Medical Biology

1st Stage

Lab 12

Hemoflagellates
Leishmania & Trypanosoma

By
Lecturer Dr. Alya hamza Yassin

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Hemoflagellates:

These are clinically significant group of protozoan parasites found in human blood and tissues, and they move by means of flagella. Two genera included in this group: Leishmania and Trypanosoma. They are classified as follows:

Kingdom: Protista

Phylum: Protozoa

Subphylum: Mastigophora (flagellata)

Class Zoomastigophora

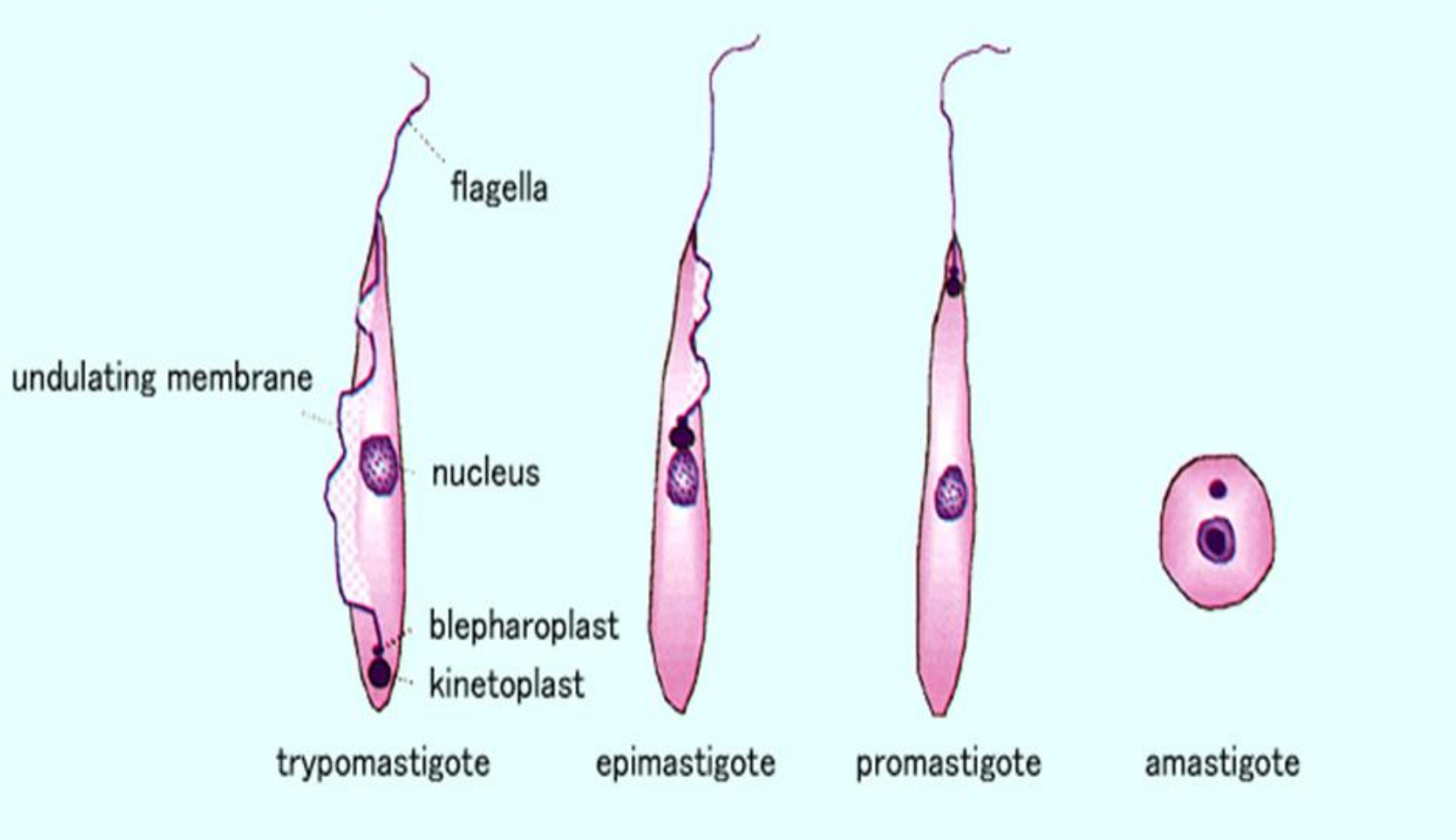
Order: kinetoplastida **(**Hemoflagellates**)**

Family : Trypanosomatidae

Genera: Leishmania & Trypanosoma

Spp.: several species distributed according to geographical location and presence of their hosts.

Different stages of Hemoflagellates



General Features of genus **Leishmania** :

1. The genus includes 21 species that infect human, most important are (*L. tropica, L. braziliensis, L. donovani*).

2. They are obligate parasites, can't survive without a host.
3. **Intracellular** (live and multiply inside human macrophage)

4. They have heteroxenous life cycles requiring two hosts; a mammalian host as the definitive (final) host and an insect vector sandfly as the intermediate host.

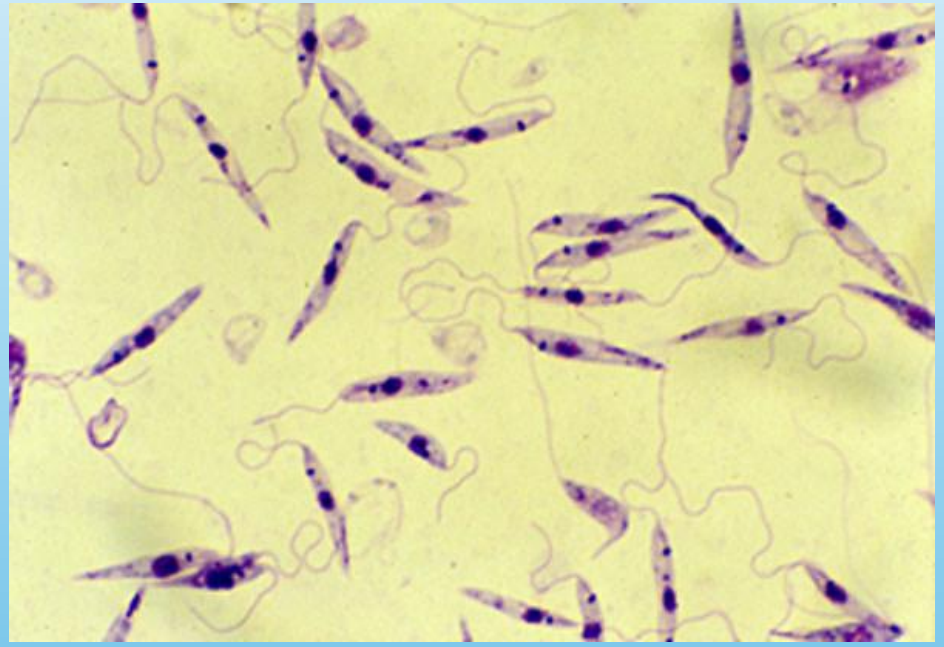
5. They cause a group of diseases called Human leishmaniasis including cutaneous, visceral and mucocutaneous.

6. Developmental stages of leishmania includes two forms:

**amastigote (non-flagellated non-motile stage)

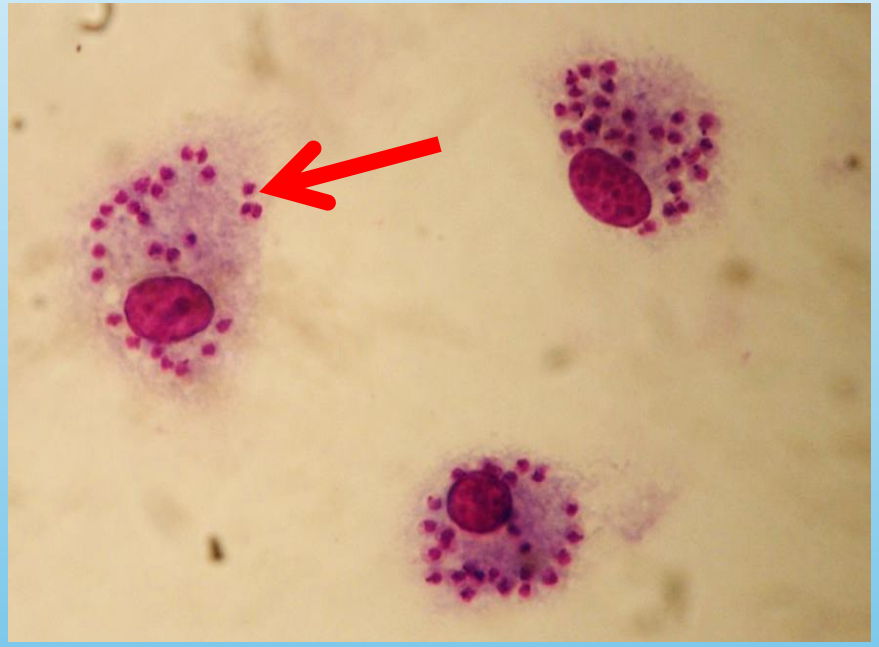
**promastigote.

Forms of Leishmania species



Leishmania Spp. promastigotes in culture and sandfly

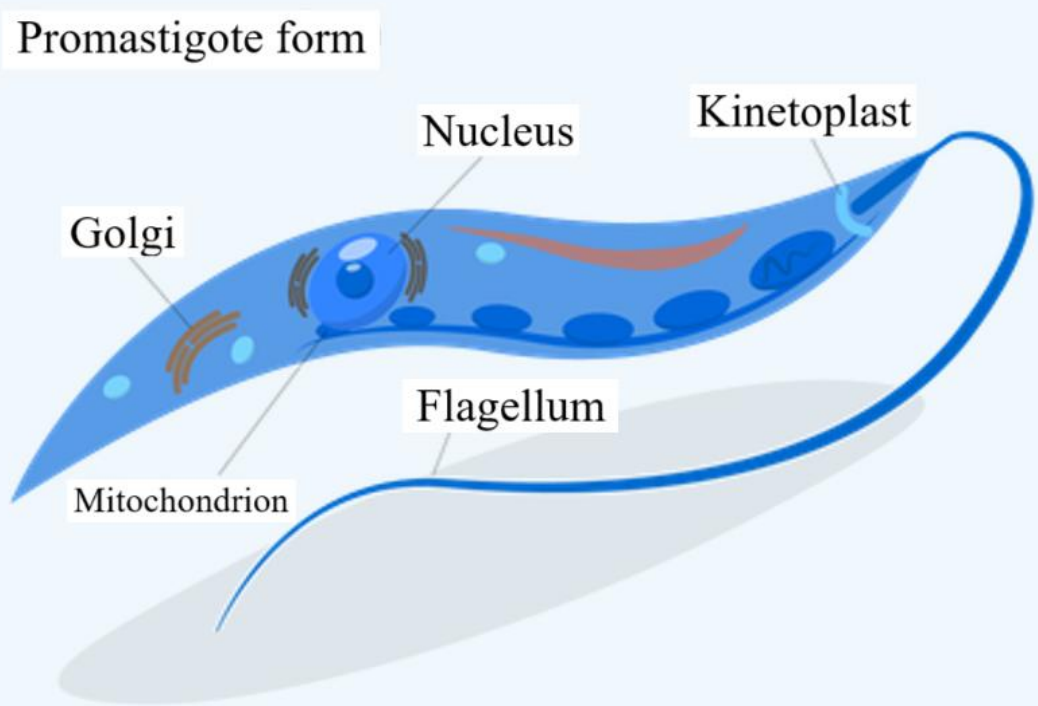
** Infective Stage

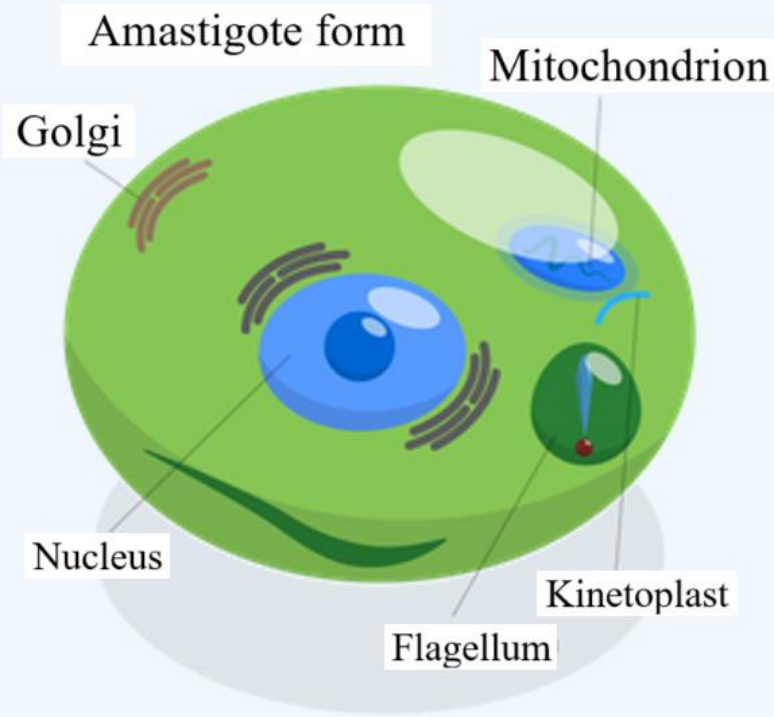


Leishmania Spp. Amastigotes (leishmanial form) inside human macrophage

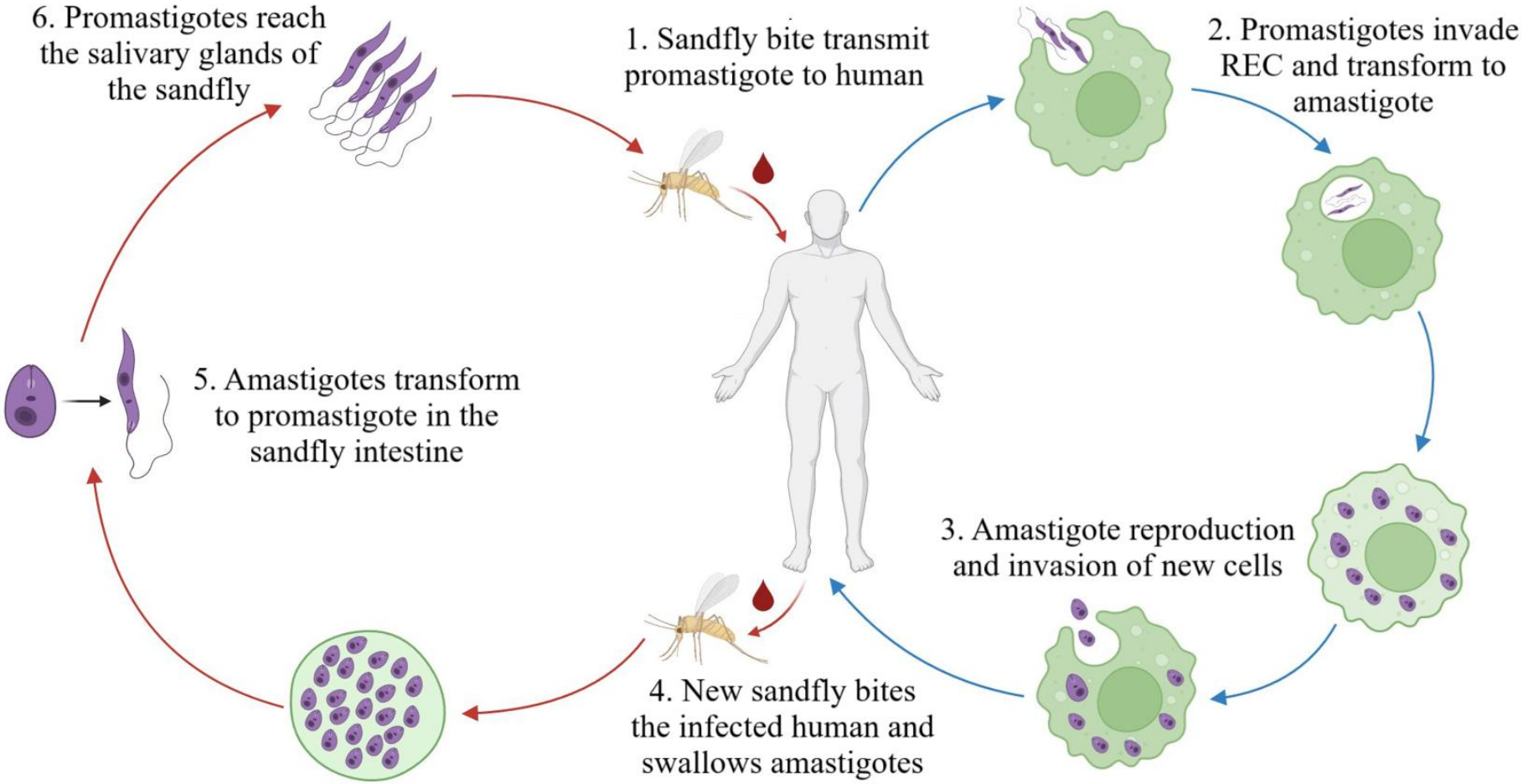
** Diagnostic stage

Leishmania Developmental Stages





Life cycle of ***Leishmania*** Spp.



L. tropica (cutaneous leishmaniasis)

Habitat: skin

Disease: Oriental sore & Baghdad boil (pus-containing skin ulcers).

Transmission :- female sandflies *Phlebotomus sp*.

Diagnosis:

1. microscopic examination of Giemsa-stained slides of aspiration of fluid underneath the ulcer bed for the typical amastigotes.
2. Culture of the ulcer tissue may also reveal the promastigote forms. Novy-MacNeal-Nicolle (NNN) medium is used to culture amastigote at 24 to 26 °C yielding motile promastigotes at 1–4 weeks

Baghdad boil
Cutaneous Leishmaniasis
by *L. tropica*

*L. braziliensis (*mucocutaneous leishmaniasis)

Habitat :- skin and mucosa.

Disease :- Espundia, (when cutaneous lesion on the face spreads to the mucocutaneous nose or mouth)

Transmission: female sandflies *Lutzomyia spp*.

Diagnosis

1. Biopsy of the infected ulcer for microscopic examination using Giemsa-stained preparations should reveal the typical amastigotes.
2. Culturing the infected material on NNN medium often demonstrates the promastigote stage

Espundia
mucocutaneous leishmaniasis
By ***L. braziliensis***

*L. donovani (*visceral leishmaniasis)

Habitat : internal organ (liver, lymph nodes, spleen, bone marrow).

Disease:

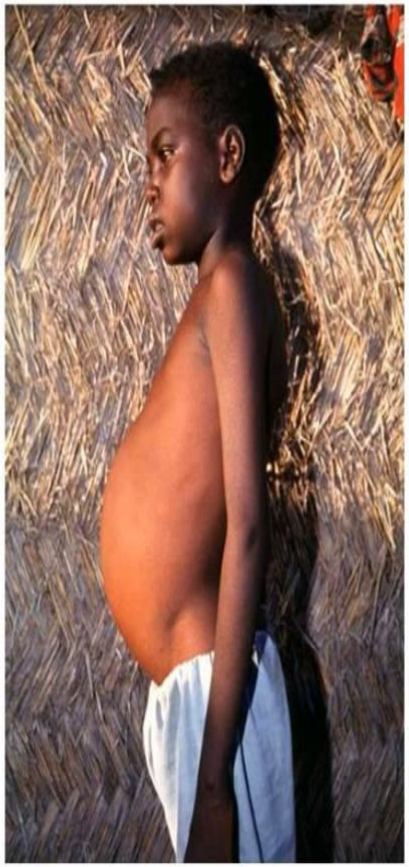
- Kala-azar (the most severe visceral leishmaniasis)

- Dum Dum fever.

Transmission: female sandflies *Phlebotomus sp.*

Diagnosis:

1. Giemsa-stained slides of blood, bone marrow, lymph node aspirates, and biopsies of the infected areas are better choices for demonstrating the diagnostic amastigote forms.
2. Serologic testing using IFA (indirect fluorescent antibody), ELISA (enzyme-linked immunosorbent assay), and DAT (direct agglutination test) since antibodies titer is high.



Kala azar
Visceral Leishmaniasis
By *L. donovani*

Sandfly
the vector and intermediate host of Leishmania

Lutzomyia
L. braziliensis

Phlebotomus
L. Tropica
L. donovani

General Features of genus **Trypanosoma** :

1. The genus Trypanosoma includes:

T. brucei → exists in 2 morphologically identical subspecies:

- *Trypanosoma brucei rhodesiense* (East African or Rhodesian African trypanosomiasis)
- *Trypanosoma brucei gambiense* (West African or Gambian African trypanosomiasis).

T. cruzi → American trypanosomiasis or 'Chagas' disease.

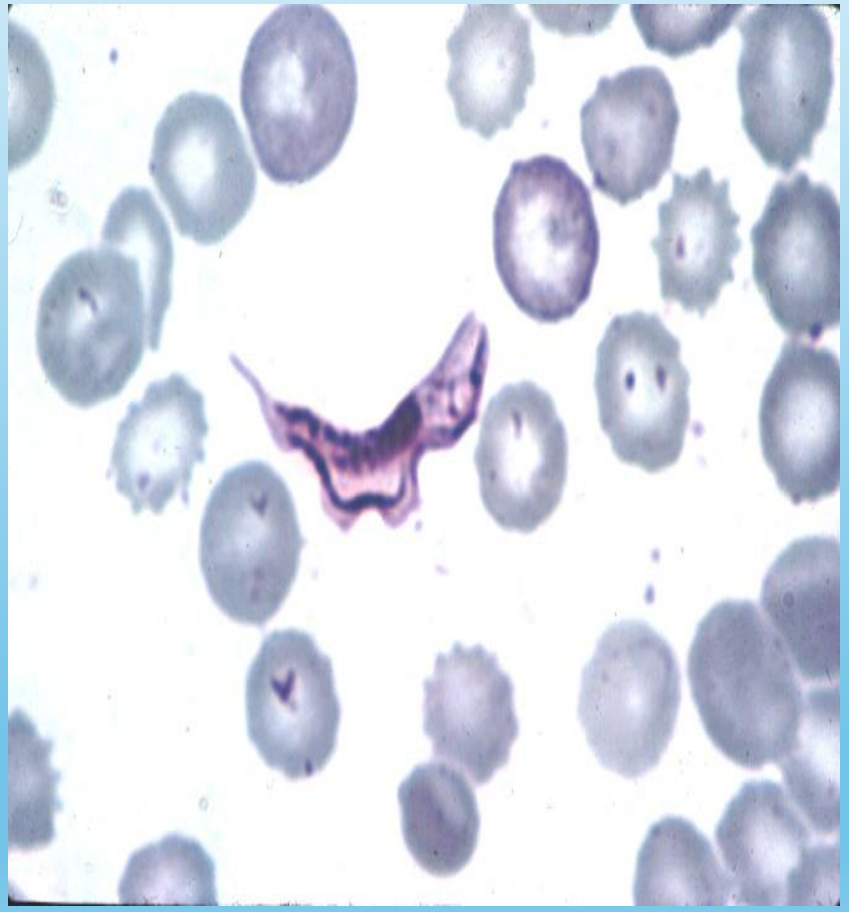
General Features of genus **Trypanosoma** :

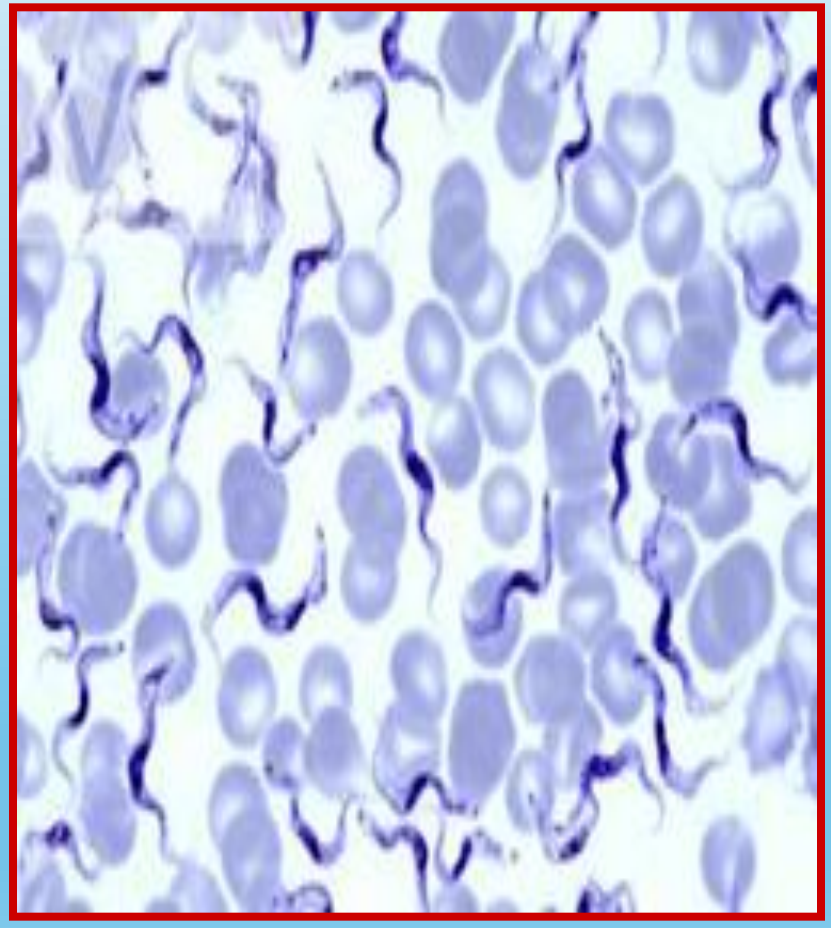
- 2. They are extracellular parasites infecting blood, lymph and spleen and CSF.

- 3. They are heteroxenous requiring two hosts to complete their life cycle, a mammalian host as a final host and an insect vector Tsetse fly (Glossina) as an intermediate host.

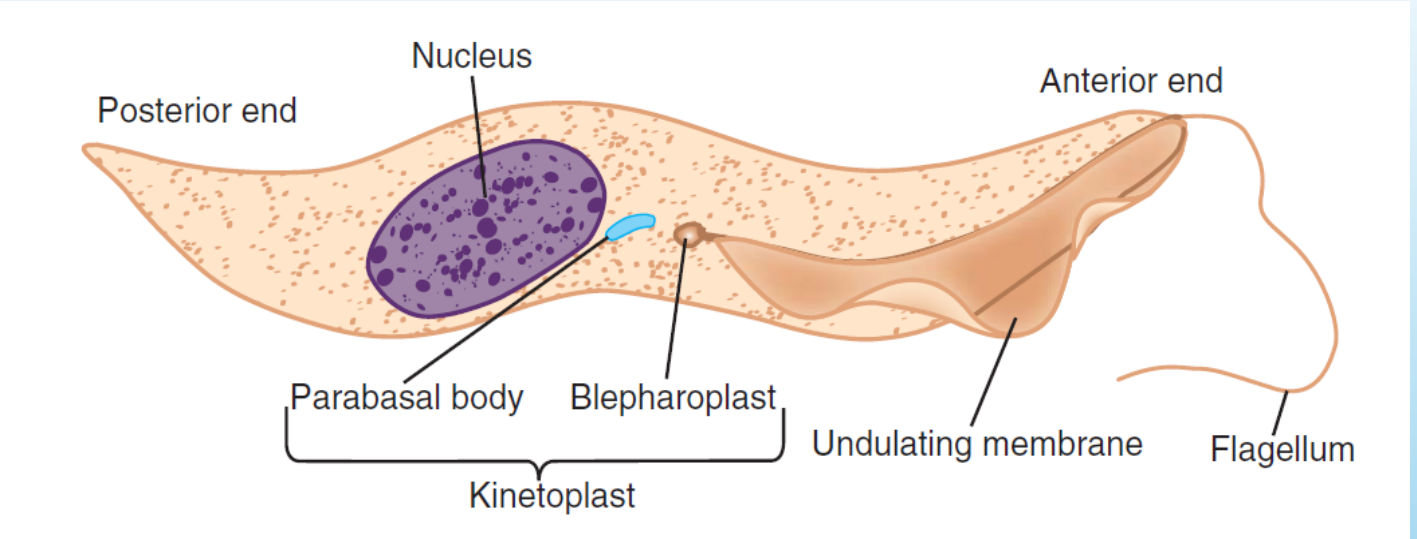
- 4. Developmental stages of the parasite including two forms: epimastigote and trypomastigote.

T. brucei **(trypomastigotes)**

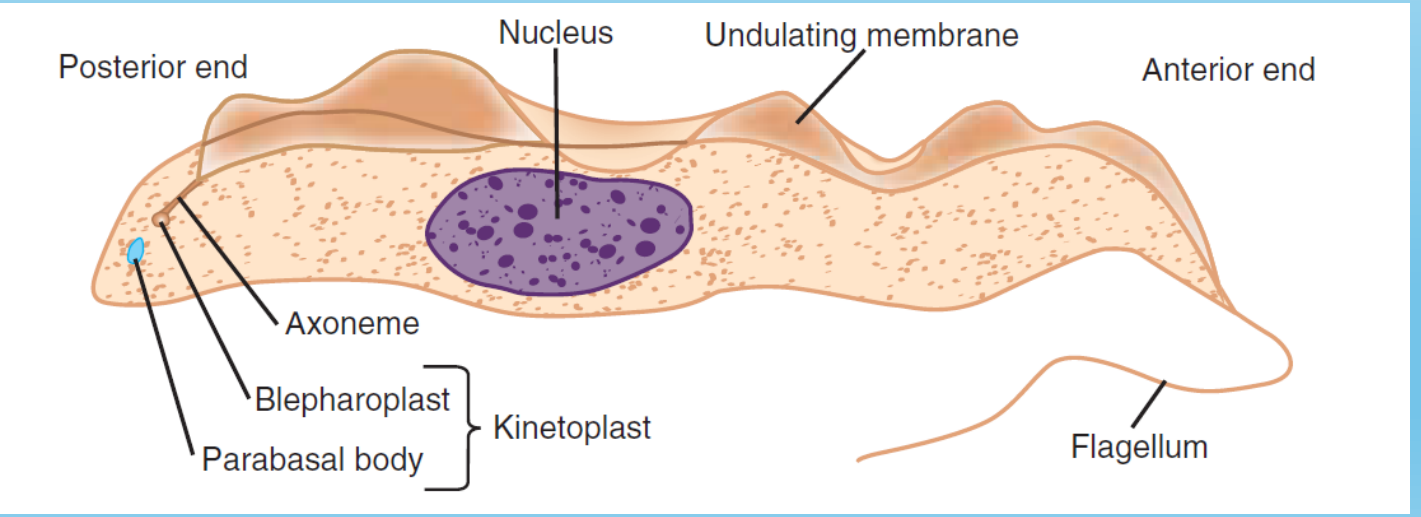




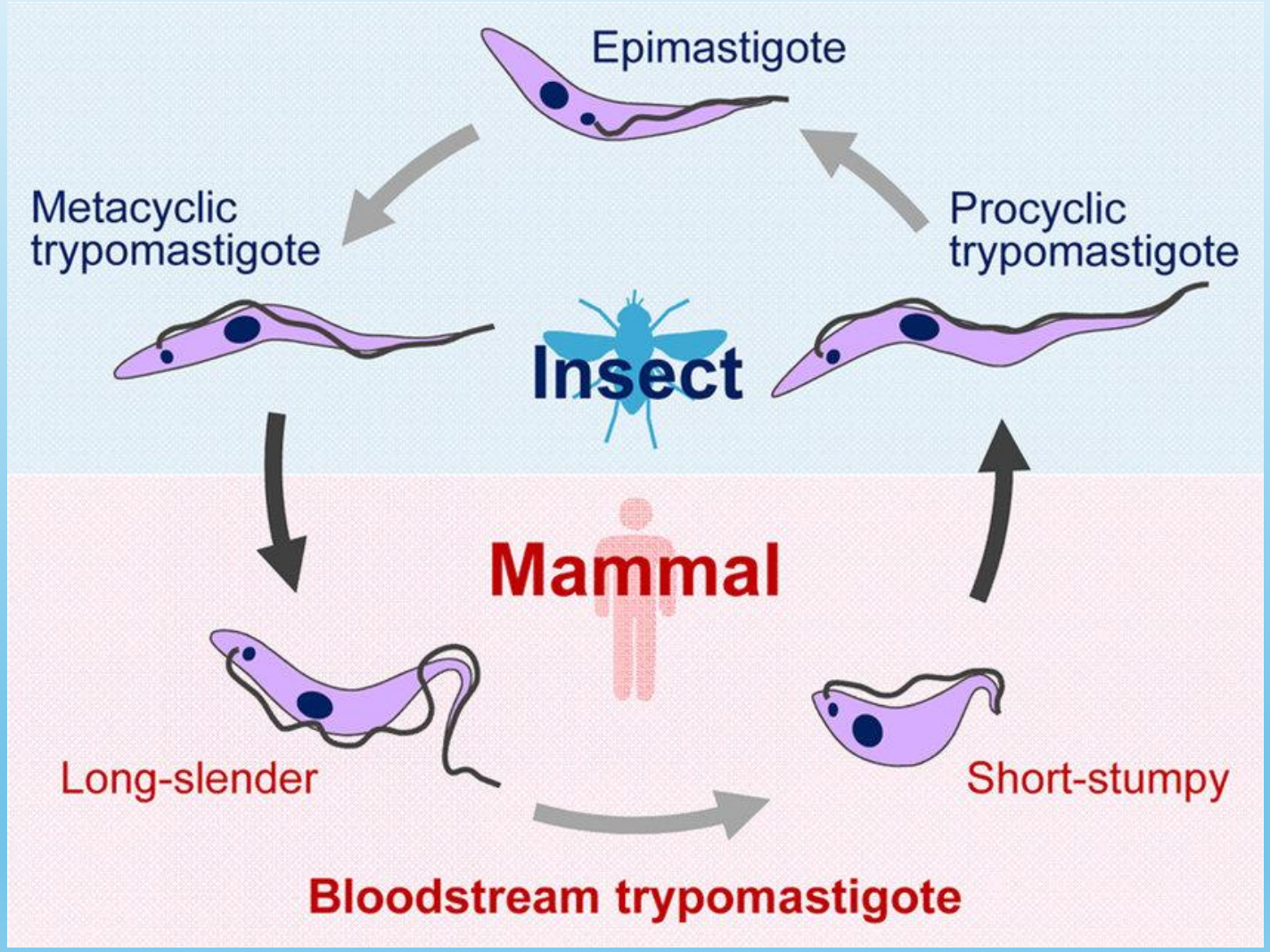
Epimastigote Form



Trypomastigote Form



Life cycle of Trypanosoma spp.



Tsetse fly (*Glossina*)

Chancre

Winterbottom sign

Laboratory Diagnosis of African Trypanosomiasis

- **Specimen**: chancre aspirate, blood, lymph and CSF in late stages of disease.
- **Methods**:

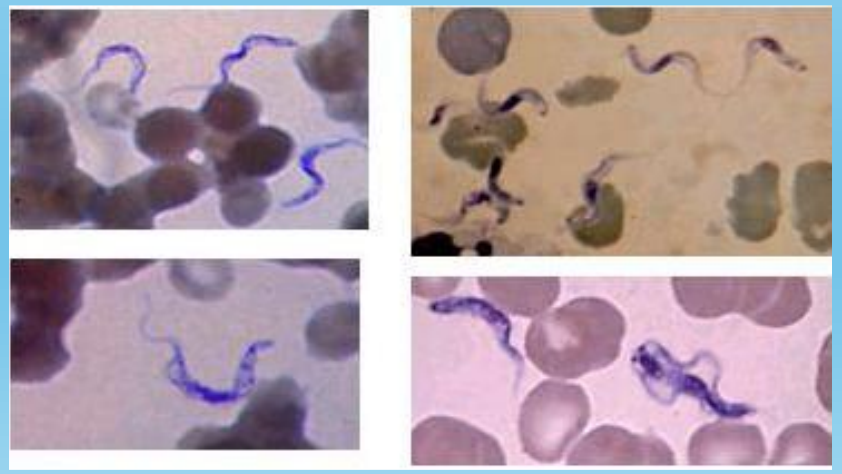
➢Microscopic examination of Giemsa-stained films demonstrating trypomastigote

➢Culture on NNN medium

➢Animal inoculation such as lab mice

➢Card Agglutination Trypanosomiasis Test [CATT]

➢Detecting anti-Trypanosoma Abs by serological methods



Comparison between Hemoflagellates genera

Leishmania	**Trypanosoma**
Intracellular inside the human host remaining inside the macrophage	Extracellular inside the human host remaining in blood and lymph
Transmitted by sandfly	Transmitted by tsetse fly
Developmental stages are amastigote and promastigote	Developmental stages are epimastigote and trypomastigote
Causes leishmaniasis (cutaneous, mucocutaneous and visceral).	Causes trypanosomiasis (sleeping sickness).
Important species include: *L. tropica, L. braziliensis* and *L. donovani*	Important species include: *T. brucei and T. cruzi*

Thank You