

# LEISHMANIA DONOVANI

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The genus *Leishmania* is named after **Sir William Leishman**, who discovered the flagellate protozoa. The *Leishmania donovani* is a digenetic, intracellular protozoan parasite causing “Kala-azar” the Indian visceral leishmaniasis.

All members of the genus *Leishmania* are obligate intracellular parasites that pass their life cycle in two hosts: the mammalian host and the insect vector, female sandfly (*Phlebotomus argentipes*)

Three different diseases are caused by various species of genus *Leishmania* in the world. These are:

1. **Visceral leishmaniasis:** *L. donovani* complex with 3 species (*L. donovani*, *L. infantum*, and *L. chagasi*); infecting internal organs (liver, spleen and bone marrow) of human is the causative parasite.
2. **Cutaneous leishmaniasis:** The *L. mexicana* complex with 3 main species (*L. mexicana*, *L. amazonensis*, and *L. venezuelensis*); *L. tropica*; *L. major*; *L. aethiopica*; are the causative parasite.
3. **Mucocutaneous leishmaniasis:** It is caused by *L. braziliensis*.

**Sir William Leishman**, a British Medical Officer in 1900, observed the parasite in the spleen smears of a soldier who died of “dumdum fever” or Kala-azar occurred in Dum Dum, Calcutta, and reported the finding from London in 1903.

In the same year, **Charles Donovan**, in Madras reported the same parasite from a patient.

Therefore, the name *Lieshmania donovani* was given for the parasite.

***Leishmania donovani* is a digenetic, intracellular protozoan parasite causing visceral leishmaniasis (kala-azar) by infecting macrophage cells in the liver, spleen, and bone marrow. It exists as non-motile amastigotes in human macrophages and flagellated promastigotes in the *Phlebotomus* sandfly vector**

# Classification

- . **Phylum:** Sarcomastigophora
  - . **Subphylum:** Mastigophora
    - . **Class:** Zoomastigophorea
      - Order:** Kinetoplastida
        - . **Family:** Trypanosomatidae
          - . **Genus:** *Leishmania*
            - . **Species:** *donovani*

- **Habitat:** It is an intracellular parasite found in the macrophages of the spleen, liver, bone marrow, and lymph nodes (reticulo-endothelial system) of humans.
- **Digenetic Life Cycle:** It requires two hosts: humans (or mammals) as the definitive host and the female *Phlebotomus* sandfly as the vector/intermediate host.

## • **Dimorphic Structure:**

**Amastigote Form (LD Body):** Found in human cells. It is oval/spherical (3–6  $\mu$ m long), non-motile, lacks an external flagellum, and has a large nucleus and kinetoplast.

**Promastigote Form:** Found in the sandfly midgut. It is elongated/spindle-shaped (15–30  $\mu$ m long), motile, and has a long anterior flagellum.

**1. Human infection is caused by about 21 of 30 species that infect mammals.**

These include the ***L. donovani complex*** with 3 species (*L. donovani*, *L. infantum*, and *L. chagasi*);

The ***L. mexicana complex*** with 3 main species (*L. mexicana*, *L. amazonensis*, and *L. venezuelensis*);

*L. tropica*; *L. major*; *L. aethiopica*; and

the **subgenus *Viannia*** with 4 main species

(*L. (V.) braziliensis*, *L. (V.) guyanensis*, *L. (V.) panamensis*, and *L. (V.) peruviana*)

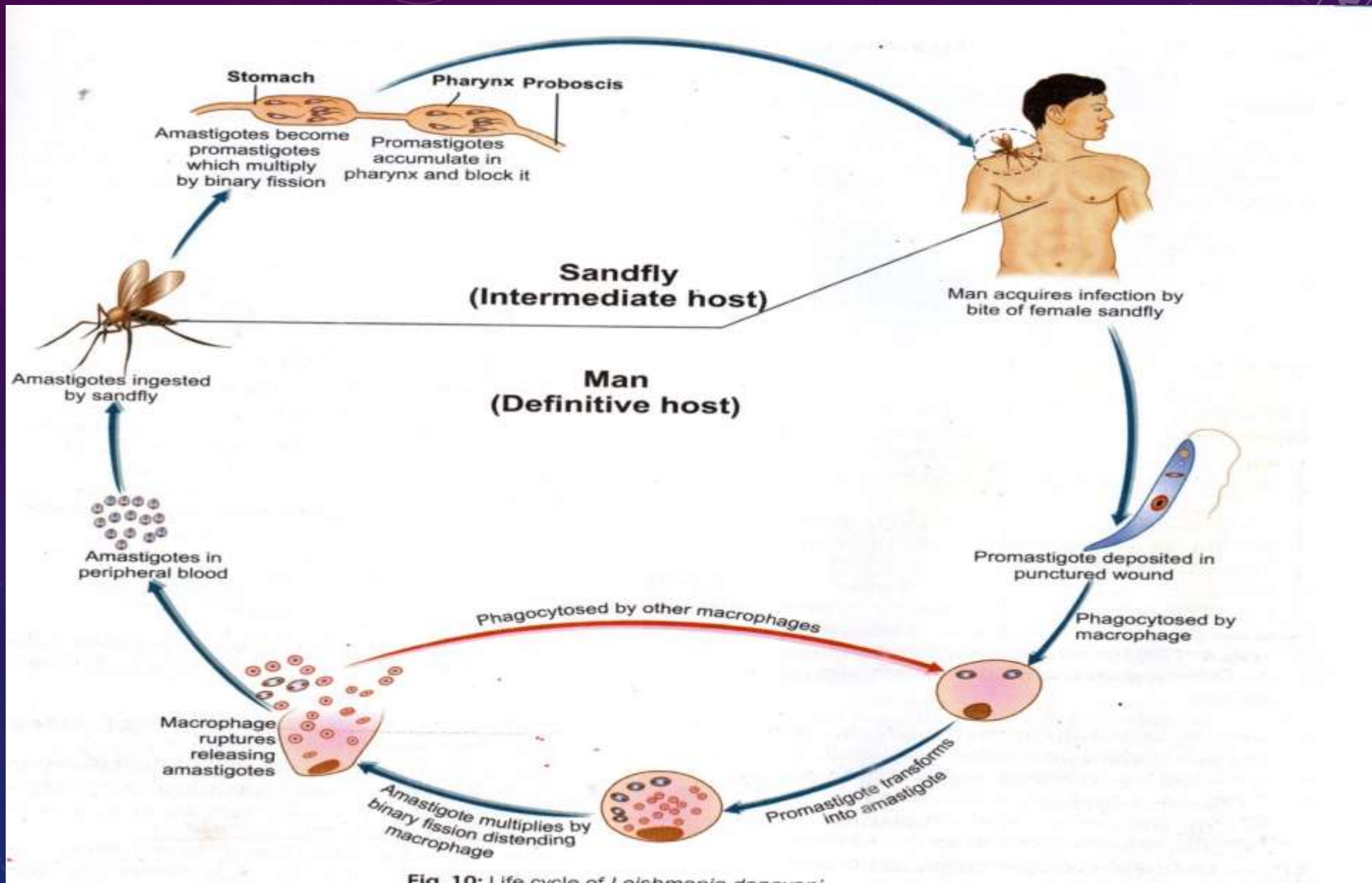


Fig. 10: Life cycle of *Leishmania donovani*

## **Infective form:**

**Promastigote form present in the midgut of female sandfly is the infective form of the parasite.**

## **Life Cycle in the Human Host (Intracellular):**

**Humans acquire the infection by the bite of an infected female sandfly during a blood meal, and it injects flagellated, motile promastigotes into the human skin.**

These Promastigotes are engulfed by the cells of the reticuloendothelial system (phagocytized by macrophages , monocytes and other mononuclear phagocytic cells). Inside these cells, they transform into rounded, non-flagellated amastigotes within the cells.

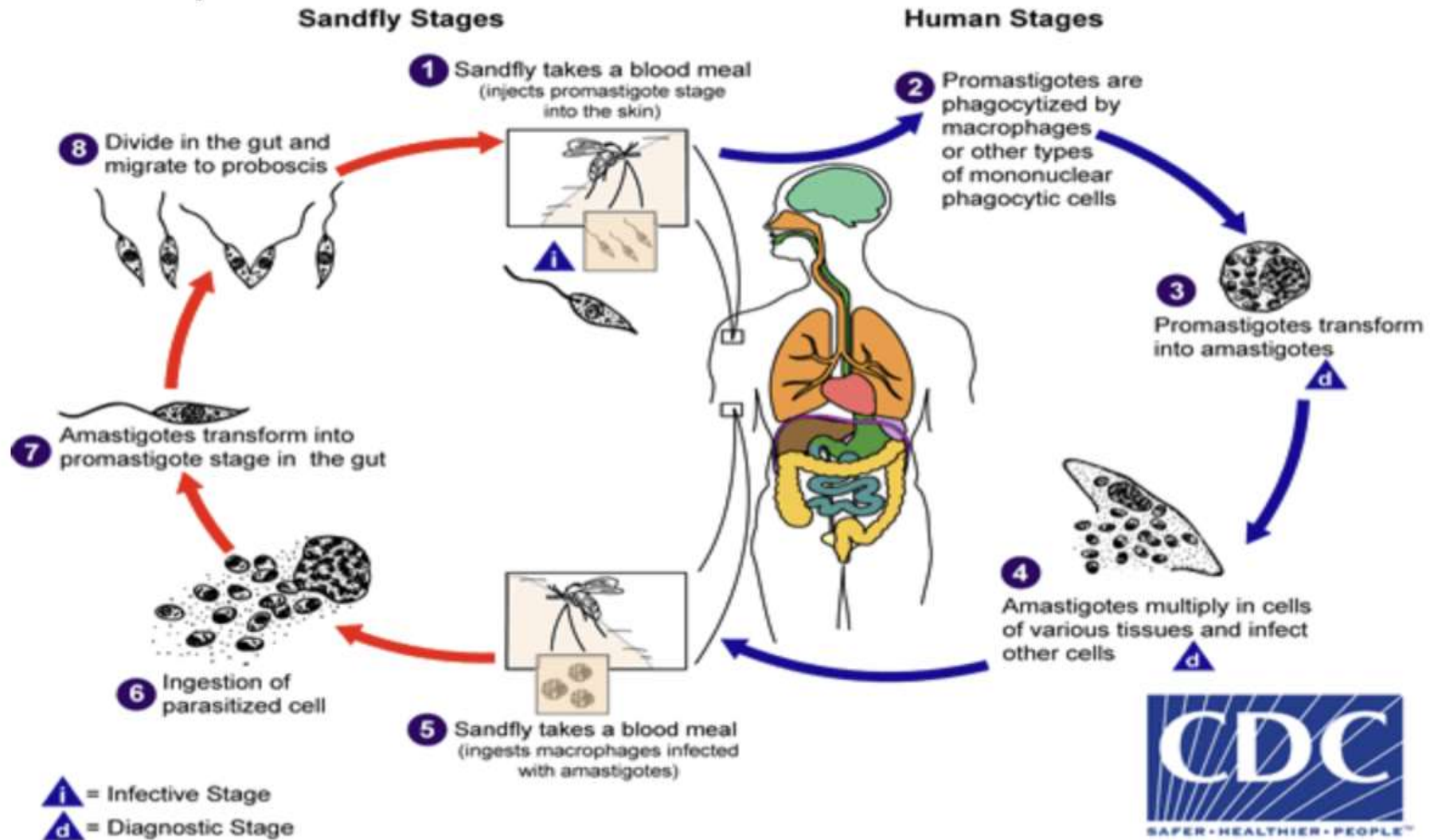
**Amastigotes** multiply by binary fission within the macrophages.

**The multiplication continues producing numerous daughter cells until the macrophage cell ruptures, releasing many amastigotes into the bloodstream.**

**These liberated amastigotes are phagocytosed by new macrophages and histiocytes, continuing the cycle and spreading to the liver, spleen, and bone marrow.**

**Small number of **LD (Leishman-Donovan)** bodies can be found in peripheral blood inside neutrophils or monocytes.**

# Life Cycle



## **Life Cycle in the Sandfly Vector (Extracellular):**

**A sandfly becomes infected when it takes a blood meal from an infected human, ingesting macrophages laden with amastigotes present in the peripheral blood and tissue fluids.**

**In the sandfly's midgut, the amastigotes are released and transform into flagellated, and develop into elongated promastigote form.**

**Development & Migration:** Promastigotes multiply by longitudinal binary fission in the fly's alimentary canal. They may be seen as **rosettes with their flagella entangled**. In the Sandfly, they migrate from the midgut to the pharynx and hypostome, and reach the proboscis (hypopharynx/labial palps) of the fly.

**In some cases, the accumulation of the promastigote in the pharynx blocks the passage, making difficulty in sucking blood.**

**The infective promastigotes are transmitted to a new human host during the next blood meal.**

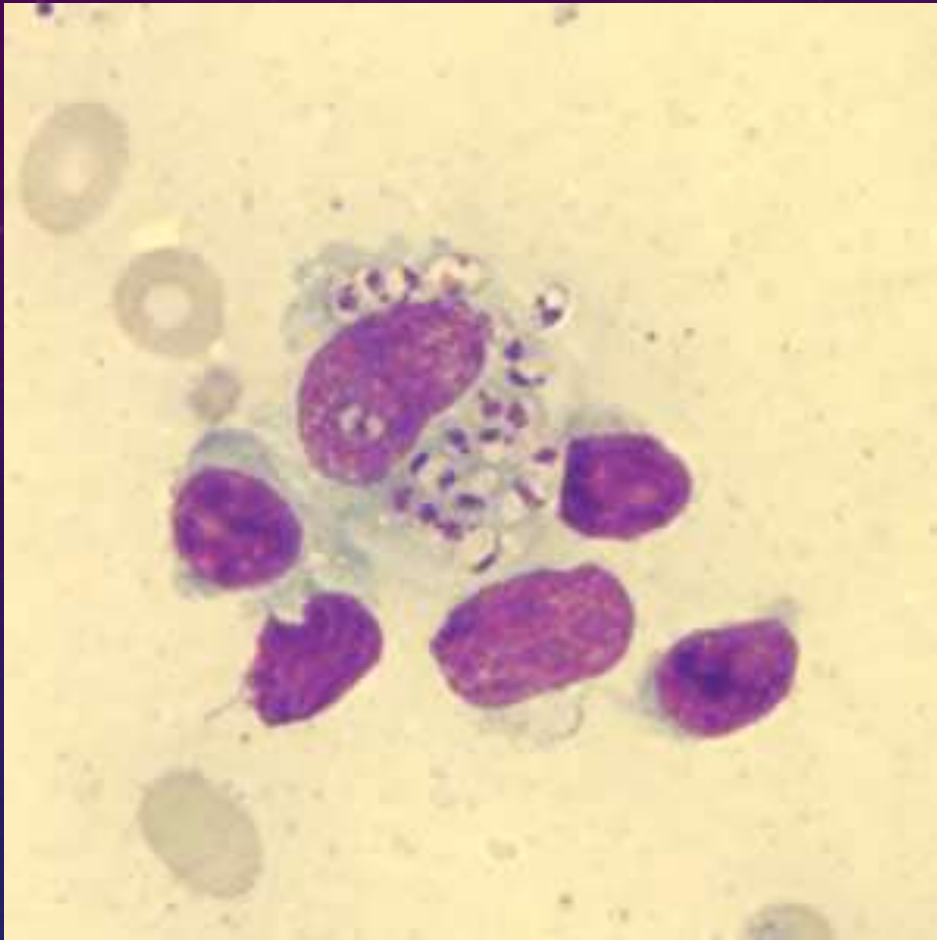


Figure A: *Leishmania* sp. amastigotes in a Giemsa-stained tissue scraping.



Figure B: *Leishmania (Viannia) panamensis* amastigotes in a Giemsa-stained tissue scraping. Identification to the species level is not possible based on morphology and other diagnostic techniques such as isoenzyme assay or PCR are needed.

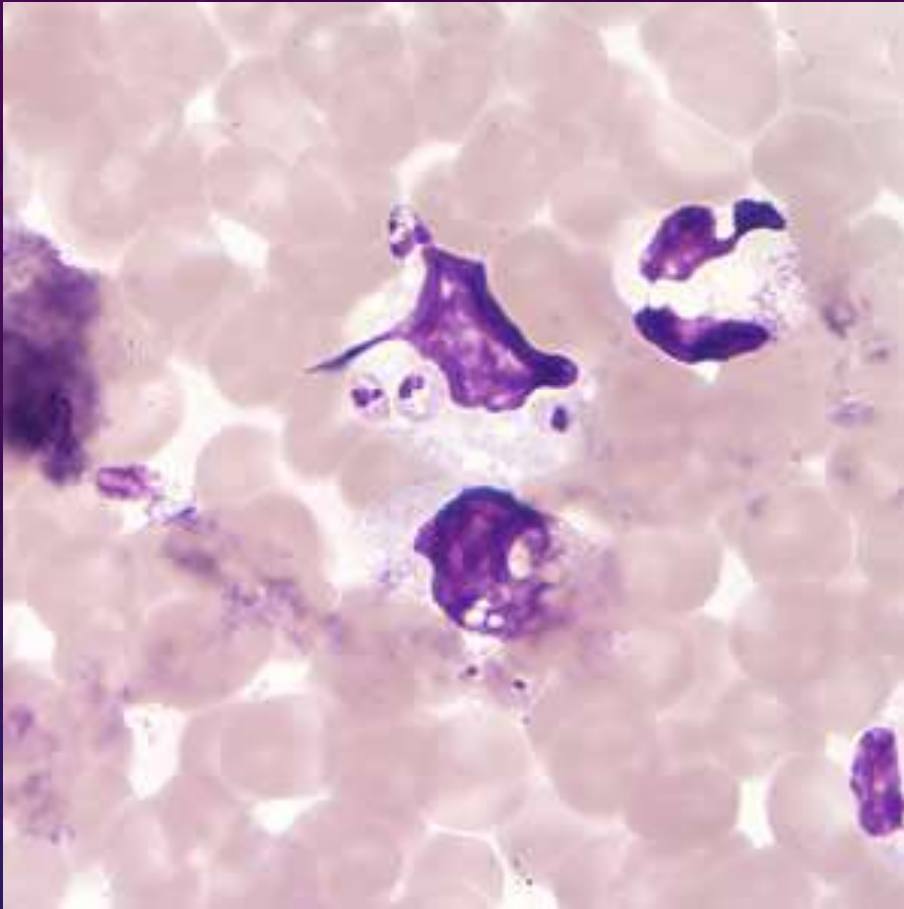


Figure C: *Leishmania (Viannia) panamensis* amastigotes in a Giemsa-stained tissue scraping.

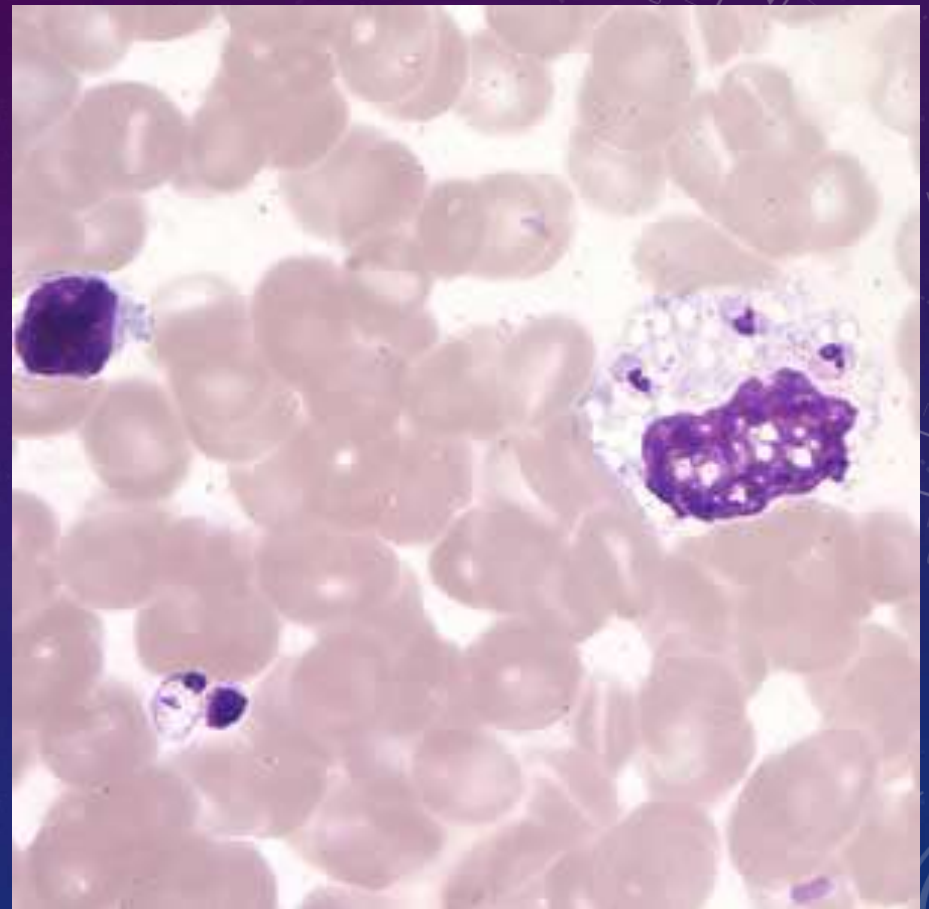
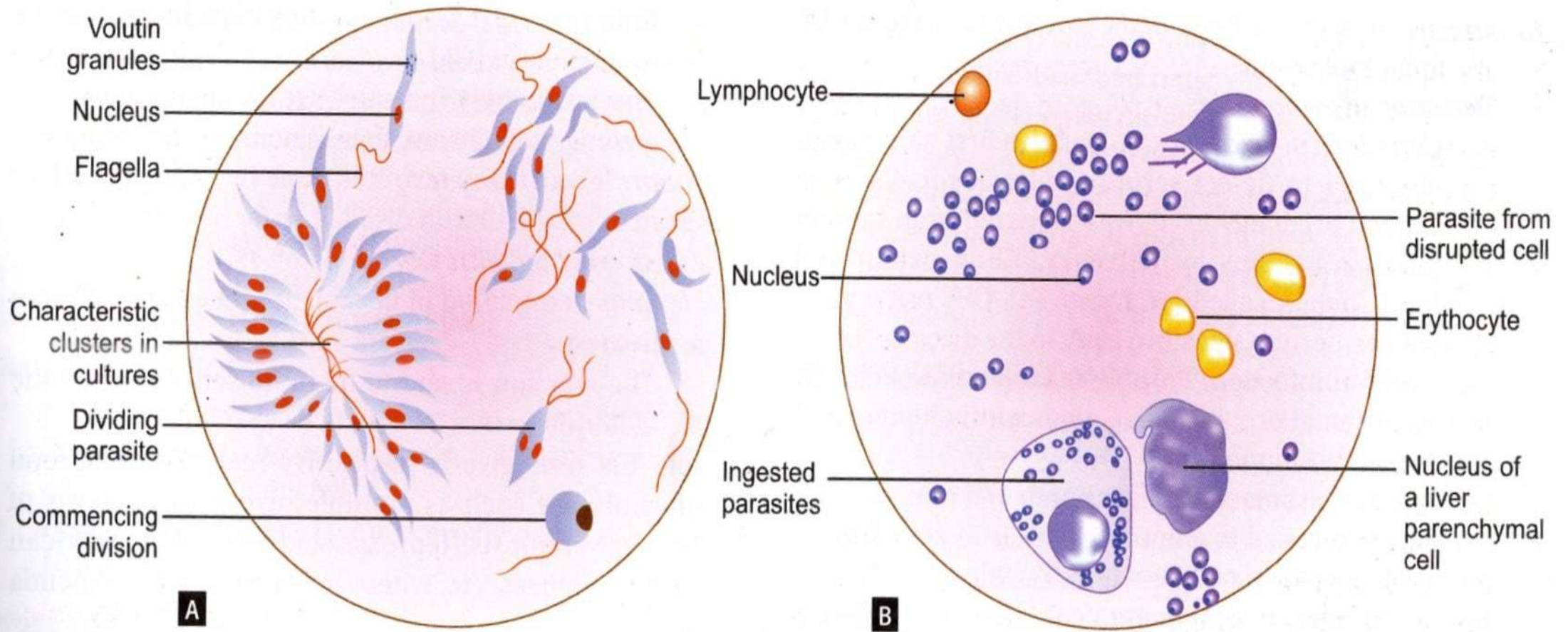


Figure D: *Leishmania (Viannia) panamensis* amastigotes in a Giemsa-stained tissue scraping.

## **Geographic Distribution (Epidemiology)**

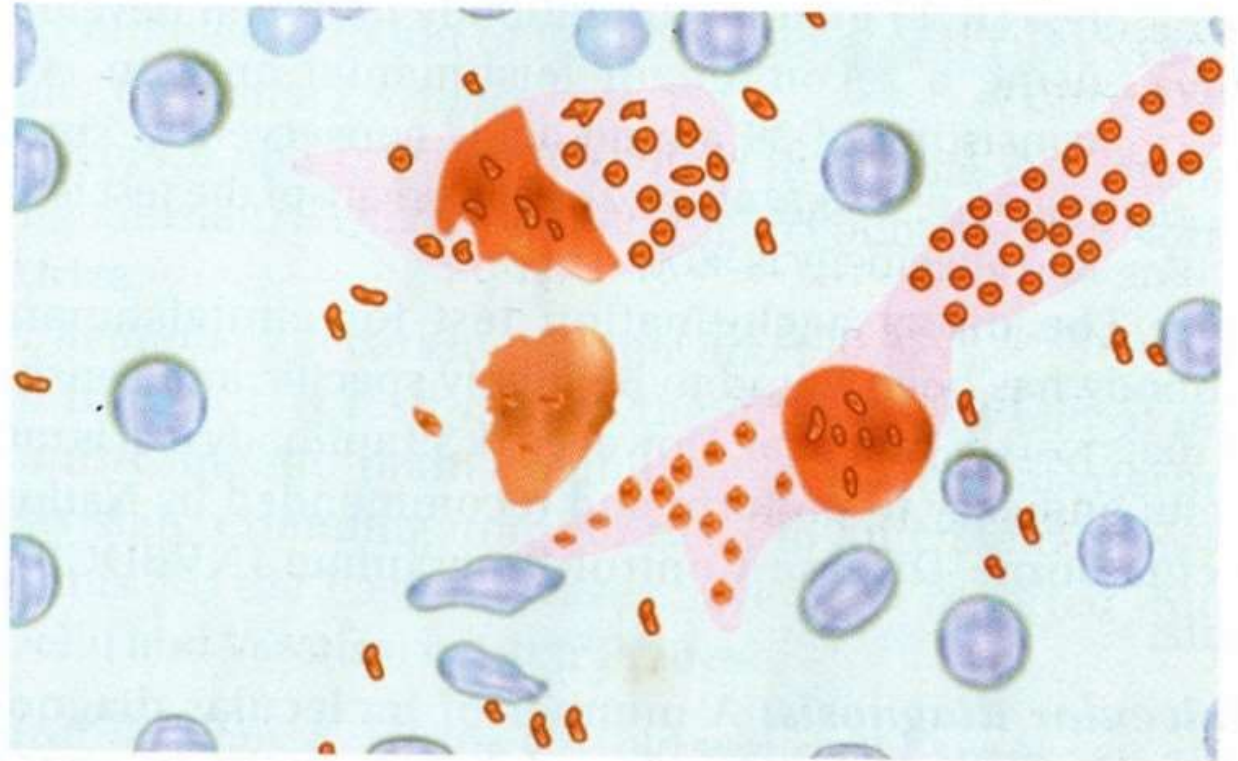
**Leishmaniasis is found in parts of about 88 countries. Approximately 350 million people live in these areas. Most of the affected countries are in the tropics and subtropics. The settings in which leishmaniasis is found range from rain forests in Central and South America to deserts in West Asia. More than 90 percent of the world's cases of visceral leishmaniasis are in India, Bangladesh, Nepal, Sudan, and Brazil.**

**Leishmaniasis is found in Mexico, Central America, and South America—from northern Argentina to Texas (not in Uruguay, Chile, or Canada), southern Europe (leishmaniasis is not common in travelers to southern Europe), Asia (not Southeast Asia), the Middle East, and Africa (particularly East and North Africa, with some cases elsewhere).**



**Figs 13A and B:** *Leishmania donovani*. (A) Culture form (Giemsa stain, magnification 1100X); and (B) Liver smear (Giemsa stain, magnification 1100X)

**Pathogenicity of Leishmaniasis donovani:**  
**Human Leishmaniasis encompasses multiple clinical syndromes, most notably visceral, cutaneous, and mucosal forms. Infections can result in two main forms of disease, cutaneous leishmaniasis and visceral leishmaniasis (kala-azar).**



**Fig. 14:** Leishman-Donovan (LD) body in spleen smear of experimentally infected animal (Giemsa stain)

**Cutaneous leishmaniasis** is characterized by one or more cutaneous lesions on areas where sandflies have fed. Persons who have cutaneous leishmaniasis have one or more sores on their skin. The sores can change in size and appearance over time

**The parasitised macrophages disseminate the infection to all parts of the body. The spleen is the most affected organ.**

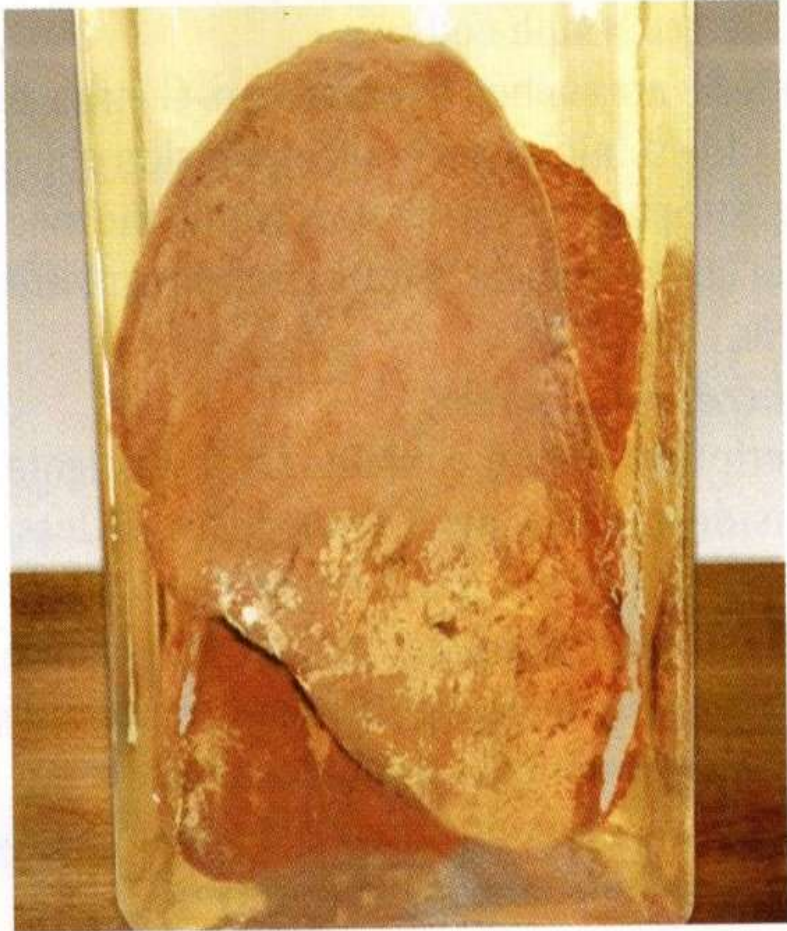
**The Kupffer cells and vascular endothelial cells of the Liver are heavily parasitised, but hepatocytes are not affected, although prothrombin production is commonly decreased.**

**The bone marrow is also heavily parasitised. Severe anemia with haemoglobin levels of 5-10 g/dl may occur in Kala-azar.**

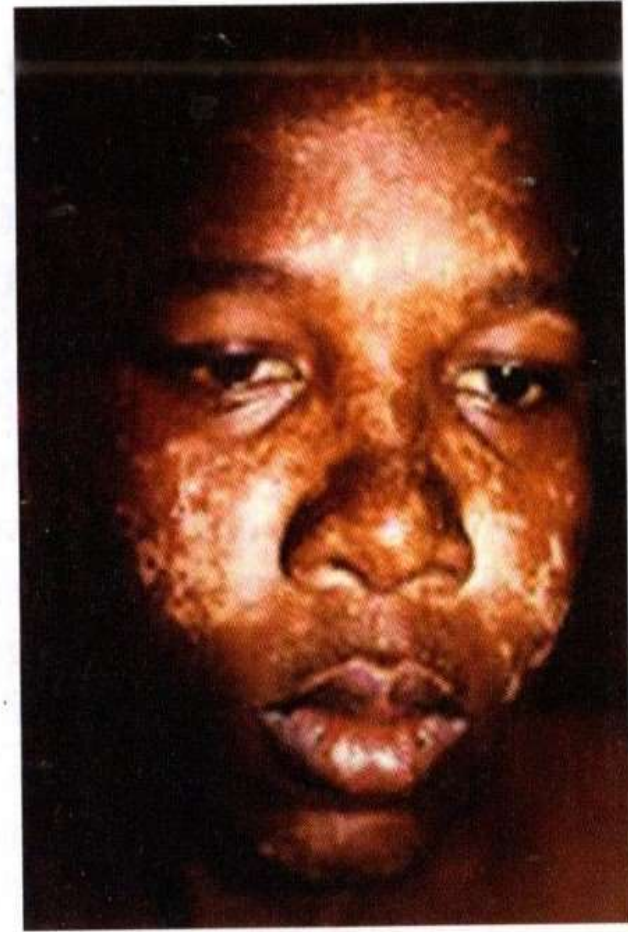
**The clinical illness begins with high –grade fever which may be remittent with twice daily or less commonly continuous.**

**About 3-10% cases of patients of VL in endemic areas develop PKDL (Post Kala-azar dermal leishmaniasis)**

**Persons who have visceral leishmaniasis usually have fever, weight loss, and an enlarged spleen and liver (usually the spleen is bigger than the liver).**



**Fig. 11:** Kala-azar spleen showing a greatly enlarged organ



**Fig. 12:** Erythematous patches (Butterfly distribution)

# References:

1. Centers for Disease Control and Prevention | CDC (.gov)  
<https://www.cdc.gov/dpdx/leishmaniasis>
2. Paniker's Textbook of Medical Parasitology- 8<sup>th</sup> Edition-  
Sougata Ghosh, MD DCH

The background is a dark blue gradient with faint, light blue technical diagrams and circular patterns. These include concentric circles, dashed lines, and arrows, suggesting a technical or scientific theme. The text 'THANK YOU' is centered in a bold, white, sans-serif font.

**THANK YOU**