Trypanosoma gambiense

Systematic Position:

Phylum – Protozoa
Sub phylum – Plasmodroma
Class – Mastigophora
Order – Protomonadina
Family – Trypanosomidae
Genus – *Trypanosoma*
Species – *T. gambiense*

Trypanosoma gambiense is a protozoan haemoflagellate intercellular, endoparasite of man inhabiting the blood, lymph and the intercellular spaces of different tissues and organs of man. Dogs, goats, cattle and sheep are potential reservoir hosts.

The parasite causes a disease called **Gambian or West-African sleeping sickness** in human-beings. The disease African sleeping sickness was first described by Atkins in 1724 and Winterbottom in 1803, but the causative parasite was described in human blood by Forde in 1901 and later on named as T. gambiense by Dutton in 1903.

Geographical distribution:

T. gambiense are found in West and Central Africa between 15° N and 15° S latitude. In Western part of Africa it is found between Senegal and Angola. Other endemic areas are Congo, Niger and Southern Sudan. Their distribution depends upon the areas where the vector of the parasite, Glossina palpalis actually exists.

Life cycle:

T. gambiens are digenetic parasites, completing their life cycle in two hosts.
Primary or definitive hosts - human-beings,
Secondary or intermediate hosts - tsetse fly (*Glossina palpalis*).

T. gambiense exits in their vertebrate host (man) as a TRYPOMASTIGOTE form. They live freely in the blood and in the intercellular spaces of lymph nodes and brain. At later stage, they appear in the cerebrospinal fluid, spinal cord and brain. The parasite, in man, appears as elongated spindle shaped unicellular protozoan, measuring 15 µ to 30 µ in length and 1.5 µ to 3 µ in breadth.

The posterior end is blunt while the anterior end is pointed. A single large oval nucleus lies in the middle of the body with a central karyosome. The nuclear membrane is clearly distinct. Near the posterior end is a disc shaped kinetoplast.

Kinetoplast is about 1 µ in size and consists of a rod shaped parabasal body and a small granule like blepharoplast. A single flagellum originates from near kinetoplast. Flagellum

curves around the body in the form of an undulating membraneand finally project out through the anterior end as a free flagellum.

The undulating membrane through its course form 3 to 4 folds, Trypanosomes are actively motile. The wavy movement is produced by contractive flagellum and undulating membrane. Nourishment is obtained from blood plasma, lymph, cerebrospinal fluid and the products of cellular disintegration of the host.

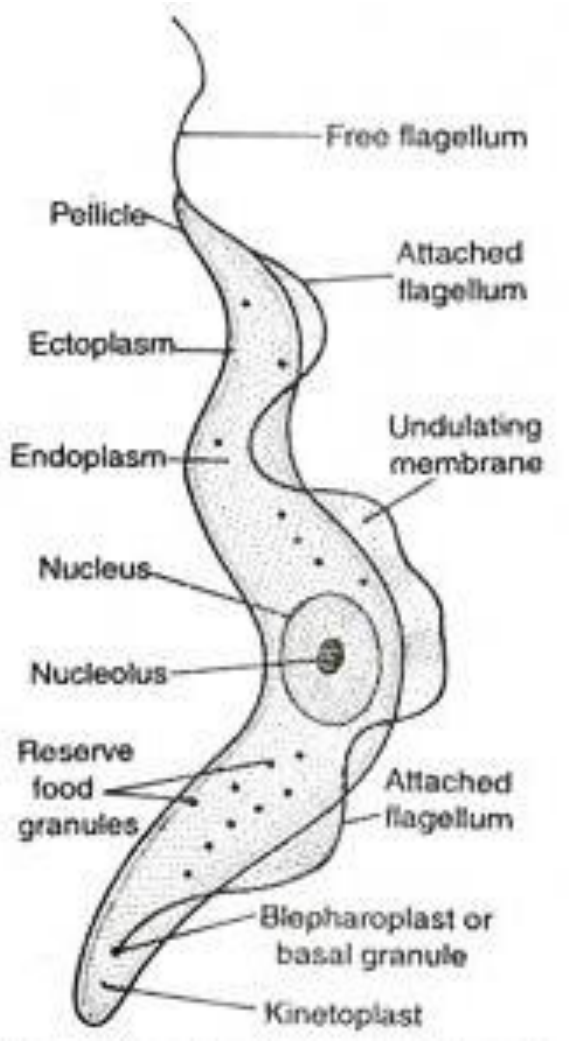
T. gambiense show the phenomenon of polymorphism. A single parasite during its different stages in human body exhibits variable shape and size. Three main forms are –

(a) Elongated, spindle shaped form with free flagellum.

(b) Stumpy form without free flagellum.

(c) Intermediate form.

The infective form (metacyclic stage) of the parasite, when enters into the body of the definitive host as a result of the bite of infected Glossina (Tsetse fly), first develop into long, slender form. It immediately starts multiplying in number by longitudinal binary fission. Later on, they are transforms into stumpy form passing through a short intermediate form.



Stumpy forms are thick and short, measuring about 10 µ in length and 5 µ in breadth, without free flagellum. The stumpy form parasite then enters into the lymphatics and blood stream resulting in parasitaemia. When a tsetse fly of either sex bite an infected man, the trypomastigote form particularly the short stumpy form enters into the gut of the intermediate host along with blood meal.

When the stumpy form of trypomastigote (trypanosoma) reaches the mid gut of tsetse fly, it undergoes morphological changes. The body becomes long and slender, the kinetoplast moves near the nucleus in the posterior half and undulating membrane becomes less pronounced with a free flagellum.

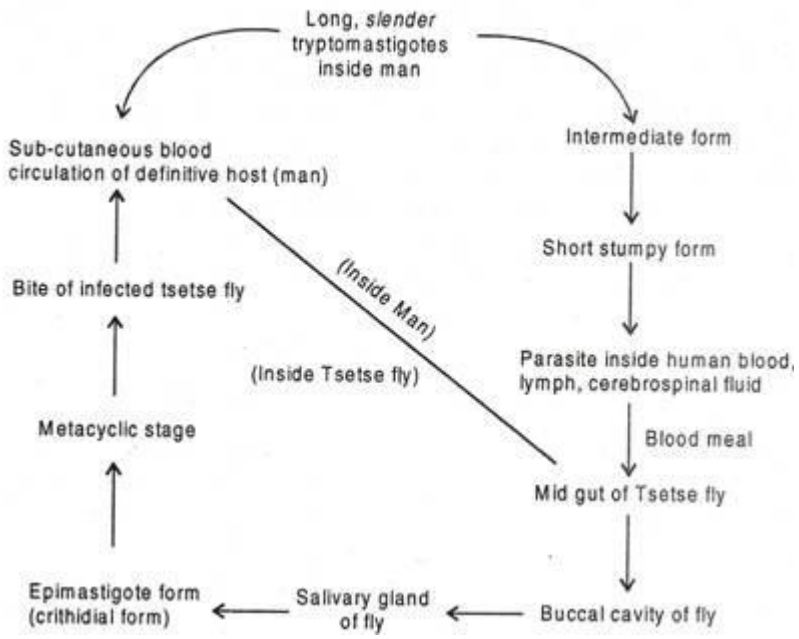
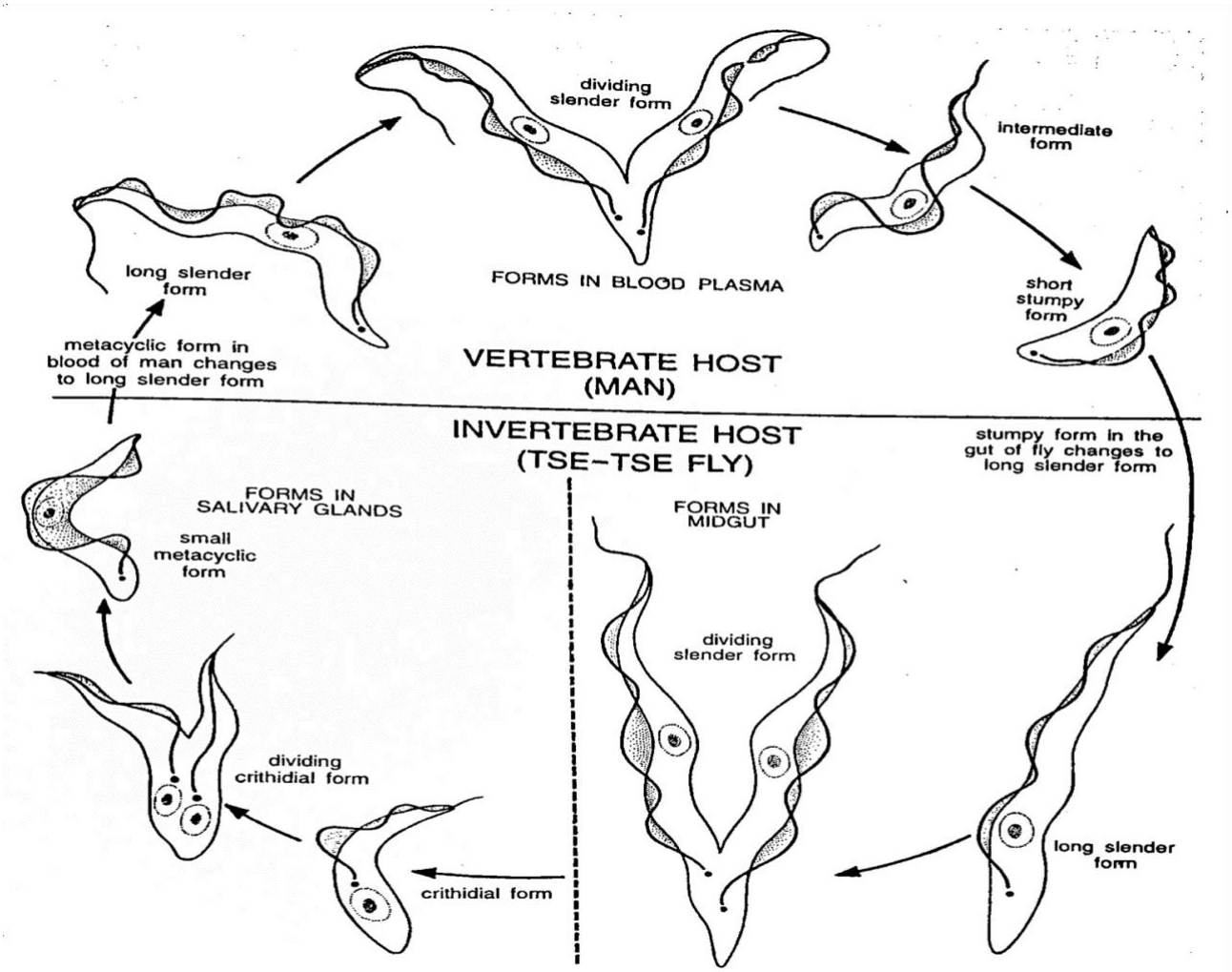


Figure 1 diagrammatic representation of Life Cycle of T. gamience



Within two days, after the fly has sucked infected blood, the parasite begins to multiply in the lumen of the mid gut. They do so up to 15th day and then migrate to the proventriculus. The parasite moves forward passing through oesophagus, buccal cavity, hypopharx sahvary duct finally reaches the salivary gland of the intermediate host. Inside salivary gland the trypanosomes attach themselves to the wall of gland by means of their long flagellum and get transformed into the epimastigote (crithidial form).

After multiplying there for 2 to 5 days epimastigotc changes into met-acyclic stage. These are short stumpy forms with or without free flagellum Meta-cyclic trypomastigote is the infective form for man. Time taken to reach the infective stag in tsetse fly is 20 to 21 days. The fly remain infective for their whole life (i.e., approximately 185 days). When an infected tsetse fly bites a man, the parasite is inoculated into the body of the definitive host to repeat the life cycle.

Mode of infection:

The mode of infection is inoculative. The infected tsetse fly *Glossina palpalis*, of either sex, when bites a man in order to suck blood transmit the infective stage parasite to the new definitive host. The meta-cyclic stage of the parasite along with the saliva of the fly reaches the sub-cutaneous blood of the host.

Pathology:

The incubation period is usually about two weeks but it may be longer in persons having fair degree of resistance. The disease caused due to this parasite is commonly known as “sleeping sickness”. Following are the important pathological conditions arising during the disease.

1. The first sign of the disease is restlessness and disturbance of the sleep, remittent fever with wide diurnal fluctuation, persistent headache, edema, dyspnea, disturbed vision edematous swelling around eyes and joints, pain in joints and muscles, weakness, cutaneous allergic etc.
2. In the early phase of the disease, there is general enlargement of lymphatic gland which later on becomes firm and fibrous.
3. The perivascular infiltration causes various psychic, motor and sensory disturbances.
4. There is severe damage of the perivascular connective tissues as the collagen fibres are disrupted and the fibroblasts are destroyed.
5. Leucocytosis and anaemia occurs. Due to high rise of gamma globulin the ESR is raised and serum aldehyde test become positive.
6. Auto-agglutination of red blood cells occur.
7. In the chronic stage (cerebrospinal stage) of the disease which begins from the early second year, the patient becomes dull and drowsy. The patient even falls asleep even in the mi s of the activity. In the terminal stage, the patient passes into almost continuous sleep.

A patient suffering from Gambian sleeping sickness, if not treated is destined to die. Death occurs from coma, dehydratin, asthenia, convulsion and pneumonia.

Treatment:

In early infection drugs like suramin and pentamidine are used. In later stages when central nervous system is involved arsenicals like tryparsamide, melarsen and tnmelarsen are being used. Nitrofurazone (fiiracin) may be used in certain cases.

Prophylaxis:

Following are the prophylactic measures:

1. Destruction of the habitat of the vector.
2. Destruction of the vector by the use of insecticides.
3. Isolation of human population from areas harbouring the vector.
4. A single intramuscular injection of 4 mg/kg may be used as chemo-prophylactic measure, which remains effective for six months.
5. Treatment of the patient.
6. **Melarsoprol** is the only treatment for late stage of *T.b. rhodesiense*.

Polymorphism:

1. Leishmania (amastigote) : It is the round or oval form. The reduced flagellum remains in the cytoplasm Blepharoplast and kinetoplast are situated in the anterior part.

2. Leptomonad (promastigote): Body is elongated and blepharoplast and kinetoplast are anterior in position. Flagellum is short, unattached and free.

3. Crithidia (epimastigote): Body is elongated. Blepharoplast and kinetoplast are situated in the middle of the body but just anterior to the nucleus. Undulating membrane is not well defined.

4. Trypanosome (trypomastigote) : Body is elongated. Blepharoplast and the kinetoplast are situated at the posterior end. Undulating membrane is well developed.

Forms of Trypanosomes	Position of kenetoplast & Blepharoplast in relation to nucleus
Leishmania (Amastigote)	anterior part
Leptomonad (Promastigote)	anterior to nucleus
Crithidia (Epimastigote):	middle of the body
Trypanosome (Trypomastigote)	posterior end

Out of these four forms, trypanosome is the adult stage while other forms represent developmental stages, which are formed during the part of its life cycle in the invertebrate host