Parasitology

Lecture: 1

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Hemoflagellates (blood and tissue flagellates)

*Classification: - Sub-kingdom: Protozoa -Phylum: Sarcomastigophora -Sub-phylum: Mastigiphora -Class: Zoomastigophora

*Flagellates (that infect man) divided into:

1-Intestinal and urogenital flagellates

- *Giardia intestinalis*
- Chilomastix mesinili
- Trichomonas vaginalis
- Dientamoeba fragilis and other.

2-Hemoflagellates (blood and tissue flagellates)

Two genera within hemoflagellates infect human which are:

- Genus Leishmania
- Genus Trypanosoma

*Morphological forms of hemoflagellates

1-Amastigote (Leishmania) form

Round or oval in shape, 2-5 microns in diameter, surrounded by delicate cell membrane, have single vesicular nucleus with large central karyosome, the kinetoplast (which consists from dot-like blepharoplast and parabasal body beside it) lies at right angle to the nucleus. Closely located nucleus and kinetoplast known as torpedo form. The axoneme is a delicate membrane extends from the kinetoplast to the margin of the body and represents the rest of the flagellum with vacuole lying alongside the axoneme. This form (amastigote) has no flagellum.

2-Promastigote (leptomonad) form

Elongated (spindle in shape) measuring 15-20 microns X 1-2 microns, have centrally located nucleus and the kinetoplast situated at the anterior end. The vacuole lying in front of the kinetoplast. From blepharoplast, single free flagellum projects from the anterior end, equal or longer than the body length. This form has no undulating membrane.

3-Epimastigote (crithidia) form

Elongated form, 15-20 microns long and slightly wider than promastigote, nucleus near middle, kinetoplast is anterior to the nucleus. From blepharoplast flagellum arise forming the undulating membrane extending half of the body length, and project from the anterior end as a free flagellum.

4-<u>Trypomastigote (</u>Trypanosome) form

Elongated form with highly polymorphism from rather short and stumpy (15micron X 2-4micron) to a long slender from (35micron X 2-4micron). In stained blood film, *Trypanosoma cruzi* appears as C or U shape. Nucleus near middle, kinetoplast is at the posterior end, the flagellum and undulating membrane pass anteriorly along entire body length and free flagellum extends from anterior end when present.

Genus Leishmania

It includes parasites cause three diseases in human:

- 1- Cutaneous Leishmaniasisor oriented sore.
- 2- MucocutaneousLeishmaniasisor Espondia
- 3- Visceral Leishmaniasis or Kala-azar

Disease	Leishmania species	Geographical location
Cutaneous leishmainiasis	- <u>L.tropica complex</u> as	- Old world (Old world
	1-L. tropica	cutaneous leishmaniasis)
	2- L. major	
	3-L. aethiopica	
	-L. mexicana complexas	-(New world)New world
	L. mexicana and other	cutaneous leishmaniasis
	species	
Mucocutaneousleishmaniasis	- <u>L.braziliensis complex</u> as	-(New world)New world
	L.braziliensis and other	cutaneous leishmaniasis
	species	
Visceral leishmaniasis	- <u>L.donovani complex</u> as	
	1- L.donovani	-Old world
	2- L.infantum	-Old world
	3- L.chagasi	-New world

Genus Trypanosoma

Cause 2 diseases in human

- 1- African trypanosomiasis (sleeping sickness)
- 2- American trypanosomiasis (Chagas' disease)

Clinical disease	Trypanosome species	Vector
-African		
trypanosomiasis		
1- Gamian type	-T.gambiense	-Tsetse fly (Glossinia)
(west African		
sleeping skiness)		
2- Rhodesian type	-T. rhodesiense	-Tsetse fly (Glossinia)
(east African		
sleeping sickness)		
-American	T. cruzi	Reduviid or kissing
trypanomiasis		bug (Triatomid bug)

Hemoflagellate



General characters of genus Leishmania

- 1- Life cycle is indirect and completed in tow hosts, vertebrate (human, dog, rodent) as a final host and invertebrate; blood sucking insect (female of sand fly) as an intermediate host (vector).
- 2- Tow developmental forms are found, amastigote and promastigote , amastigote in the final host (human) and promastigote in the vector (sand fly).
- 3- The vector is sand fly of genus *Phlebotomus* in Old World and genus *Lutzomyia* in New World.

- 4- Promastigote is the infective stage to final host (man) and amastigote is infective stage to sand fly (vector).
- 5- The parasite infects the reticuloendothelial cells of skin, mucus membrane or viscera (as liver, spleen and bone marrow) of the final host (man).
- 6- The parasite multiplies by binary fission (asexual).

Life cycle

Involves an alternative existence in a vertebrate (man,...ect) and an insect (sand fly). The flagellated promastigote enter the body (skin) of the final host through infected sand fly bite \rightarrow the parasites engulfed by macrophage and endothelial cells of skin capillaries →promasitgote develops into amastigote (Leishman-Donovan (LD) bodies) →amastigote multiply inside macrophages by binary fission \rightarrow cell burst \rightarrow free amastigote either infect other cells (macrophages) in skin as in cutaneous leishmaniasis or other cells in skin and the adjacent cells in mucous membrane as in mucocutaneousleishmaniasis or pass to different organ by blood stream (spleen, liver, bone marrow and lymph nodes) as in visceral leishmaniasis, then amastigotes engulfed by new reticuloendothelial cells \rightarrow a blood sucking sand fly (female) draws amastigotes (L.D bodies) with its blood meal (by bites of proboscis) -- amastigotes develop in promastigote forms in the mid gut of sand fly \rightarrow multiply by longitudinal binary fission \rightarrow solid mass of promastigotes fill up the anterior end of the mid gut and the esophagus , extending up to the pharynx \rightarrow a heavy pharyngeal infection of the sand fly is known as anterior station development , which may block esophagus \rightarrow at the time of sucking blood , regurgitation of promastigotes from their buccal cavity in the skin puncture by proboscis (biting organ) \rightarrow infection of man.

<u>Anterior station development</u> is the anterior migration of the parasites from the mid gut to foregut, pharynx and buccal cavity of insect vector (as sand fly in Leishmania species).

<u>Posterior station development</u> is the posterior migration of the parasite from the midgut to the hindgut and excreted with feces if insect vector (as Ruduviid bug in *Trypanosoma cruzi*).



Developmental forms (stages) of Leishmania







-Life cycle of leishmania spp.