# Trypanosomiasis

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# Trypanosoma spp.

- require more then one host to complete their life cycle
- transmitted through blood feeding invertebrates (insects)
- mostly live in blood tissue but can be found in different locations in the host
- uses antigen variation, or variation of the protein coat, in order to avoid detection by the body

# Human Trypanosomiasis

- African Trypanosomiasis“sleeping sickness”.

West-Africa: *Trypanosoma brucei gambiense*

East-Africa: *Trypanosoma brucei rhodesiense*

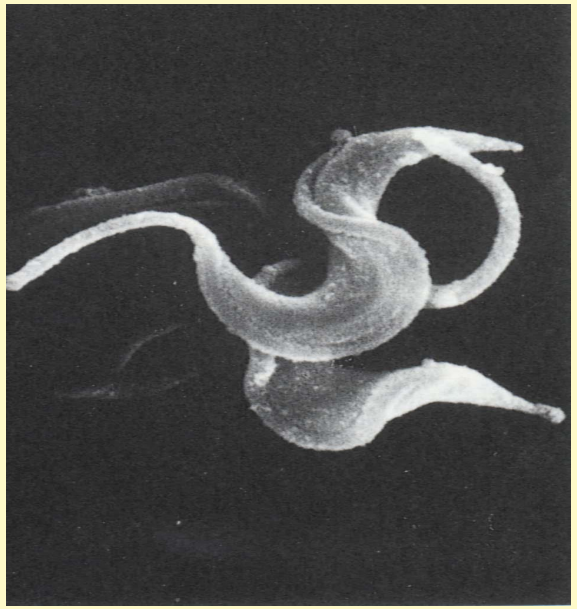
- American Trypanosomiasis“ chagas disease”

*Trypanosoma cruzi*

# Trypanosomes

- **Stercorarian trypanosomes** – Infective forms which develop in the faeces of the insect vector and enter the vertebrate host by contamination of the bite area.
- **Salivarian trypanosomes** – Infective forms which develop in the mouth parts or salivary glands and enter the vertebrate host by inoculation during biting. This is also known as the anterior station development.

# American trypansomiasis



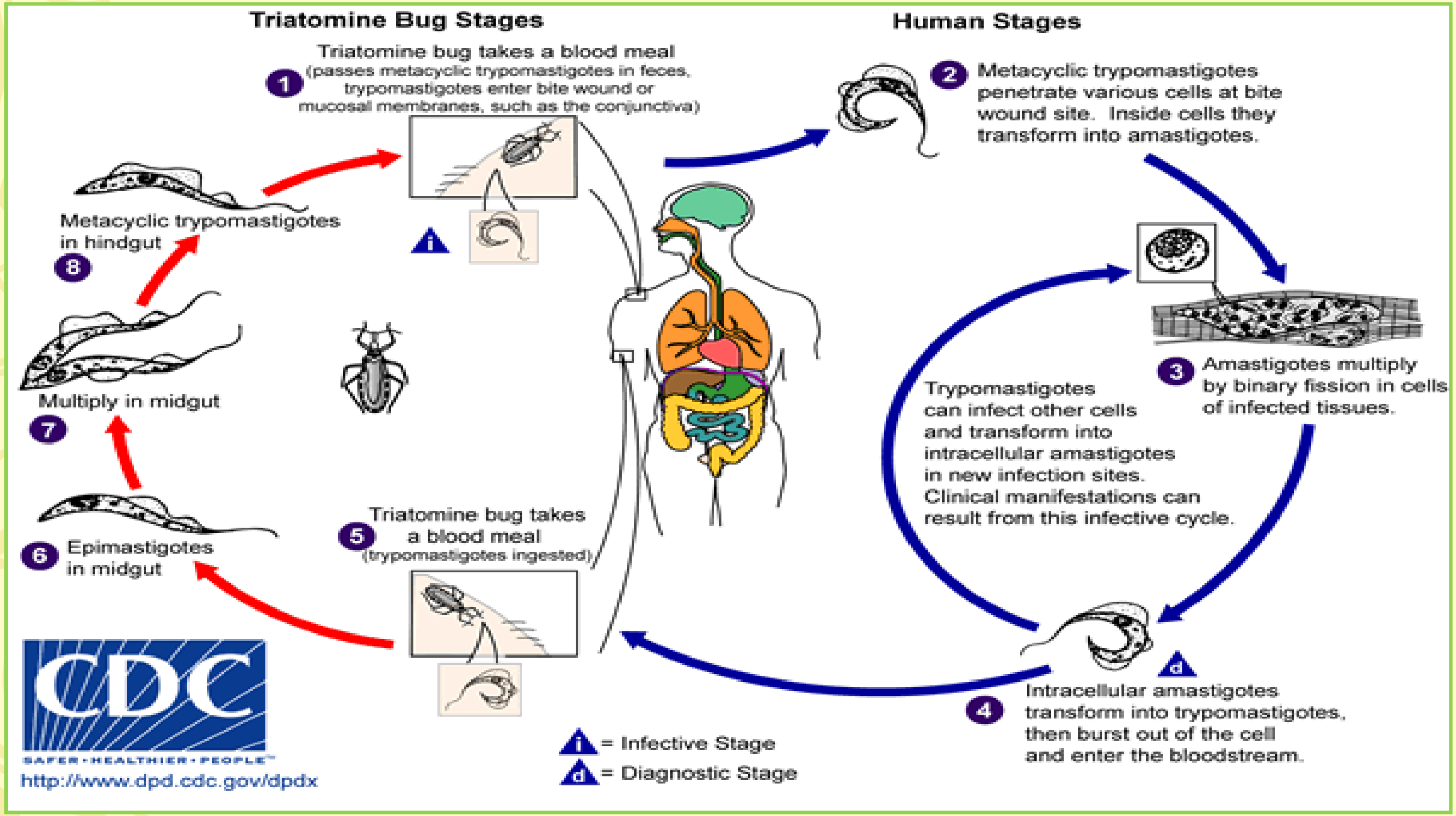
• American trypanosomiasis is a vector-borne infection caused by the protozoan parasite *Trypanosoma cruzi*. Also called **Chagas disease**, it is found only on the American continent.

• The parasite alternately infects triatomine insects (reduviid, assassin or “kissing” bugs) and a wide range of vertebrate hosts in a complex life cycle.

# Life Cycle

- An infected triatomine insect vector (or "kissing" bug) takes a blood meal and releases **metacyclic trypomastigotes** in its feces near the site of the bite wound.
- Metacyclic trypomastigotes enter the host through the wound or through intact mucosal membranes, such as the conjunctiva .
- Inside the host, the metacyclic trypomastigotes invade cells near the site of inoculation, where they differentiate into intracellular amastigotes .
- The amastigotes multiply by binary fission and differentiate into trypomastigotes, and then are released into the circulation as bloodstream trypomastigotes .
- Trypomastigotes infect cells from a variety of tissues and transform into intracellular amastigotes in new infection sites. Clinical manifestations can result from this infective cycle.

- The bloodstream trypomastigotes do not replicate (different from the African trypanosomes). Replication resumes only when the parasites enter another cell or are ingested by another vector.
- The “kissing” bug becomes infected by feeding on human or animal blood that contains circulating parasites .
- The ingested trypomastigotes transform into epimastigotes in the vector’s midgut .
- The parasites multiply and differentiate in the midgut and differentiate into infective metacyclic trypomastigotes in the hindgut .


Triatomine Bug Stages
Human Stages
Triatomine bug takes a blood meal
(passes metacyclic trypomastigotes in feces, trypomastigotes enter bite wound or mucosal membranes, such as the conjunctiva)
1
2
Metacyclic trypomastigotes penetrate various cells at bite wound site. Inside cells they transform into amastigotes.
Metacyclic trypomastigotes in hindgut
8
3
Amastigotes multiply by binary fission in cells of infected tissues.
Multiply in midgut
7
Trypomastigotes can infect other cells and transform into intracellular amastigotes in new infection sites. Clinical manifestations can result from this infective cycle.
Epimastigotes in midgut
6
Triatomine bug takes a blood meal
(trypomastigotes ingested)
5
4
Intracellular amastigotes transform into trypomastigotes, then burst out of the cell and enter the bloodstream.
= Infective Stage
= Diagnostic Stage
CDC
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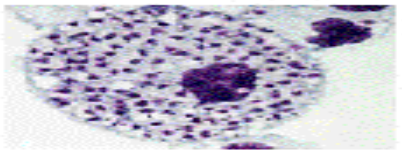
# THE LIFE CYCLE OF *TRYPANOSOMA CRUZI*
## (AMERICAN TRYPANOSOMIASIS OR CHAGAS' DISEASE)

Vector bites a human and defecates on the skin.

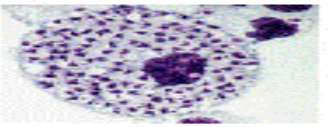
Metacyclic trypomastigotes are rubbed into the eye or bug's bite.

Trypomastigotes enter cells and reproduce as amastigotes.

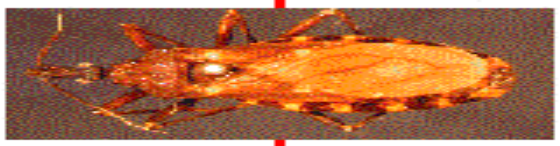


Cell dies, amastigotes released. Some amastigotes will infect new cells, some amastigotes will transform into trypomastigotes and remain in the blood stream.

Vector infected when it ingests amastigotes or trypomastigotes in a blood meal.



The parasite reproduces asexually in the vector's gut. Metacyclic trypomastigotes move to the rectum of the vector.



(Parasites and Parasitological Resources)

# Transmission

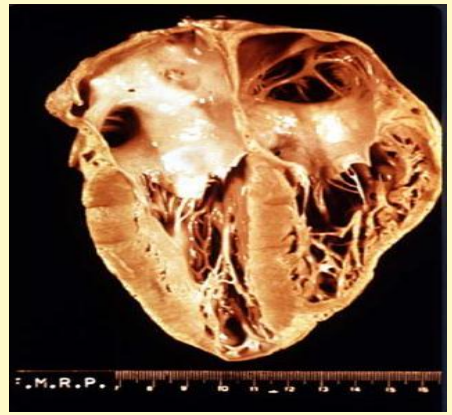
- A triatomine becomes infected
- Hides during day
- Emerges at night
- Bites, feeds, then defecates
- Scratching
- blood transfusions
- organ transplantation
- transplacentally, and in laboratory accidents.

# Clinical aspects

- Chagoma as primary lesion: ( Acute phase )

An erythematous subcutaneous nodule is formed at the site of deposition of bug's feces. It is painful, commonly occurs on face and may take 2–3months to resolve

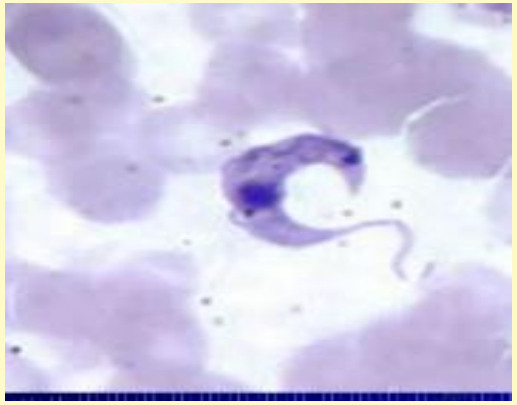
- Romans's sign : When the parasites enter through conjunctiva, there occurs an unilateral painless edema of the eye lid and conjunctivitis .



- **Chronic disease** is cardiomyopathy
- **mild case** : extra systole, slight tachycardia
- **Severe case**: heart block partially or completely cardiac failure
- **Some case: Digestive system abnormalities (**megaesophagus; dysphagia megacolon ) .
- **Neurological disorders**
- **Potentially fatal if untreated**

# Diagnosis

- Diagnosis by detection of trypomastigotes in the blood or the presence of *T.cruzi*-specific antibodies in serum to indicate acute or chronic infection, respectively. The shape of *T.cruzi* appear as U or C shape in blood film.

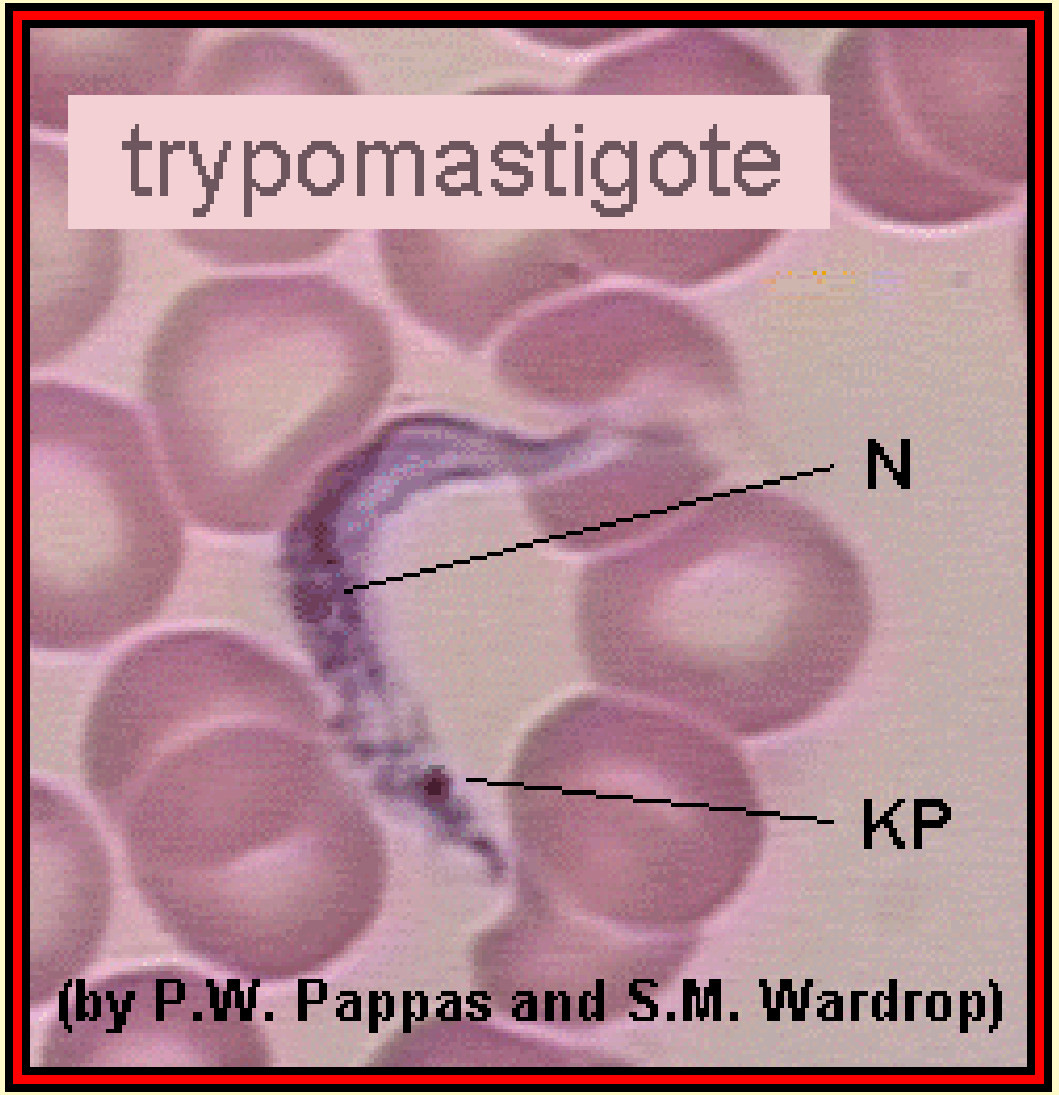


- In chronic infection these specimens can be cultured in vitro in liquid medium or by growth within uninfected insect vectors (xenodiagnoses)

**Xenodiagnosis**: A method of diagnosis in which a vector is fed on a suspected case and is later examined for the presence of the parasite.

- Direct detection of parasites using PCR.

- Trypomastigotes may be seen in cerebrospinal fluid (CSF) in central nervous system infections; also the amastigote stage parasite may be seen in histopathology specimens from affected organs.


trypomastigote
N
KP
(by P.W. Pappas and S.M. Wardrop)

# African trypanosomes (sleeping sickness)

Human African trypanosomiasis (HAT), also called sleeping sickness, is an illness endemic to sub-Saharan Africa. It is caused by the flagellate protozoan *Trypanosoma brucei*, which exists in 2 morphologically identical subspecies:

- ***Trypanosoma brucei gambiense*** **,** causes chronic infections in **West and Central Africa which can persist up to 10 years**.

- ***Trypanosoma brucei rhodesiense*** **,** is more prevalent **in Eastern Africa and mostly results in acute human infections that can be lethal within a few months**.

**Vector**：**biting flies;** **tsetse fly** **(*Glossina*),** is found only in Africa.

# Transmission

- Via vector – bite from the tse tse fly
- Mother to child infection (perinatal death)
- Blood transfusion
- Sexual contact

# Life cycle

- The arthropods are obligate bloodsucking insects (genus *Glossina*), that get infected through feeding on a parasitized host and accommodate the trypanosome during their entire lifespan.
- trypanosomes colonize the mid gut, proliferate and undergo differentiation while directionally migrating towards the insect salivary glands.
- The vertebrate-infective metacyclic form of the parasite resides in the salivary glands or mouthparts of the fly, using the blood feeding behaviour for its transmission to a new host.
- Upon transmission to the vertebrate host, trypanosomes will transform into actively proliferating (long slender) forms to allow a systemic colonization of the host.
- trypanosomes in the bloodstream become quiescent (short stumpy) and pre-adapt to uptake and subsequent survival in the tsetse fly

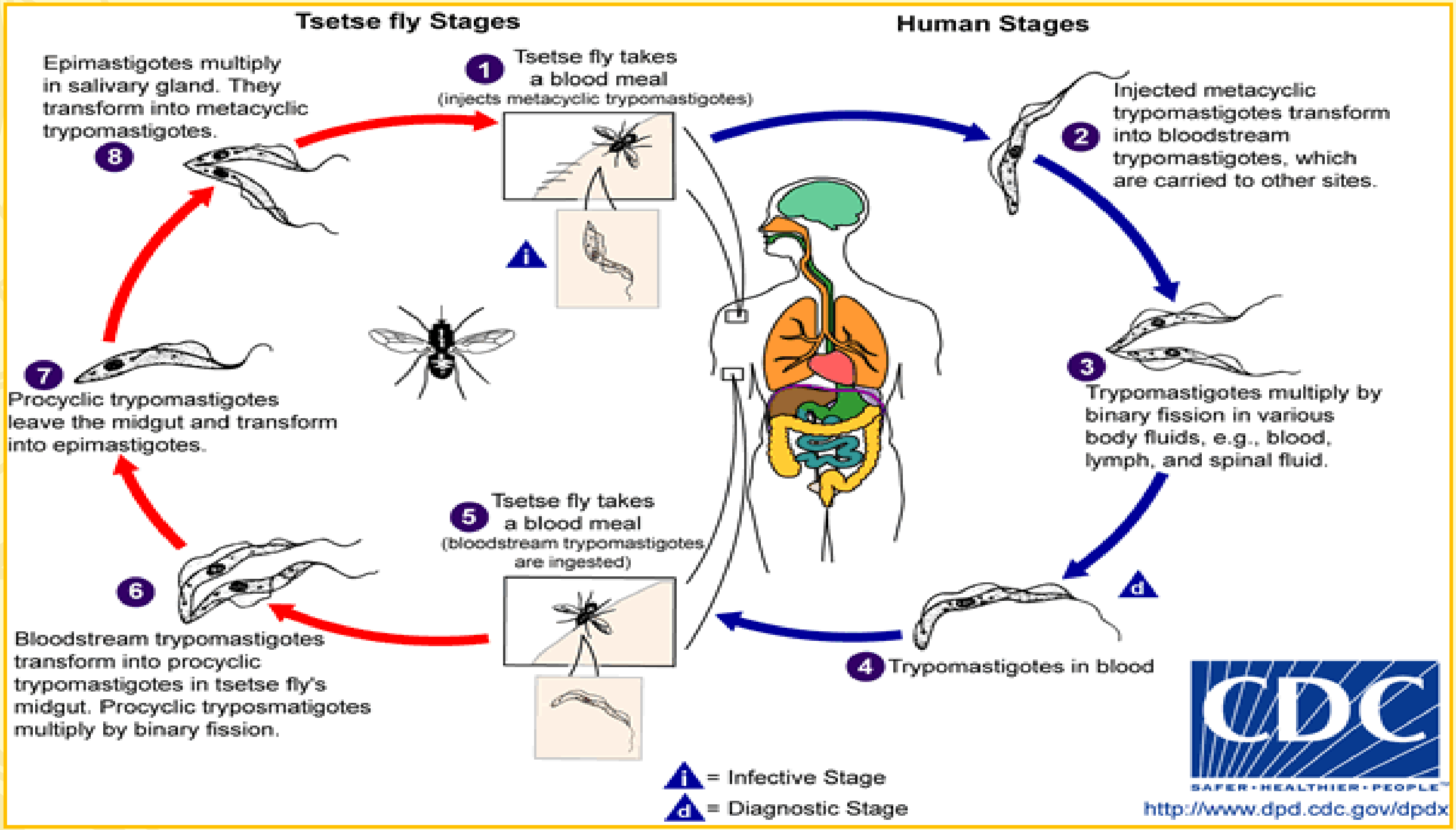
# Lifecycle

Fly injects metacyclic trypomastigotes when it feeds on blood.

Parasite reproduces asexually in the fly's gut (epimastigotes), migrates to the fly's salivary glands (metacyclic trypomastigote)

Trypomastigotes reproduce asexually in the bloodstream

Fly ingests trypomastigotes when it feeds on blood of infected individual.


Tsetse fly Stages
Human Stages
Epimastigotes multiply in salivary gland. They transform into metacyclic trypomastigotes.
8
1 Tsetse fly takes a blood meal
(injects metacyclic trypomastigotes)
i
2 Injected metacyclic trypomastigotes transform into bloodstream trypomastigotes, which are carried to other sites.
3 Trypomastigotes multiply by binary fission in various body fluids, e.g., blood, lymph, and spinal fluid.
d
4 Trypomastigotes in blood
5 Tsetse fly takes a blood meal
(bloodstream trypomastigotes are ingested)
6 Bloodstream trypomastigotes transform into procyclic trypomastigotes in tsetse fly's midgut. Procyclic tryposmatigotes multiply by binary fission.
7 Procyclic trypomastigotes leave the midgut and transform into epimastigotes.
i = Infective Stage
d = Diagnostic Stage
CDC
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http://www.dpd.cdc.gov/dpdx

# Signs & Symptoms

- First Stage

In the first stage the parasite is found in the peripheral circulation, but has not yet invaded the central nervous system.( hemolymphatic stage )

Symptoms include:

- Headaches
- aching muscles and joints
- Fever
- Swollen lymph nodes all over the body
- Swollen, red, painful nodule at site of fly bite (Primary chancre) - resolves 2-3 weeks

**Winterbottom's sign** - Swollen lymph nodes along back of neck in child with early trypanosomiasis

# Chronic Disease Phase

In the second stage, the parasite crosses the blood-brain barrier and infects the central nervous system.( Neurological phase )

Symptoms include:

- Confusion
- Difficulty walking and talking
- Seizures
- Night insomnia
- loss of consciousness and coma

# Diagnosis

- Microscopic examination

  chancre fluid

  lymph node aspirates

  Blood

  bone marrow

  cerebrospinal fluid (late stages of infection)

- Serology

Card agglutination trypanosomasis test (CATT)

- Animal inoculation


Thank You