



INTERNATIONAL SCHOOL OF MEDICINE

Department of Infectious Diseases

The topic of the lecture:

Trypanosomiasis

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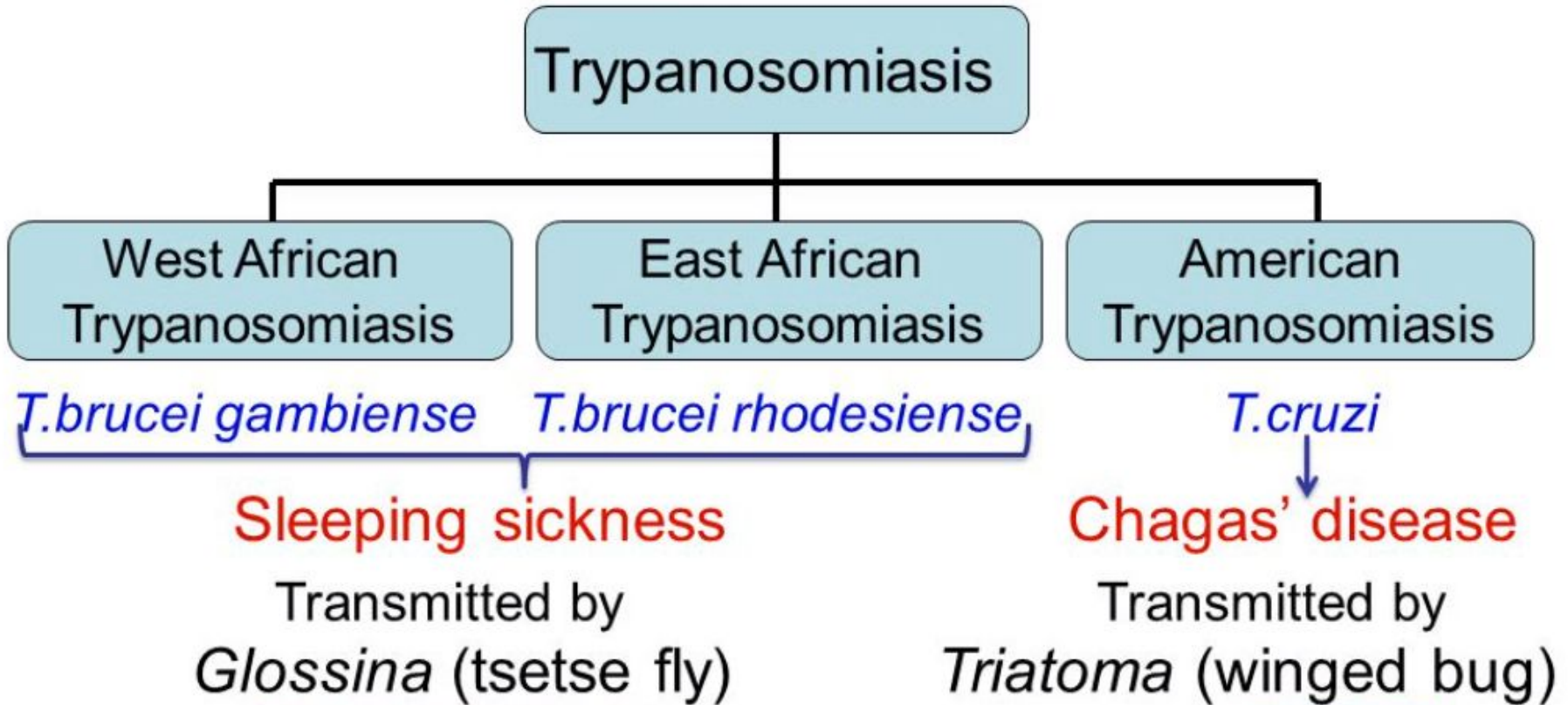
History

- its species was discovered by a scientist "Valentine" in 1841.
- But these are found in mammals after 50 – 80 years later.
- Then further studied about their diseases.

Introduction

- The name is derived from Greek word,
 - trypano means (borer)
 - soma means (body)
- They are unicellular flagellate protozoa.
- Have spiral like motion.
- Need more than one host to complete its life cycle.
- Oftenly transmitted by a vector.
- Generally found in intestine, but some time found in blood stream or in heart.

Trypanosoma



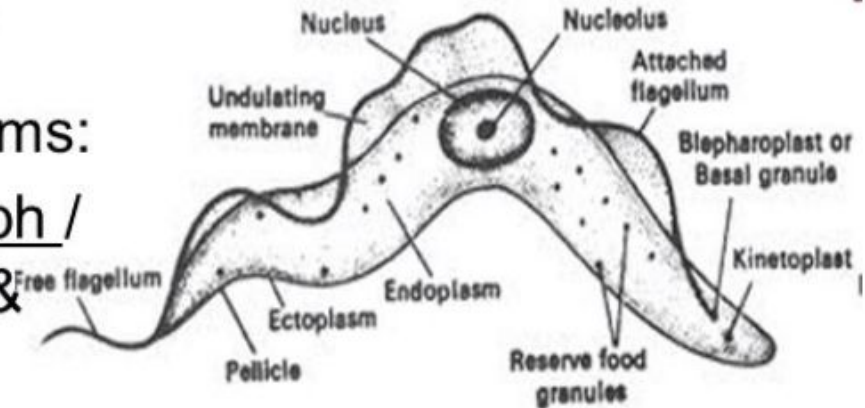
Morphology of trypanosome

Morphology

Exist into 2 interchangeable forms:

Trypomastigote in Blood/ Lymph / tissue space of various organs & C.N.S is terminal & fatal

Epimastigote in salivary gland of vector & Culture media.



Trypanosoma gambiense

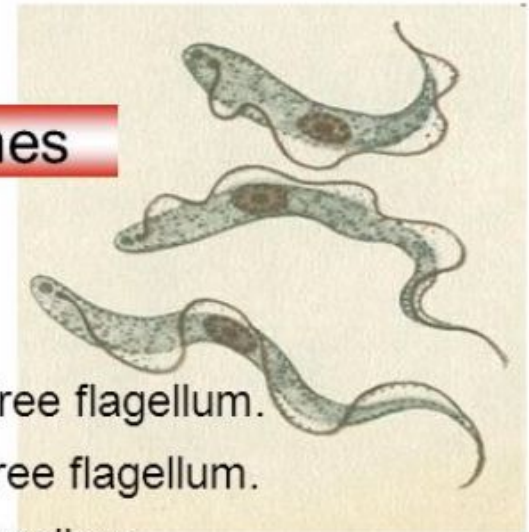
Trypomastigote (Polymorphic Trypanosomes)

Spindle shaped – Central nucleus – free flagellum – undulating membrane. **3 forms**

1- long Slender Form (30 μ): active motile with free flagellum.

2- Short stumpy Form (15 μ): sluggish without free flagellum.

3- Intermediate Form (20 μ): with a short free flagellum.



African Trypanosomiasis (Sleeping Sickness)

The parasites

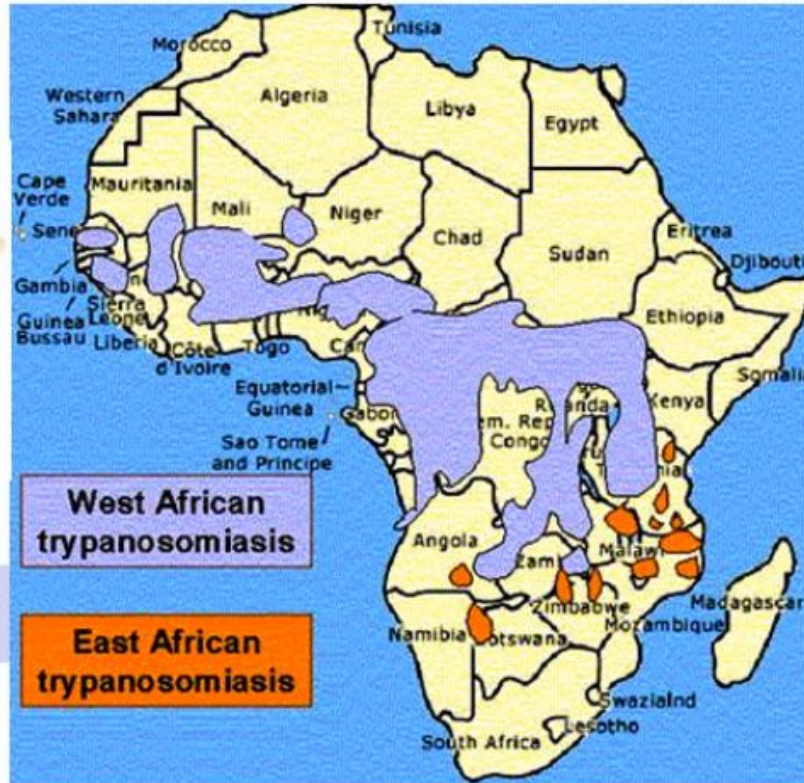
- Belong to a group of closely related trypanosomes in the *Trypanosoma brucei* species complex. Three morphologically indistinguishable species are recognized:
 - *T. brucei* infects game animals/livestock (causes nagana)
 - *T. rhodesiense* causes E. African trypanosomiasis
 - *T. gambiense* causes W. and Central African sleeping sickness
- (Some authors consider these as subspecies: *T. brucei brucei*, *T. b. rhodesiense*, *T. b. gambiense*.)

Distribution



G. palpalis

In West Africa



G. morsitans

In East Africa

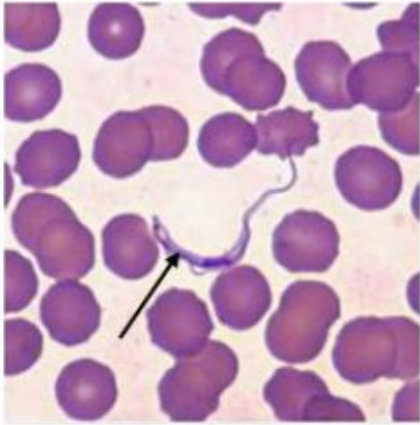
T. rhodesiense causes E. African trypanosomiasis

T. gambiense causes W. and Central African sleeping sickness

Trypanosoma brucei species

West Africa

T. brucei gambiense



Less plentiful

Cannot live in lab animals

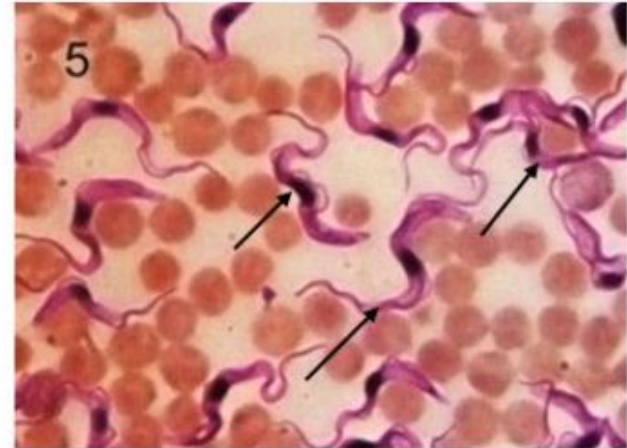
Reservoir host:

goats, cattle & pigs

Transmitted by: *G. palpalis*

East Africa

T. brucei rhodesiense



More plentiful

Can live in lab animals

Nucleus is shifted posteriorly



Reservoir host:

wild game animals

Transmitted by: *G. morsitans*

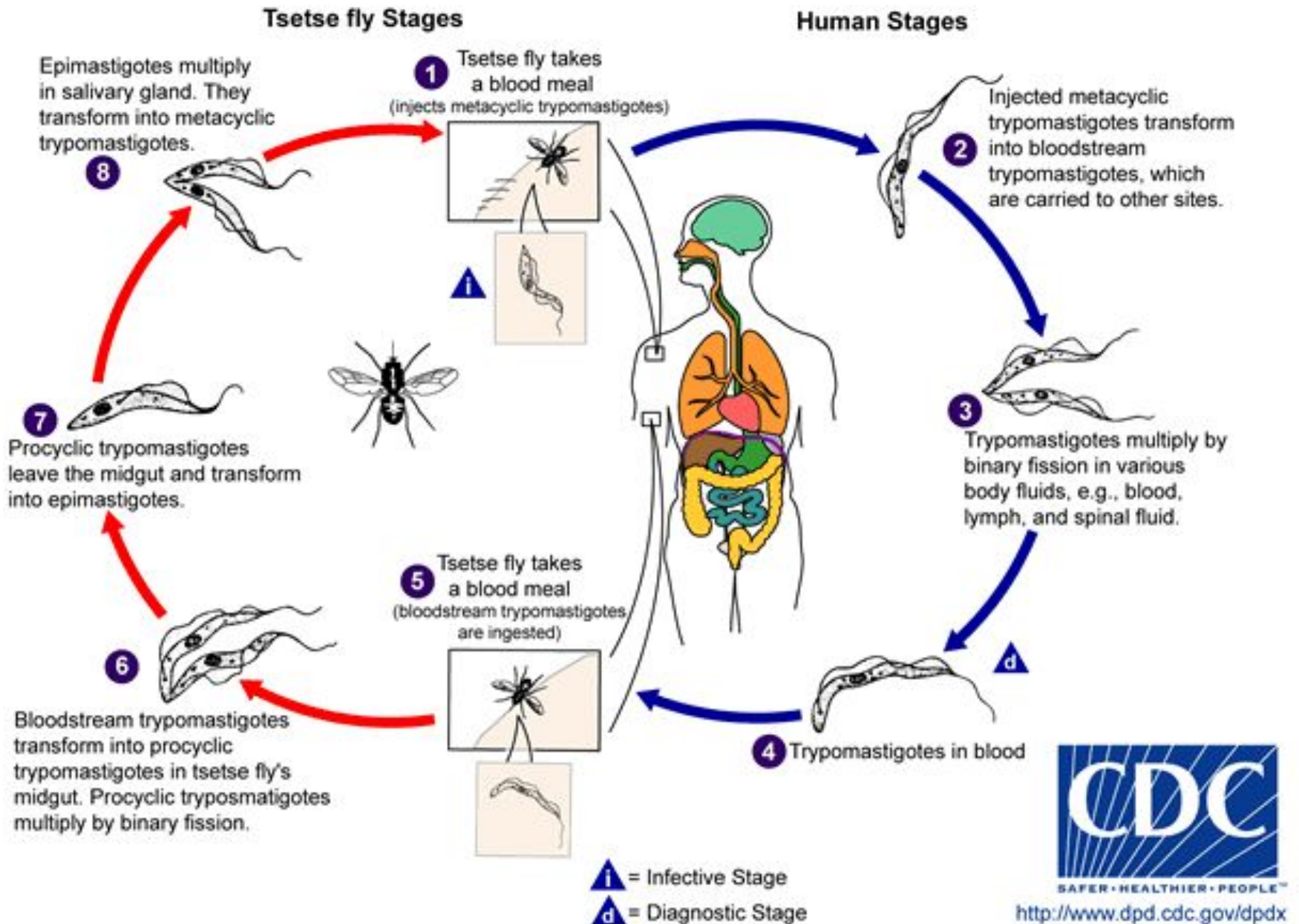
Major Differences Between African Trypanosome Species

Attribute	<i>T. rhodesiense</i>	<i>T. gambiense</i>
tsetse vector	<i>G. morsitans</i> group	<i>G. palpalis</i> group
ecology	dry bush, woodland	rainforest, riverine, lakes
transmission cycle	ungulate-fly-human	human-fly-human
non-human reservoir	wild animals	domestic animals
epidemiology	sporadic, safaris	endemic, some epidemics
disease progression	rapid, often fatal	slow (~1 yr) acute ⇒ chronic
parasitemia	high	low
asymptomatic carriers	rare	common

Transmission

- A bite from an infected tsetse fly causes African trypanosomiasis.
- Blood transfusions are a rare cause of parasitic transmission.
- In rare cases, accidental transmission in the laboratory has been implicated.

Life cycle



Pathogenesis

Incubation period (2 weeks)

Trypanosoma chancre (at the site of bite)

Via lymphatics: enlarged lymph nodes especially posterior cervical region. (*Winterbottom's sign*)

Via blood stream: headache, fever (fluctuating), muscle & joint pain, irregular erythematous rash.

Invasion of bone marrow (*hypoplastic anaemia*)

Enlarged liver & spleen, generalized weakness.

Invasion of CNS: severe headache, mental apathy, slow speech, deep sleep, coma & death

In East African Trypanosomiasis:

Disease runs more rapid & fatal course

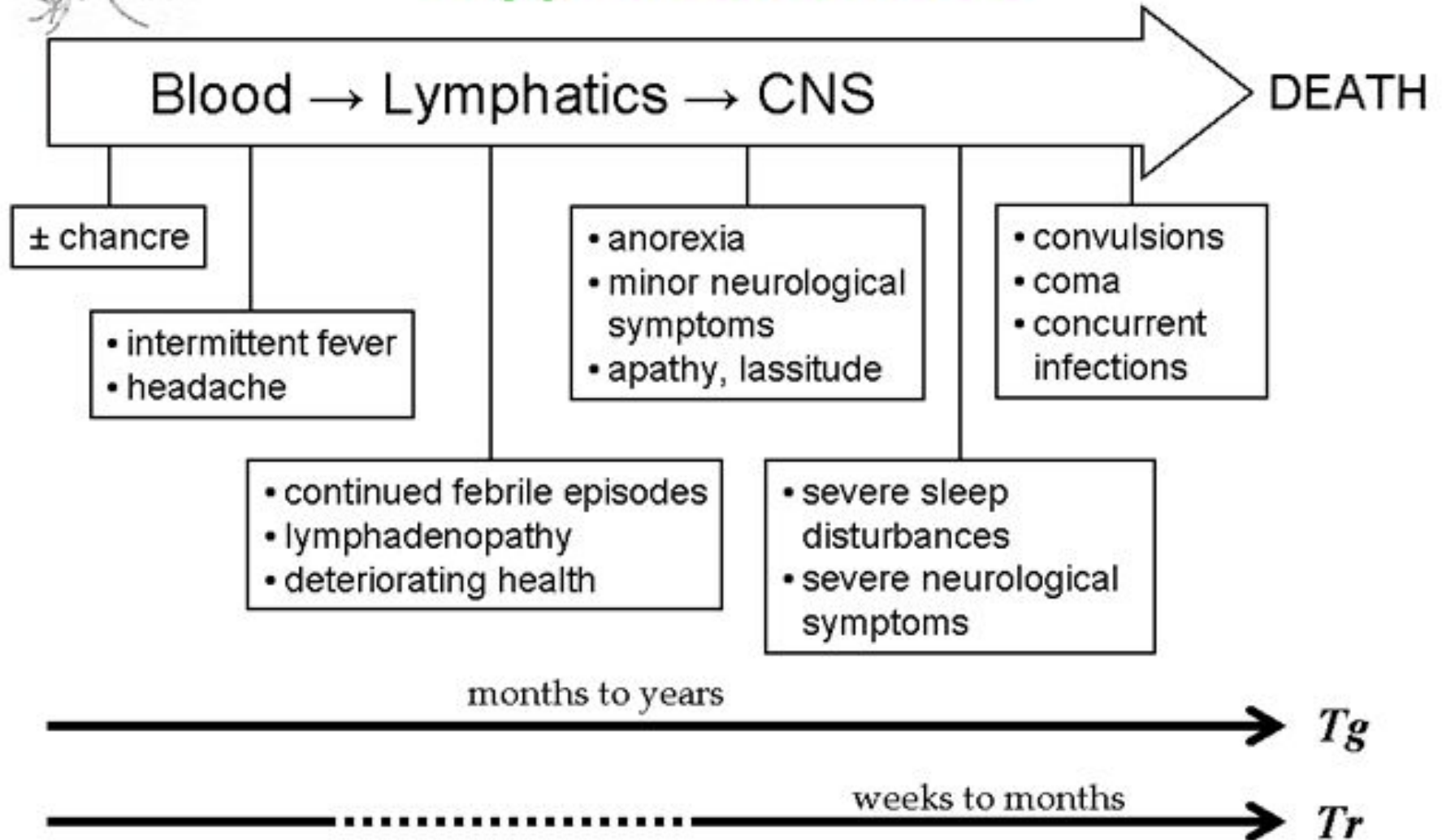


Clinical presentation

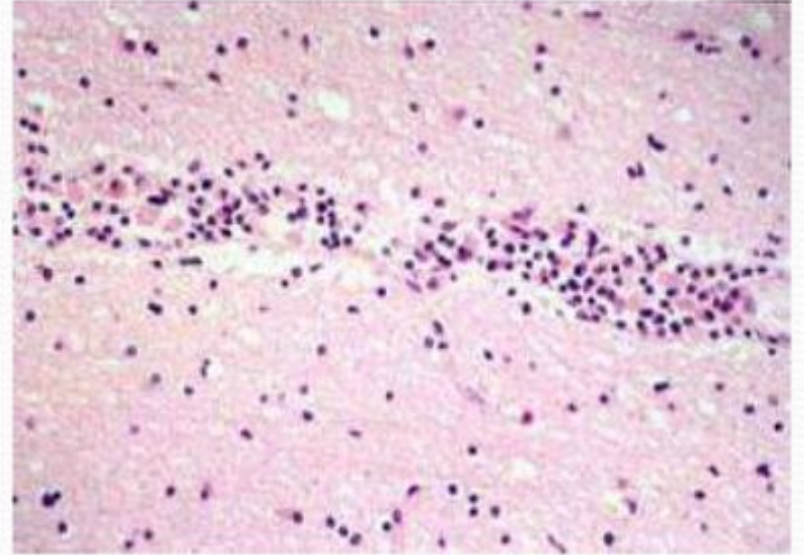
- Incubation period may be from few days to weeks.
- The first clinical manifestation of African trypanosomiasis chancre occurs at the site of inoculation .



Progression of African Trypanosomiasis



Clinical presentation



Diagnosis

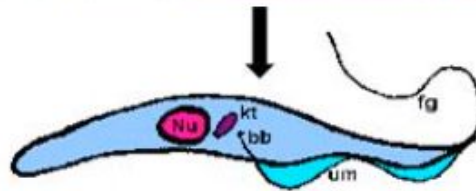
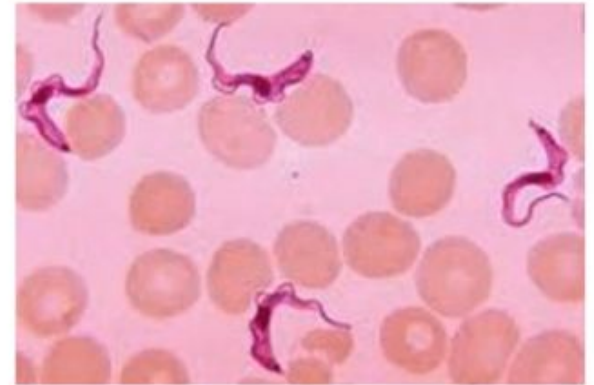
1- Clinical picture

2- Demonstration of **trypanosomes**:

- Microscopic examination of unstained or stained blood films

- Culture on suitable medium (N.N.N OR Weinmann's media to detect Epimastigote)

Polymorphic Trypanosomes



- Animal inoculation

N.B. in case of *T. brucei rhodesiense* injected in lab Animal produce a new form "Posterior Nucleus Shift"



Diagnosis

- **General**

- Anemia, hypergammaglobulinemia, low complement levels, elevated ESR, thrombocytopenia, hypoalbuminemia, but not eosinophilia or abnormal liver function.
- The total IgM level is higher in blood and CSF.
- A definitive diagnosis of infection requires actual detection of trypanosomes in blood, lymph nodes, CSF, skin chancre aspirates, or bone marrow.
- However, symptomatic improvement after empiric treatment is the usual confirmatory test in areas where diagnostic studies are not readily available.

Imaging Studies

- CT scanning and MRI of the head: Both head CT scanning and MRI reveal cerebral edema and white matter enhancement, respectively, in patients with late-stage African trypanosomiasis.
- EEG in neurologic involvement usually shows slow wave oscillations (delta waves), a nonspecific finding

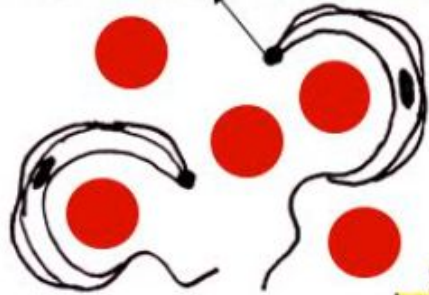
Treatment

Drug	Use	Drawbacks
Pentamidine	Effective against early-stage <i>gambiense</i> disease	<ul style="list-style-type: none">• Adverse side effects• Non-oral route
Suramin	Effective against early-stage <i>gambiense</i> and <i>rhodesiense</i> disease	<ul style="list-style-type: none">• Adverse side effects• Non-oral route
Melarsoprol	First line drug for late-stage <i>gambiense</i> and <i>rhodesiense</i> disease involving CNS	<ul style="list-style-type: none">• Adverse side effects, especially encephalopathy• Fatal in 1-5% of cases• Parasite resistance• Non-oral route
Eflornithine	Effective against late-stage <i>gambiense</i> disease involving CNS	<ul style="list-style-type: none">• High cost• Not effective against <i>T. rhodesiense</i>• Non-oral route - has to be given intravenously (needs hospitalization for 14 days)

American Trypanosomiasis (Chagas Disease)

Distribution

Prominent kinetoplast



Winged bug
Kissing bug
Triatoma or
Rhodnius



Trypanosoma
cruzi

C-shaped

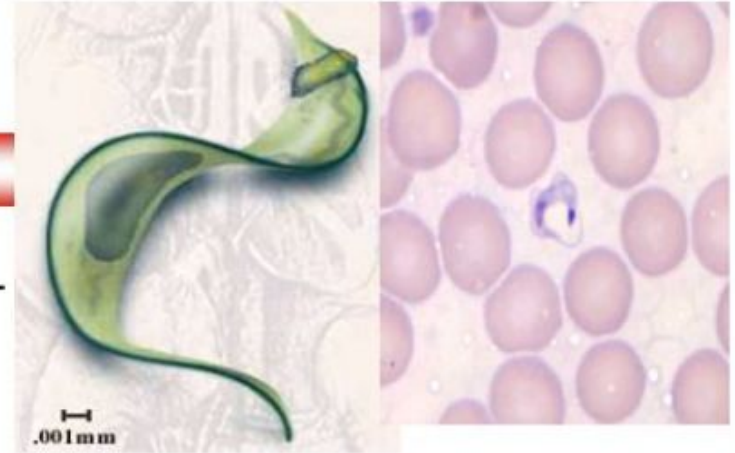


Morphology

Morphology

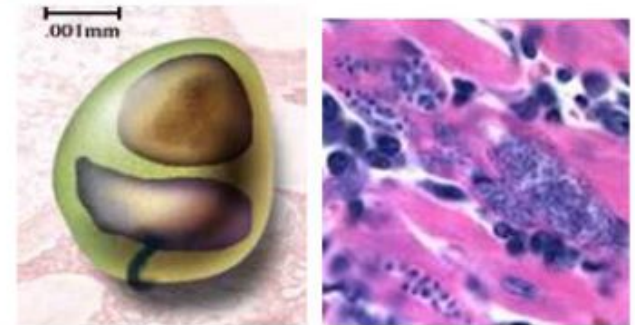
Trypomastigote (Monomorphic)

Slender shaped (20μ) – Central nucleus – C or U-shaped – Free flagellum 1/3 body – Large bulging peripheral kinetoplast



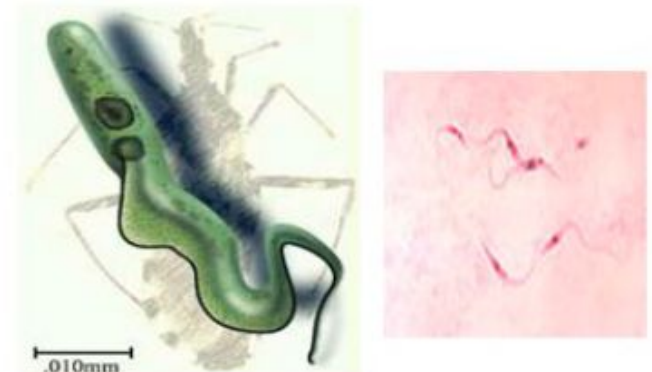
Amastigote

Obligatory intracellular – mainly in cardiac & Skeletal muscles – Brain meninges – Nerve ganglia – cells of GIT etc



Epimastigote (Vector only)

Spindle shape – Kinetoplast anterior to central nucleus – Undulating membrane is short – terminal free flagellum



Transmission

Cyclopropagative transmission

T. cruzi in human blood

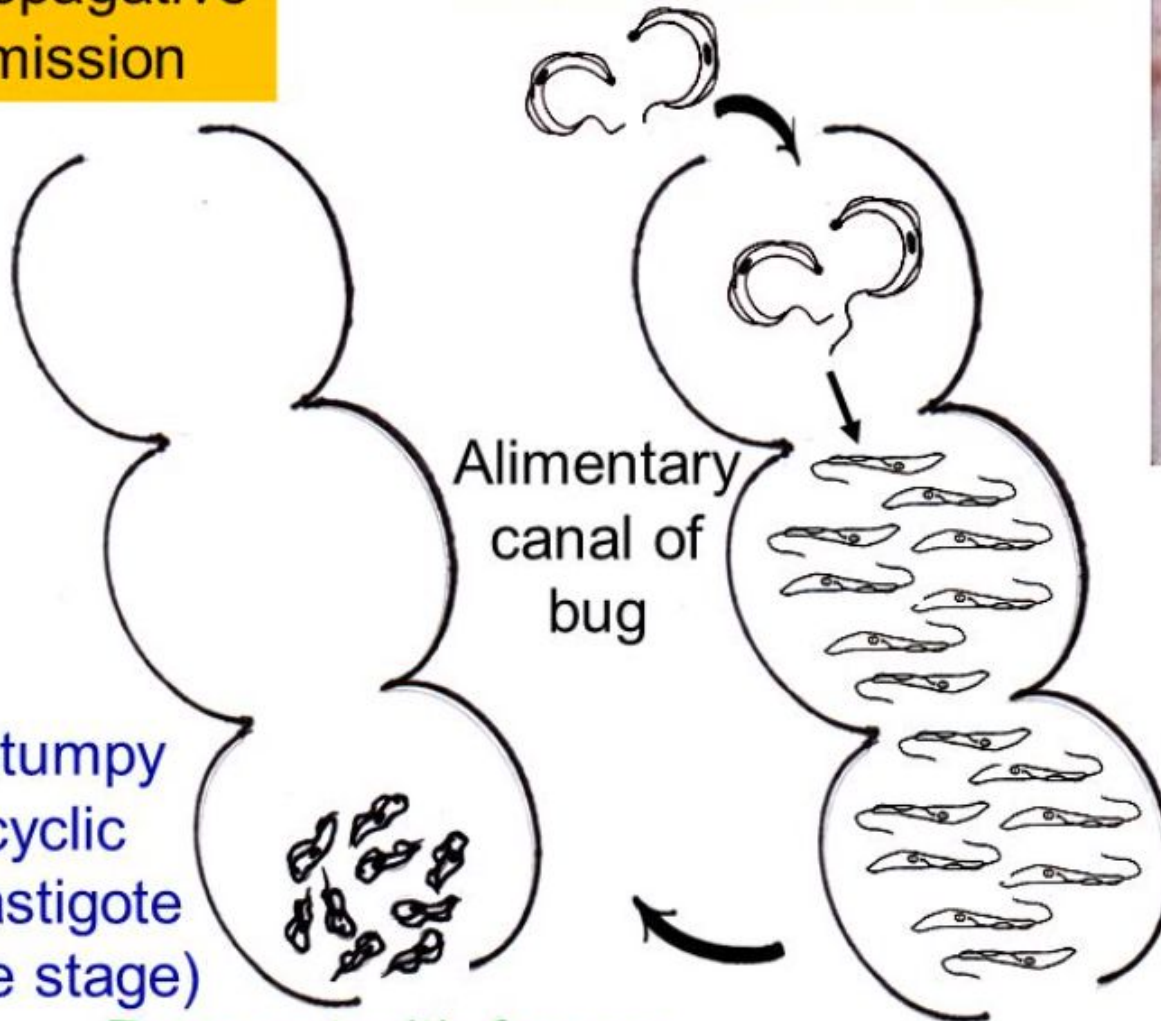


Alimentary canal of bug

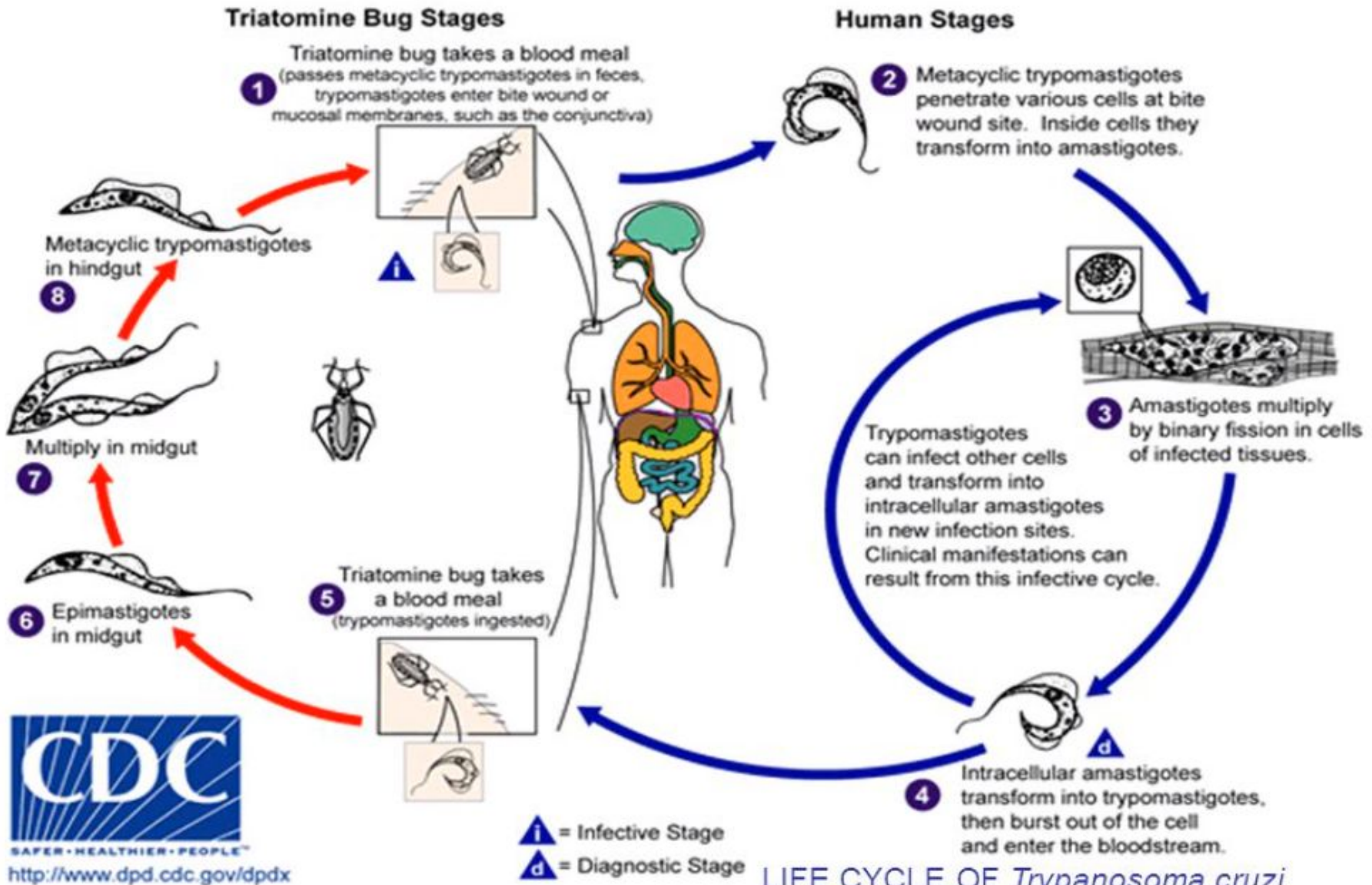
Short stumpy metacyclic trypomastigote (infective stage)

Pass out with faeces

Epimastigote form



Life cycle



Transmission

Mainly by

Contamination of
skin abrasion by winged bug
faeces

Cone nose Bug – kissing Bug – Assassin bug

Rarely by

Through infected blood transfusion

Through infected mother's milk

Through the placenta



Pathogenesis

I- Acute Form

Chagoma occurs at the site of bite.

Parasite reaches regional lymph nodes

To ↓

Blood

To ↓

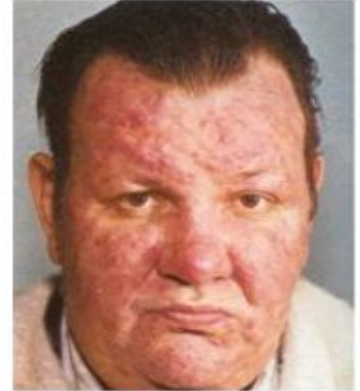
Organs and tissues

Fever, enlarged lymph nodes, skin rash,
enlarged liver & spleen.

Romana's sign (Unilateral conjunctivitis appear suddenly
together with oedema of upper & lower eye lids & cheek)

Meningoencephalitis, heart failure

Death or pass to Chronic form

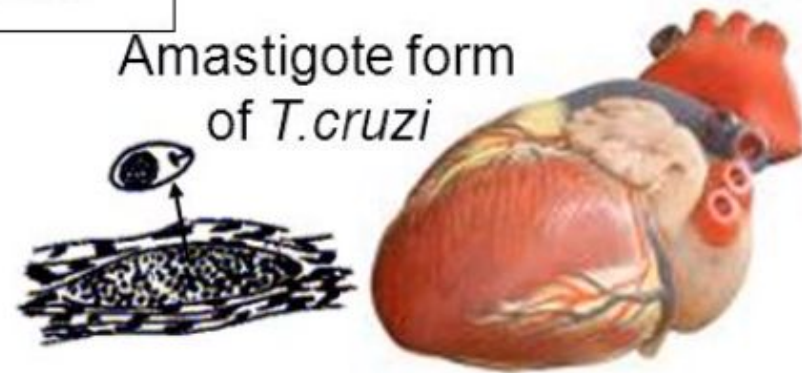


Pathogenesis

II- Chronic form

Parasite produces antigens similar to patient's self antigens:
The body produces auto-antibodies that cause damage to:

- ❑ Heart muscle fibres:
congestive heart failure.
- ❑ Oesophageal muscle fibres:
megaesophagus and dysphagia.
Destruction of Auerbach's plexus
- ❑ Colon muscle fibres:
megacolon and constipation.
- ❑ CNS or thyroid gland
Exacerbation of infection in immunosuppressed patients.



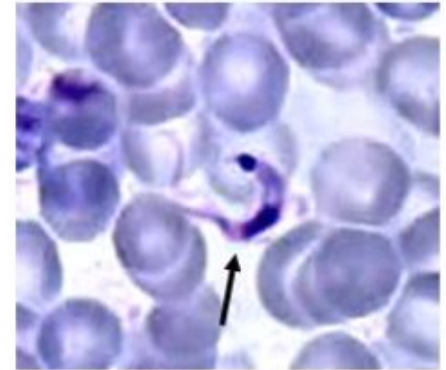
Diagnosis

Finding the parasite in:

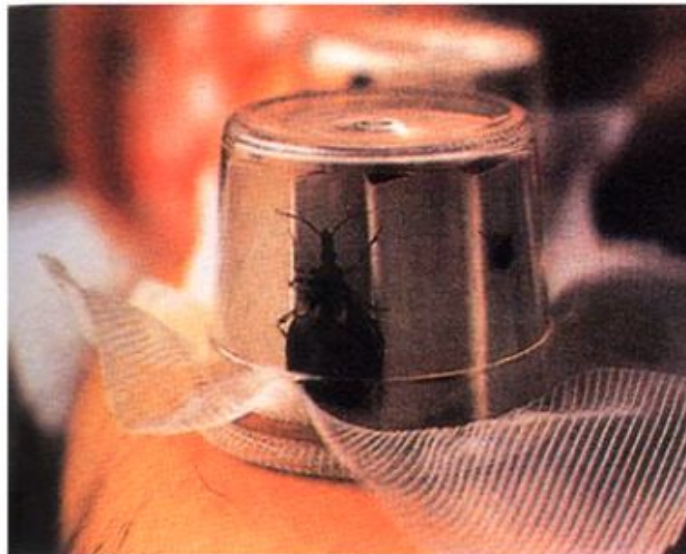
Blood film (C-shaped *T.cruzi*)

Biopsy from lymph node, liver or spleen
(amastigotes) 

Culture (Epimastigotes) 



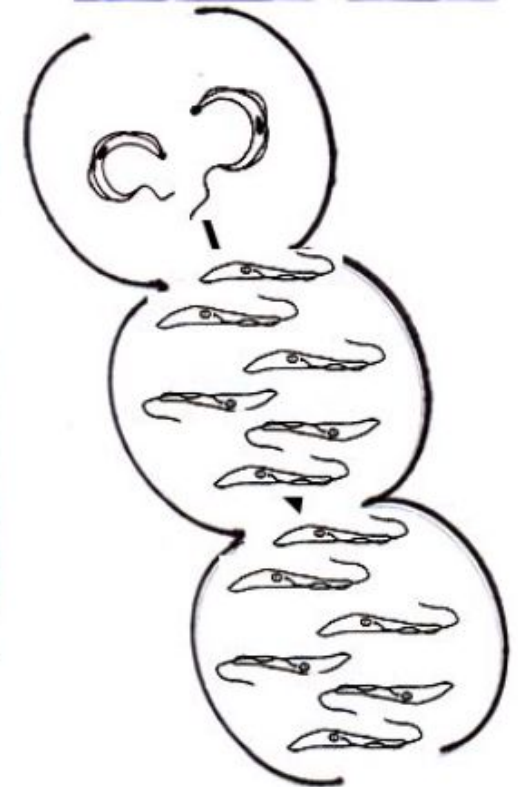
Xenodiagnosis



Serological tests

Cruzin test (I.D.)

Molecular techniques



Diagnosis (Xenodiagnosis)

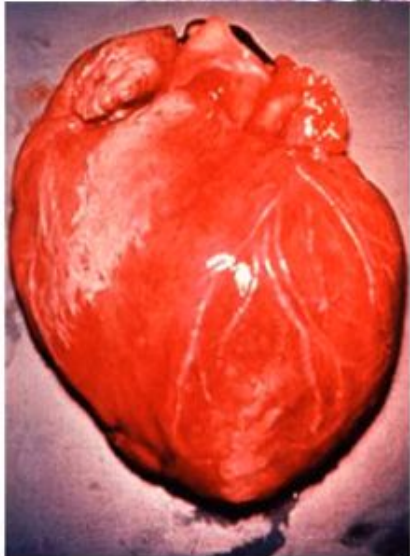
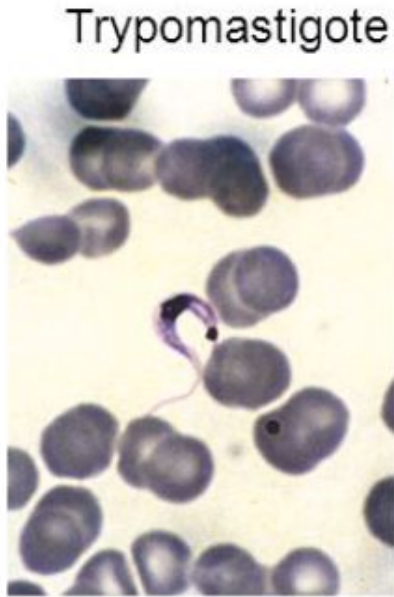
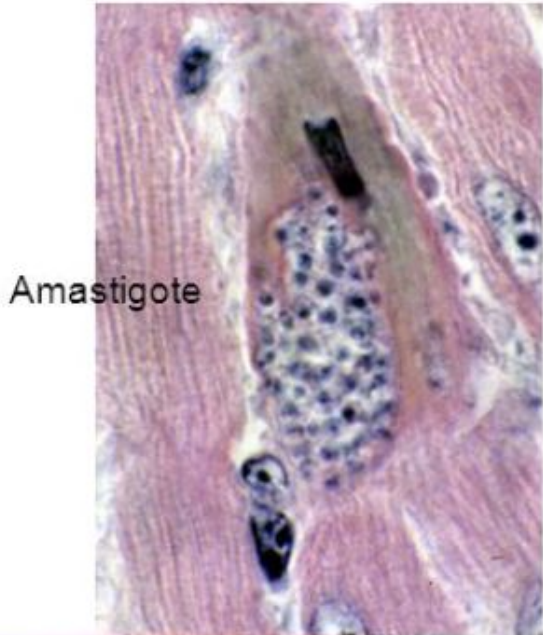


Highly efficient – demonstrate low level of parasite in blood

Method:

A Laboratory bred winged bug is starved for 2 weeks then fed on suspected patient's blood – 30 days later, it faeces & gut examined for trypanosomes.

Diagnosis

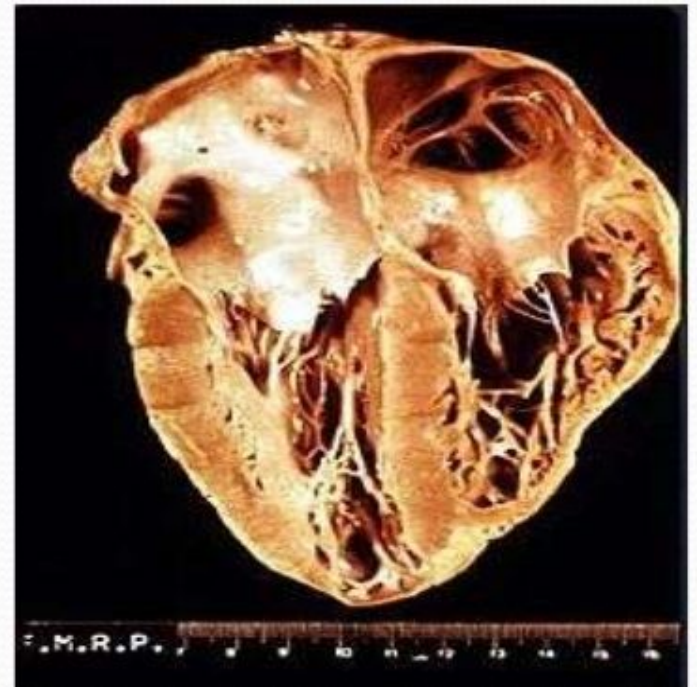


Romana's sign



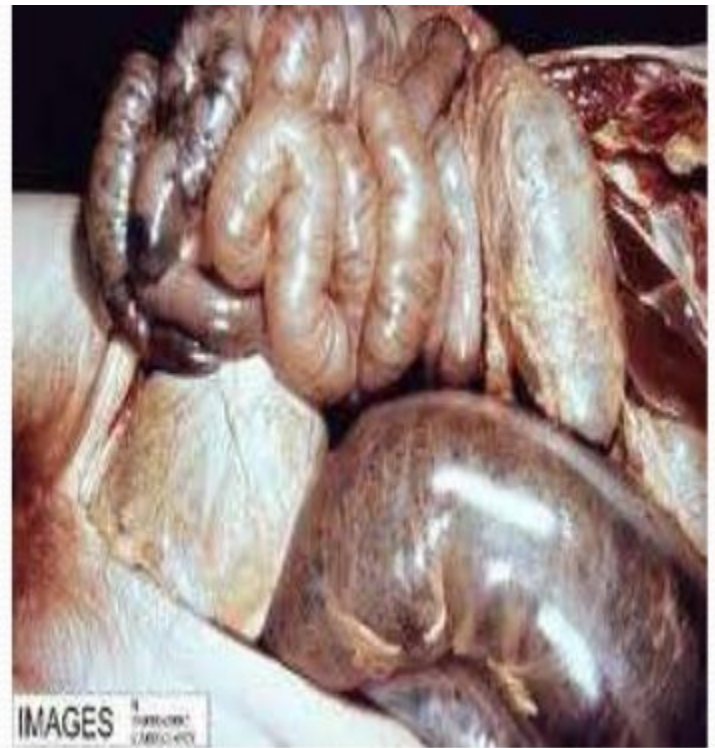
Clinical presentation

- Chronic stage.
 - In chronic stage these parasites reside in heart and midgut, and some time in hind gut causing giantism of the midgut.



Clinical presentation

- Gigantism of midgut



Treatment

Sleeping Sickness

In early stage of the disease:

Pentamidine OR Suramin

In late stages of the disease:

Tryparsamide

For both early and late stages
of the disease:

Eflornithine (DFMO)
Ornidyl

Chagas Disease

Nifurtimox

- inhibits **intracellular** development .
- Drug of choice in acute and early chronic

OR

Primaquine

destroys **Trypanosoma** in blood

Control

Sleeping Sickness

Treatment of patients

Control of vectors
(*Glossina*)

Pentamidine as
prophylactic drug

Chagas' disease

Treatment of patients

Control of vectors
(*Triatoma*)

Elimination of reservoir
hosts