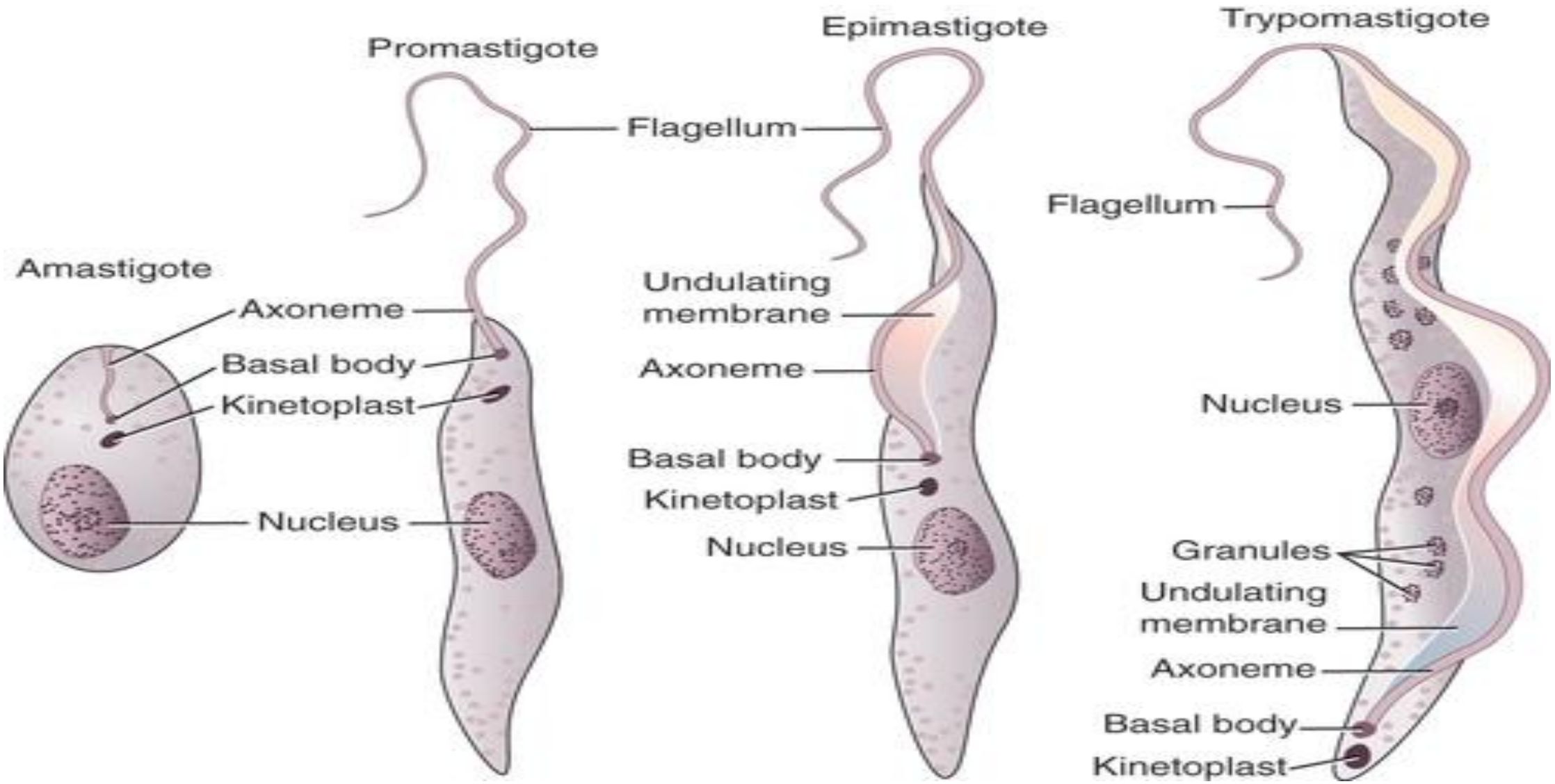
Hemoflagellates

By Prof. Hala Tabl

Morphological stages of hemoflagellates



Amastigote:

-Spherical or ovoid, Exclusive **Intracellular**.

-Has 2 nuclei, a large nucleus and kinetoplast.

-**No** free flagellum.

-Found in **man**.

Promastigote:

-Spindle-shaped.

-Has 2 nuclei, a large nucleus and **very anterior** kinetoplast & basal body (bb).

-A **free** flagellum.

-Found in **vector**.

Epimastigote:

-Spindle-shaped.

-Large nucleus and an **anterior** kinetoplast & bb **just in front** of the nucleus.

-Has **short** undulating membrane with a **free** flagellum.

-It occurs in the **vector**.

Trypomastigote:

-Long and slender.

- Large nucleus and posterior kinetoplast & bb.

-Has **long** undulating membrane with a **free** flagellum.

-It occurs in **blood** of man and the vector saliva.

Leishmania

Visceral leishmania:

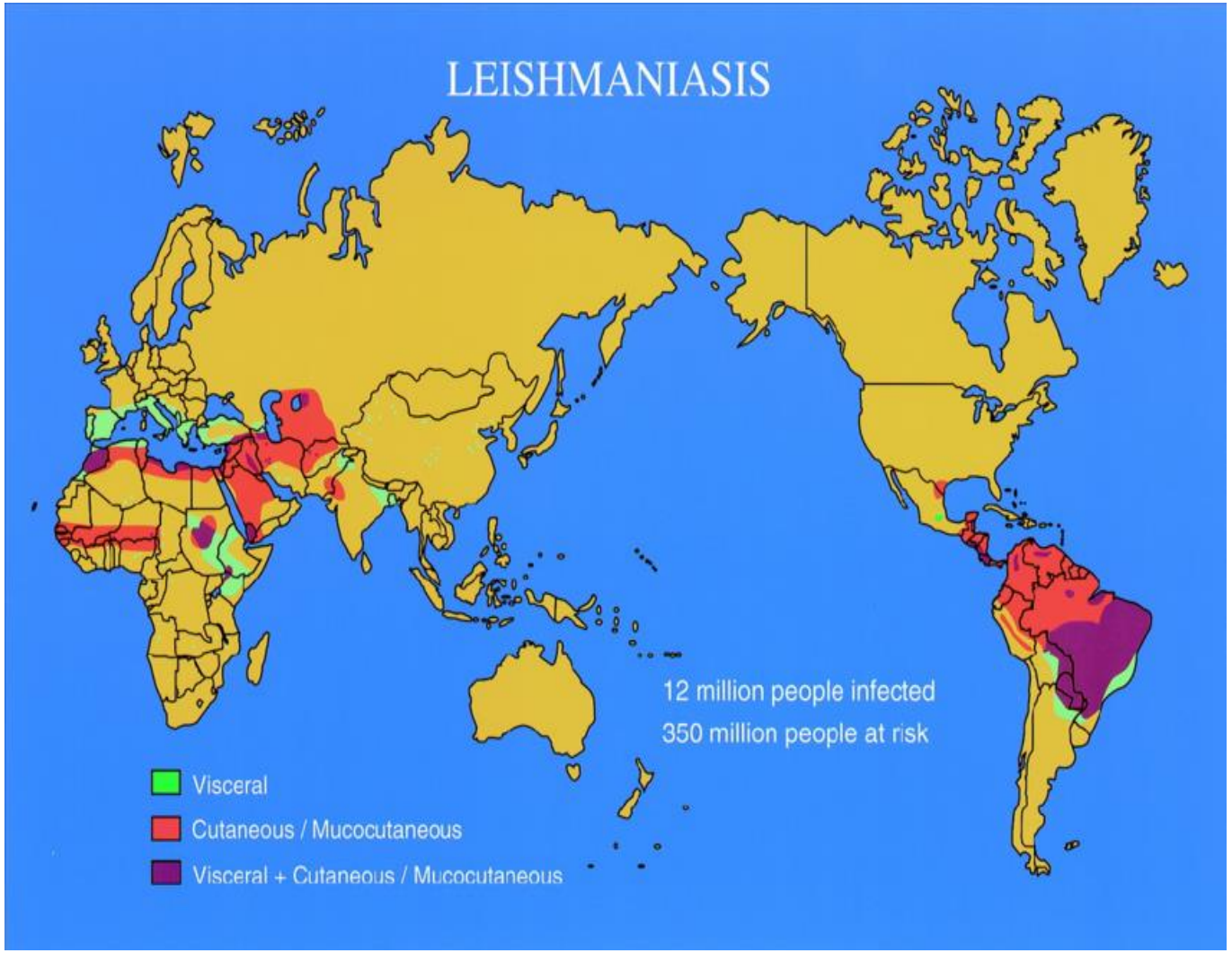
-*L. donovani*

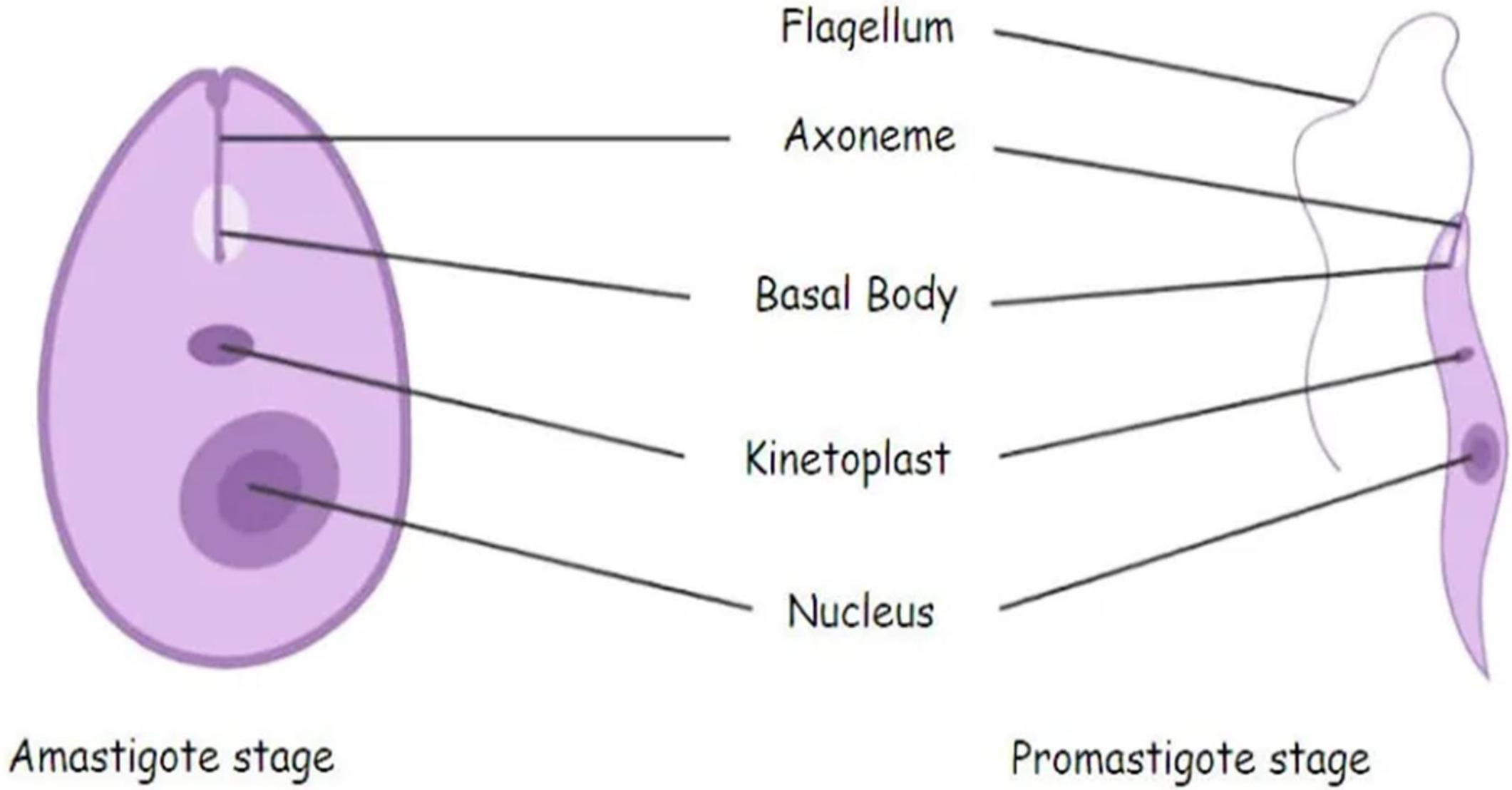
Cutaneous leishmania:

-*L. tropica*

-*L. mexicana*

-*L. braziliensis*




Flagellum
Axoneme
Basal Body
Kinetoplast
Nucleus
Amastigote stage
Promastigote stage

Life cycle

Definitive host: Man.

Habitat: Reticuloendothelial cells(REC)

Vector: Female Sand fly.

Infective stage: Promastigote.

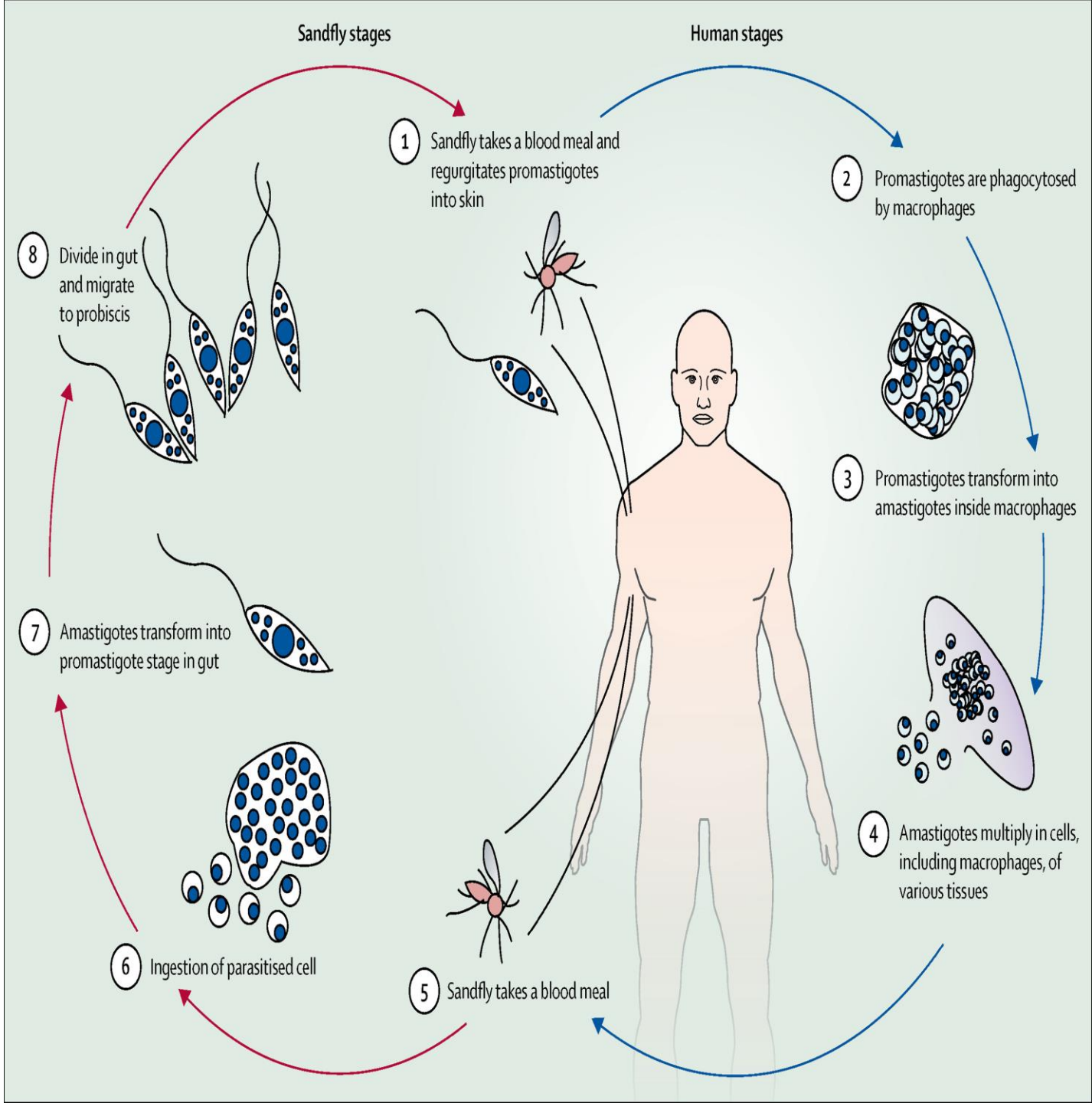
Mode of infection:

-Bite of an infected female sandfly.

-Vertically from mother to fetus.

-Blood transfusion.

Diagnostic stage: Amastigote.



Leishmaniasis

Results from the invasion of RES by amastigotes which multiply enormously in the macrophages. This leads to a marked destruction and proliferation of reticuloendothelial tissue. It may be:

Visceral leishmaniasis (kala-azar) (black fever):

- Persistent fever (Azar) and hyperpigmentation of skin (Kala).
- Hepatomegaly, splenomegaly and generalized lymphadenopathy.
- Pancytopenia (Anaemia, repeated infections, intestinal hemorrhage).

Cutaneous leishmaniasis:

- Single or multiple papules that ulcerate.
- The ulcers healed leaving scars or secondary infected.

Mucocutaneous leishmaniasis:- Rare, affect nasopharynx.

Trypanosomes

Trypanosomes are divided into two main groups:

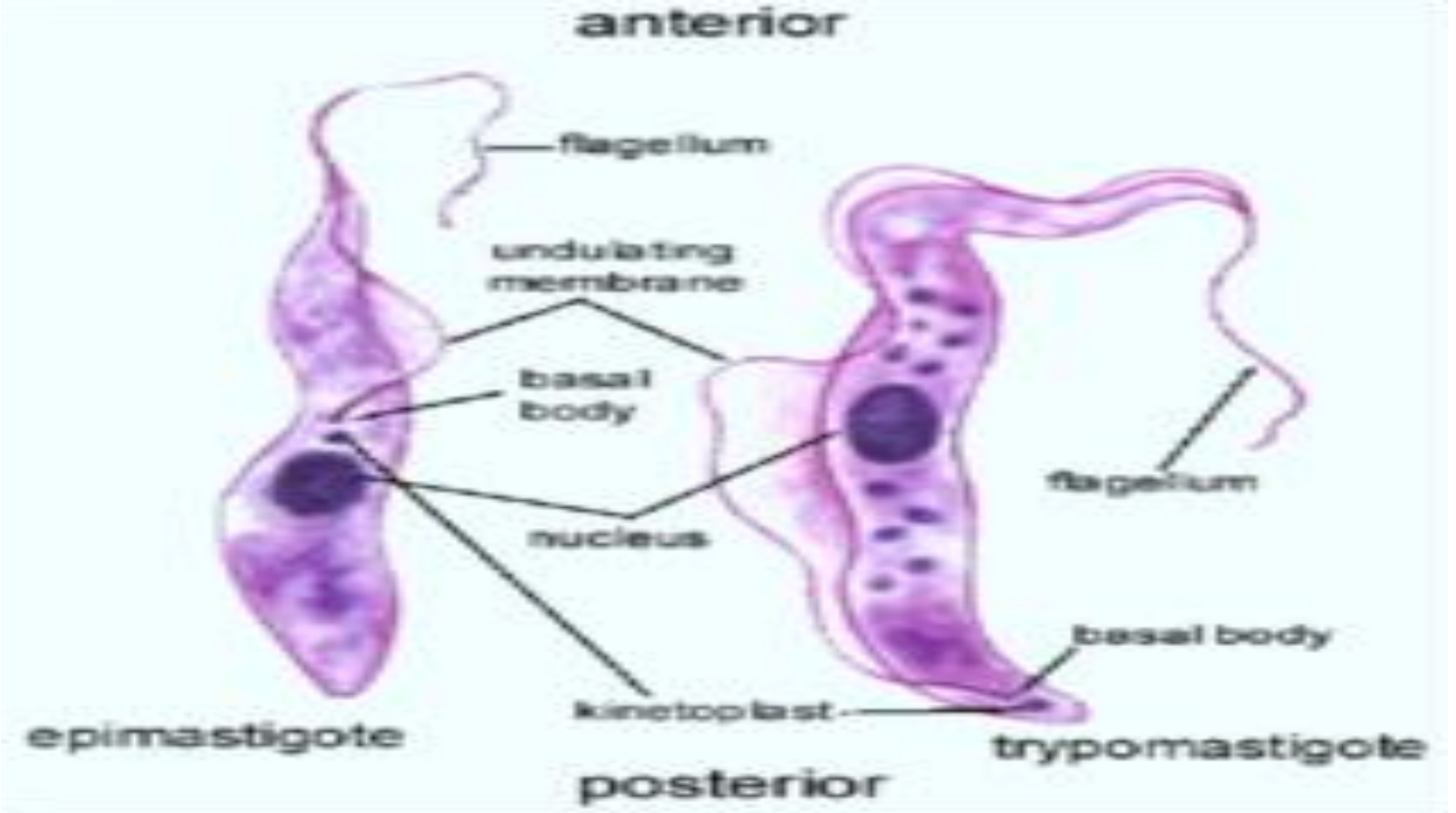
1- Trypanosoma brucei (African trypanosomes):

- Found in Central Africa.
- Transmitted by *Glossina* fly (tsetse fly).
- Causing sleeping sickness.

2- Trypanosoma cruzi (America trypanosomes):

- Found in South and Central America.
- Transmitted by winged bugs.
- Causing Chaga’s disease.

Trypanosoma brucei



Life cycle

Definitive host: Man.

Habitat: All tissues specially REC and CNS.

Vector: *Glossina* (tsetse fly).

Infective stage: Trypomastigote.

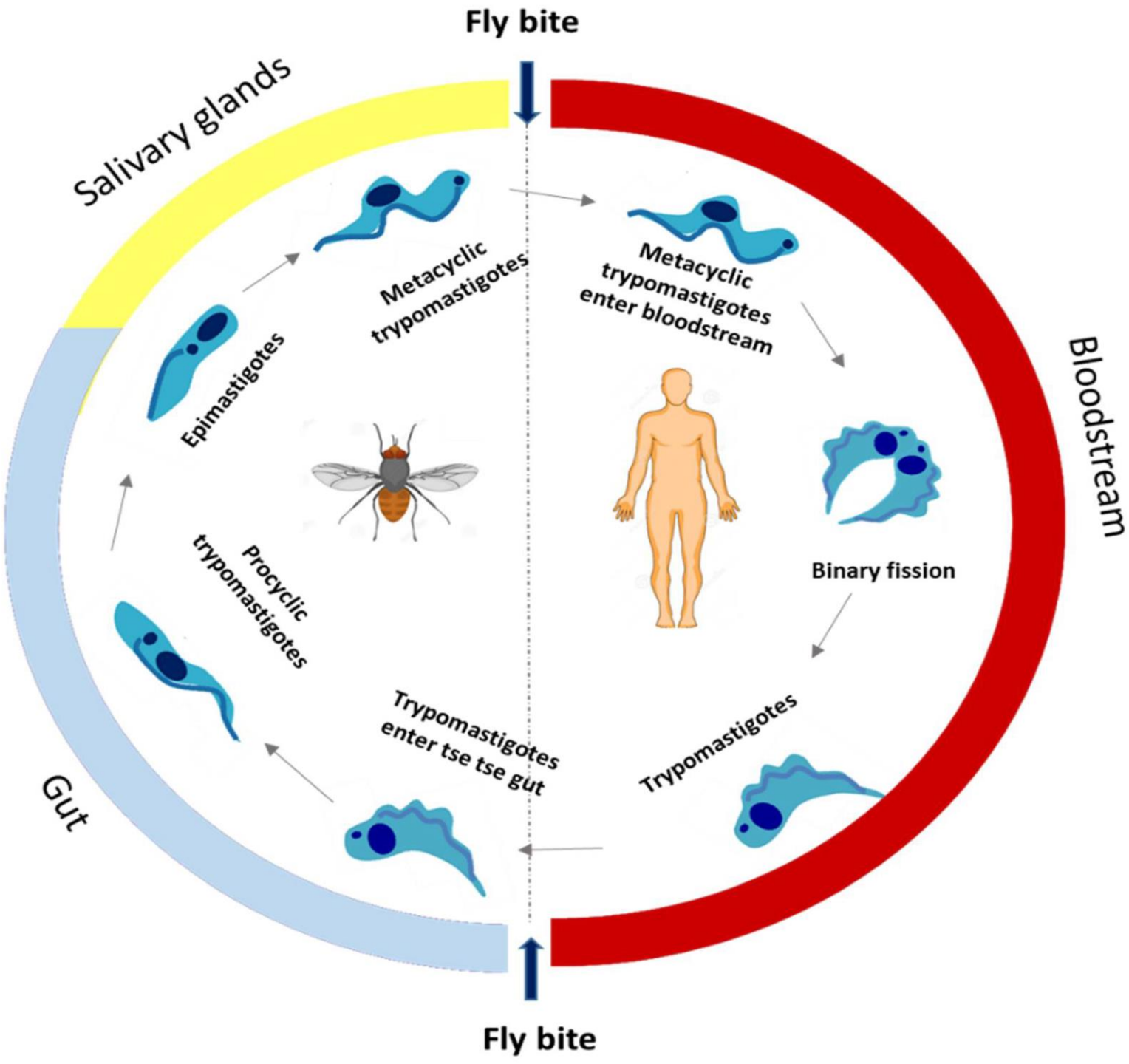
Mode of infection:

1) Bite of tsetse fly.

2) Congenital infection (rare).

3) Blood transfusion.

Diagnostic stage: Trypomastigote.



Sleeping sickness

1. **Hemo-lymphatic stage:** (parasite invade blood and REC).

-Fevers, headache, malaise, anorexia.

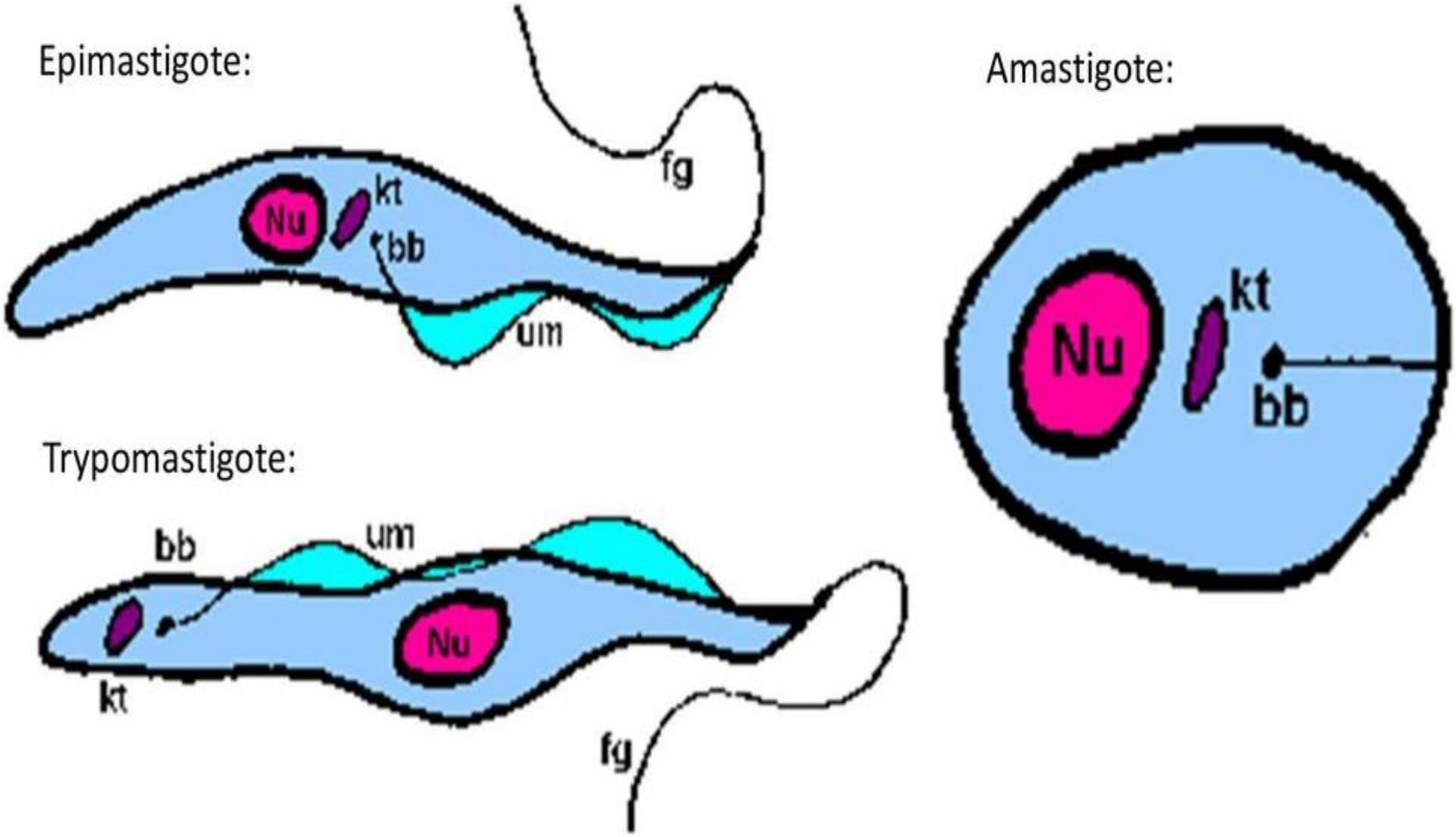
-Hepato-splenomegaly, generalized lymphadenopathy and pancytopenia.

2. **Meningo-encephalitic stage:** (parasite invade CNS).

-There is steady progressive apathy, confusion, personality changes and loss of coordination.

-In terminal phase, the patient becomes emaciated, progressing to coma and death.

Trypanosoma cruzi



Life Cycle

Definitive host: Man.

Habitat: All tissues specially REC, myocardial muscle cells, brain cells.

Vector: Winged bug (*Triatoma megista*)

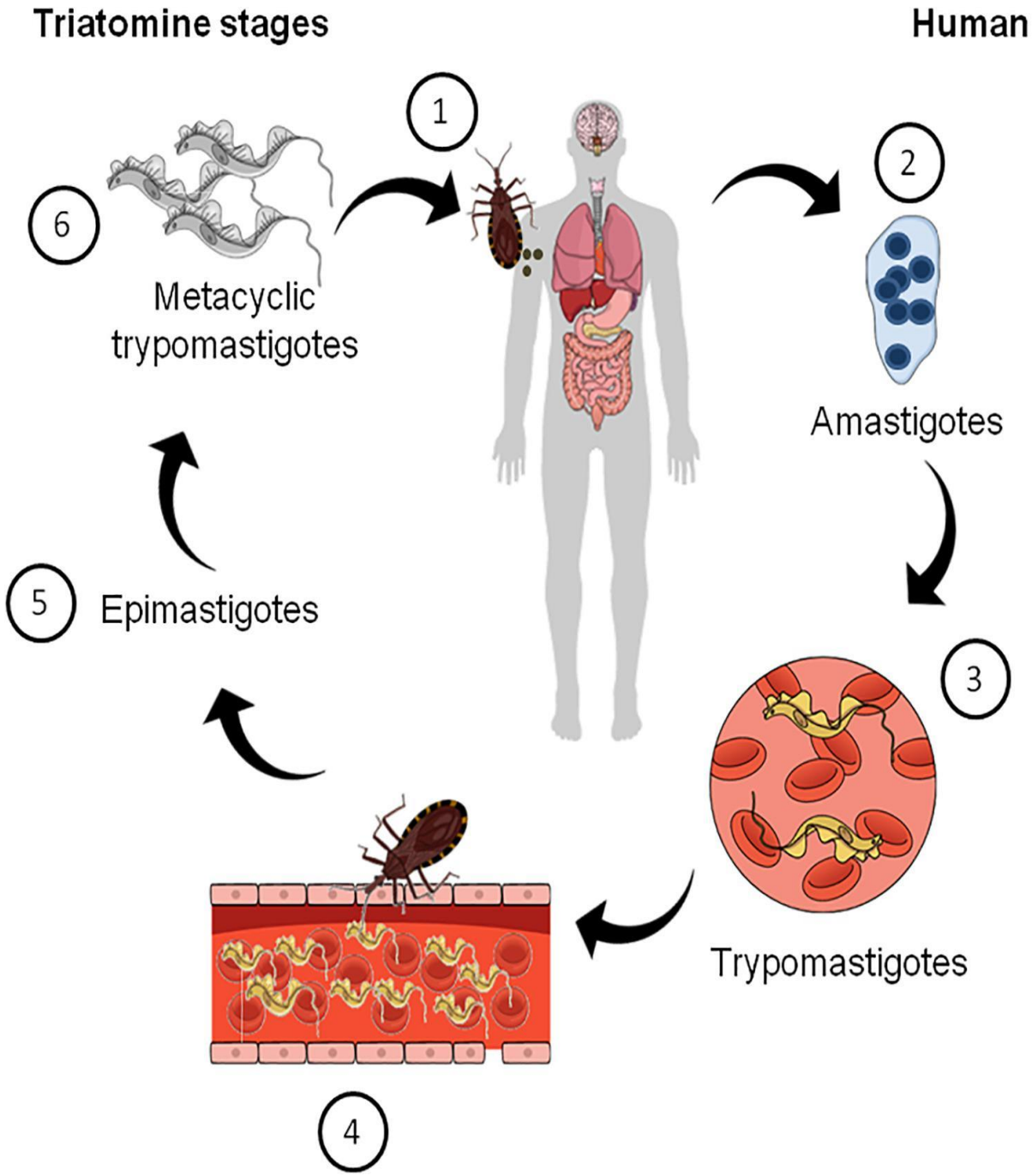
Infective stage: Trypomastigotes.

Mode of transmission:

a) Trypomastigote passes with the vector feces and contaminate the bite site.

b) Congenital. c) Blood transfusion.

Diagnostic stage: Trypomastigotes.



Chaga’s disease

-The infection can affect any organ, but the organism has a predilection for REC, “myocardium & conducting system”, and CNS.

-**Chagoma:** an inflammatory nodule at the bite site of the vector.

-**Romana's sign:** periorbital soft tissue swelling which occurs when the organism enters through the conjunctiva.

-There is anemia, hepato-splenomegaly, lymphadenopathy.

-Myocarditis, ventricular aneurysm, arrythmia and heart block.

-Meningo-enchephalitis.

PHYLUM

SPOROZOA

Sporozoa

- Intracellular.
- Complex life cycle (more than one host), asexual reproduction occurs in one host and sexual reproduction in another host.
- **Medically important sporozoa:**

- Intestinal sporozoa:

Cryptosporidium

Cyclospora

Isospora

- Tissue sorozoa:

Toxoplasma

Plasmodium

Plasmodium

The genus plasmodium contains 4 human species: -

1-*Plasmodium malariae* (The mildest type).

2- *Plasmodium vivax.*

3- *Plasmodium ovale.*

4- *Plasmodium falciparum* (The most dangerous type).

The causative agent of malaria, a life-threatening disease distributed in hot moist tropical and subtropical areas.

Life cycle

Habitat: Red Blood Cells **(**Early after infection the Plasmodium inhabits the liver cells for a certain time).

Vector: Females of *Anopheles* mosquitoes **(definitive host).**

Intermediate host: Humans

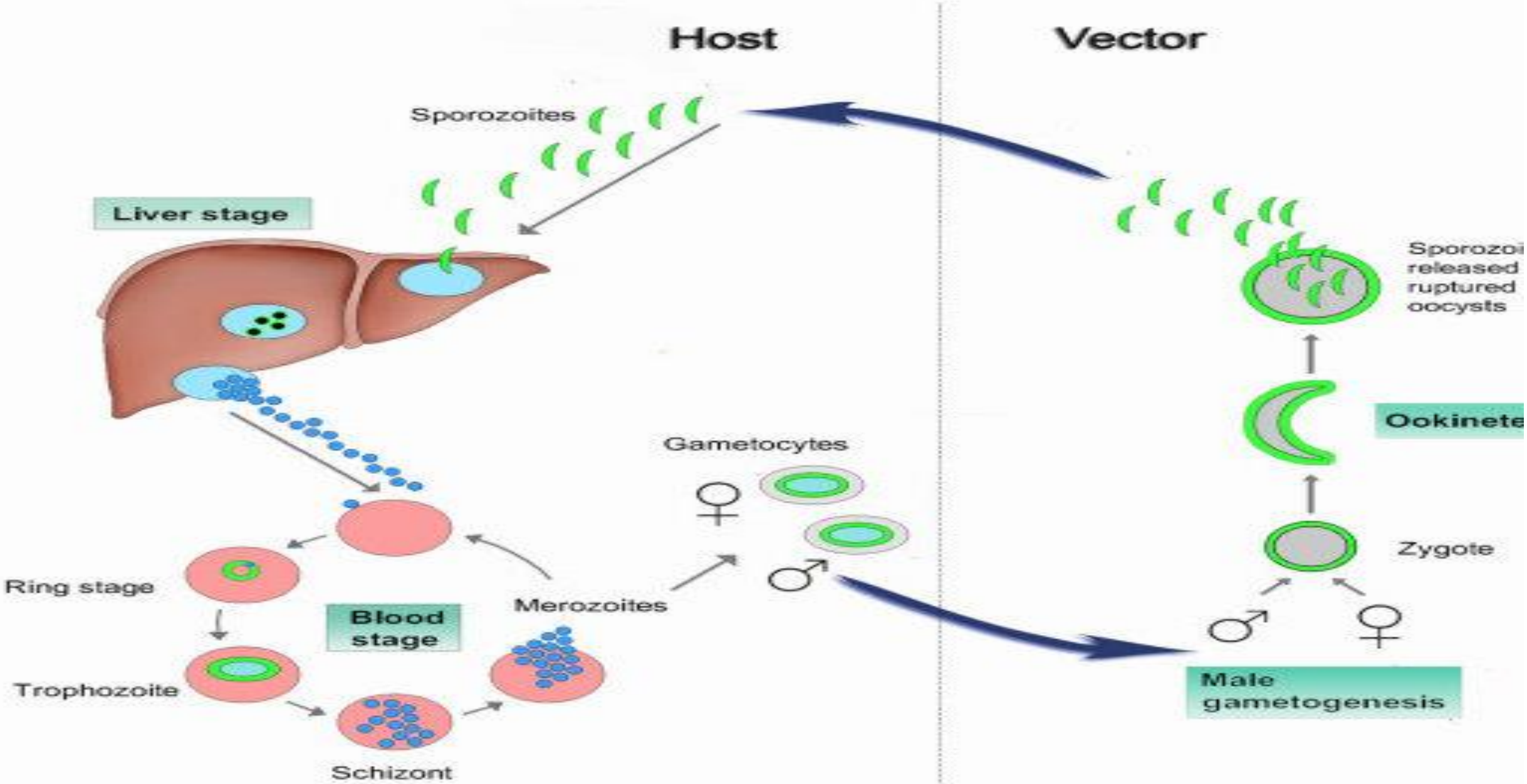
Infective stage: **Sporozoites** in the saliva of infected female mosquitoes.

Mode of infection:

- Bite of Females of Anopheles mosquitoes.

- Blood transfusion. - Transplacental transmission (congenital malaria).

Diagnostic stages: All stages (Ring, trophozoites, schizonts and gametocytes).


Host
Vector
Sporozoites
Liver stage
Gametocytes
Ring stage
Merozoites
Blood stage
Trophozoite
Schizont
Sporozoi
released
ruptured
oocysts
Ookinete
Zygote
Male
gametogenesis

Pathogenesis & Clinical findings:

A) Prodroma: Fever, Anorexia, Headache, Myalgia and Malaise (FAHM), for 1 to 2 days.

B) Fever: Characterized by regular paroxysmal febrile attacks.

➢ **Typical malarial febrile attack consists of:**

1) Cold stage (half to one hour): Sensation of intense cold, shivering with fever.

2) Hot stage (2-4 hours): fever, up to 41^0C with hot dry skin.

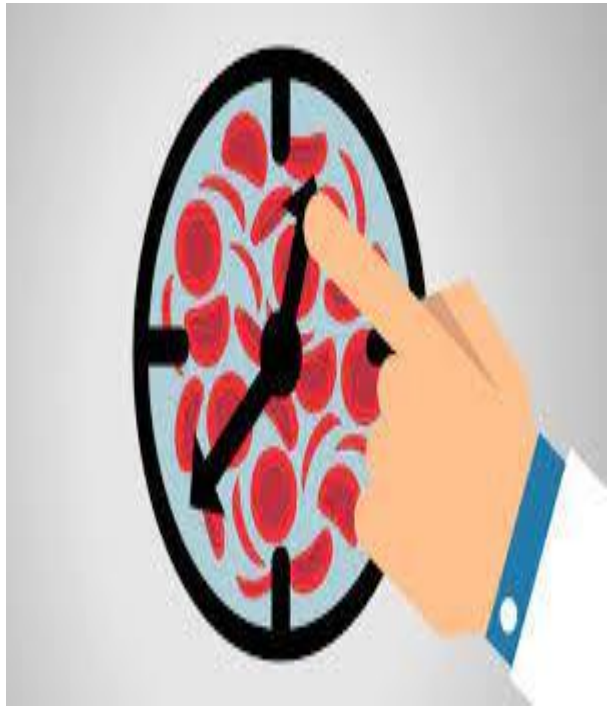
3) Sweating stage (2-4 hours): Profuse sweating & temperature falls.

- Malarial paroxysmal attacks recur at the following intervals:

a) *P. vivax and P. ovale* attack occurs every 48 hs (**tertian malaria).**

b) *P. malariae* attack occurs every 72 hs (**quartan malaria).**

c) *P. falciparum* attack occurs from 24 -48 hs (**Subtertian or irregular malaria).**



- Between paroxysms, the patient may be tired but otherwise feel fairly good.
- Pathogenesis of malarial paroxysm is based on regular erythrocytic cycles that end in schizont rupture → liberation of metabolites, toxins and the formation of malarial pigment.

C) Hemolytic anemia & jaundice (Hemolysis and destruction of R.B.Cs)

D) Hepato-splenomegaly.

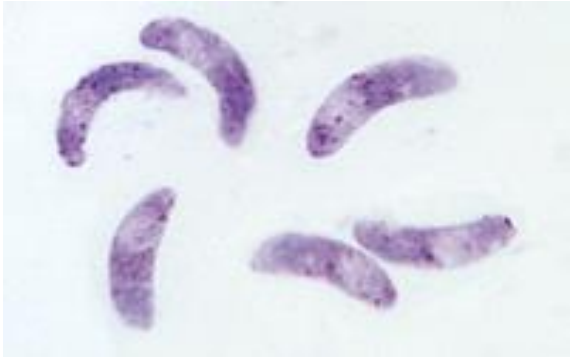
E) Malignant malaria (*P. falciparum*) is severe and fatal:

(blood vessels become plugged by masses of parasitized red cells → ischemia & haemorrhage in different organs). Characterized by:

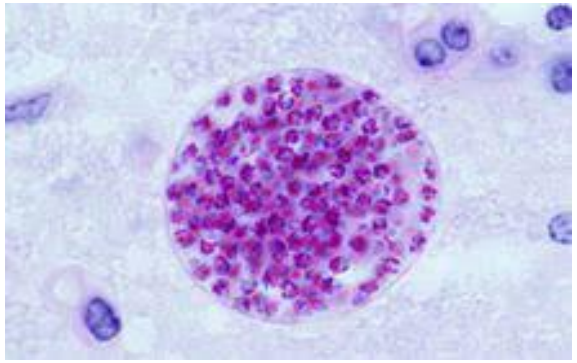
- **Cerebral Malaria:** Meningo-enchephalitis.
- **Gastrointestinal syndromes:** Dysentery.
- **Pulmonary edema.**
- **Black water fever (Malarial haemoglobinuria):**acute renal failure.

Toxoplasma gondii

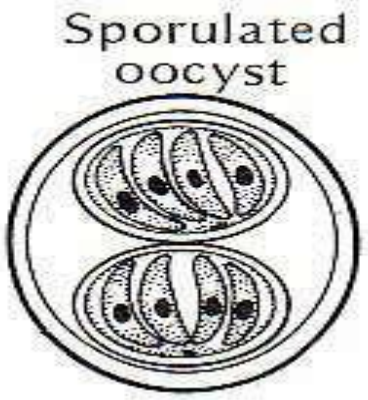
Morphology



- Tachyzoite: It is crescent-shaped, rapidly multiplying parasite stage .



- Bradyzoite (tissue cyst): This is accumulation of slowly multiplying parasite stage.



- Oocyst: It is oval, 2 sporocysts each contain 4 sporozoites. It is formed only in cats (definitive host).

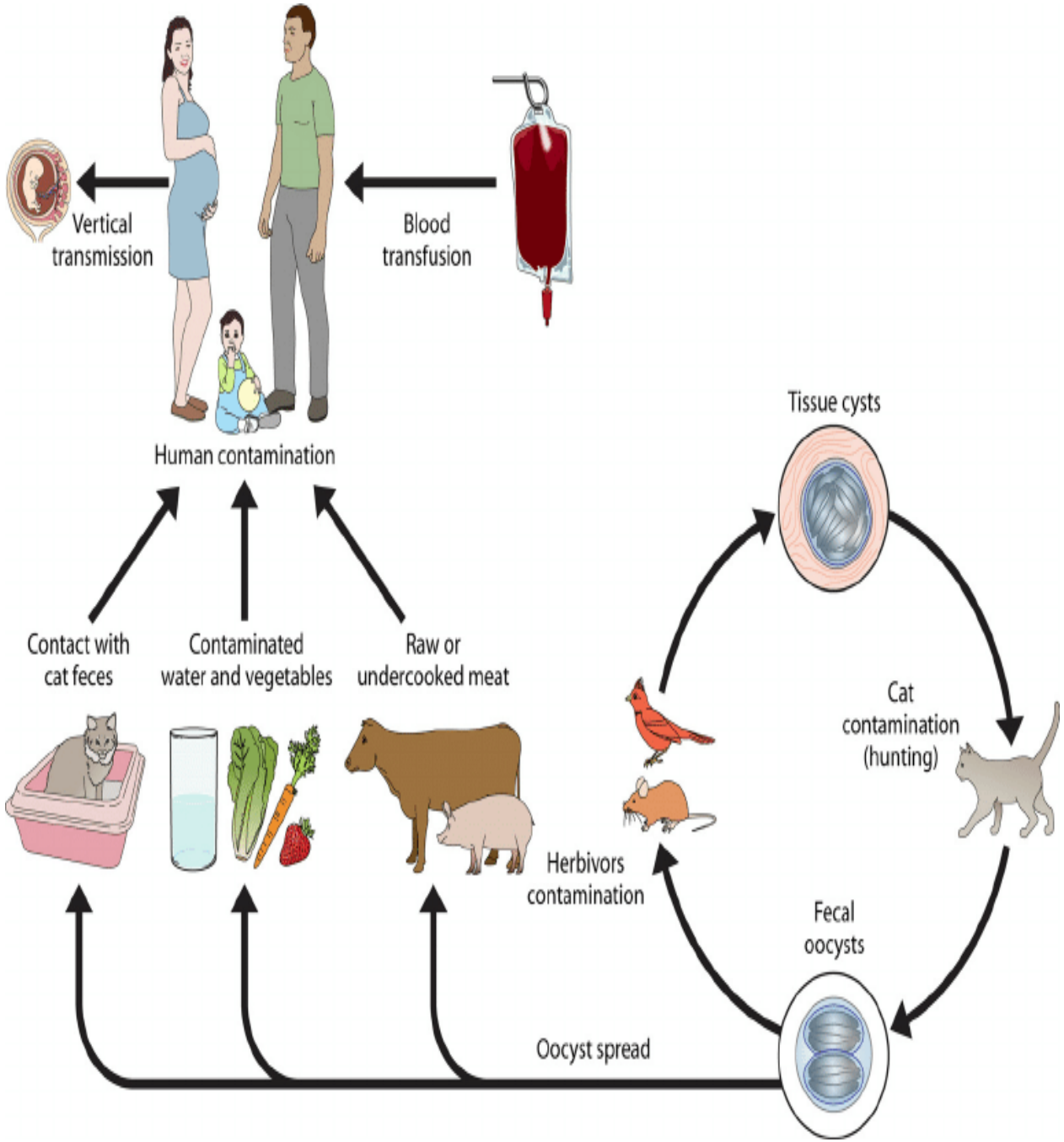
Life cycle:

- **Habitat:** Intestinal mucosa of cats.
- **Definitive host:** Cat is the specific host.
- **Intermediate host:** Man, mammals.
- **Infective stage:** *Oocysts in soil.

  *Bradyzoites (Tissue cysts) in meat.

  *Tachyzoites in blood.
- **Mode of infection:**

1. Ingestion of tissue cysts in raw meat.
2. Ingestion of oocysts in contaminated food.
3. Trans-placental transmission.
4. Blood transfusion or organ transplantation.



Pathogenesis & Clinical findings:

Toxoplasmosis is a **zoonotic** disease, causing chronic (latent) infection which is mostly asymptomatic. It is of highly significance in:

1- Pregnant women: cross placenta leading to:

- Still-birth or abortion.
- Congenital infection: Predominate in the CNS leading hydrocephalus, microcephalus, intracranial calcifications, mental retardation, hearing loss.

2- Immunocompromised patient:

Encephalitis and retinitis are the most common manifestation.


QUIZ
?
TIME

Which of the followings is NOT a character of Amastigote?

A) Spherical or ovoid.

B) Has 2 nuclei, a large nucleus and kinetoplast.

C) Has a free flagellum.

D) Exclusive Intracellular form.

E) Found in man.

A woman, recently returned from Africa, complains of having paroxysmal attacks of chills, fever, and sweating; these attacks recur every 36 hours. Examination of a stained blood specimen reveals ringlike forms within red blood cells. The infecting organism most likely is:

A) Plasmodium falciparum.

B) Plasmodium vivax.

C) Plasmodium malariae.

D)Trypanosoma brucei.

E) Leishmania donovani.

Which of the following statements concerning *Toxoplasma gondii* is INCORRECT:

a) It can be transmitted across the placenta to the fetus.

b) It can be transmitted by ingestion of food contaminated by cat feces.

c) It can cause encephalitis in immunocompromised patients.

d) It can cause severe congenital anomalies in fetus.

e) Human is the definitive host of the disease.

Which one of the following protozoa primarily infects macrophages?

A) Plasmodium vivax.

B) Leishmania donovani.

C) Entamoeba histolytica.

D) Trichomonas vaginalis.

E) Giardia lamblia.

Thank you