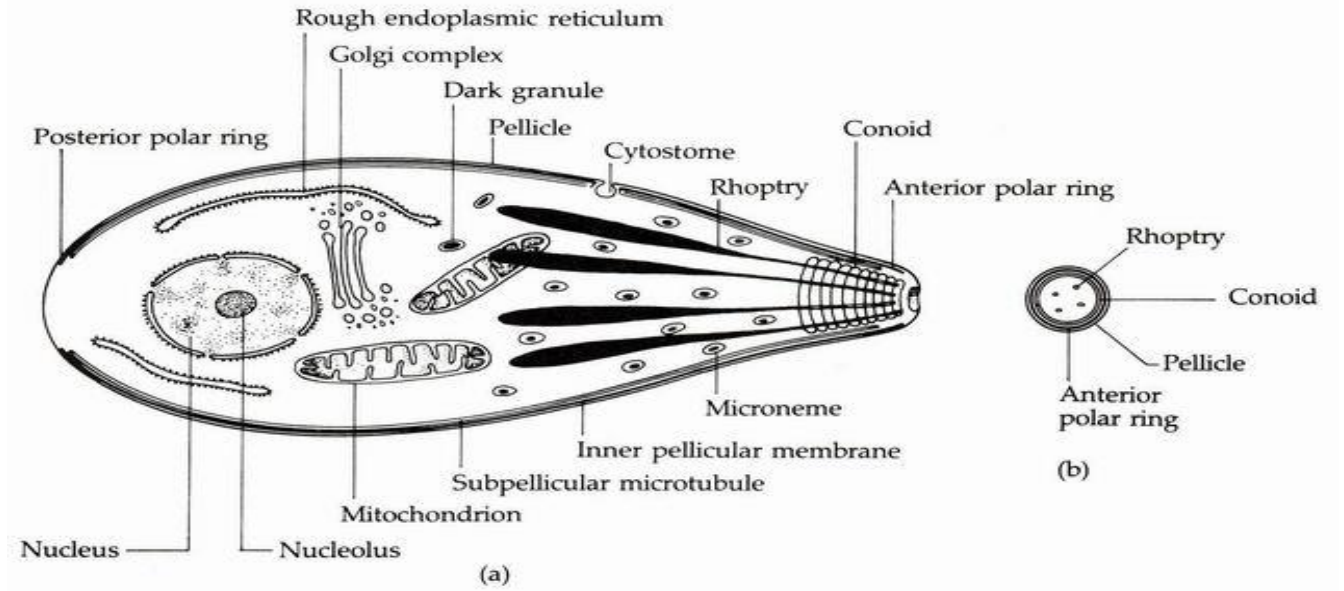
- 1- Sporozoites (Infective stages)
- 2- Merozoites (Feeding stages)
- 3- Microgametes (Male gametes)

Difference between merozoite and sporozoite

...Is The presence of two refractile bodies at two sides of nucleus in sporozoites



The typical structure of apicomplexan merozoite



The typical structure of apicomplexan sporozoite

The apicomplexan parasites contain 3 genomes

Mitochondrial genome

6–7 kb linear extrachromosomal DNA encoding three cytochrome b proteins of the respiratory chain and two extensively fragmented ribosomal RNAs.

Nuclear genome

87 Mb (megabase) nuclear genome consisting of 11 chromosomes.

Apicoplast genome

35-kb circular extrachromosomal DNA molecule resembling the plastid genome but it is smallest genome because loss of genes for photosynthesis and a single apicoplast is only found.

Apicoplast of Apicomplexa.

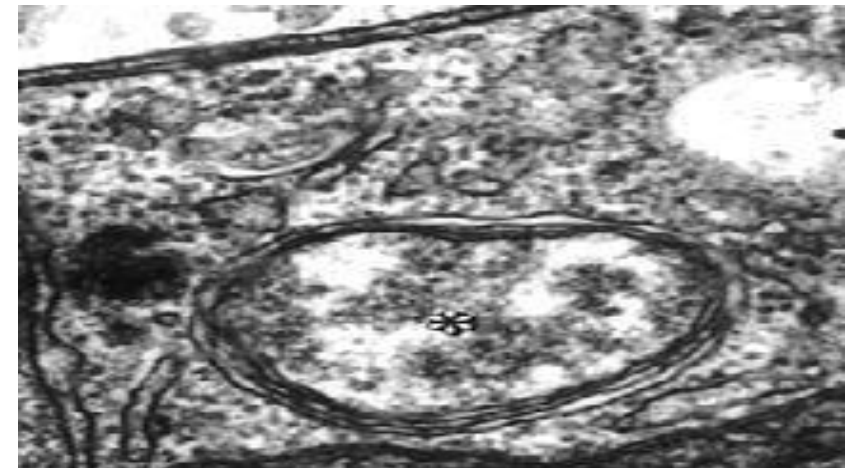
....A single novel non-photosynthetic plastid organelle homologous to chloroplasts of plants and algae, found just apical to the nucleus

Structure of the apicoplast.

....The apicoplast is composed of:

35-kb (kilobase) circular extrachromosomal DNA

Four membranes



Functions of the apicoplast.

a...Apicoplast acts as a potential drug target for chemotherapy.

...Pharmacological studies suggest that the Apicoplast is the potential therapeutic target for a variety of antibiotics commonly thought of as antibacterial agents and herbicides.

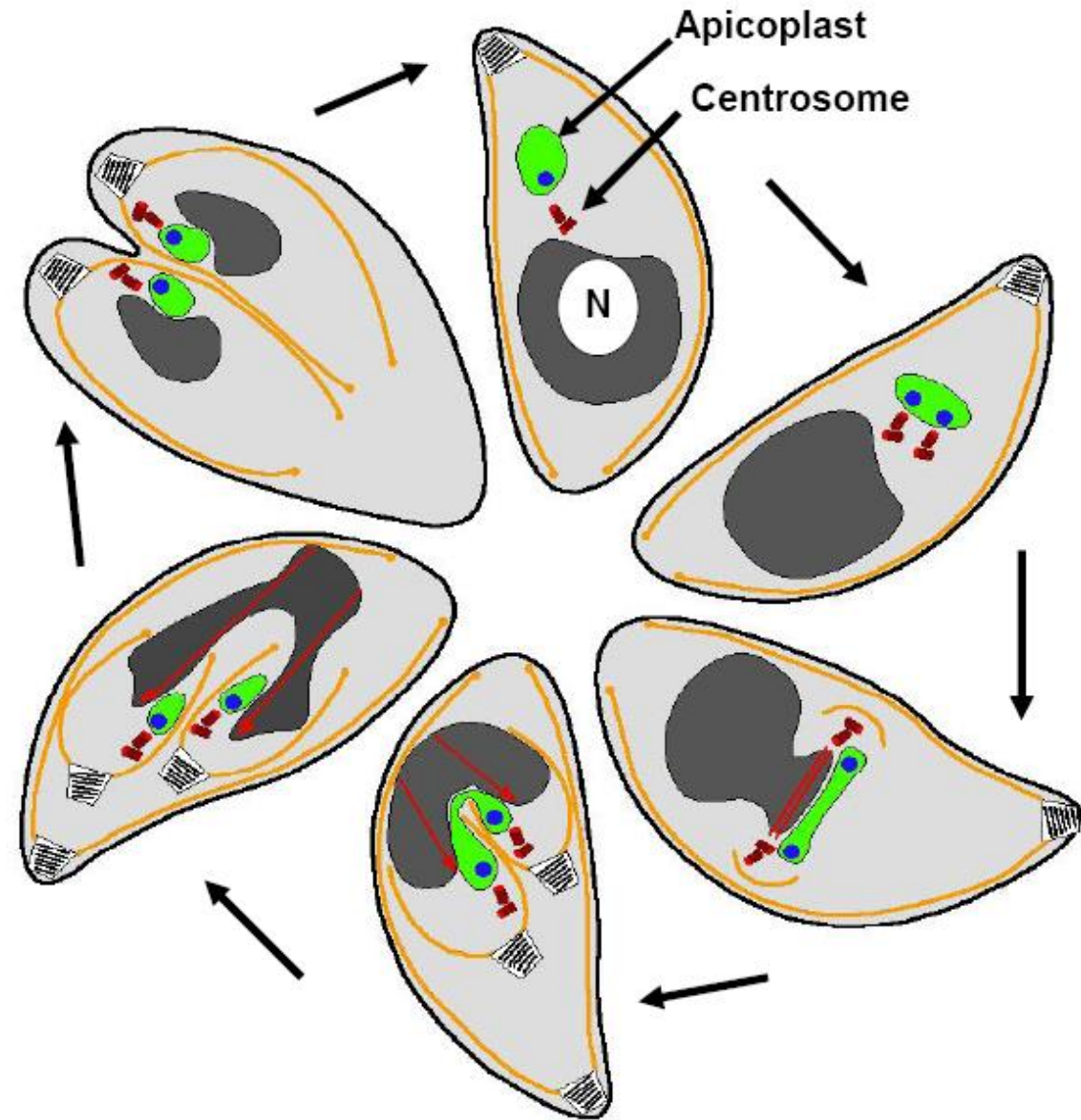
b...The "Delayed cell death phenomenon" and the formation of the parasitophorous vacuole..

c... Essential metabolic functions (Housekeeping functions) of the apicoplast.

i...The Apicoplast is a site of type II pathway for fatty acid biosynthesis.

ii...The Apicoplast is a site of non-mevolonate pathway of isoprenoid biosynthesis.

d... The Apicoplast plays an important role in cell division of apicomplexan parasites.



Diagrammatic representation showing the role of apicoplast in endodygony of Apicomplexan merozoite.

Thank You

