Haemflagellate

TRYPANOSOMA & LEISHMANIA

By: Ass. Prof. Nader Alaridah MD, PhD

Haemflagellate

Trypanosoma

leishmania

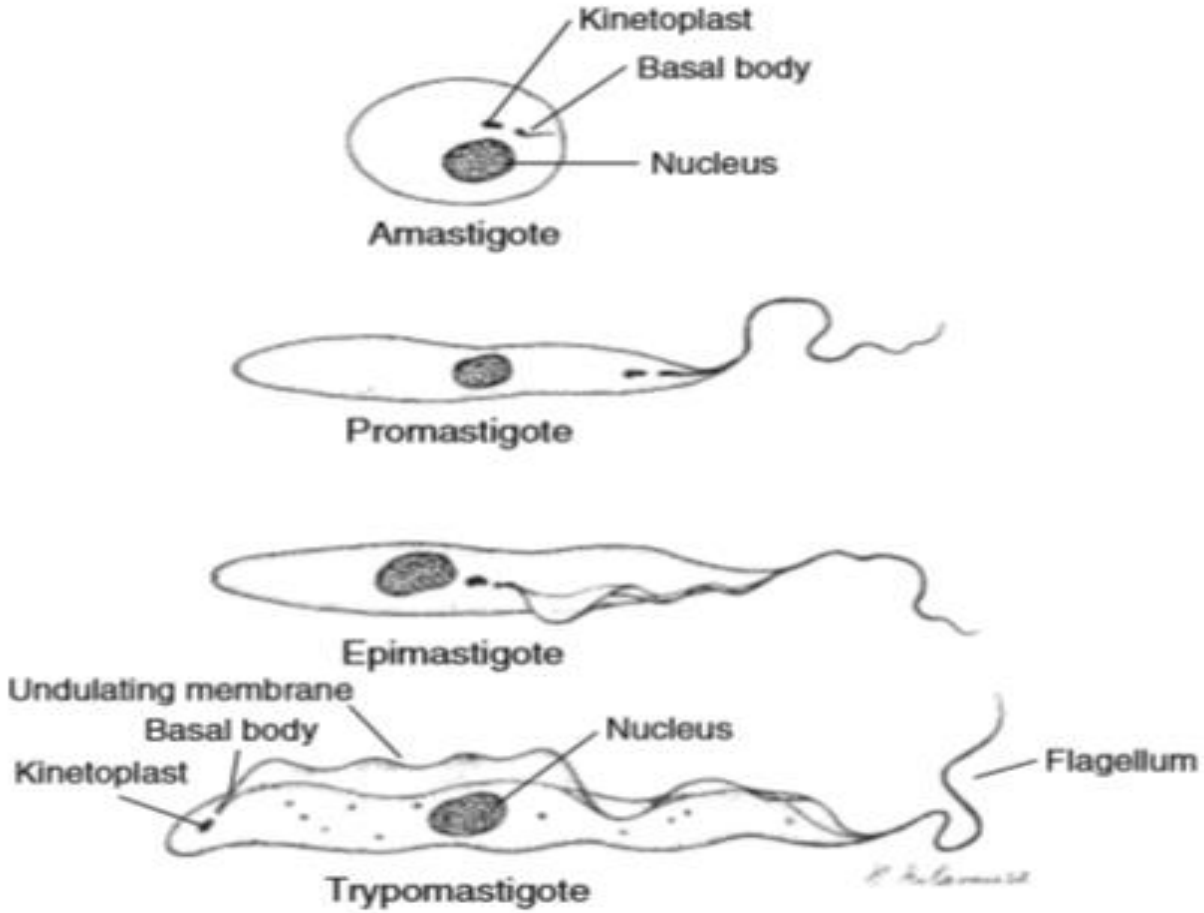


Figure 49-8 Characteristic stages of species of *Leishmania* and *Trypanosoma* in human and insect hosts. (Illustration by Nobuko Kitamura.)

Trypanosoma

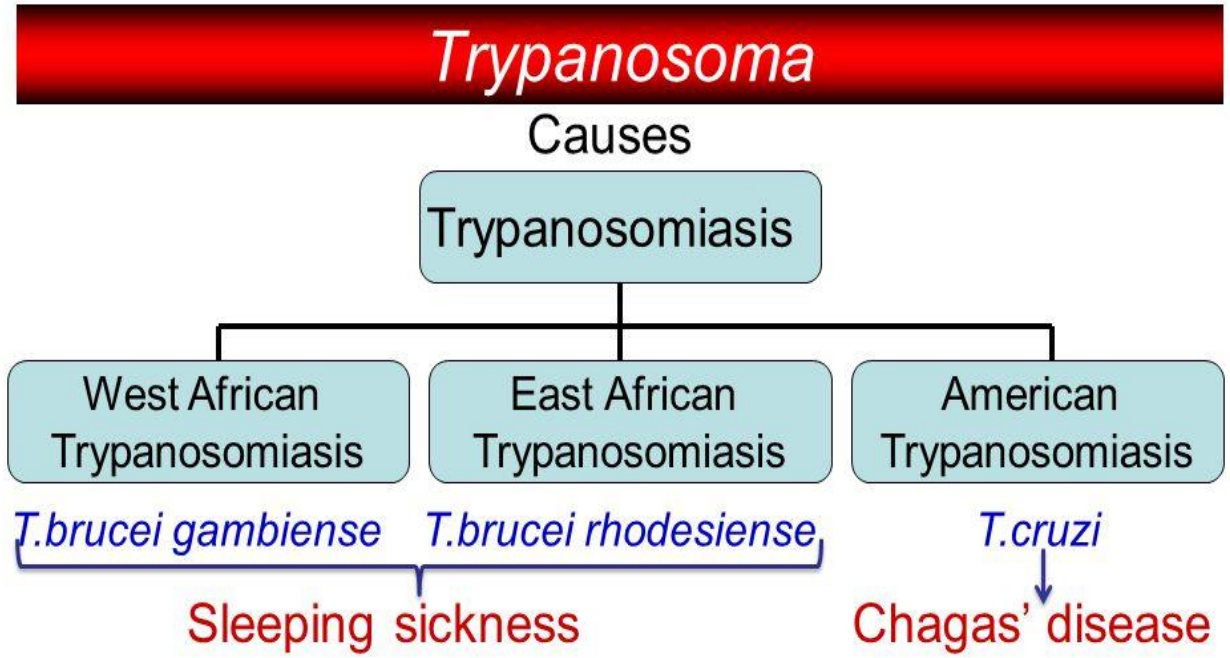
- Causative agents of African trypanosomosis (sleeping sickness) and American trypanosomosis (Chagas disease).

- Trypanosoma brucei gambiense and Trypanosoma brucei rhodesiense cause African trypanosomosis (sleeping sickness) in humans.
- Trypanosoma cruzi, the causative agent of American trypanosomosis (Chagas disease) occurs in humans and many vertebrate animals in Central and South America.

TRYPANOSOMA

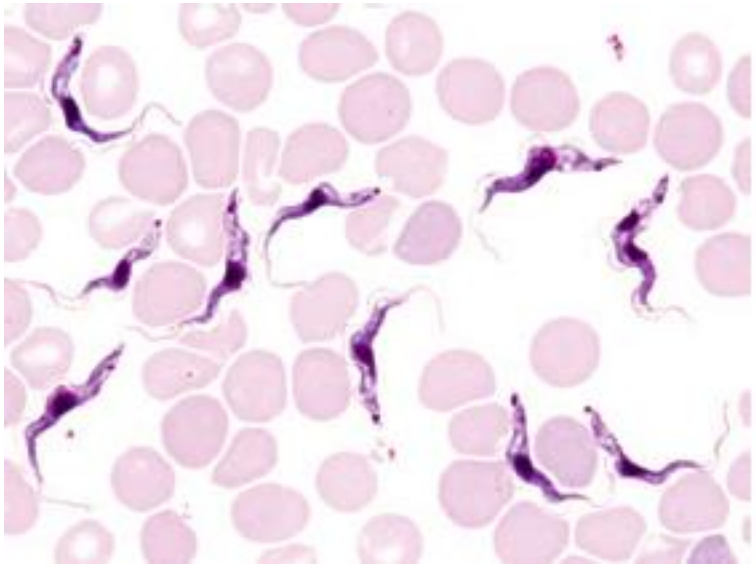
African trypanosomiasis : African sleeping sickness

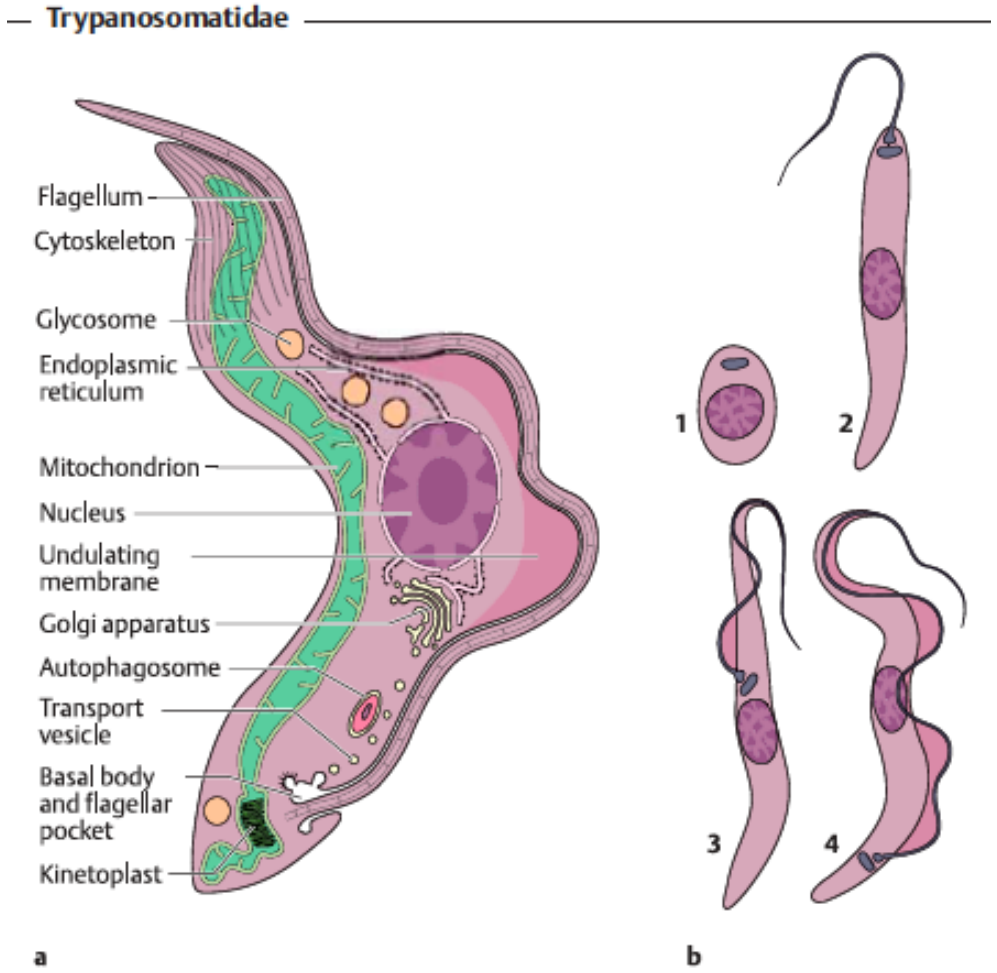
American trypanosomiasis (Chagas' disease)



Morphology

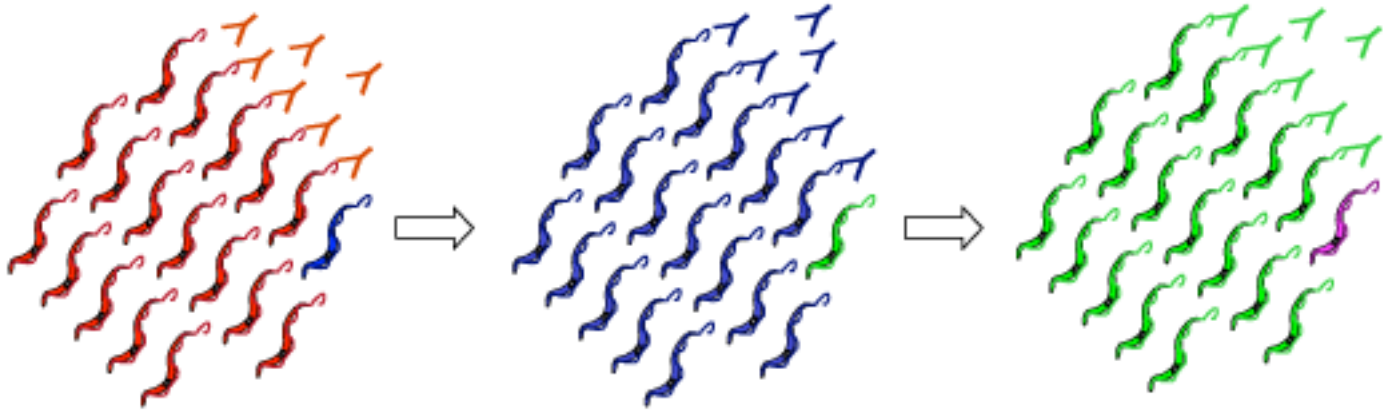
- The morphologically differentiated forms include spindly, uniflagellate stages (trypomastigote, epimastigote, promastigote) and a rounded, amastigote form.





ANTIGENIC VARIATION

- A unique feature of African trypanosomes is their ability to change the antigenic surface coat of the outer membrane of the trypomastigote, helping to evade the host immune response.
- The trypomastigote surface is covered with a dense coat of variant surface glycoprotein (VSG)
- Each time the antigenic coat changes, the host does not recognize the organism and must mount a new immunologic response



AFRICAN TRYPANOSOMIASIS

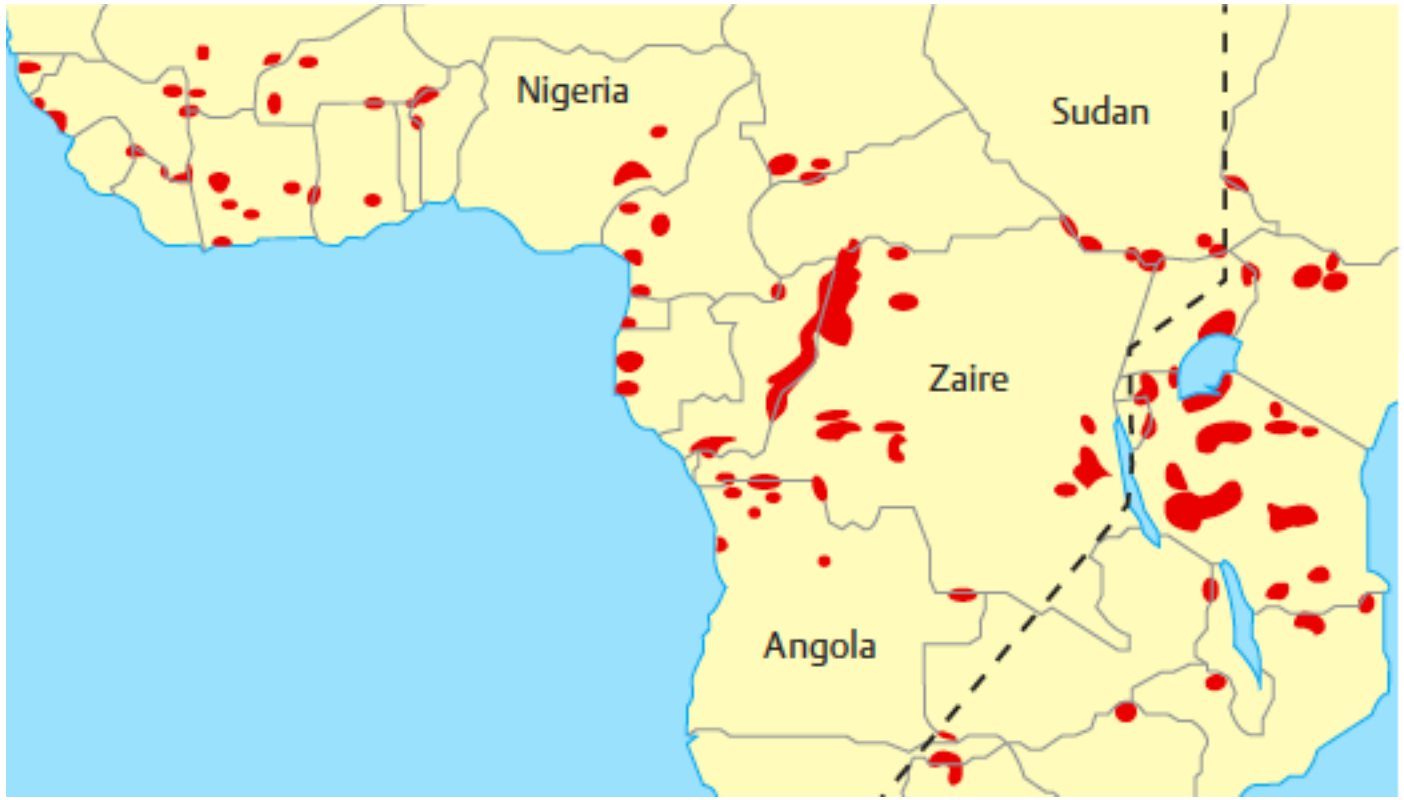
- Is caused by 2 sub spp. :
- T. brucei gambiense :West African trypanosomiasis
- T. brucei rhodesiense: East African trypanosomiasis

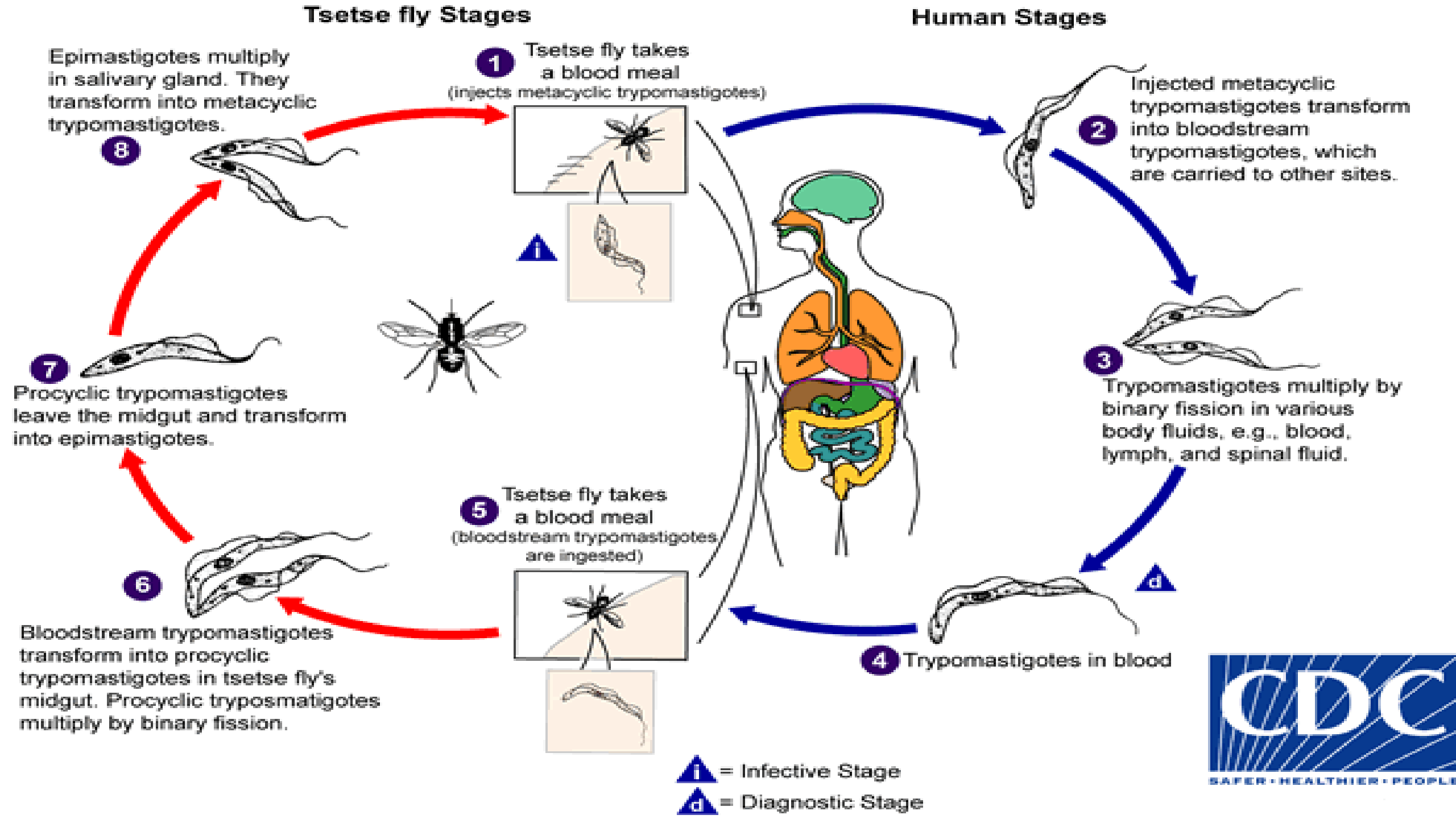
- Vector: **tsetse fly** (Glossina spp.)
- Which is found only in rural Africa
- Glossina palpalis transmits T. b. gambiense
- Glossina morsitans transmits T. b. rhodesiense

Epidemiology.

- There are epidemiological differences between T. gambiense and T. rhodesiense), the main one being that T. rhodesiense persists in a latent enzootic cycle in wild and domestic animals and is normally transmitted by Glossina from animal to animal, more rarely to humans.
- T. gambiense, on the other hand, is transmitted mainly from human to human by the tsetse flies, although various animal species have also been identified as reservoir hosts for T. gambiense strains.

Epidemiology




Tsetse fly Stages
Human Stages
Epimastigotes multiply in salivary gland. They transform into metacyclic trypomastigotes.
8
1
Tsetse fly takes a blood meal
(injects metacyclic trypomastigotes)
i
2
Injected metacyclic trypomastigotes transform into bloodstream trypomastigotes, which are carried to other sites.
3
Trypomastigotes multiply by binary fission in various body fluids, e.g., blood, lymph, and spinal fluid.
d
4
Trypomastigotes in blood
5
Tsetse fly takes a blood meal
(bloodstream trypomastigotes are ingested)
6
Bloodstream trypomastigotes transform into procyclic trypomastigotes in tsetse fly's midgut. Procyclic tryposmatigotes multiply by binary fission.
7
Procyclic trypomastigotes leave the midgut and transform into epimastigotes.
i = Infective Stage
d = Diagnostic Stage
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Trypanosoma brucei gambiense

- **Clinical feature:**
- After the host has been bitten by an infected tsetse fly, **a nodule or chancre** at the site may develop after a few days.

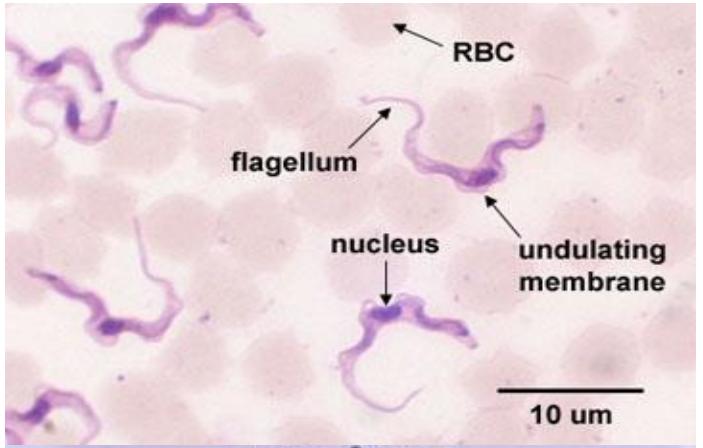
- **stage I:** the patient have systemic trypanosomiasis without CNS involvement.
- The trypomastigotes enter the bloodstream and invade the lymph nodes
- The first symptoms appear and include: irregular fevers with night sweats, enlargement to liver and spleen, Winterbottom's sign.

Winterbottom's sign

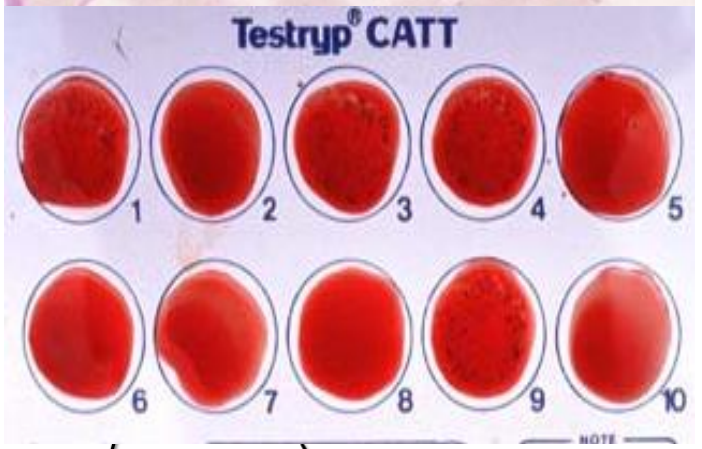
- **Stage II**: organisms invade the CNS, the sleeping sickness stage of the infection is initiated
- The patient becomes emaciated and progresses to profound coma and death

Laboratory Diagnosis

- **Specimen: blood, serum,CSF, aspiration from lymphnode**
- **Routine Methods**: thick and thin blood films

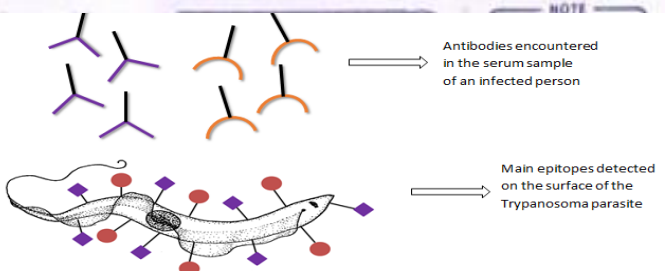


- **Antigen Detection**: simple and rapid test
  card indirect agglutination



- **Antibody Detection:** Serologic by using ELISA Serum or CSF IgM concentrations

- **Molecular Diagnostics**: PCR-based methods to detect infections and differentiate species, but these methods are not routinely used



Therapy

- All drugs used in the therapy of African trypanosomiasis are toxic and require prolonged administration
- anti parasitic drug selected depends on whether the CNS is infected
- Suramin or pentamidine isethionate can be used when the CNS is not infected
- Melarsoprol, a toxic trivalent arsenic derivative, is effective for both blood and CNS stages but is recommended for treatment of late-stage sleeping sickness

prevention

1. preventing flies from biting through the use of insecticide will reduce the transmission of the parasite.
2. Screening of people at risk helps identify patients at an early stage
3. Treatment cases and should be monitored for 2 years after completion of therapy.

AMERICAN TRYPANOSOMIASIS

- Trypanosoma cruzi **(Chagas' disease)**
- Zoonosis
- Transmitted by vector : reduviid bugs.
- Reduviid bug defecates while taking a blood meal

- **Definitive host:**
- Human, dog, cat, rats…etc.
- **Habitat** in the Definitive host:
- Trypomastigote in blood
- Amstigote in tissue

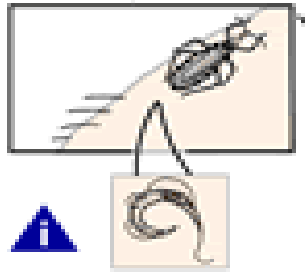
Epidemiology

Through out central and south America

Triatomine Bug Stages

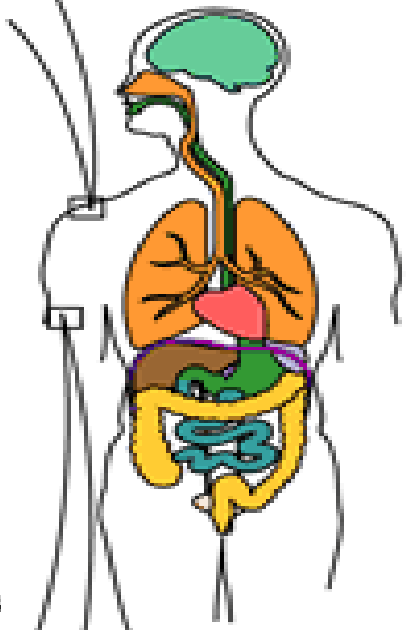
Human Stages

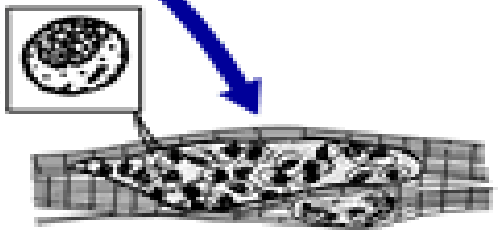
1 Triatomine bug takes a blood meal
(passes metacyclic trypomastigotes in feces, trypomastigotes enter bite wound or mucosal membranes, such as the conjunctiva)



i

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



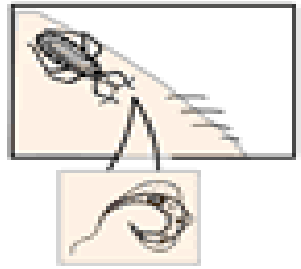


3 Amastigotes multiply by binary fission in cells of infected tissues.

Trypomastigotes can infect other cells and transform into intracellular amastigotes in new infection sites. Clinical manifestations can result from this infective cycle.

d

4 Intracellular amastigotes transform into trypomastigotes, then burst out of the cell and enter the bloodstream.



5 Triatomine bug takes a blood meal
(trypomastigotes ingested)

6 Epimastigotes in midgut

7 Multiply in midgut

8 Metacyclic trypomastigotes in hindgut

i = Infective Stage

d = Diagnostic Stage

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Pathogenesis

- Chagas' disease are categorized as acute, indeterminate, and chronic
- Nodule chagoma: near the bite

- The incubation period in humans is about 7-14 days

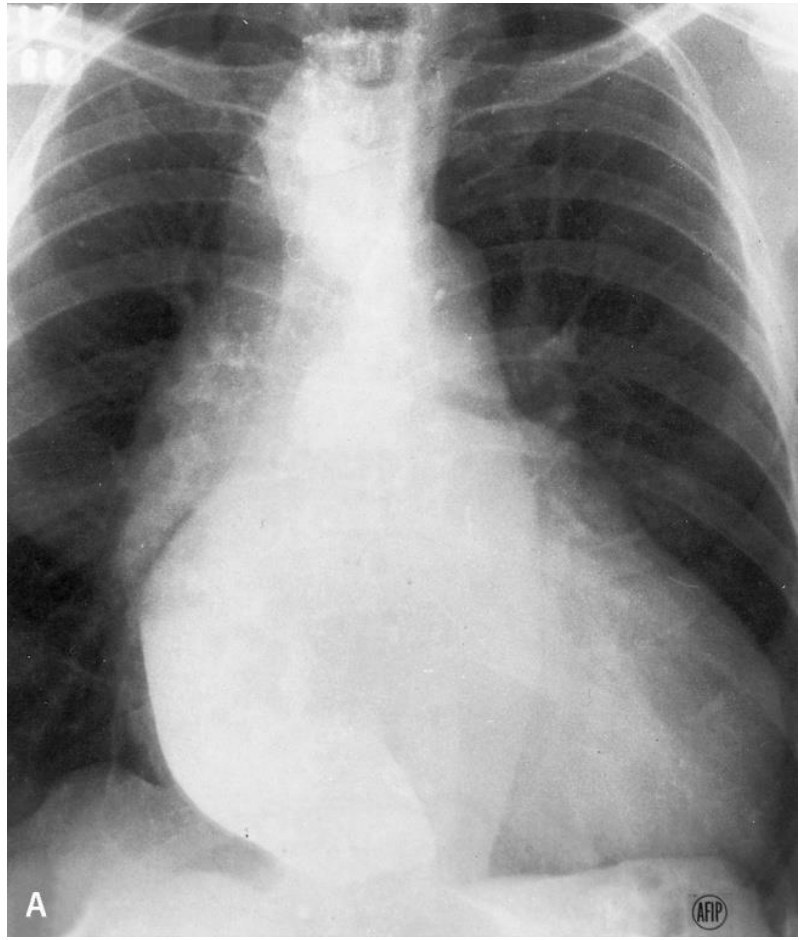
•Acute phase:

- Start 1 week after infection
- Fever
- Lymph node enlargement
- Enlarge liver and spleen
- Unilateral swelling of eyelids romana’s sign
- Acute myocarditis

•Chronic phase:

- Develop years after the diagnosis of acute disease

- Most frequent clinical signs of chronic Chagas' disease involve the heart, where enlargement of the heart , including cardiac changes
- Enlargement of the colon



Therapy

- Nifurtimox and benznidazole reduce the severity of acute Chagas' disease.

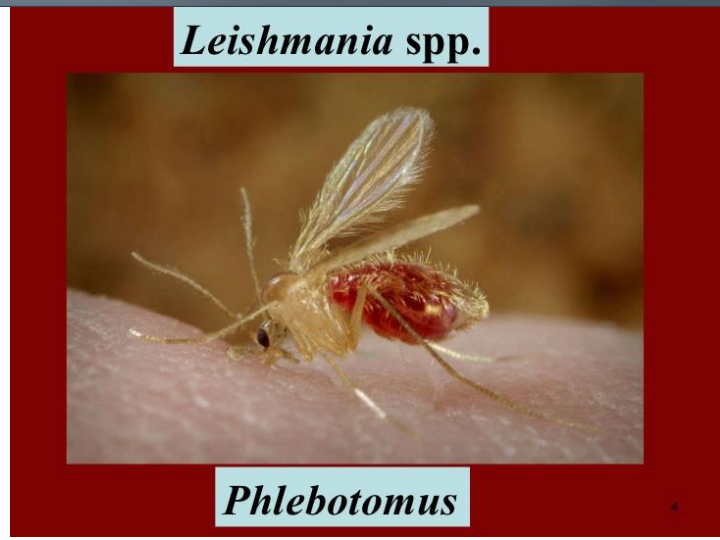
- Both medicines are almost 100% effective in curing the disease if given soon after infection at the onset of the acute phase including the cases of congenital transmission.

Prevention

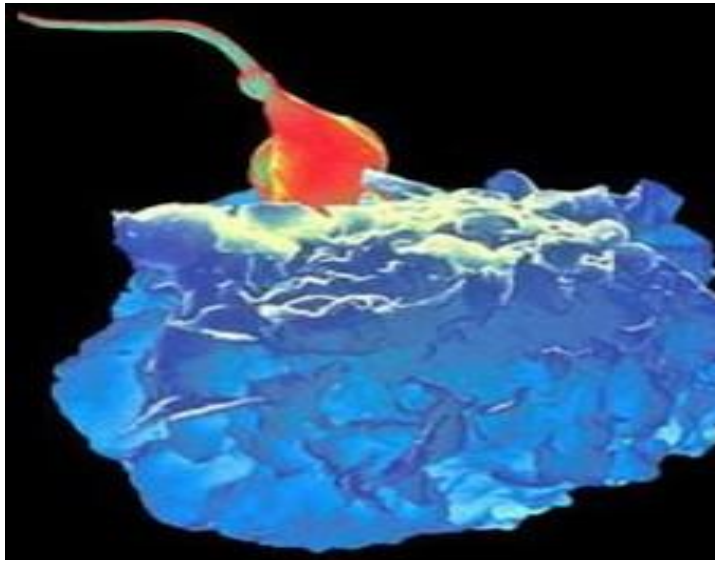
1. Vector control
2. Transfusion control and screening of blood donors
3. testing of organ, tissue or cell donors and receivers

LEISHMANIA

- It is a flagellated protozoan
- Life cycle requires two hosts :
  a) **vertebrate** ; mammalian host
  b) **Invertbrate vector** ; female sand fly



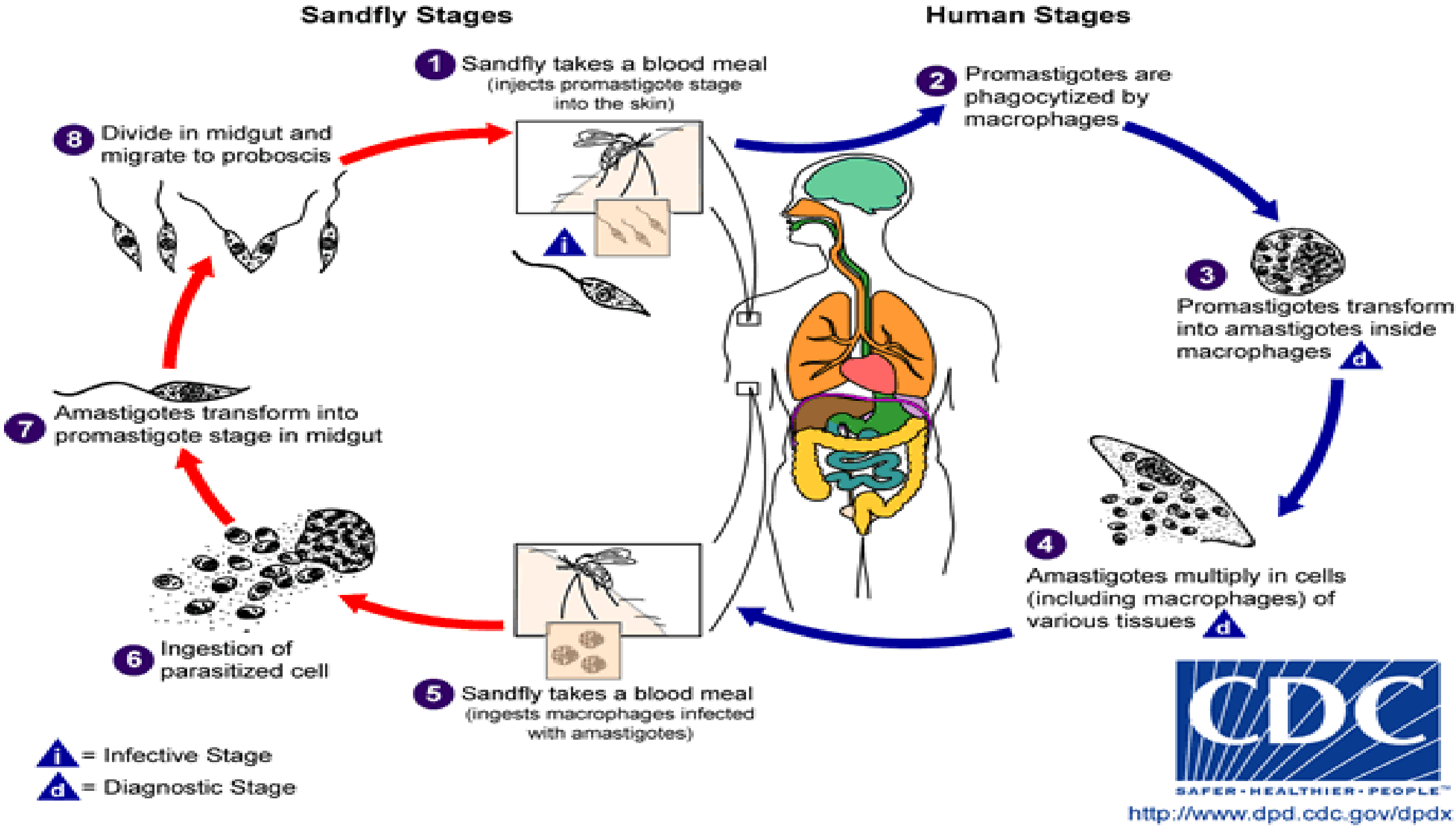
- Obligate intracellular organism
- Infects primarily phagocytic cells and macrophages
- The incubation period ranges from 10 days to 2 years,



LEISHMANIA SPP.

- Leishmaniasis is divided into clinical syndromes according to what part of the body is affected most.

1. **Cutaneous Leishmaniasis(L.tropica,Leishmania major)**
2. **Mucocutaneous leishmaniasis(L. braziliensis)**
3. **Visceral Leishmaniasis(L.donovani).**


Sandfly Stages
Human Stages
1 Sandfly takes a blood meal
(injects promastigote stage
into the skin)
2 Promastigotes are
phagocytized by
macrophages
3 Promastigotes transform
into amastigotes inside
macrophages
d
4 Amastigotes multiply in cells
(including macrophages) of
various tissues
d
5 Sandfly takes a blood meal
(ingests macrophages infected
with amastigotes)
6 Ingestion of
parasitized cell
7 Amastigotes transform into
promastigote stage in midgut
8 Divide in midgut and
migrate to proboscis
i = Infective Stage
d = Diagnostic Stage
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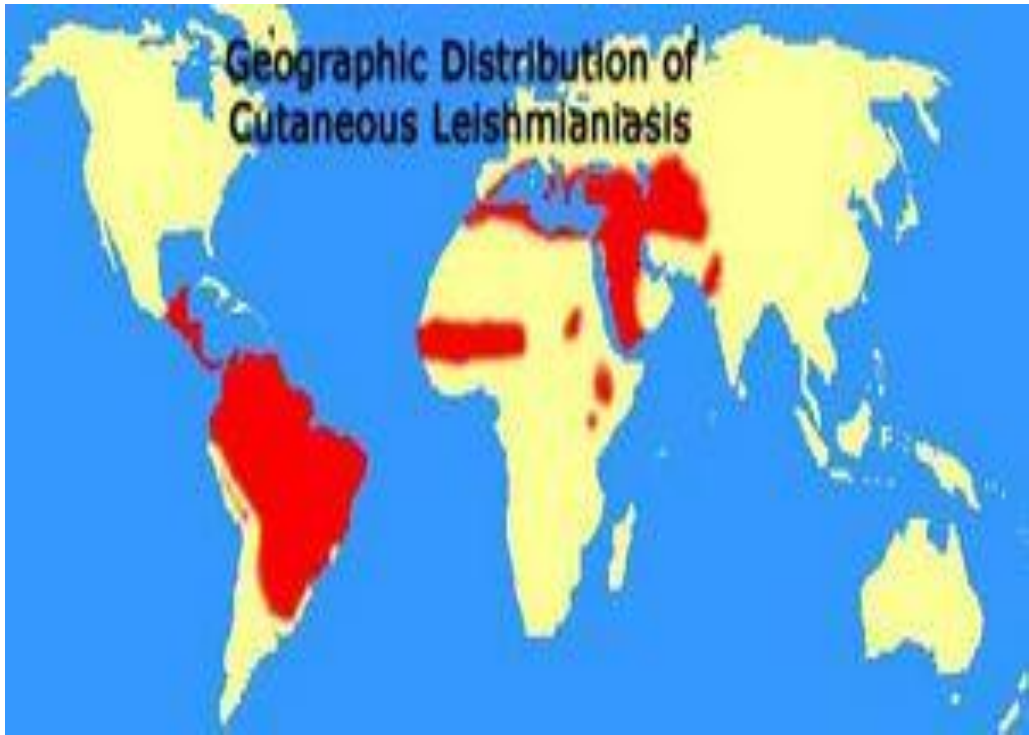
Transmission

1. Bite of sand fly
2. Transfusion blood and transplantation
3. Mother to baby
4. Direct contact; from man to man through nasal secretion.

Cutaneous Leishmaniasis : Leishmania tropica, L major, L infantum

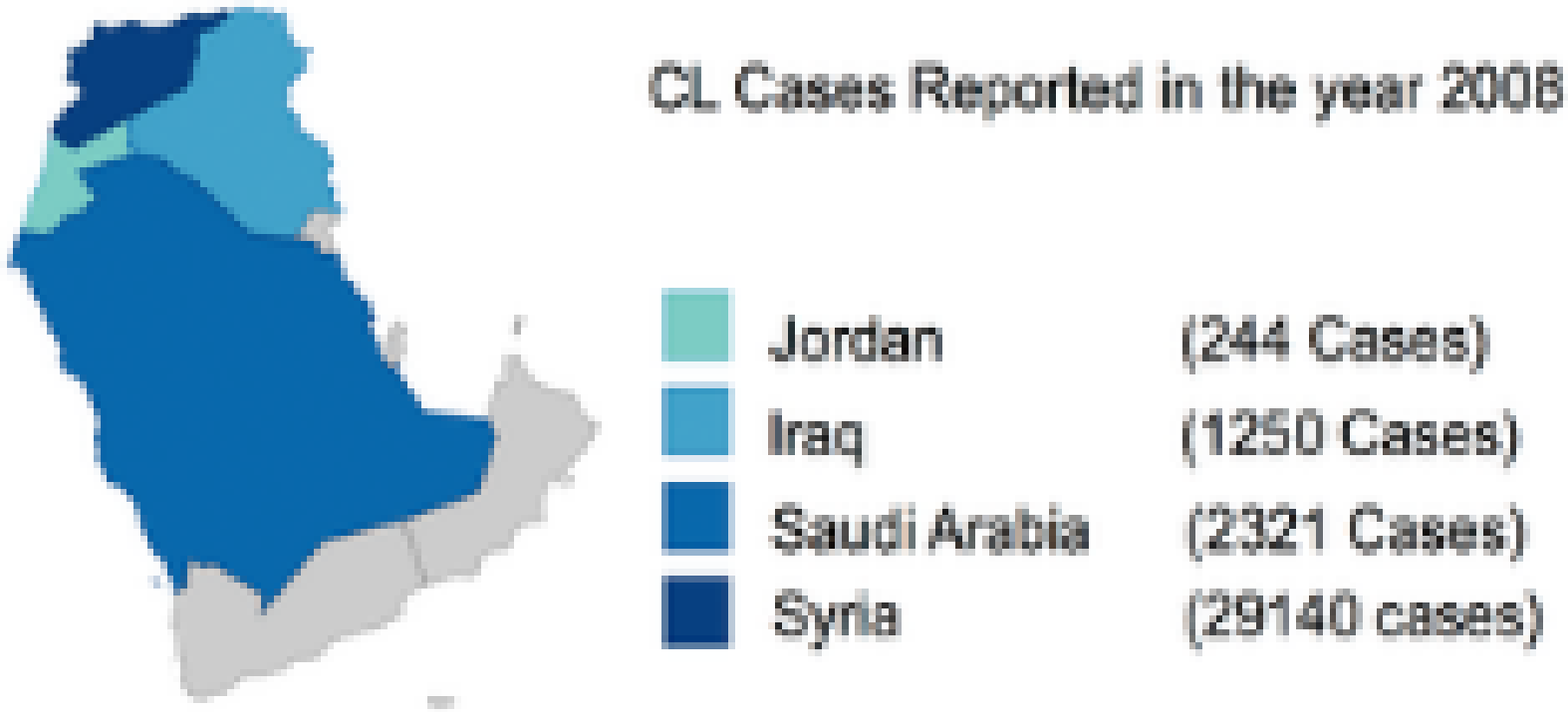
- **Habitat**: skin
- **Disease**: Cutaneous leishmaniasis
- **Clinical feature** : first sign is a **lesion** (generally a firm, The lesions begin as reddish , soft itchy papular , gradually enlarges ,raised and firm , with serous discharge at the bite site.

- **Epidemiology**: the Middle East , south America



Leishmania In Jordan

- In Jordan there are several species of Leishmania; Leishmania infantum, Leishmania tropica, and Leishmania major.
- Leishmania major is the major species of Leishmania parasite in Jordan .



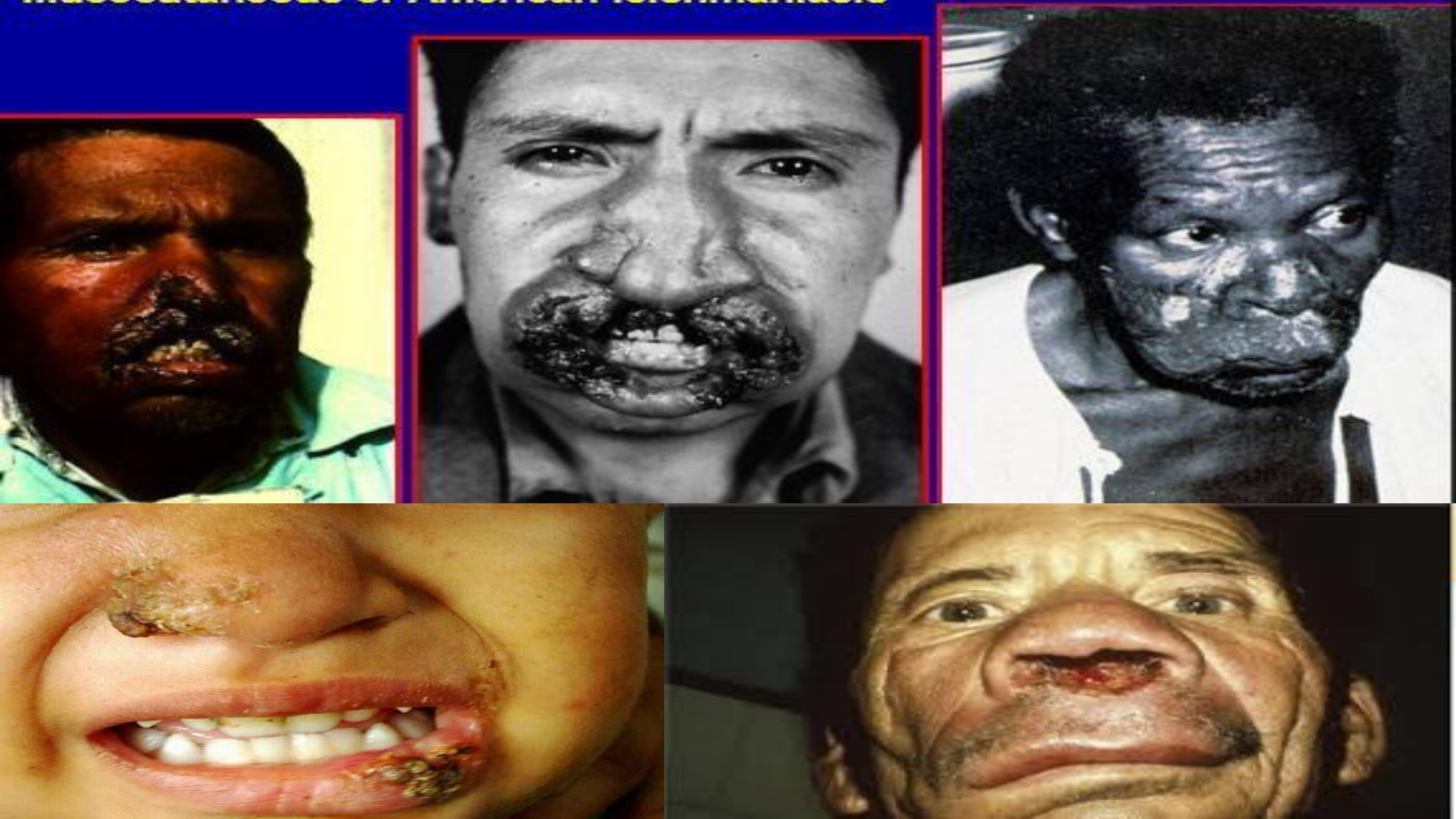

Courtesy: Amer Al-Jawabreh
Jericho-Palestine


courtesy: A. Al-Jawabreh

Mucocutaneous leishmaniasis(*L. braziliensis*)

- The primary lesions are similar to those found in cutaneous leishmaniasis.

- Dissemination to the nasal or oral mucosa may occur from the active primary lesion or may occur years later after the original lesion has healed.
- These mucosal lesions do not heal spontaneously, and secondary bacterial infections are common and may be fatal.



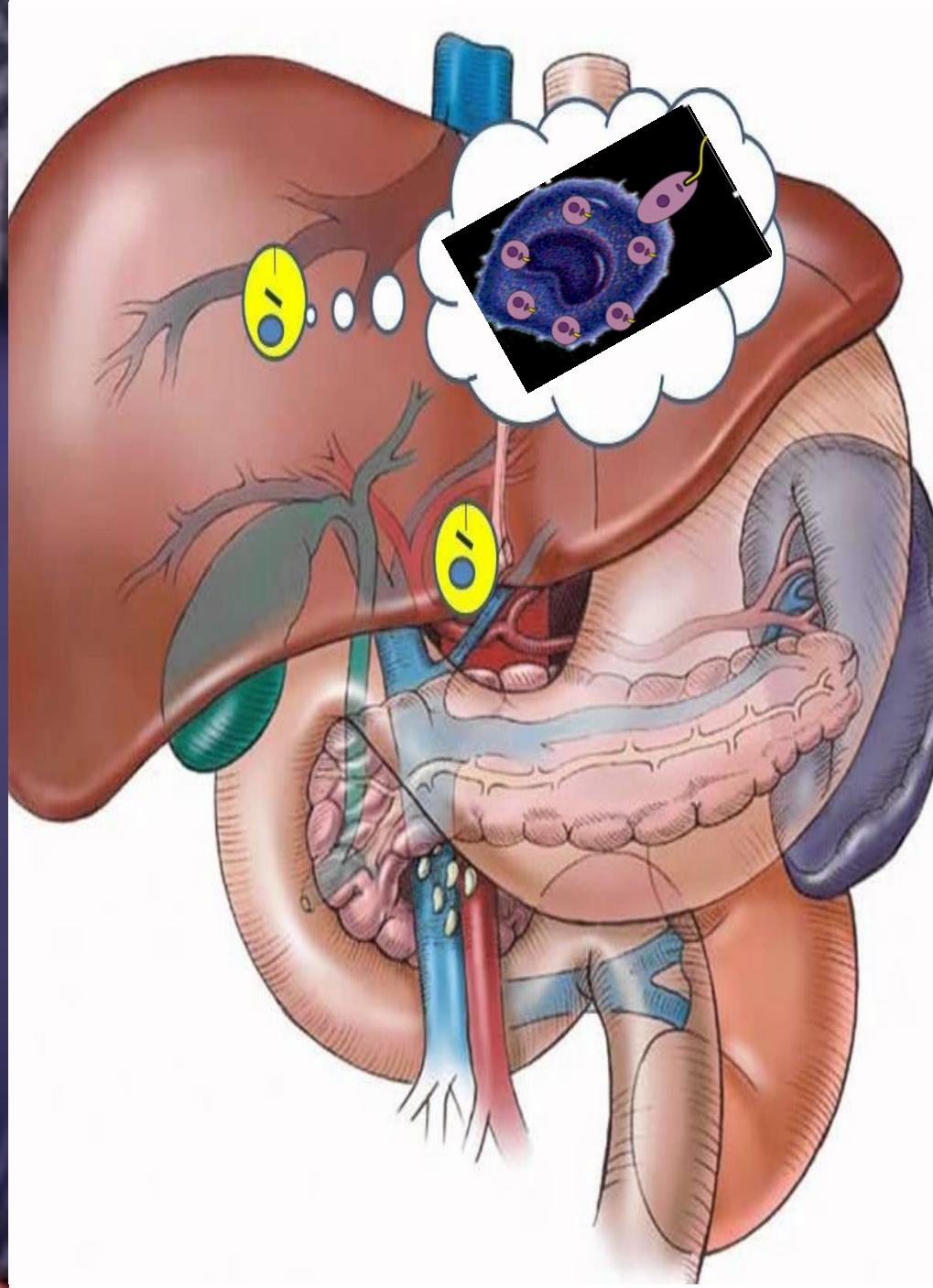
Visceral Leishmaniasis(*L.donovani*)

- Is the most severe form of leishmaniasis
- The parasite migrates to the internal organs such as the liver, spleen (hence "visceral"), and bone marrow

- **The incubation period** : 10 days to 2 years, usually
- **Symptoms** : fever, anorexia, malaise, weight loss, and, frequently, diarrhea
- **Clinical signs** : enlarged liver and spleen
  swollen lymph nodes
  occasional acute abdominal pain

if left untreated, will almost always result in the death of the host

Epidemiology: Bangladesh, Brazil, Ethiopia, India, South Sudan and Sudan.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LABORATORY DIAGNOSIS

1) **Stained blood smear**: aspiration, scraping
2) **Cultured** :cultured using special techniques

3) **ElISA ,IFA or direct agglutination** give useful indication of active or recent kala-azar .

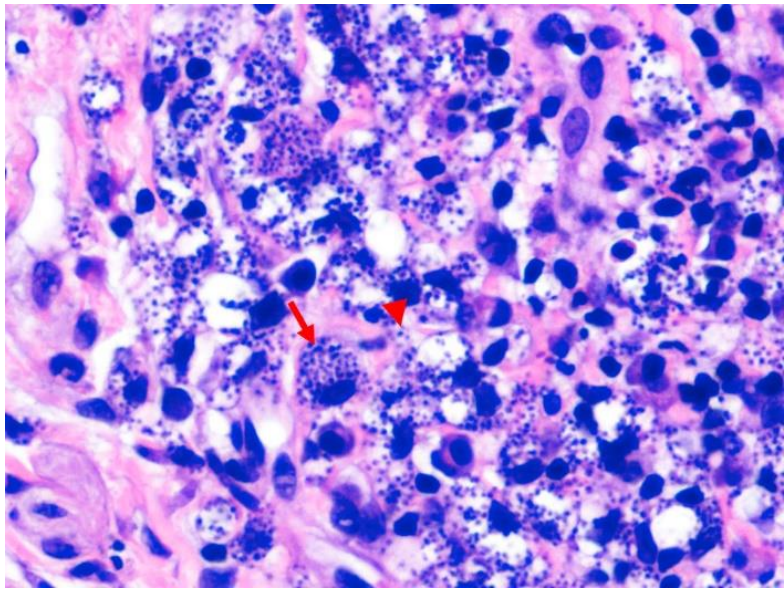
4) **PCR** methods have excellent sensitivity and specificity for direct detection

5-Intradermal Montenegro test :

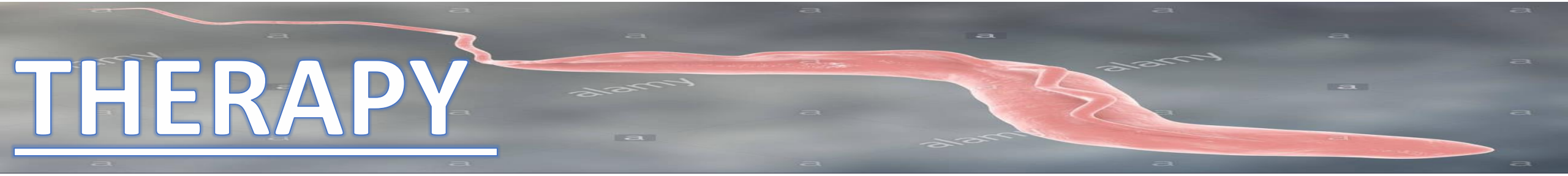
Injection of intradermal antigen prepared from cultured promastigotes of Leishmanian spp .

This produces a typical cell-mediated response .

6-Histologic examination by biopsy from tissue to demonstrate the presence of organism in the tissue.



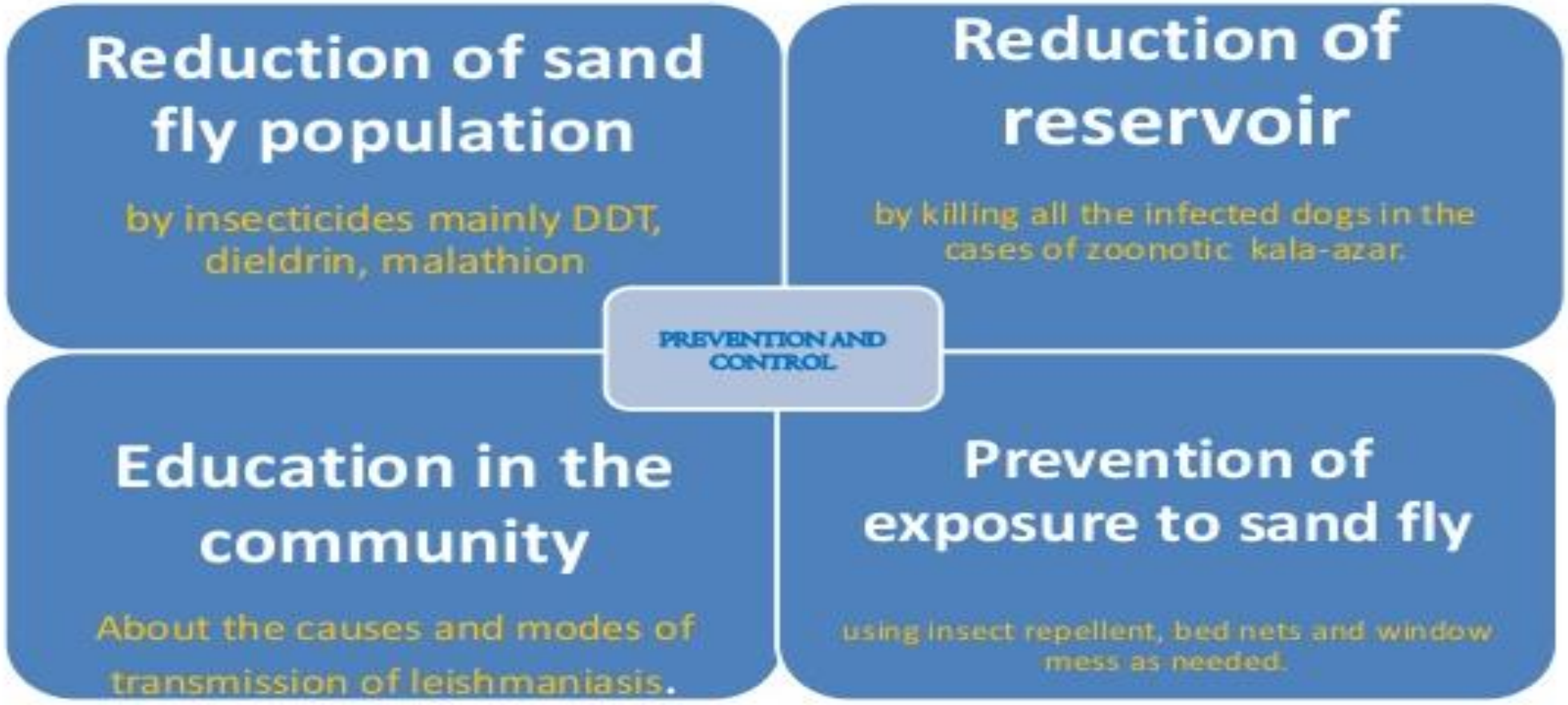
THERAPY



- The patient response varies depending on the Leishmania species and type of disease.

- In simple cutaneous leishmaniasis, lesions usually heal spontaneously
- **Antimony ,sodium stibogluconate** drugs of choice for the treatment of visceral leishmaniasis.

PREVENTION



There are No Vaccines to prevent leishmaniasis.

The End