Diagnostic Parasitology

Medically Important Ciliates & Flagellates

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Disclaimer

- This presentation was meant to provide students with both didactic and laboratory skills as they apply to clinical parasitology. It is meant for educational purposes only and does not represent Cleveland Clinic views or practices.
- The presentation contains images and other references copyrighted by another entity or person and credits shall be given to the rightful owners of the materials and I claim no copyright to the said content.
- Most of the information was adopted from the Textbook of Diagnostic Microbiology by Mahon & Lehman (see citation) but condensed for bite sized learning.

Protozoa

- Unicellular parasites
- Classified according to their motility organelles
  - Amebae move by pseudopodia
  - Ciliates move by cilia
  - Flagellates move by flagella
  - Sporozoa are nonmotile
- All reproduce asexually except for the sporozoa

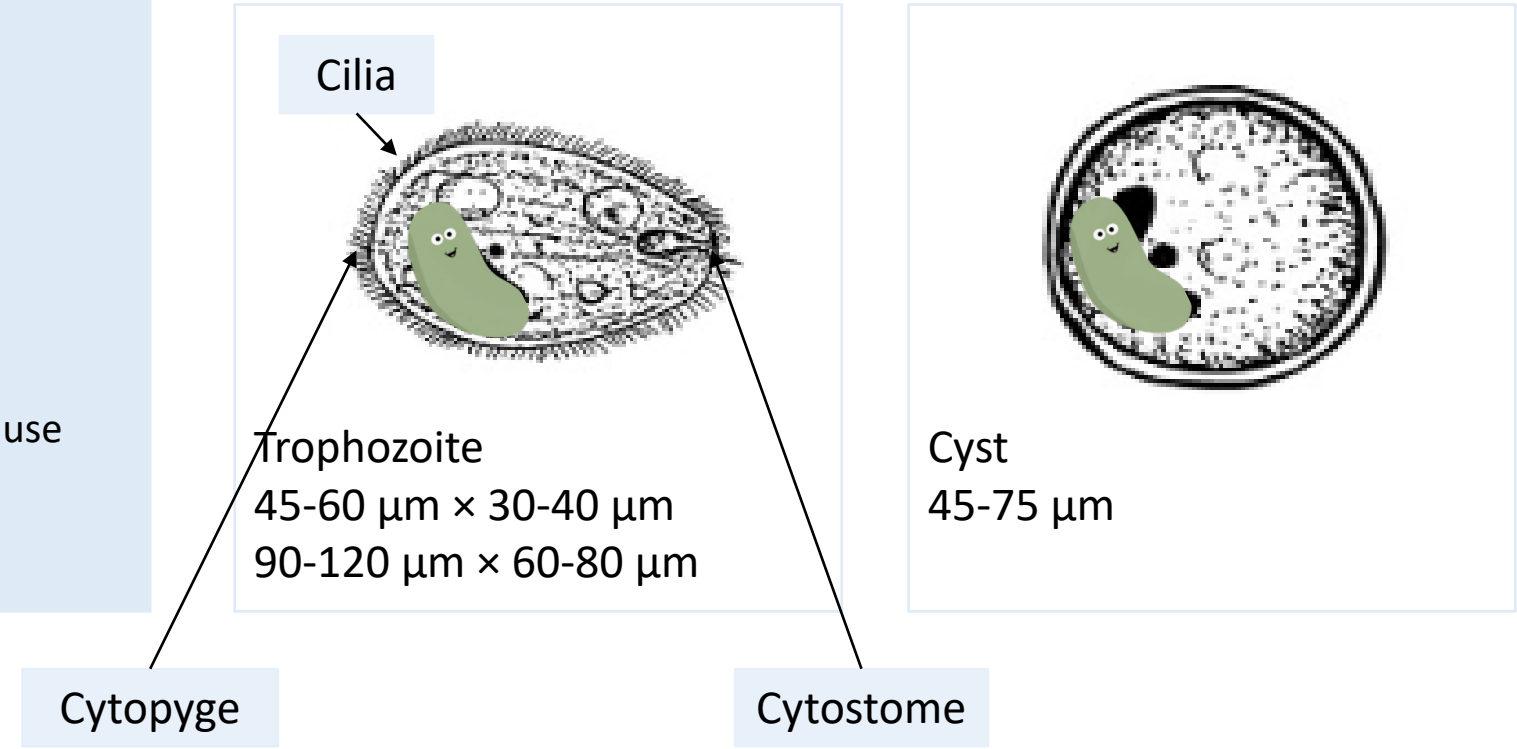
Cyst: nonmotile form resistance to environmental factors
Trophozoite: feeding motile form replicates in the host and responsible for causing damage

The Ciliates

Intestinal

- Only one medically important ciliate
  - *Neobalantidium coli*
- Pigs are the natural host
- Cyst is the infective stage
- Humans are accidental host
- Fecal oral transmission
- Lives in the large intestine and may cause mucosal lesions however, most are asymptomatic

Two nuclei: a kidney bean-shaped macronucleus and a small round micronucleus



The Flagellates

Intestinal

- Four medically important members
  - *Giardia duodenalis*
  - *Dientamoeba fragilis*
  - *Chilomastix mesnili*
  - *Pentatrichomonas hominis*
- Includes pathogens and nonpathogens
- *Giardia duodenalis* and *Dientamoeba fragilis* are the only pathogens
- Fecal oral transmission
- If there is a cyst stage, it is the infective form; otherwise, it is the trophozoite

Urogenital

- One medically important member
  - *Trichomonas vaginalis*
- Sexually transmitted infection

Blood/Tissue

- Two medically important members
  - *Trypanosoma* species
  - *Leishmania* species
- Transmitted by vectors

Intestinal Flagellates: *Giardia duodenalis*

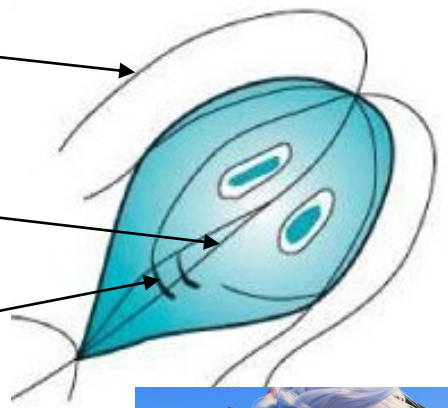
- The main groups are risk for infection
  - Travelers
  - Hikers “backpacker’s diarrhea”
  - Children
  - Oral-anal sex participants
- Beavers may serve as reservoirs in streams or rivers “beaver fever”
- Frequent cause of outbreaks of gastroenteritis and traveler’s diarrhea
  - Asymptomatic
  - Acute infection
  - Chronic infection (malabsorption-like syndrome and steatorrhea)

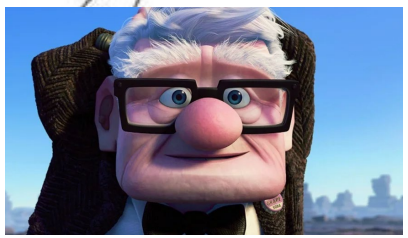
Intestinal Flagellates: *Giardia duodenalis*

Flagellum

Axostyle

Media bodies





Trophozoite
Size: 9-21 µm × 5-15 µm

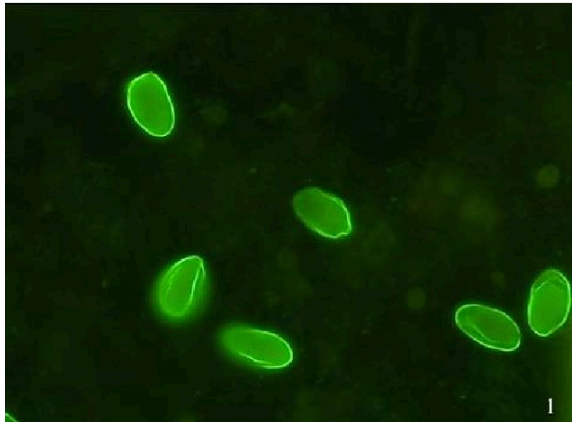
Cyst
Size: 8-12 µm

Intestinal Flagellates: *Giardia duodenalis*

- Other tests for identification
  - Wet mount to demonstrate falling leaf motility [A]
  - Enzyme immunoassasys using monoclonal antibodies to detect antigens of giardia
    - Lateral flow immunochromatographic tests [B]
  - Direct fluorescent antibody tests [C]

[A]

[B]



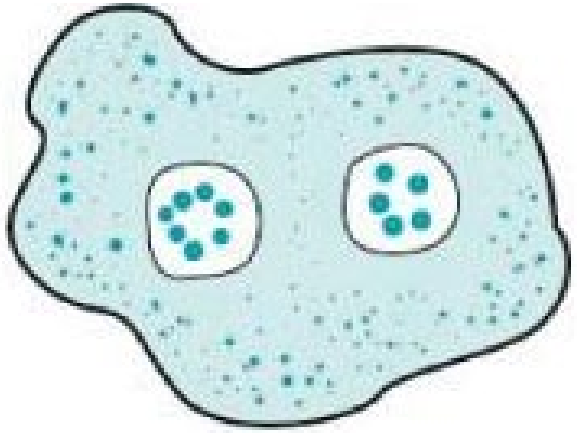
[C]

https://youtu.be/OxGTdgka6t8?si=Bh0v2VBPcBLN_oML

Intestinal Flagellates: *Dientamoeba fragilis*

- Patients may be asymptomatic or symptomatic (abdominal pain and diarrhea)
- No cyst stage
- Permanently lost its flagella

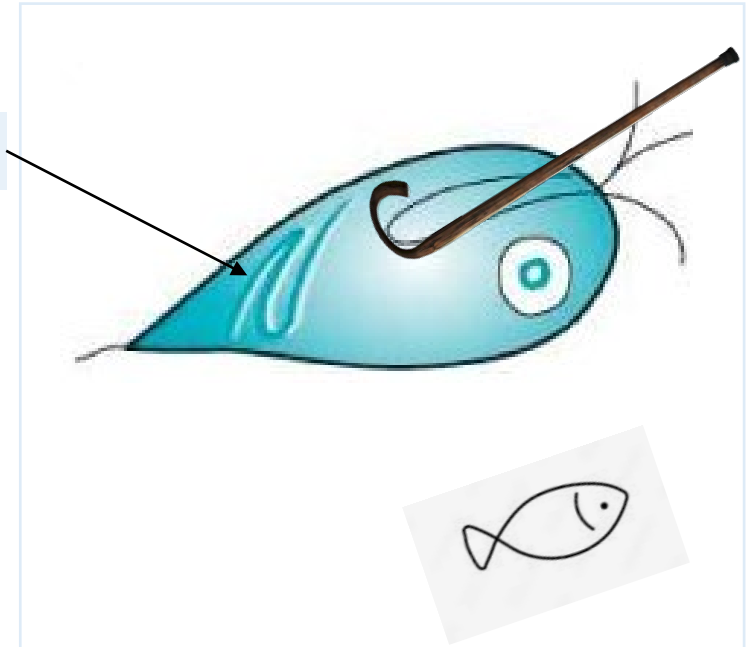
Up to two nuclei: containing 4-8 chromatin granules and no peripheral chromatin.



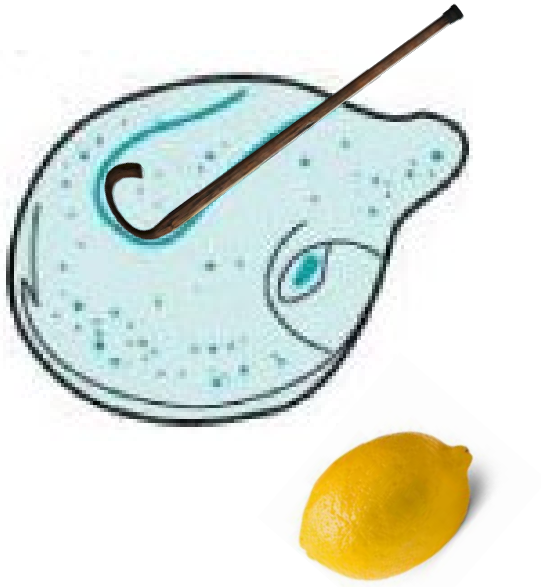
Trophozoite
Size: 5-12 µm

Intestinal Flagellates: *Chilomastix mesnili*

Spiral groove

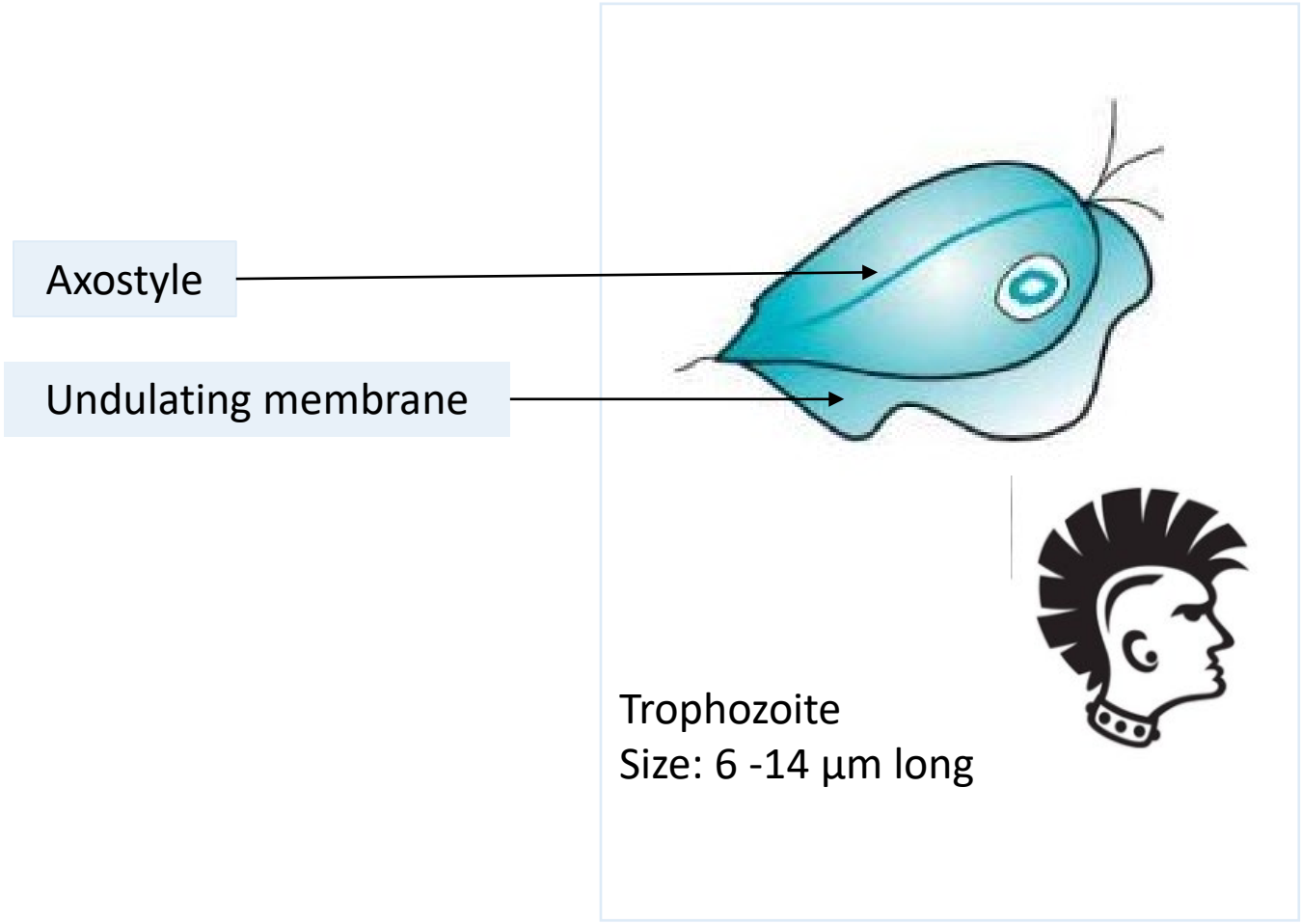


Trophozoite
Size: 10-20 µm long × 3-10 µm wide



Cyst
Size: 6-10 µm

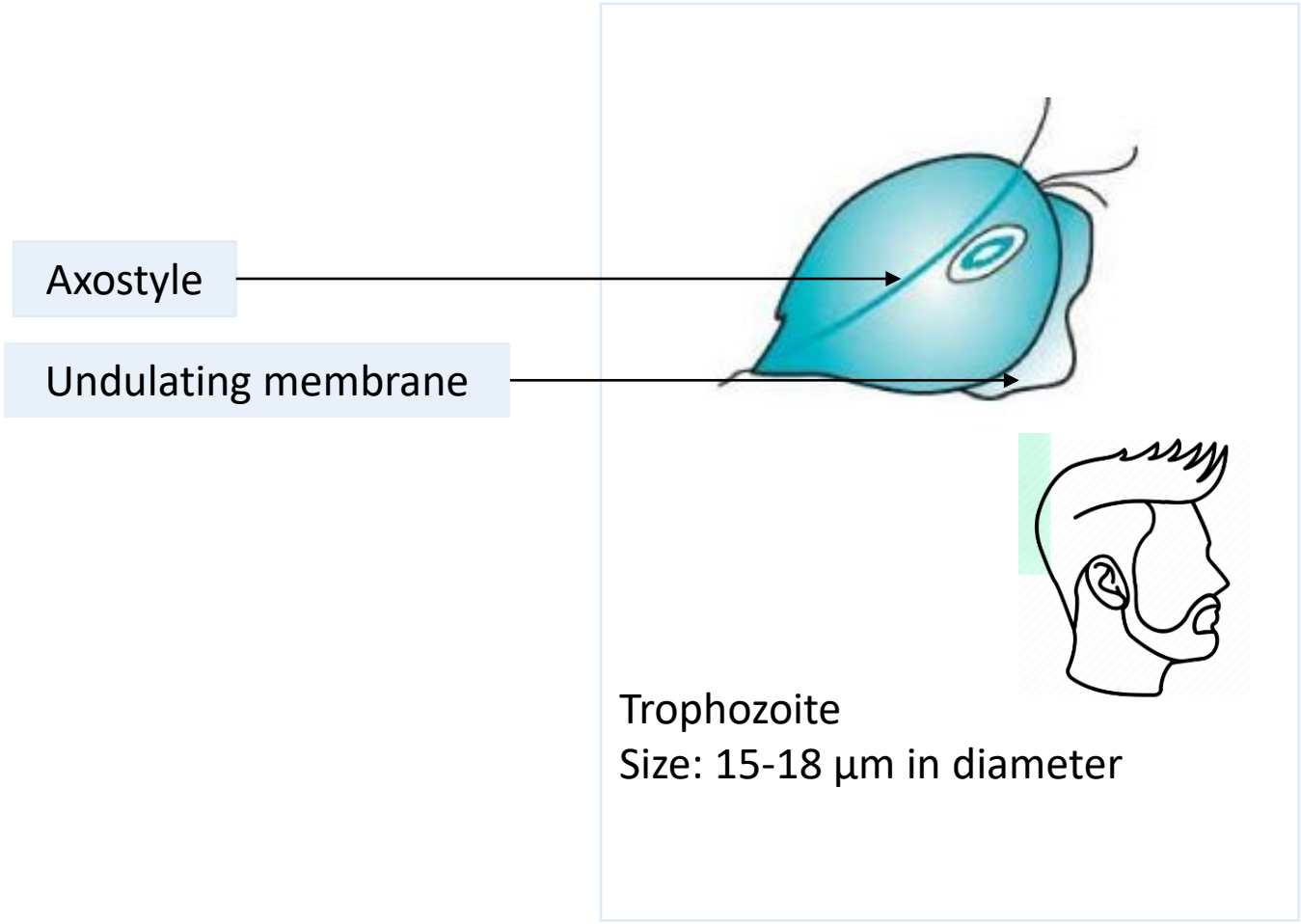
Intestinal Flagellates: *Pentatrichomonas hominis*



Urogenital Flagellate: *Trichomonas vaginalis*

- Sexually transmitted infection
  - Co-infection with gonorrhea is common
- Symptoms
  - Women: itching and production of a frothy, creamy, micropurulent vaginal discharge as well as dysuria or asymptomatic.
  - Men: typically, asymptomatic but can develop nonspecific urethritis with a milky discharge.

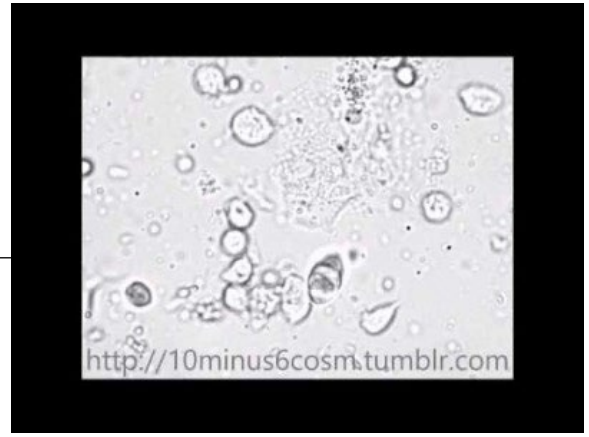
Urogenital Flagellate: *Trichomonas vaginalis*



Trophozoite
Size: 15-18 µm in diameter

Urogenital Flagellate: *Trichomonas vaginalis*

- Other tests for identification
  - Wet preps show jerky motility [A]
  - Culture using a plastic pouch containing culture medium [B]
  - PCR methods (useful for detecting infection in asymptomatic men)
  - Antigen detection assays
    - Ex. immunochromatographic enzyme immunoassay using monoclonal antibodies [C]



[A]

[B]

[C]

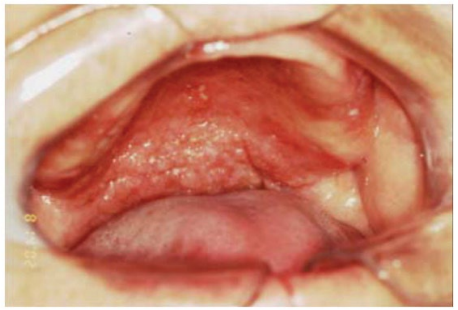
https://youtu.be/rim2dXF3Oac?si=zBMCj2gHKcbfKxWB

Blood and Tissue Flagellates: *Leishmania* species

Species	Vector	Disease
Leishmania tropica complex	Sand fly [A]	Cutaneous leishmaniasis [B]
Leishmania mexicana complex		New world cutaneous leishmaniasis
Leishmania braziliensis complex		Mucocutaneous leishmaniasis (espundia) [C]
Leishmania donovani complex		Visceral leishmaniasis (kala azar) [D]

[A]

[B]

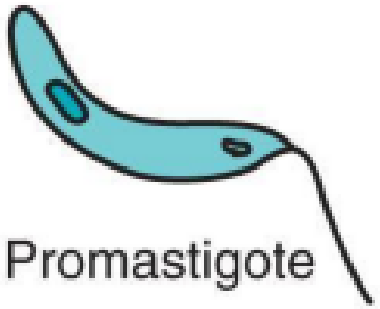


[C]

[D]

Blood and Tissue Flagellates: *Leishmania* species

Sand fly
(vector for *Leishmania* spp.)



Promastigote

- Free flagellum

Tissue

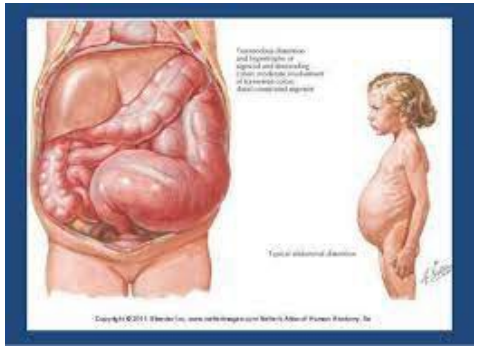
Amastigote

- Retracted flagellum

Blood and Tissue Flagellates: *Trypanosoma* species

Organism	Vector	Disease
Trypanosoma cruzi	Reduviid bug [A]	Chagas [B]
Trypanosoma brucei subspecies gambiense	Tsetse fly [C]	West African Sleeping Sickness [D]
Trypanosoma brucei subspecies rhodesiense		East African Sleeping Sickness [D]

[A]



[B]

[C]

[D]

Blood and Tissue Flagellates: *Trypanosoma* species

Trypanosoma brucei

Tsetse fly
Reduviid bugs

Epimastigote

- Free flagellum
- Undulating membrane attached anterior to nucleus

Blood/cerebrospinal fluid

Trypomastigote

- Free flagellum
- Undulating membrane attached posterior to nucleus

Tissue

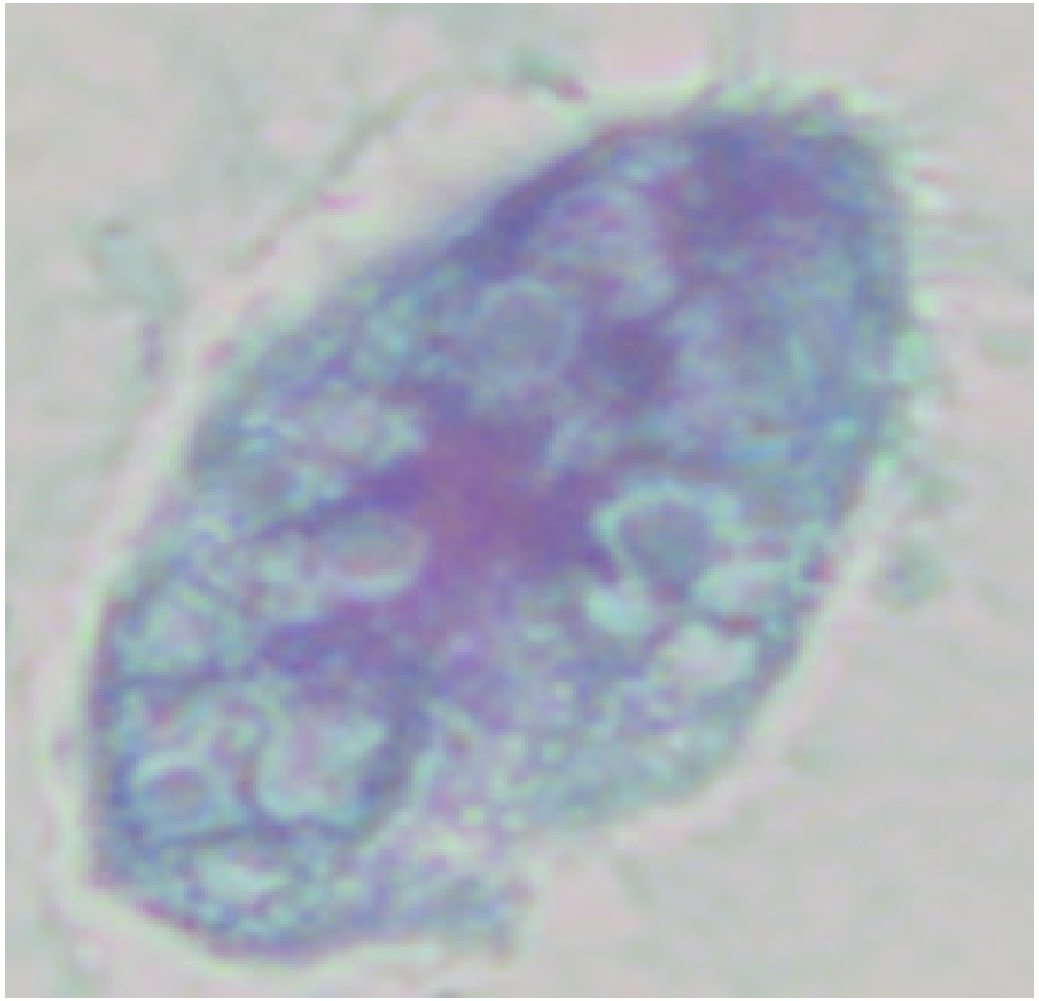
Amastigote

- Retracted flagellum

Trypanosoma cruzi

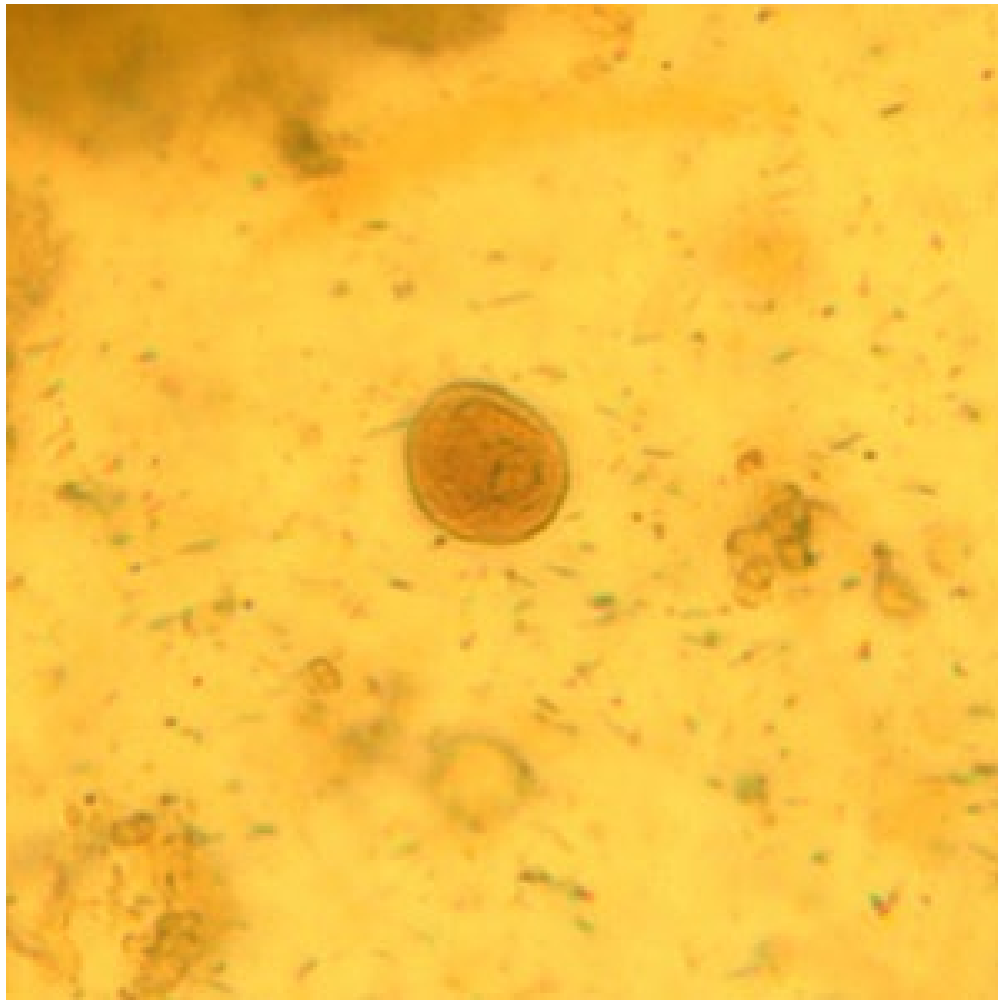
Amebae Ova and Parasite Examination (OVAP)

Iodine wet preparation



Trichrome

Amebae Ova and Parasite Examination (OVAP)



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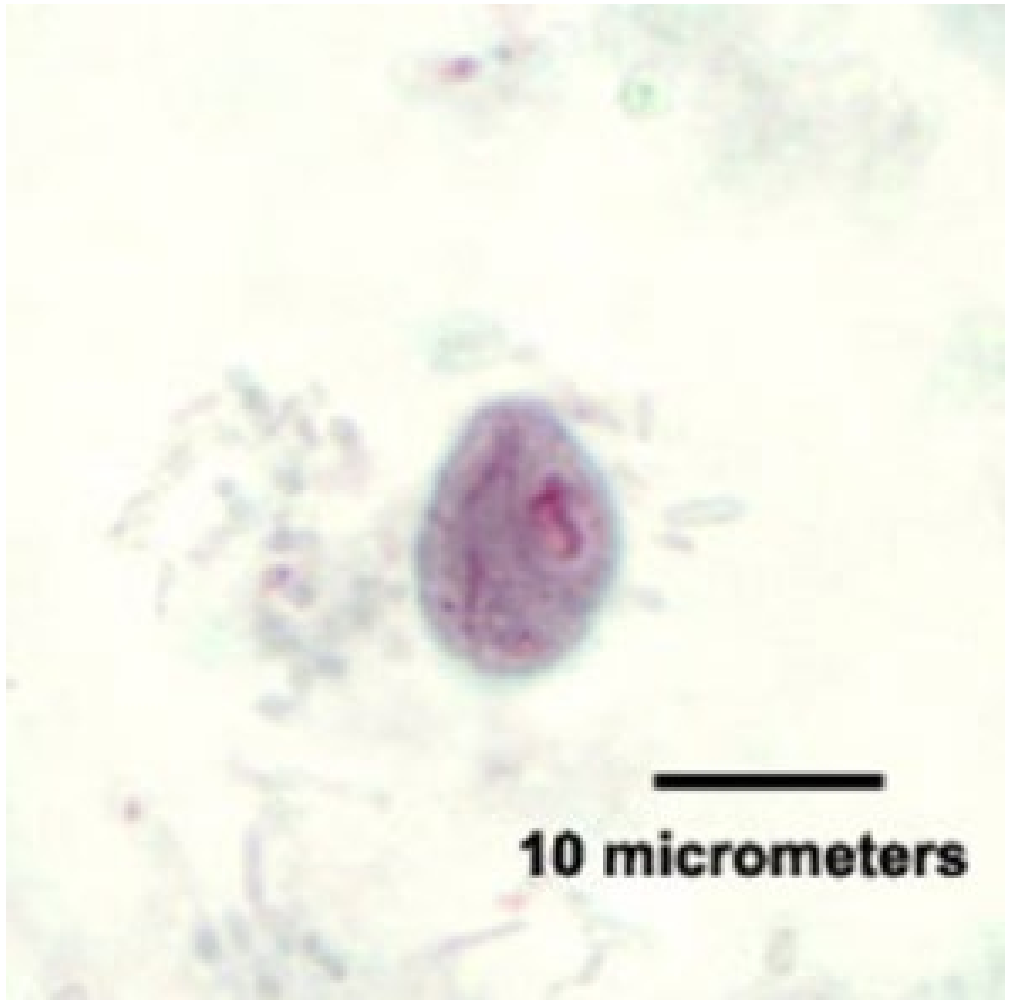

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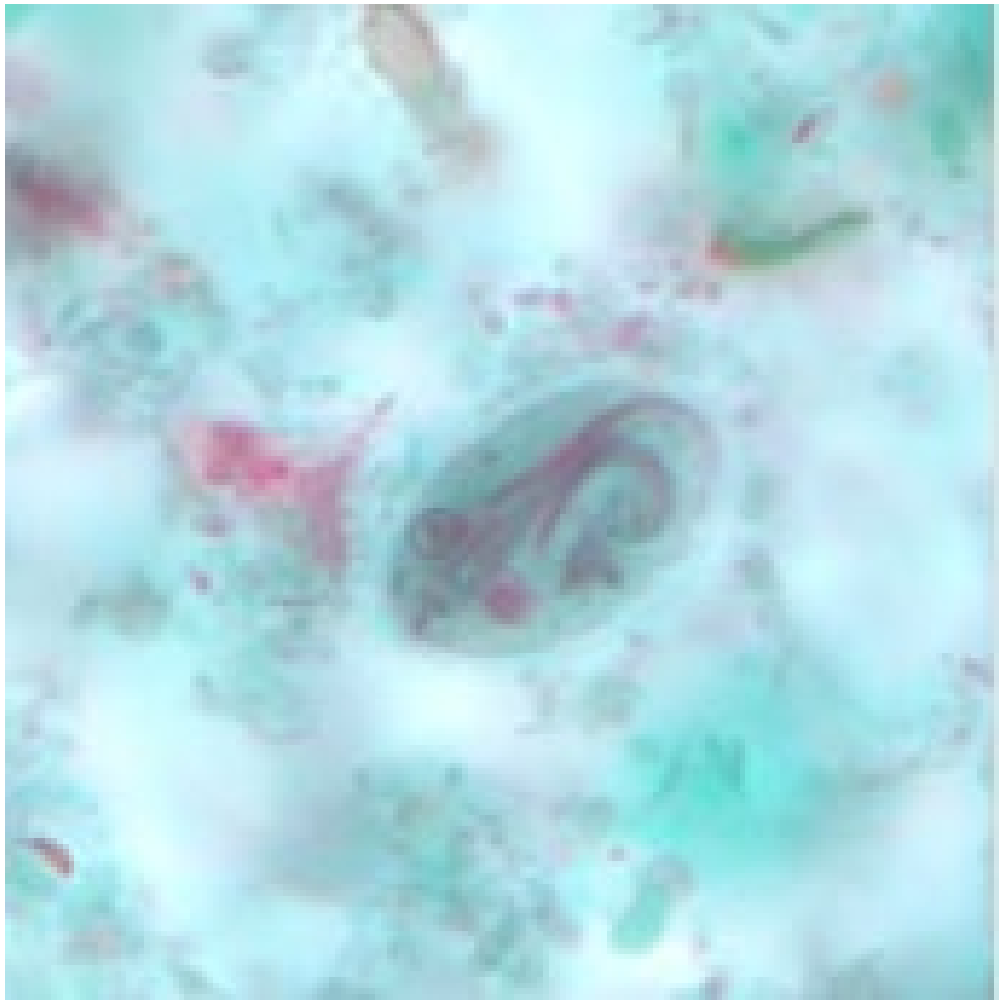

Trichrome

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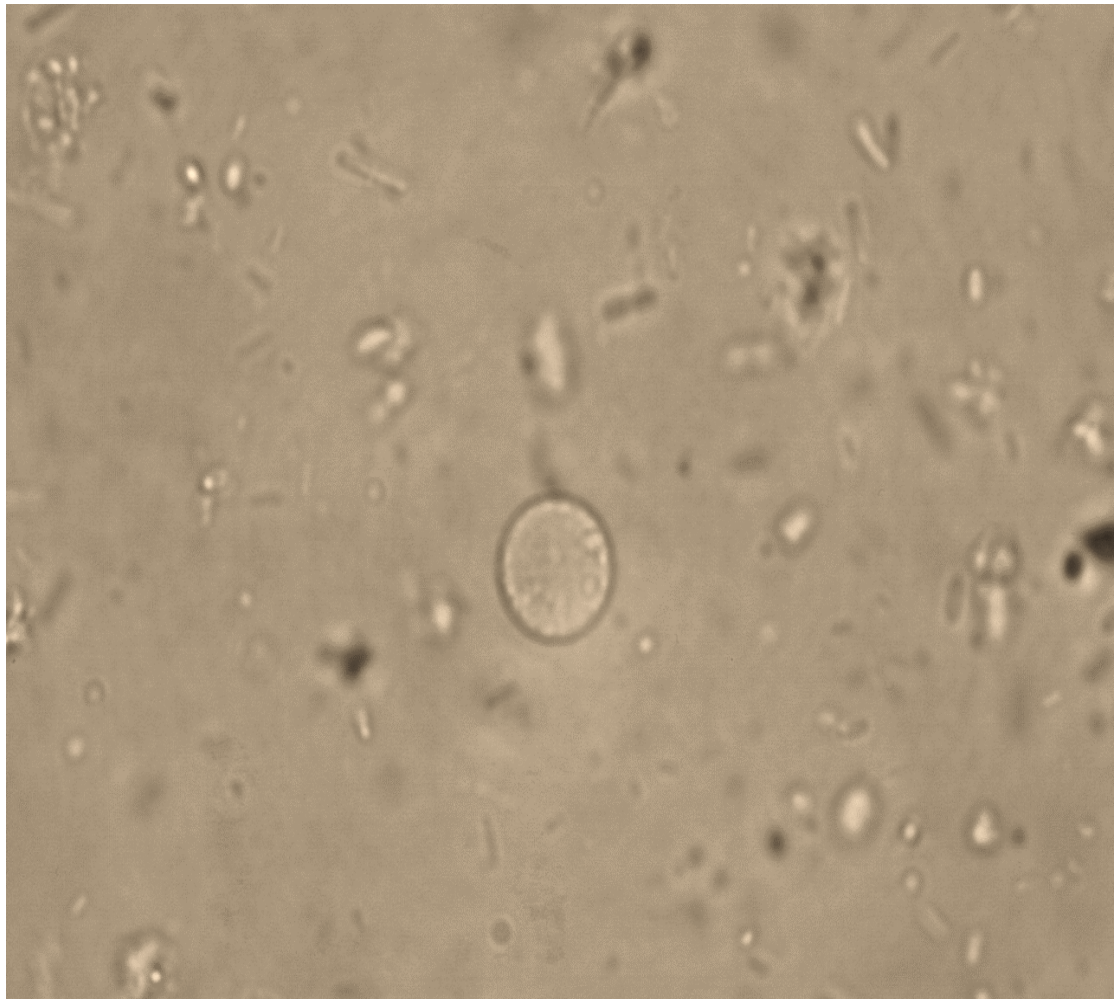
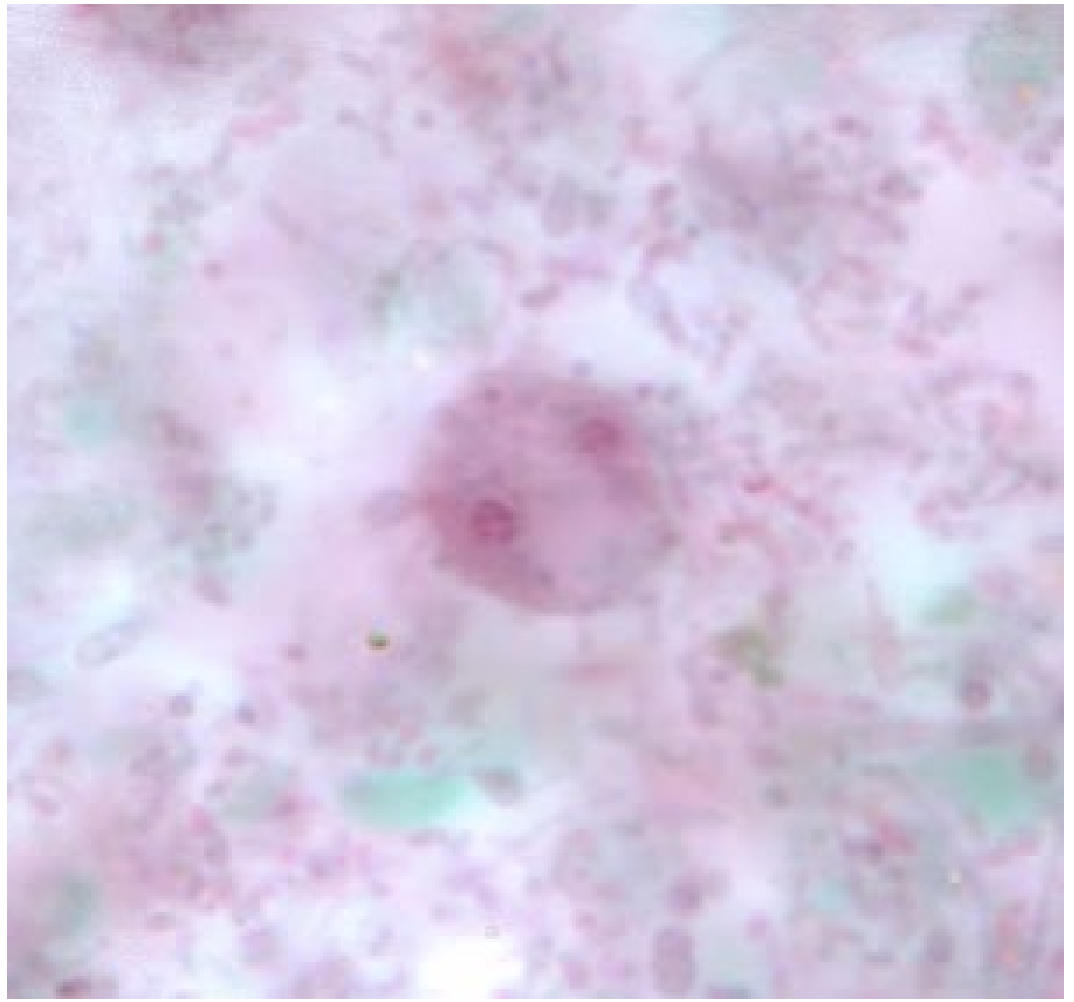
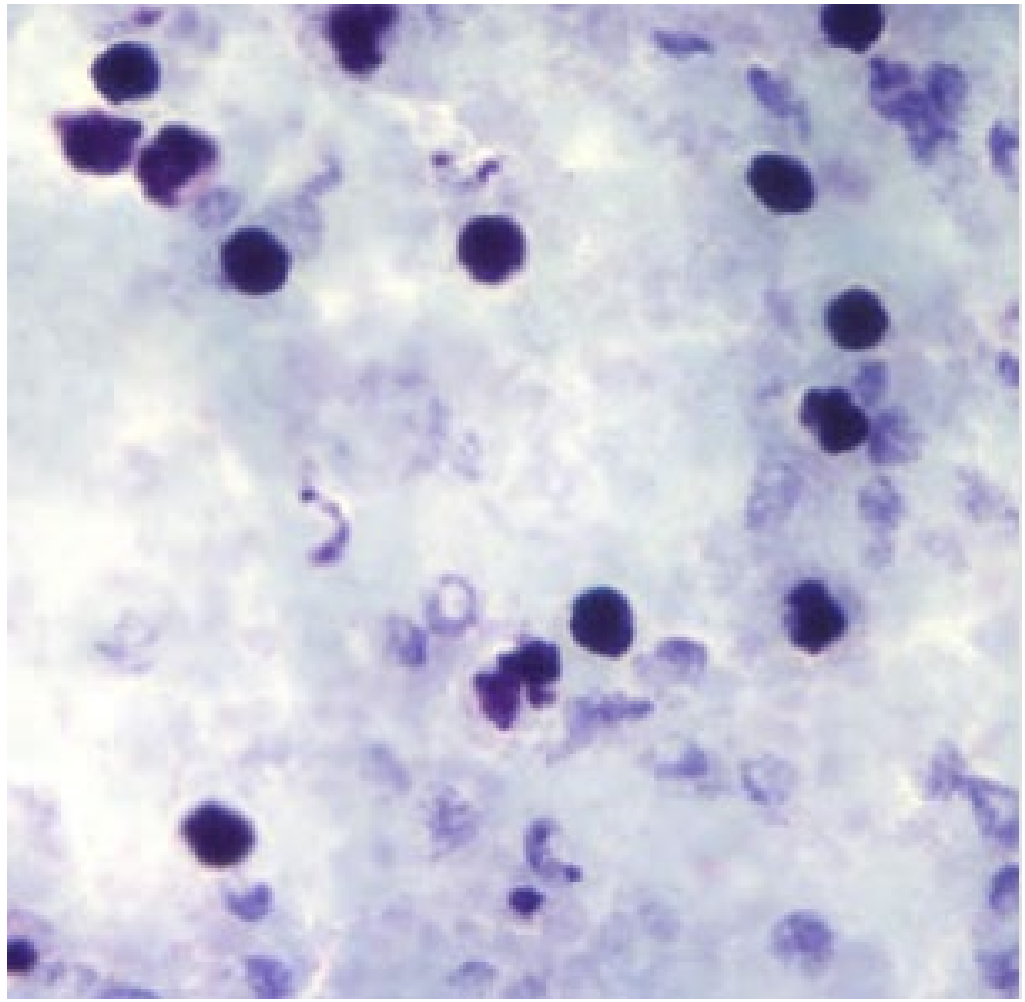


Iodine wet preparation

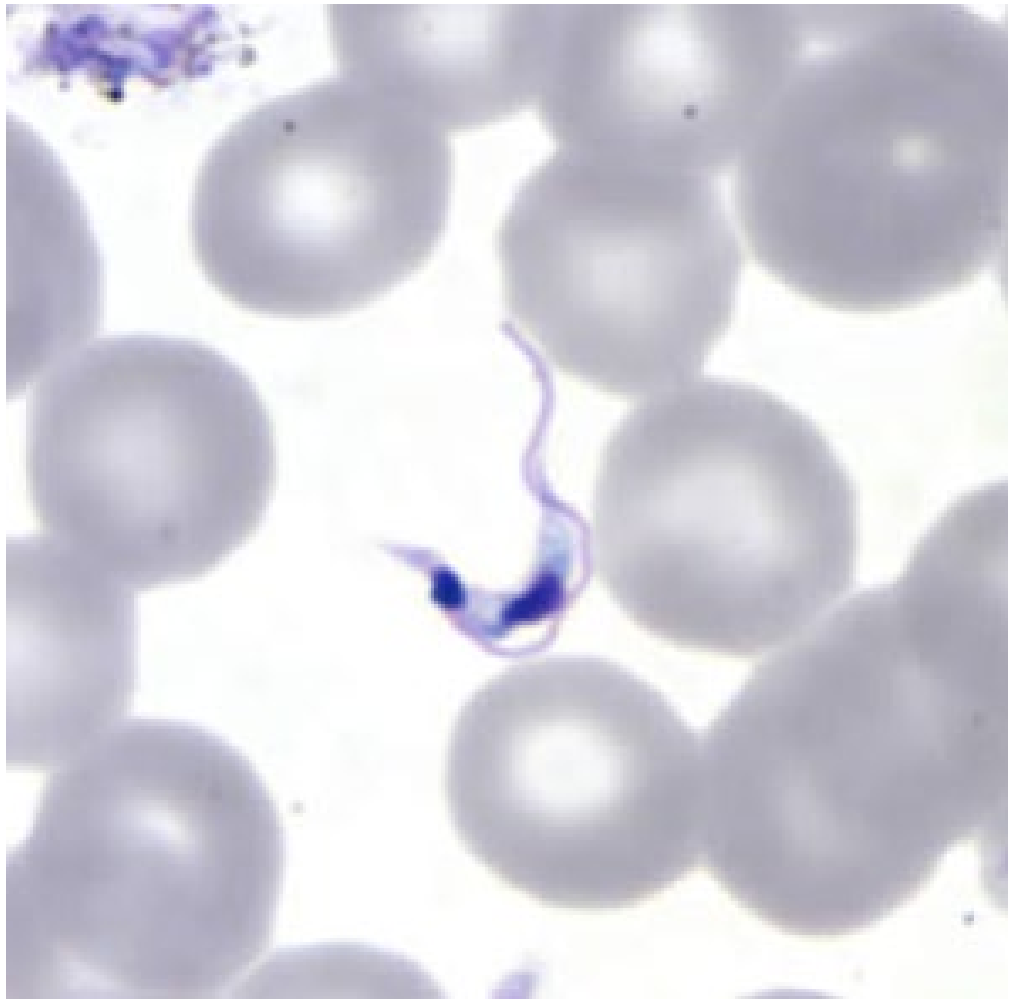


Trichrome

Blood Parasite

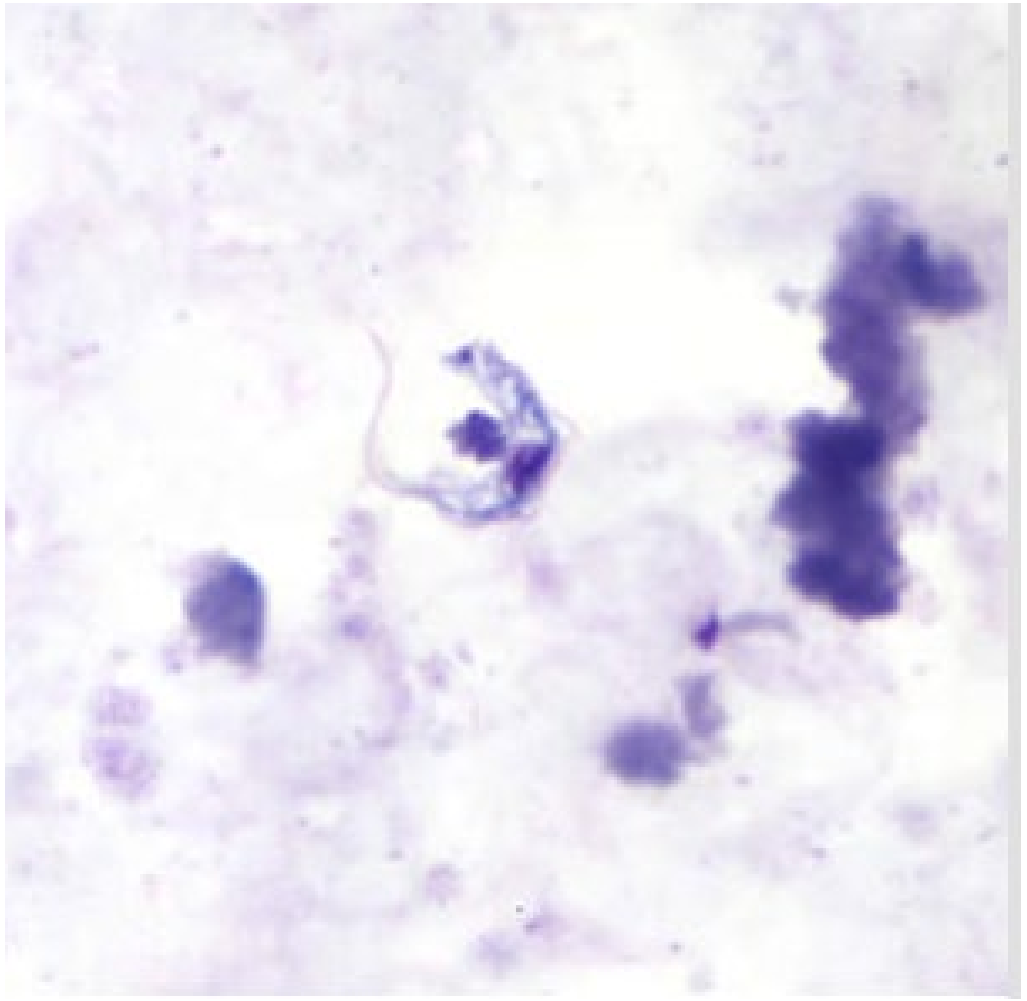


Thick Smear

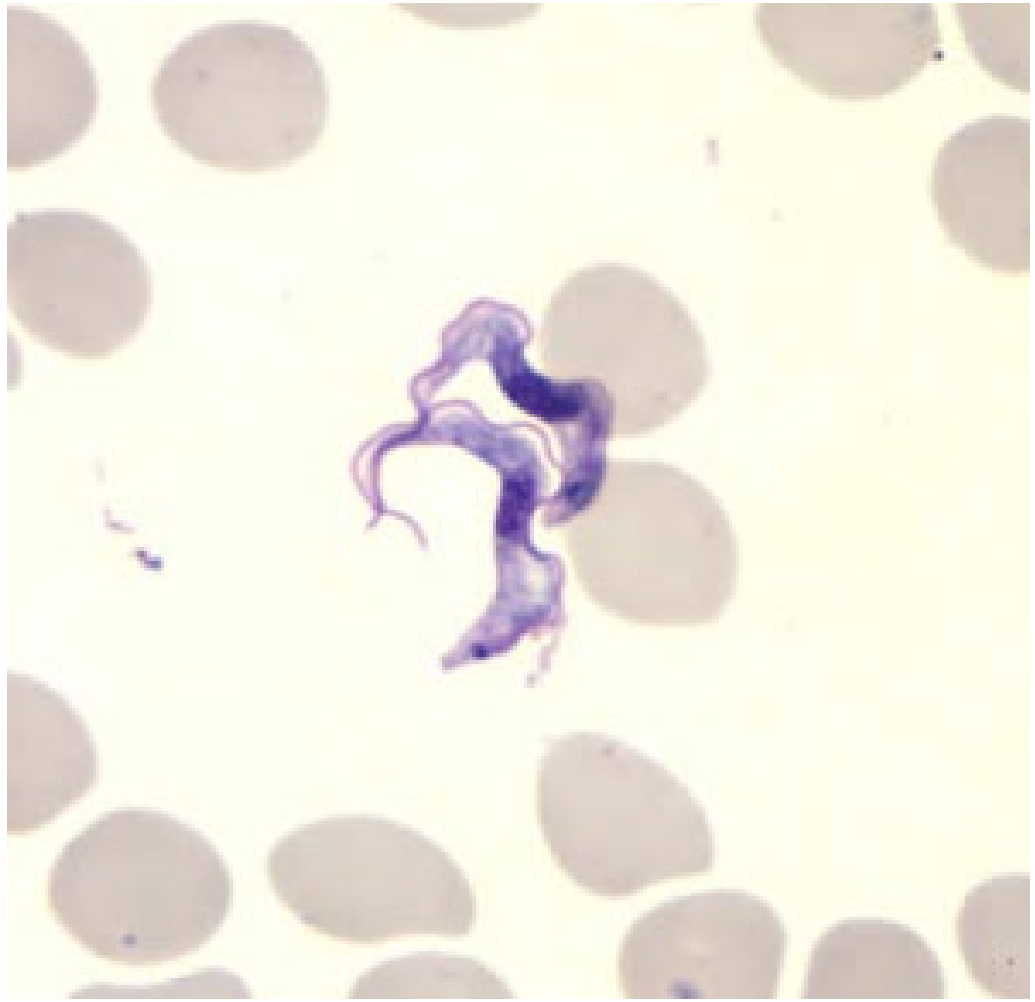


Thin Smear

Blood Parasite



Thick Smear



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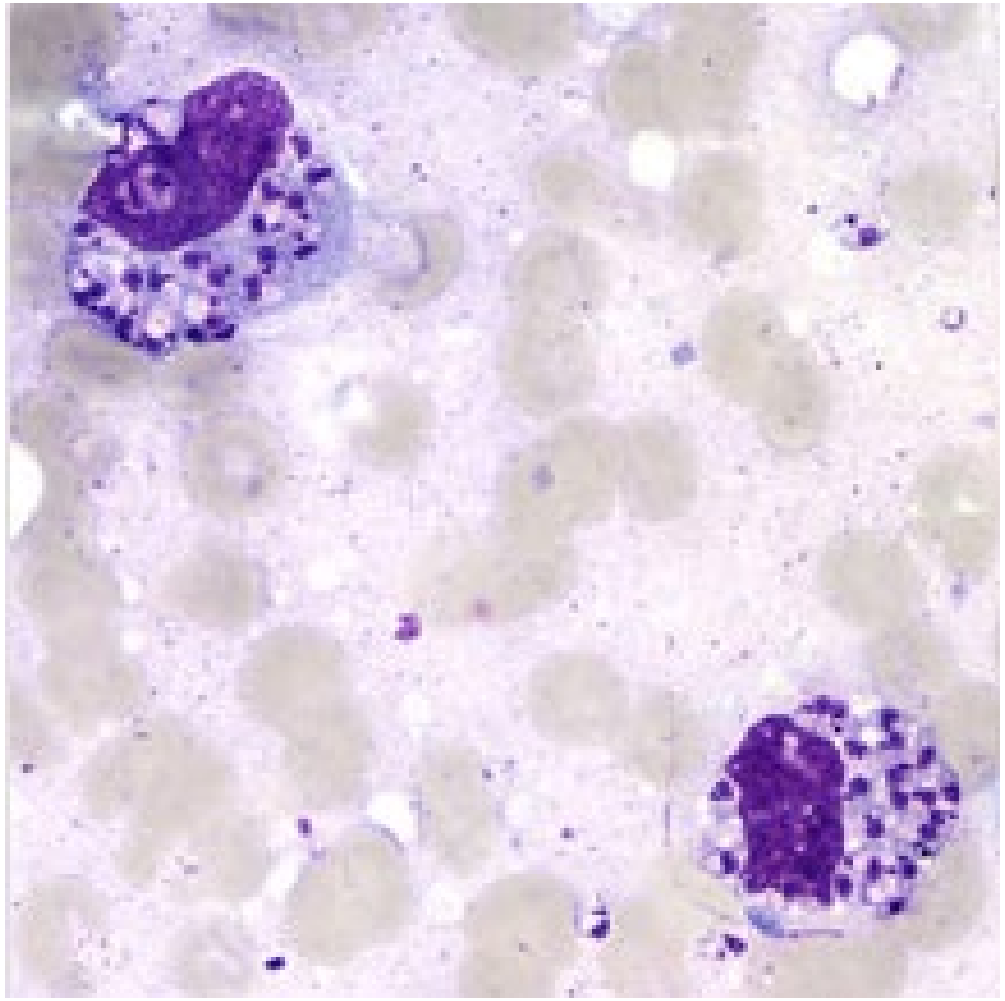
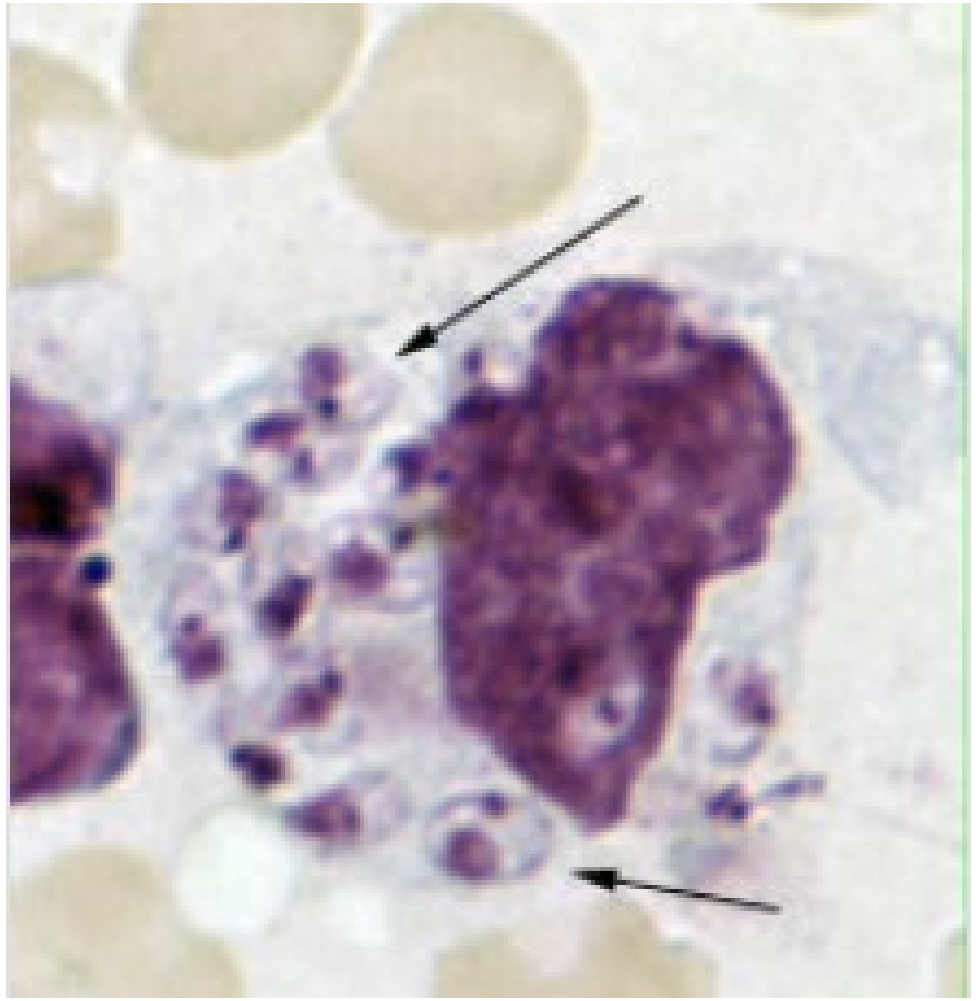
Blood Parasite





Thin Smear

Citations

- Mahon, C. R., & Lehman, D. C. (2023). *Textbook of Diagnostic Microbiology* (7th ed., pp. 639-707). Elsevier.
- Centers for Disease Control and Prevention (2019, November 20). DPDx-Laboratory Identification of Parasites of Public Health Concern. Retrieved November 13, 2023, from https://www.cdc.gov/dpdx/az.html