Leishmania donovani

Presented by

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INTRODUCTION

- ***Leishmania*** is a genus of trypanosomatid protozoa, which causes a fatal vector-borne parasitic disease called Leishmaniasis .

- It is spread by the bite of sandflies of the genus *Phlebotomus* in the Old World, and of the genus *Lutzomyia* in the New World.

- **Leishmaniasis** is the second-largest parasitic killer in the world (after malaria) and is endemic in many parts of Africa, Asia and South America.

HISTORY

- The parasite was named by Ronald Ross in 1903 after the Scottish pathologist William Boog Leishman.

- In 1901, Leishman identified the organism in smears taken from the spleen of a patient who had died from "dum-dum fever".

CLASSIFICATION

• Kingdom	Protista
• Subkingdom	Sarcomastigophora
• Phylum	Protozoa
• Subphylum	Mastigophora
• Class	zoomastigophora
• Order	Kinetplastida
• Genus	*Leishmania*
• Species	*donovani*, *tropica*, *mexicana*, *braziliensis*, etc.

IMPORTANT SPECIES

- *L. donovani*
- *L. tropica*
- *L. mexicana*
- *L. braziliensis*
- *L.major*
- *L.guyanensis*
- *L.lainsoni*
- *L.naiffi*
- *L.aethiopica, etc*

HABITAT

(*L.donovani*)

- Are essentially the parasites of visceral organs.
- Promastigote forms found in sand fly and in culture.
- Amastigote forms found in man in

  reticuloendothelial cells *of*

  spleen,

  bone marrow,

  liver,

  intestinal mucosa,

  mesentric lymph node.

HABITAT OF OTHER SPECIES

	L.donovani	*L. tropica*	*L.mexicana*	*L. braziliensis*
Parasites of	Visceral organs	Skin	Skin	Skin and mucus membrane of nose and buccal cavity
Amastigote form found in	Human Reticuloendothelial cells of •spleen, • bone marrow , • liver •intestinal mucosa	Human •Reticuloendothelial cells of skin	Human •Reticuloendothelial cells of skin	Human •Macrophage of skin •Mucous membrane of nose and buccal cavity
Promastigote form found in	Sand fly and culture	Sand fly and culture	Sand fly and culture	Sand fly and culture

Morphological Differences

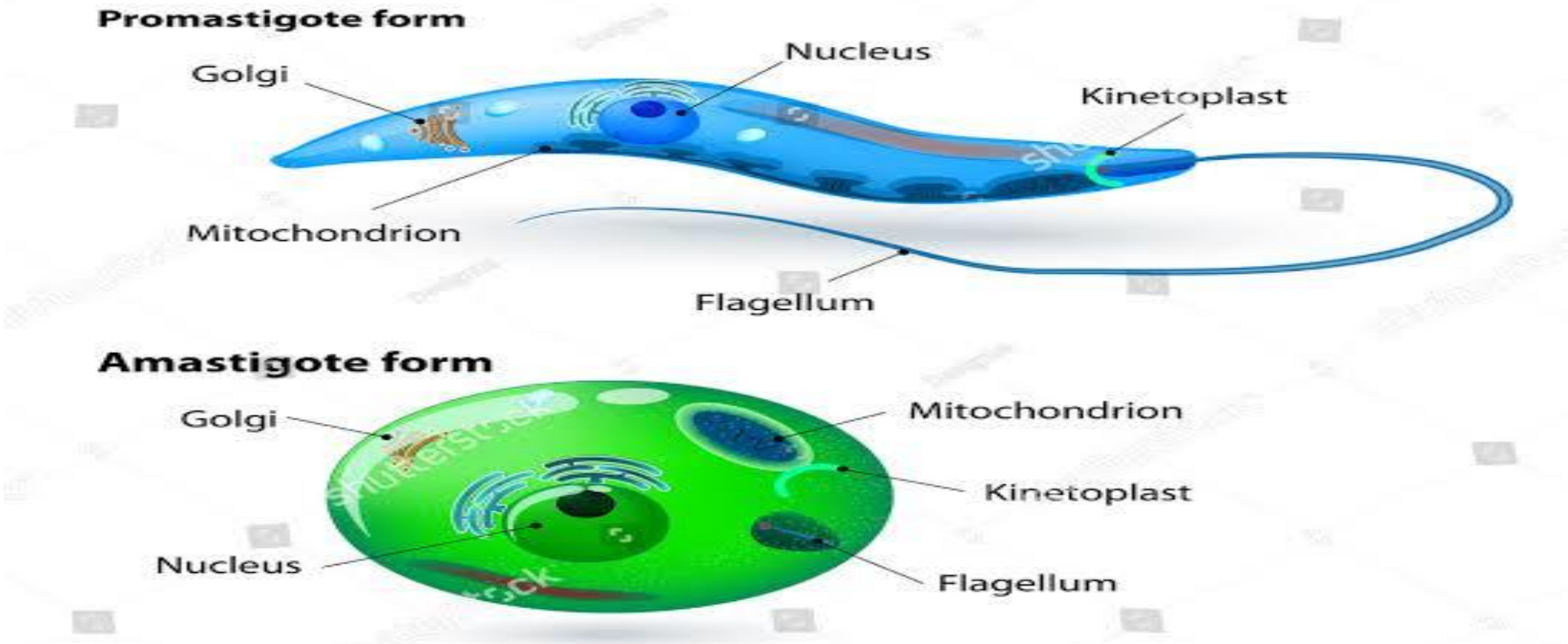
Amastigotes

- Aflagellar stage
- Occurs in the vertebrate host
- divides by binary fission at **37°C.**
- There are round or oval ;2-4µm along longitudinal axis.
- Nucleus relatively larger and situated centrally.
- Kinetoplast situated right angle to nucleus.

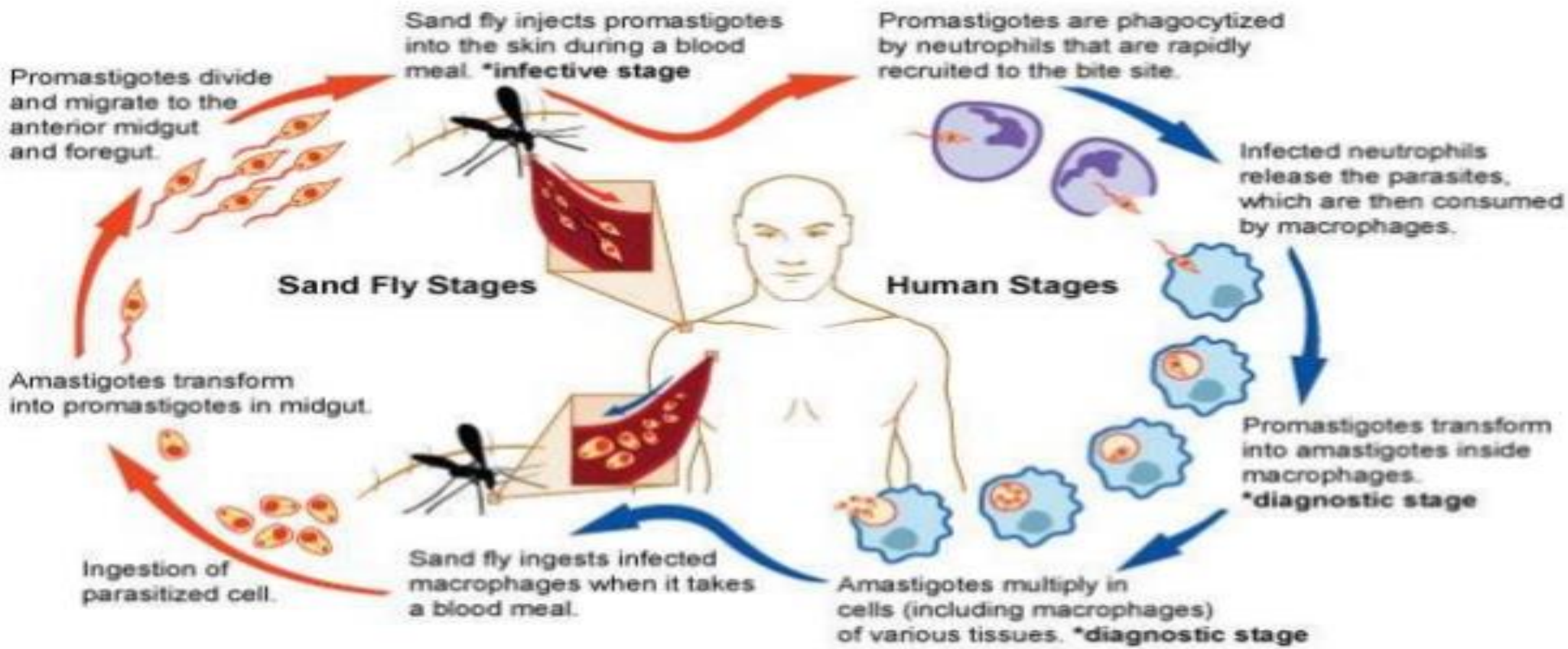
Promastigotes

- Flagellar stage
- Occurs in the sand fly
- divides by binary fission at **27°C.**
- They are spindle shaped ; 15-20 µm in length & 1-2µm in width.
- Nucleus smaller and situated in the middle of the cell or along the side of cell-wall.
- Kinetoplast lies transversely near the anterior end.

Leishmania



LIFE CYCLE (*L.donovani*)



Life cycle of other species of *Leishmania* are similar to *L.donovani* except that

In *L.tropica*

- amastigotes reside in the large mononuclear cells of the skin

In *L.mexicana*

- Amastigotes found in reticuloendothelial cells and lymphatic tissues of skin

In *L.braziliensis*

- amastigotes are found in reticuloendothelial cells and lymphatic tissues of skin and mucus membrane

MODE OF TRAMSMISSION

(*L.donovani*)

1. Mainly by the bite of sand fly (vector) Phlebotomus argentipus
2. Les frequently by

- blood transfusion,
- congenital infection,
- accidental inoculation of cultured promastigotes in the lab. workers, and
- sexual intercourse.

❑ Males are affected more (due to increased exposure to sand flies through the occupation and leisure activities).

RESERVOIR
(*L.donovani*)

- Human:- in Indian subcontinent
- Rodents:- in Africa
- Foxes:- in Brazil and Central Asia
- Dogs :- In Mediterranean and China

Reservoir, vector and transmission of other species

	L.donovani	*L.tropica*	*L.mexicana*	*L.braziliensis*
Reservoir	Man, rodents, foxes, dogs	Man, Dog	Sloth, ant eater, rat, dog	Sloth, ant eater, rat, dog
Vector	Sand fly *Phlebotomus argentipus*	Sand fly *Phlebotomus argentipus*	Sand fly *Lutzomyia spp.,*	Sand fly *Lutzomyia spp.,*
Mode of transmission	•Bite of sand fly •blood transfusion •Congenital infection •sexual intercourse	Bite of sand fly	•Bite of sand fly, •Bite of ticks , •autoinfection	•Bite of sand fly, •Bite of ticks , •autoinfection
Individual at risk	Males are affected more	Adolescents and young adults	Persons working at the edge of forest and in the people staying in rural areas.	Persons working at the edge of forest and in the people staying in rural areas.

VECTOR

(Sand fly)

- *Phlebotomas*
- *Lutzomyia*

CLINICAL MANIFESTATIONS

1. Pyrexia
2. Spleen enlargement
3. Lymphadenopathy
4. Darkening of the skin (*KALA AZAR*, MEANING "BLACK FEVER" IN HINDI, BECAUSE OF ITS TENDENCY TO DISCOLOR ITS VICTIM'S COMPLEXION DURING ADVANCED STAGES)
5. Others:- kala-azar with HIV co-infection

   Post kala-azar dermal leishmaniasis(PKDL)

- Complications:- pneumonia, TB, dysentery, uncontrolled haemorrhage
- Prognosis:- With an early treatment, cure rate >90%

  If not treated, death occurs within 2 years.

CLINICAL MANIFESTATIONS OTHER SPECIES

L.tropica

- Oriental sore
- Acute necrotizing lesion
- scar

L.mexicana

- Chiclero ulcer
- Indolent nodular lesion

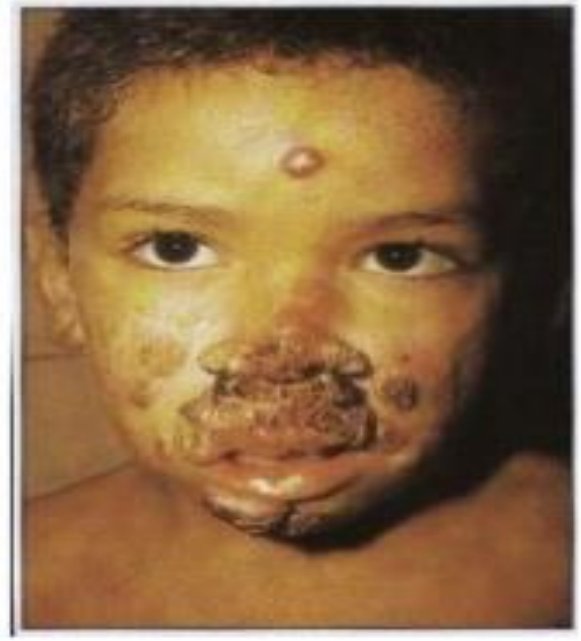
L.braziliensis

- Espundia
- Uta
- Pian bois

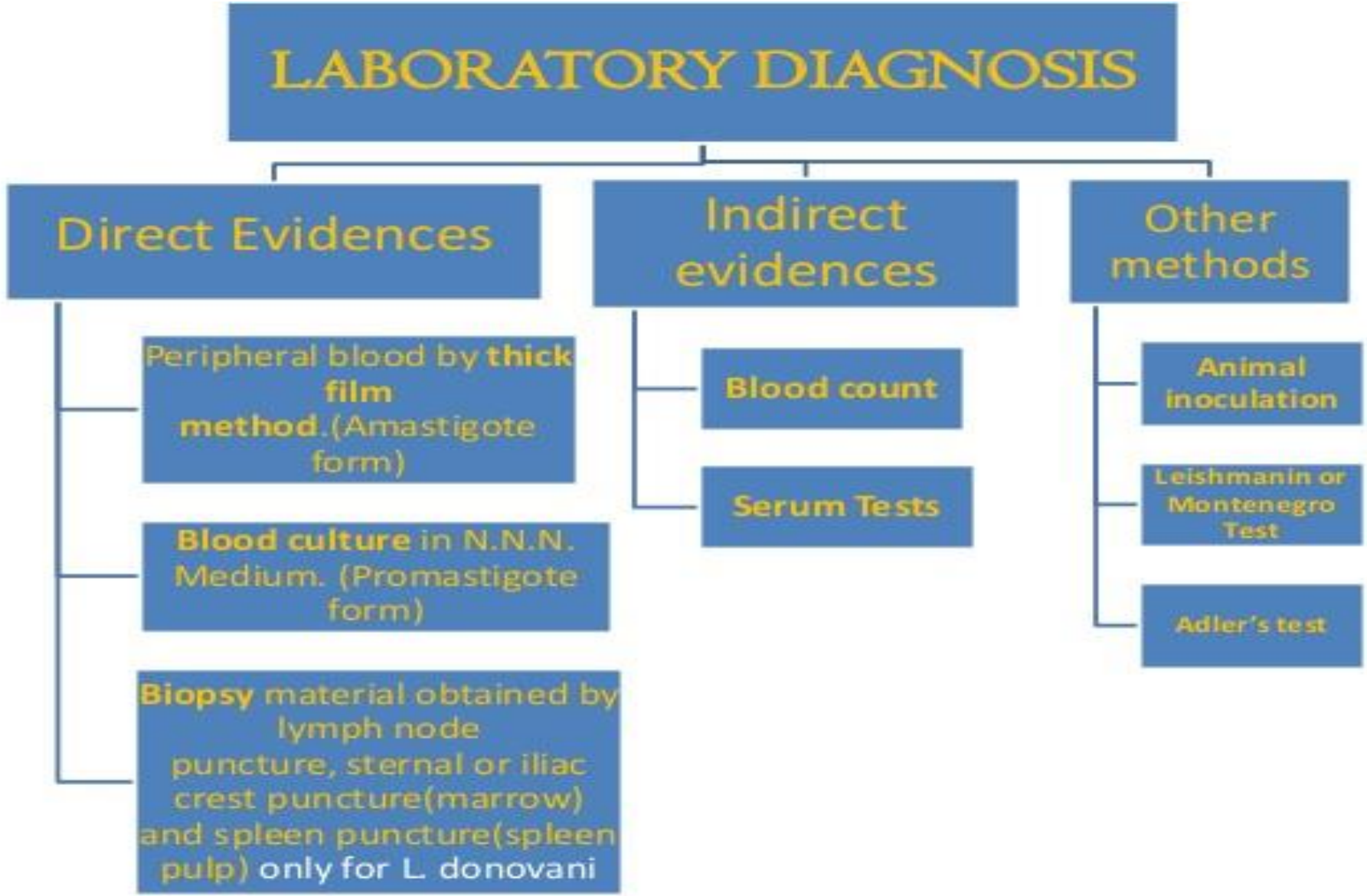
....continued

3. **Mucocutaneous leishmaniasis(MCL)**

- Caused by *L. braziliensis* and occasionally by *L.panamensis*
- Part of the body affected most is skin and mucous membrane of nose and pharynx

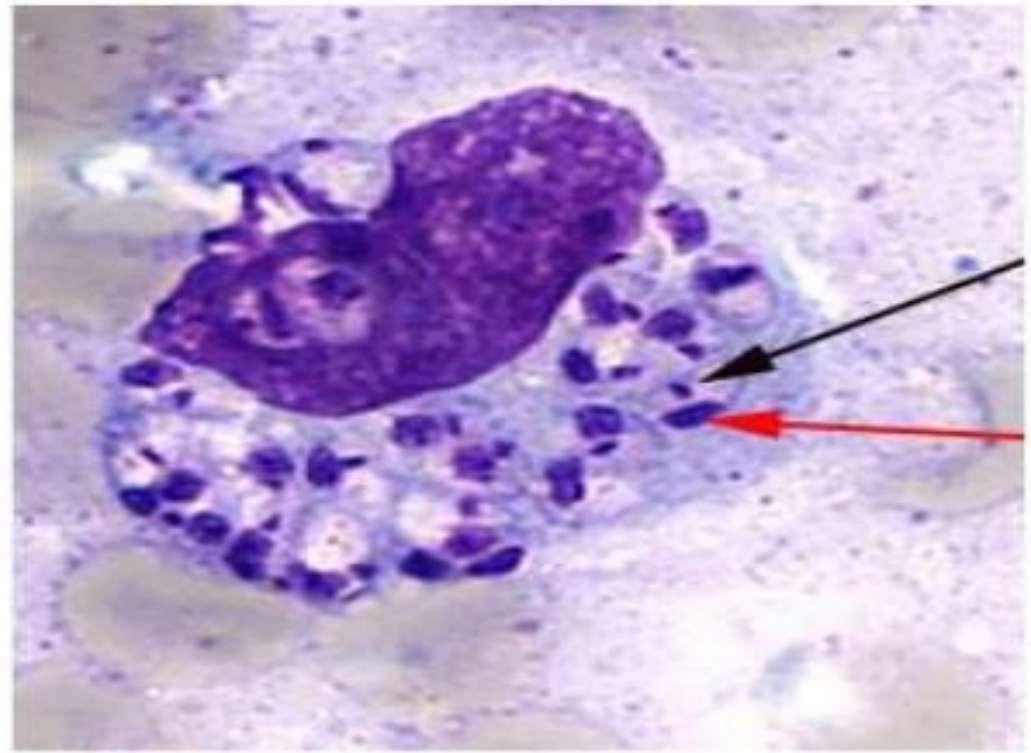


LABORATORY DIAGNOSIS



Direct Evidences (contd.....)

1. **Peripheral blood by thick film method.(Amastigote form)**



Amastigotes in a macrophage

Direct Evidences (contd.....)

2. **Blood culture** in N.N.N. Medium. (Promastigote form)

Promastigote from culture in NNN medium

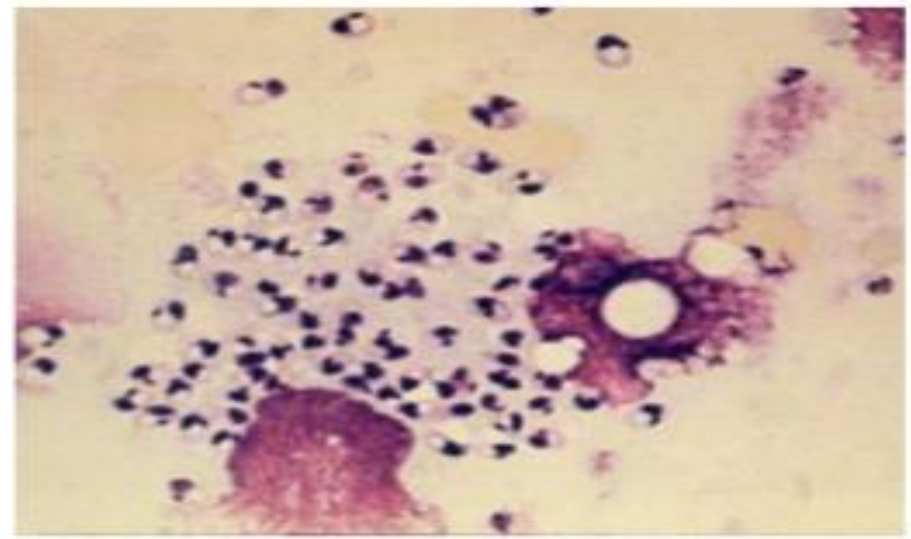
Direct Evidences (....contd)

3. **Biopsy** material obtained by

- lymph node puncture,
- sternal or iliac crest puncture(marrow) and
- spleen puncture(spleen pulp)

Amastigote form in a stained smear

Promastigote in culture in NNN medium



Amastigotes of *L. donovani.*
Splenic aspirate.

Indirect evidences

1. **Blood count:-**
- Leucopenia (progressive)
- Anaemia (raised ESR)

2. **Serum Tests**
- Aldehyde test- positive after 3 months.
- Antimony test- less reliable. Not used now.
- Complement fixation test with W.K.K. antigen. Not used now.
- Demonstration of antibodies (ELISA, DAT, IHA, IFA with specific antigen etc.)
- Molecular diagnosis:- DNA Probes, PCR, etc.

Other methods

- **Animal inoculation** Wherever in vitro facilities are not there, the material from patients can be injected **intraperitoneally** in hamster or mice and the parasite is recovered from the animal. In positive cases, the amastigotes can be demonstrated in the stained impression smears of spleen from animals.

- **Leishmanin or Montenegro Test**

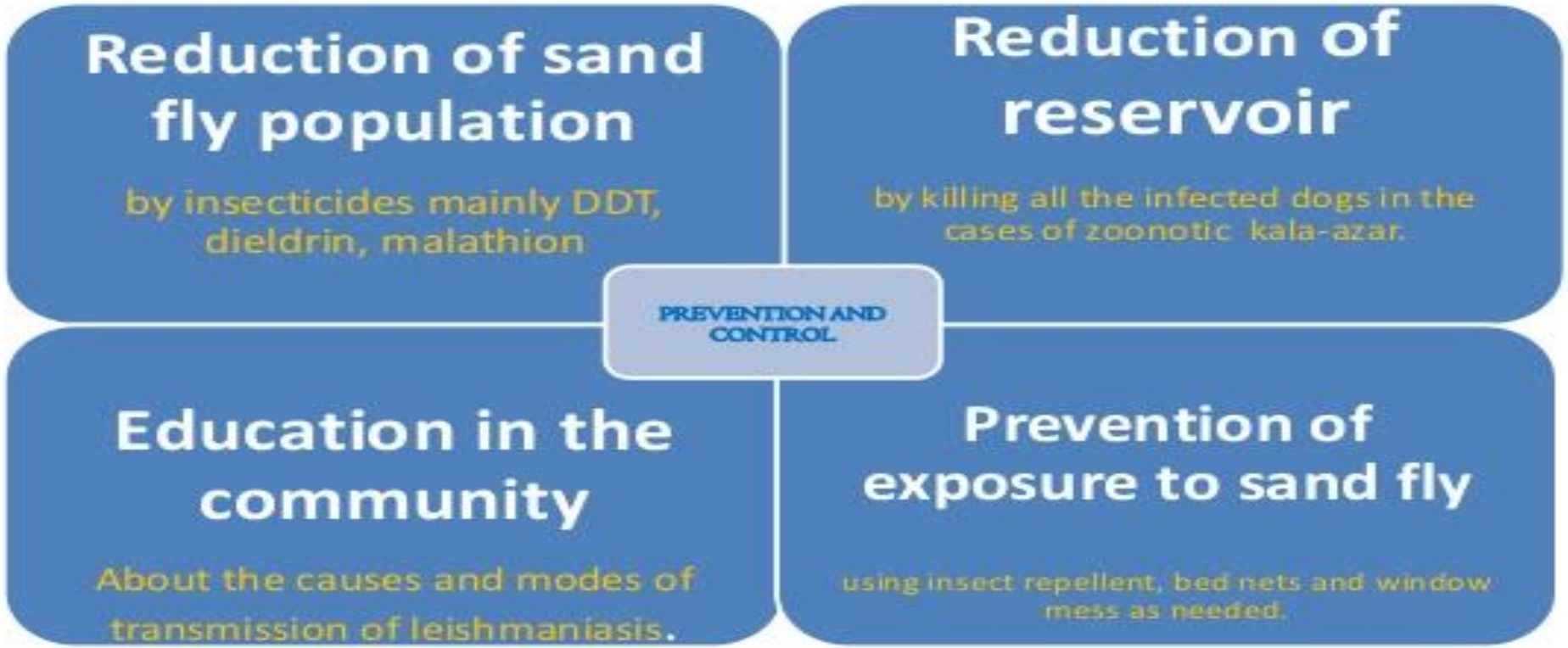
It is a delayed hypersensitivity test. 0.2 ml of leishmania antigen is injected **intradermally**. The test is read after 48-72 hrs. Positive result is indicated by an induration of 5mm or more. In kala-azar (visceral leishmaniasis), this test is negative

- **Adler's test:-** It is a serological method. The development of promastigote forms of Leishmania in Locke's serum agar can be inhibited by a immune serum specific to L.donovani, L.tropica and L.braziliensis.

EPIDEMIOLOGY

- Found in more than 88 countries.
- Found on every continent except Australia and Antarctica.
- For **cutaneous leishmaniasis**, number of cases range from 0.7 million to 1.2 million .
- For **visceral leishmaniasis**, number of cases range from 0.2 million to 0.4 million.
- Annual incidence of disease= 600,000 cases per year.
- People infected worldwide=12 million.
- People at risk=350 million.

PREVENTION AND CONTROL



There are No Vaccines to prevent leishmaniasis.

PREVENTION AND CONTROL

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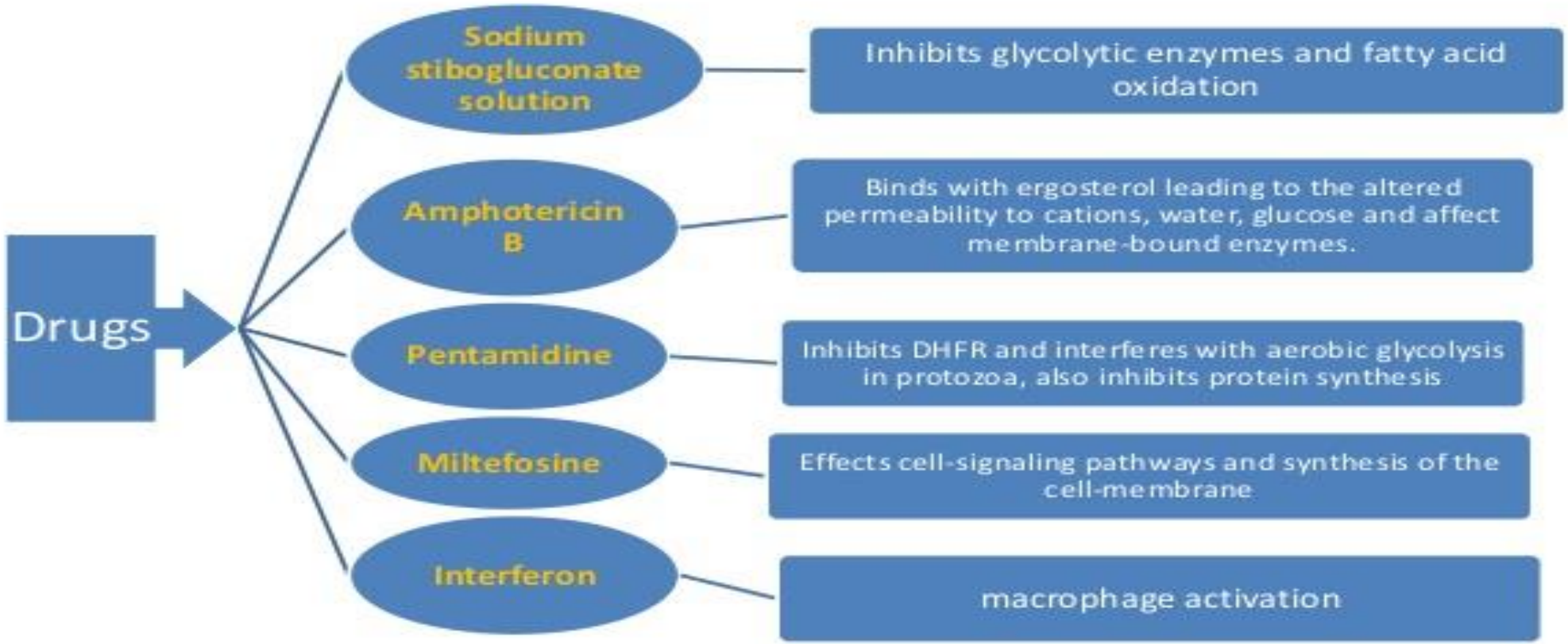
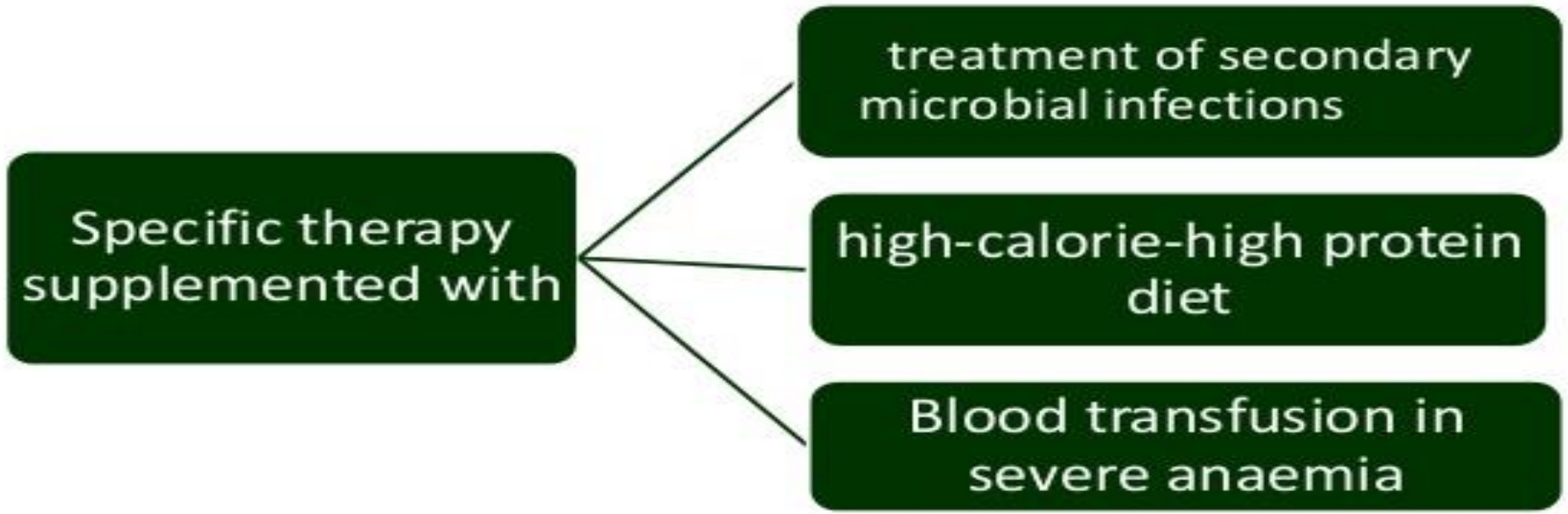
TREATMENT


Drugs
Sodium stibogluconate solution
Inhibits glycolytic enzymes and fatty acid oxidation
Amphotericin B
Binds with ergosterol leading to the altered permeability to cations, water, glucose and affect membrane-bound enzymes.
Pentamidine
Inhibits DHFR and interferes with aerobic glycolysis in protozoa, also inhibits protein synthesis
Miltefosine
Effects cell-signaling pathways and synthesis of the cell-membrane
Interferon
macrophage activation

TREATMENT (....contd)



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THANK YOU