Parasitic Infections Affecting CNS and Special senses

Each Slide has Two Questions

Q1: Identify?? متنساش

Q2: A. Parasite Life cycle (DH, IH, RH, Habitat, Stages of life cycle, Infective stage, Diagnostic stage, Mode of infection).

B. Diagnostic specimens or samples.

C. Most important or commonest C/P

D. Most important or commonest Complication

E. Specific treatment

➢ Parasitic Infections Affecting CNS :

Free living amoeba:	• Primary Amoebic Meningoencephalitis • Granulomatous Amoebic Meningoencephalitis
***Trypanosoma bruci* :**	• Sleeping Sickness
Entamoebae histolytica	• Secondary Amoebic Cerebral Abscess
Taenia solium:	• NeuroCysticercosis

1) Pathogenic Free-Living Amoebae

1) Naegleria fowleri

2) Acanthamoeba castellani

Naegleria fowleri (Primary Amoebic Meningoencephalitis)

DH: Man

IH: No

RH: No

Habitat: Free living in soil & fresh stagnant water, CNS in humans

Stages of life cycle: Amoeboid Trophozoite, Flagellate Trophozoite, Cyst

IS: Amoeboid trophozoite

DS: Trophozoite

Mode of infection: Nasal route → swimming/sniffing contaminated water, inhaling contaminated air

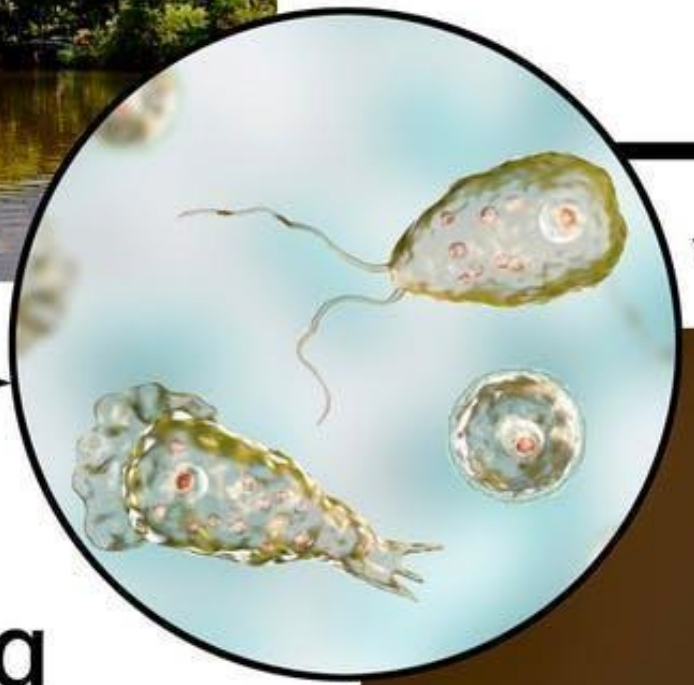
Most C/P: Neck stiffness, Fever, photophobia, seizures, altered mental status

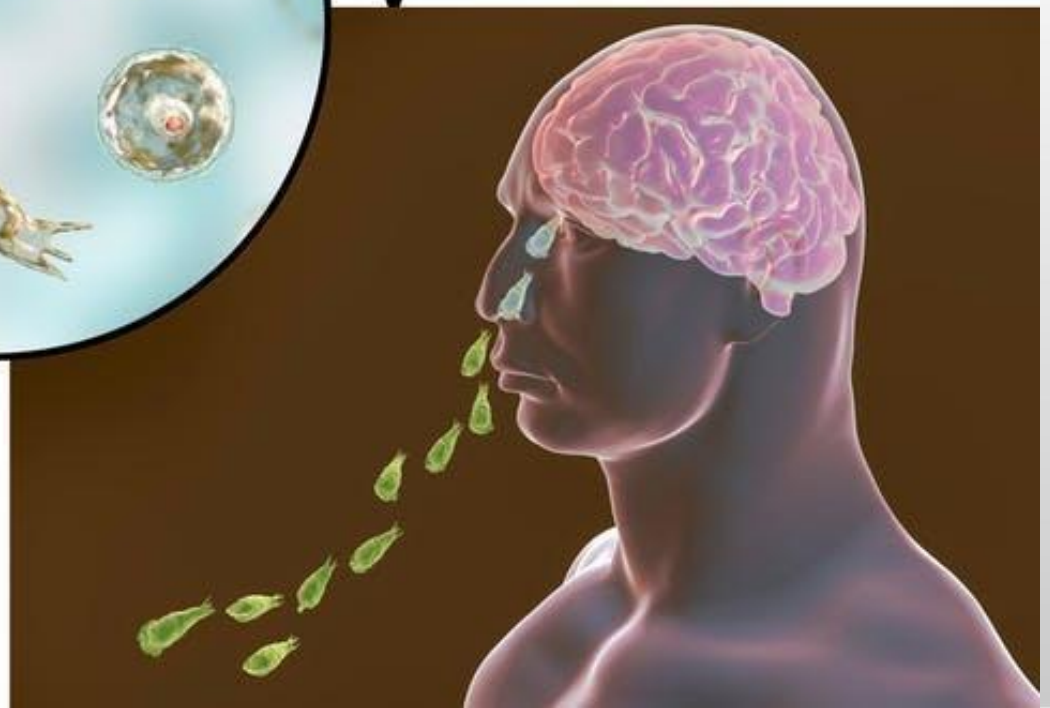
Most Complications: Coma and death

Diagnostic specimens: CSF

Treatment: Hospitalization, IV. Amphotericin-B, Fluconazole & Rifampicin

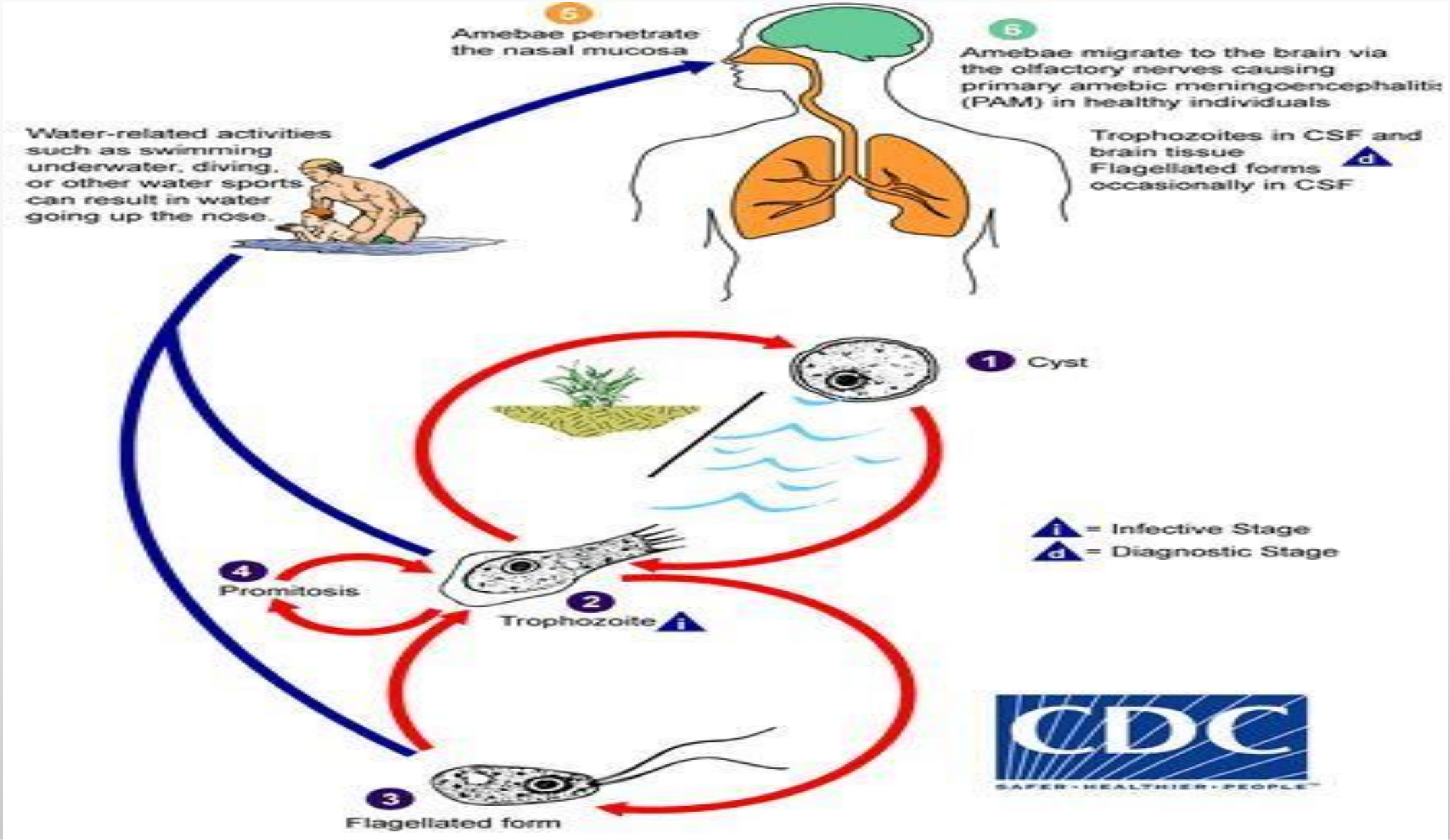
Naegleriasis





Brain-Eating Amoeba Infection

Naegleria fowleri Life cycle:



Naegleria fowleri Life cycle:

- Habitat:
- Free living in soil and fresh- stagnant water
- In man it attack CNS
- Infective stage: Amoeboid trophozoite
- Mode of infection: through Nasal route.

1 Swimming in /or sniffing contaminated water.

2 Inhalation of contaminated air.

➢ *Naegleria fowleri* morphological stage:

Amoeboid Trophozoite:

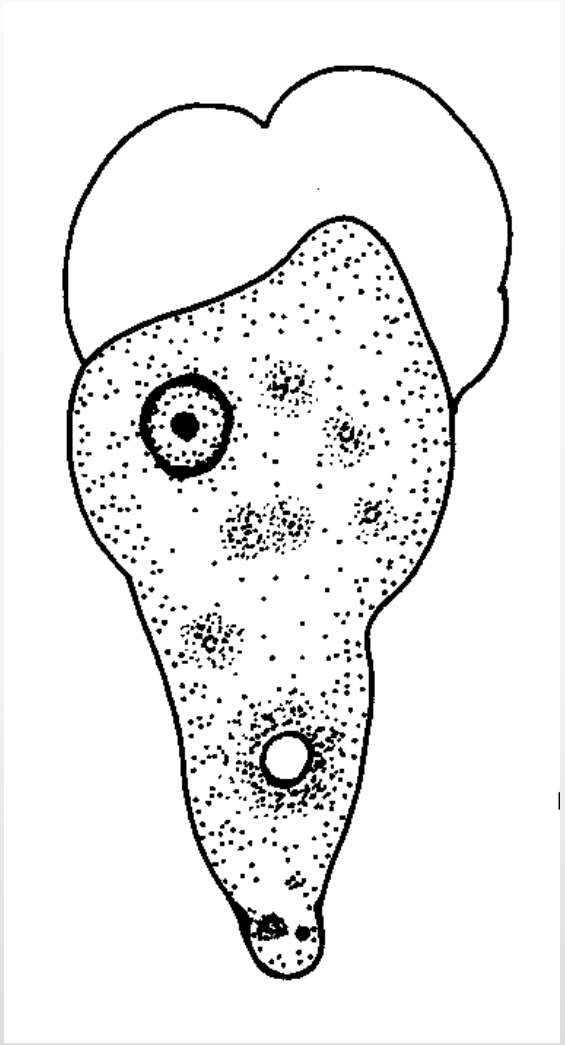
- (in tissues and CSF)
- Elongate with broad anterior end, tapering posterior end.
- with single pseudopodium.
- 15µ

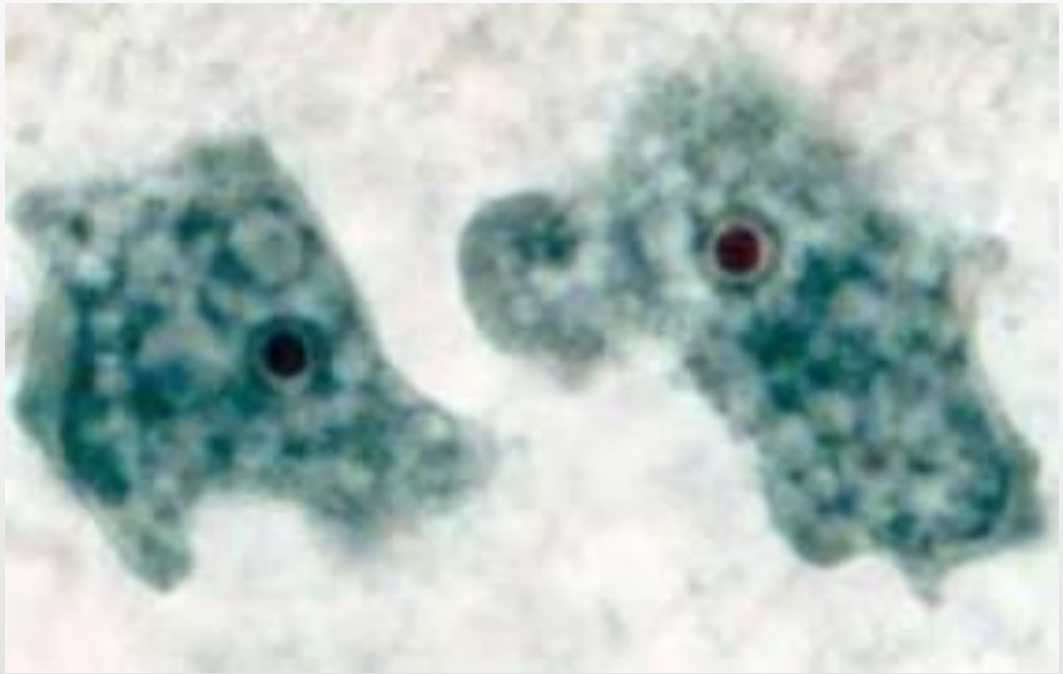
Flagellate Trophozoite

- (when contact with water)
  - Pear shaped
  - two long equal flagellae

Cyst:

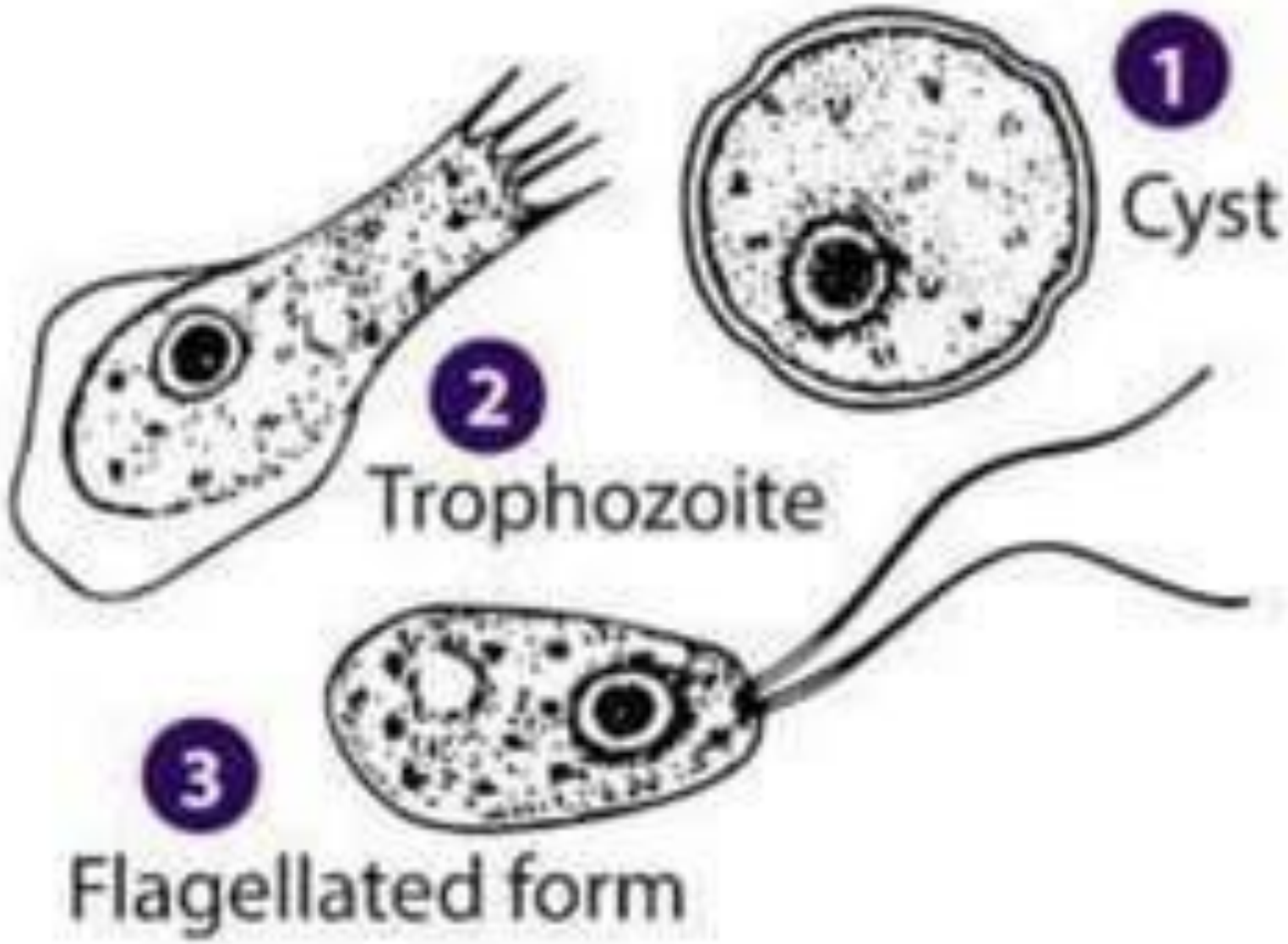
- Occurs in soil (never in tissues):
- Rounded
- 10 µm.



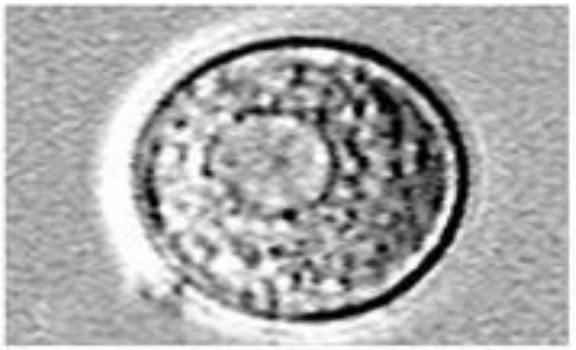


Naegleria fowleri **Amoeboid Trophozoite**

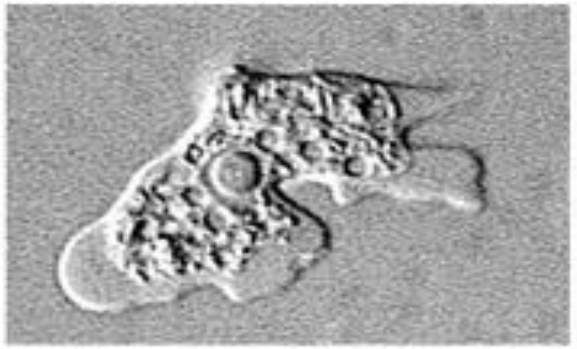
Naegleria fowleri stages



Naegleria fowleri morphological stage:



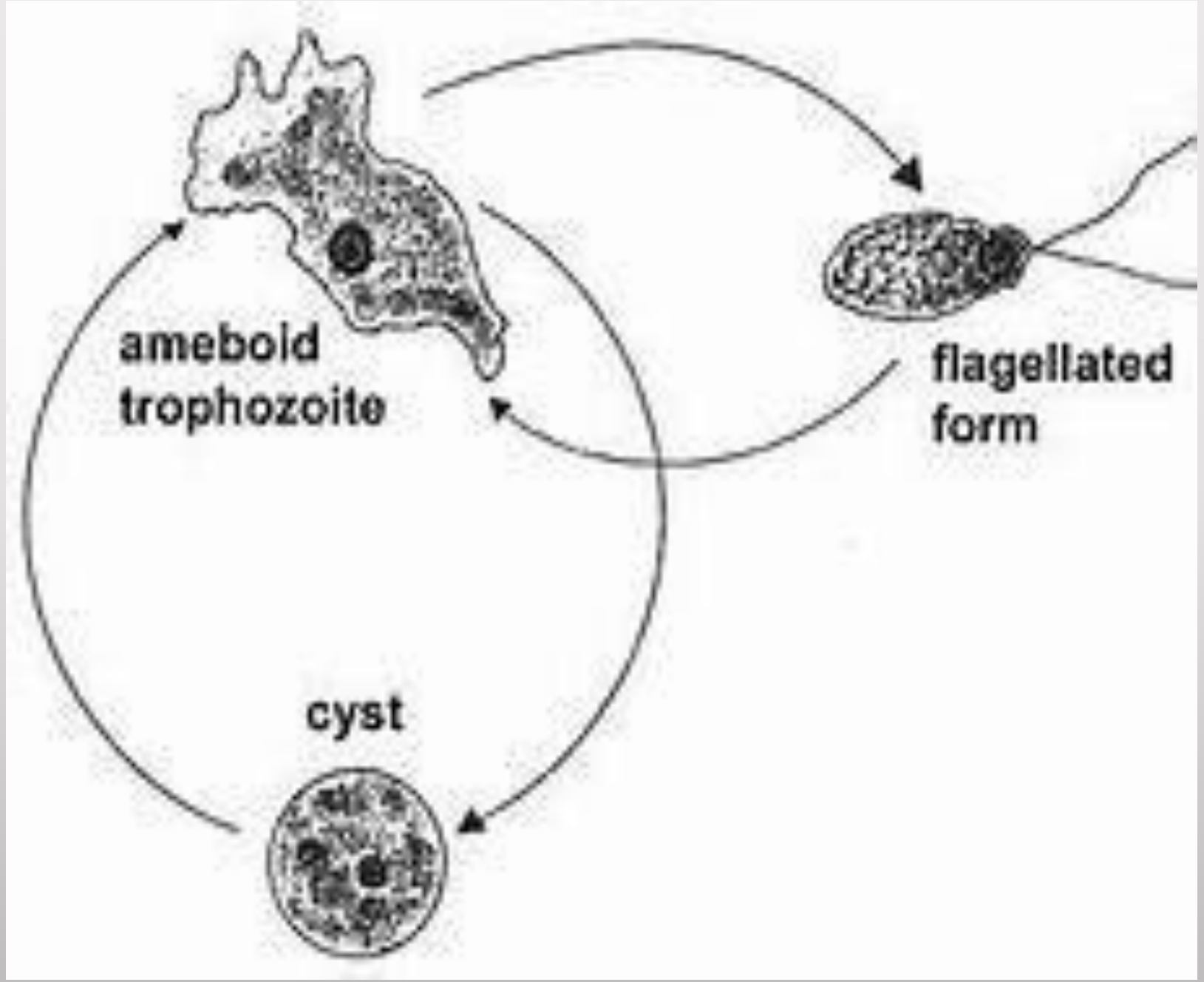
Cyst stage



Trophozoite stage

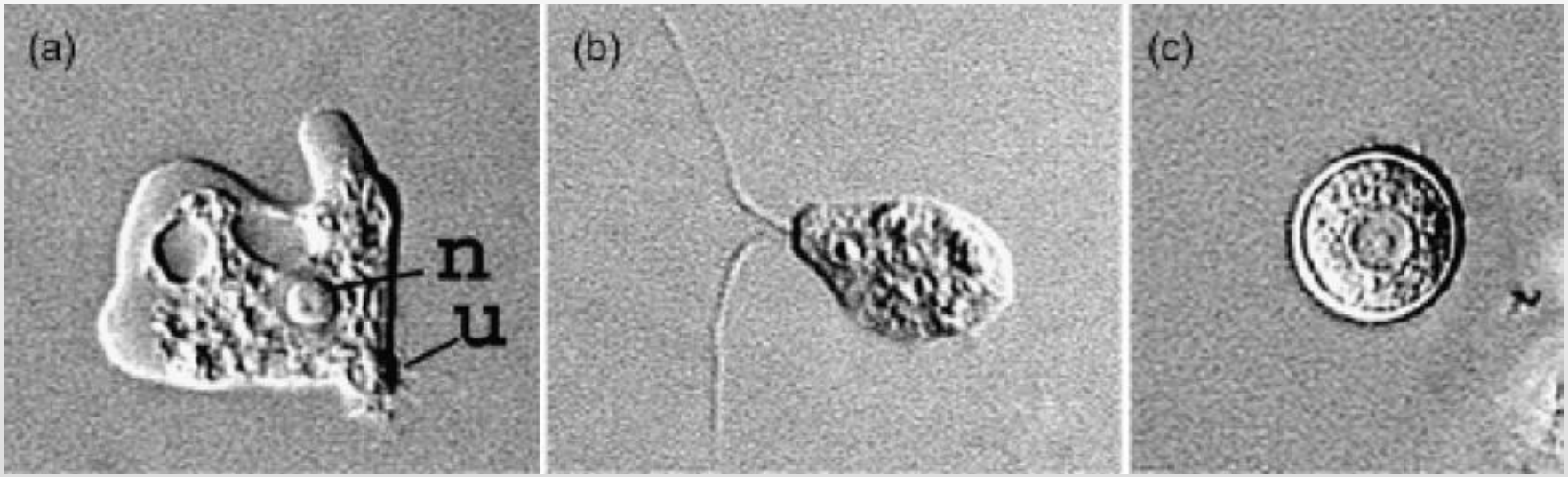
Flagellated stage

Naegleria fowleri stages



Naegleria fowleri morphological stage:

- (a).....?
- (b) .....?
- (c) .....?



1) Pathogenic Free-Living Amoebae

1) Naegleria fowleri

2) Acanthamoeba castellani

Acanthamoeba castellani (Granulomatous amoebic meningoencephalitis)

DH: Man

IH: No

RH: No

Habitat: soil, stagnant water & dust. In Man (Brain, eye, skin)

Stages of life cycle: Trophozoite, Cyst

IS: Trophozoite & Cyst

DS: Trophozoite & Cyst

Mode of infection: Through cornea (contact lenses), skin and mucosal ulcers, Inhalation

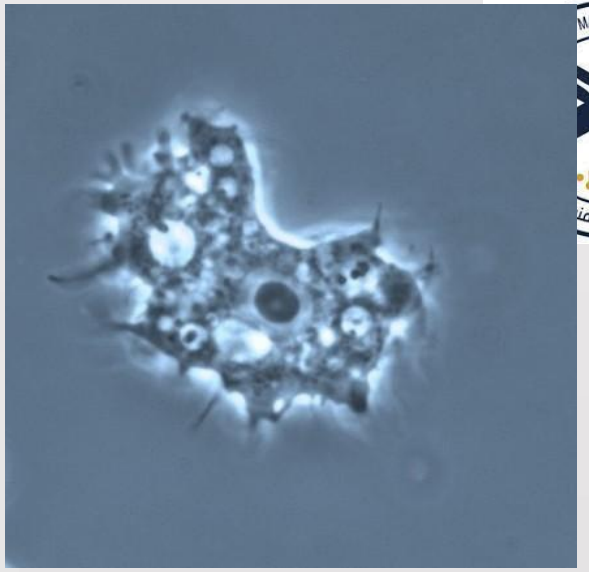
Most C/P: Keratitis, headache, seizers, stiff neck ...

Most Complications: Chronic granulomatous skin lesions

D.Specimens: CSF, Corneal scrapings

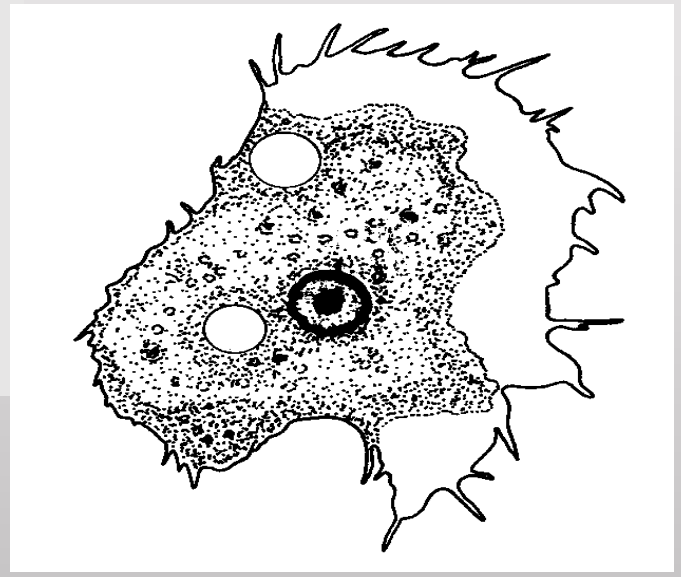
Treatment: Sulfamethoxazole/Trimethoprim+ Fluconazole & Rifampin

Acanthamoeba castellani



<u>Free-living trophozoite and cyst stages may exist in environment and in tissues</u>

- **Present in soil, dust, stagnant water and contact lens fluid.**
- **<u>in man it affect CNS, eye, skin and lungs.</u>**



Acanthamoeba castellani trophozoite

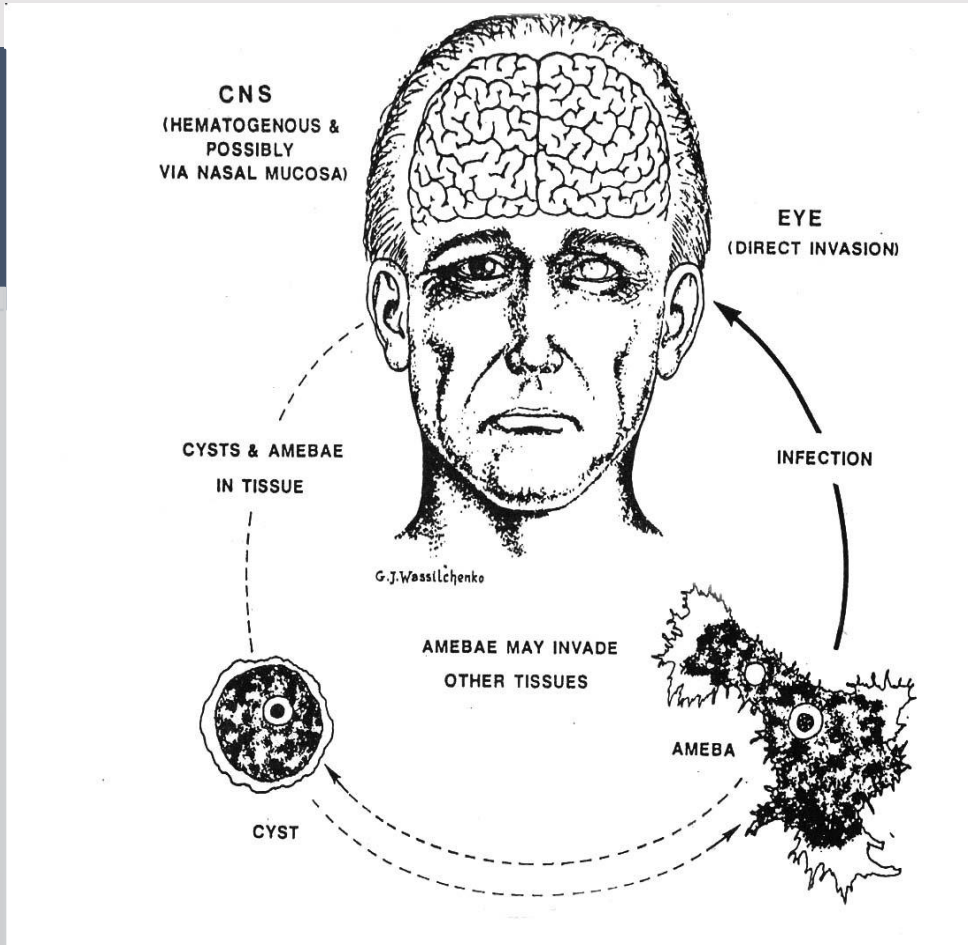
Acanthamoeba castellani Morphology

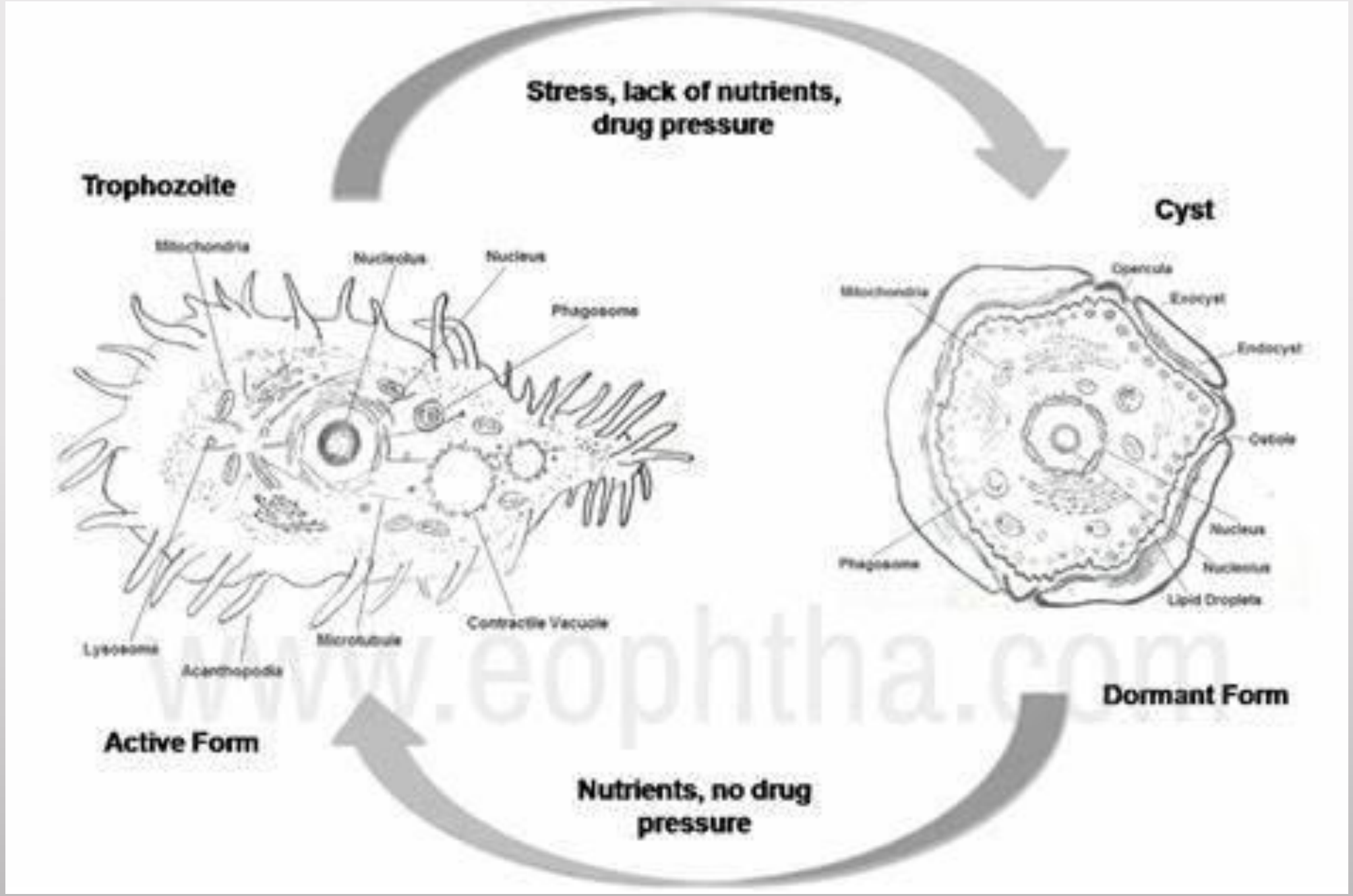
Trophozoite:

- Amoeboid
- Cytoplasm is well differentiated
- Pseudopodia are multiple and spiky (Acanthopodia).
- 20-40 µm in size

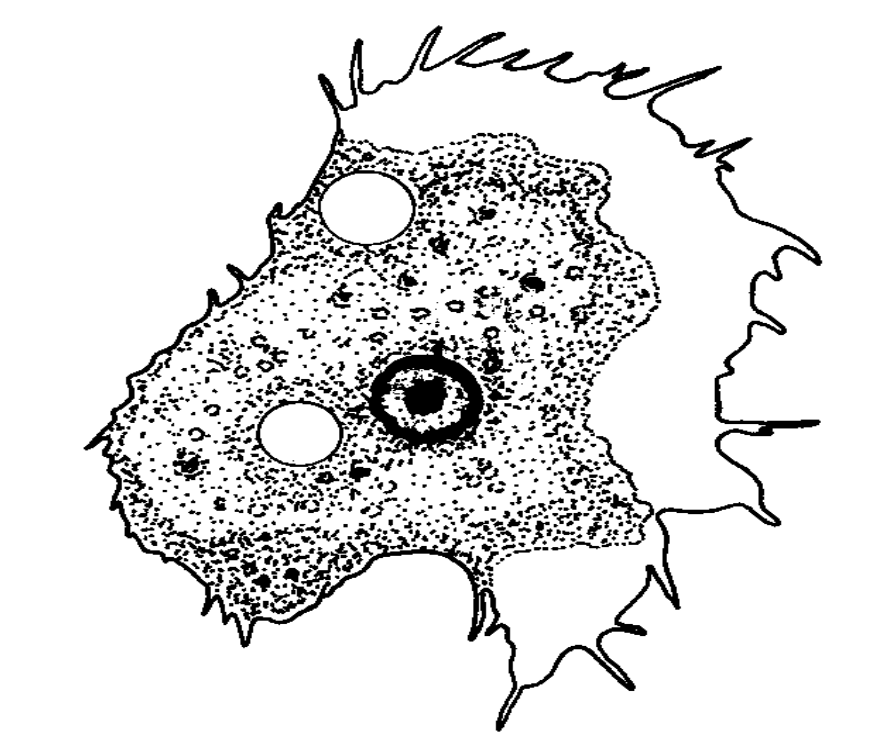
Cyst:

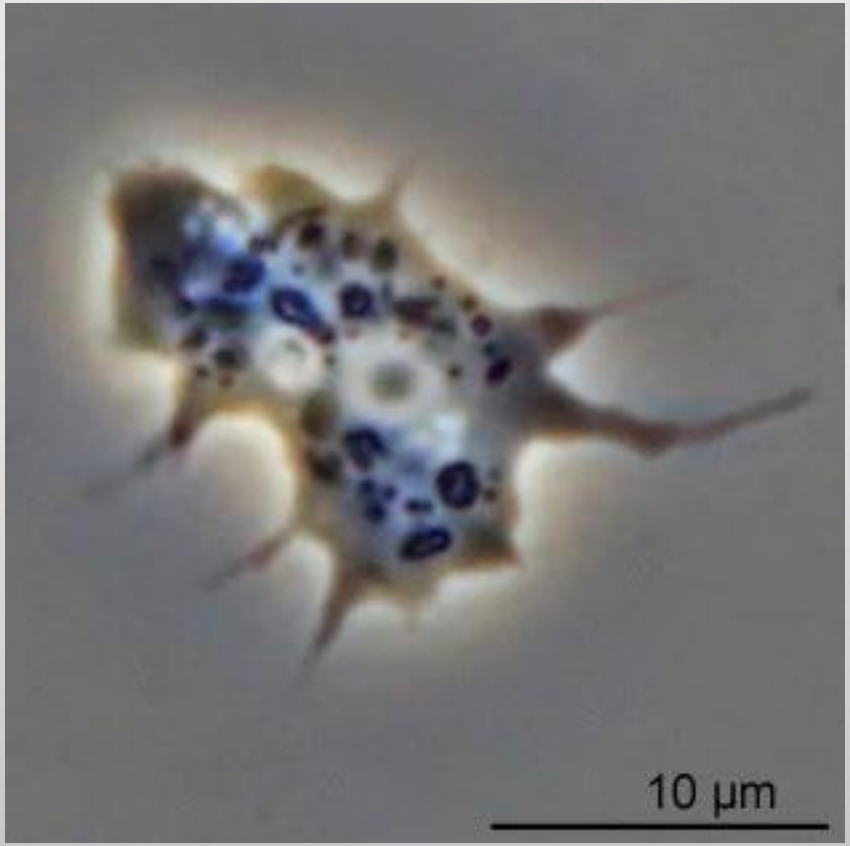
- Double wall
- Rounded
- 20 µm.

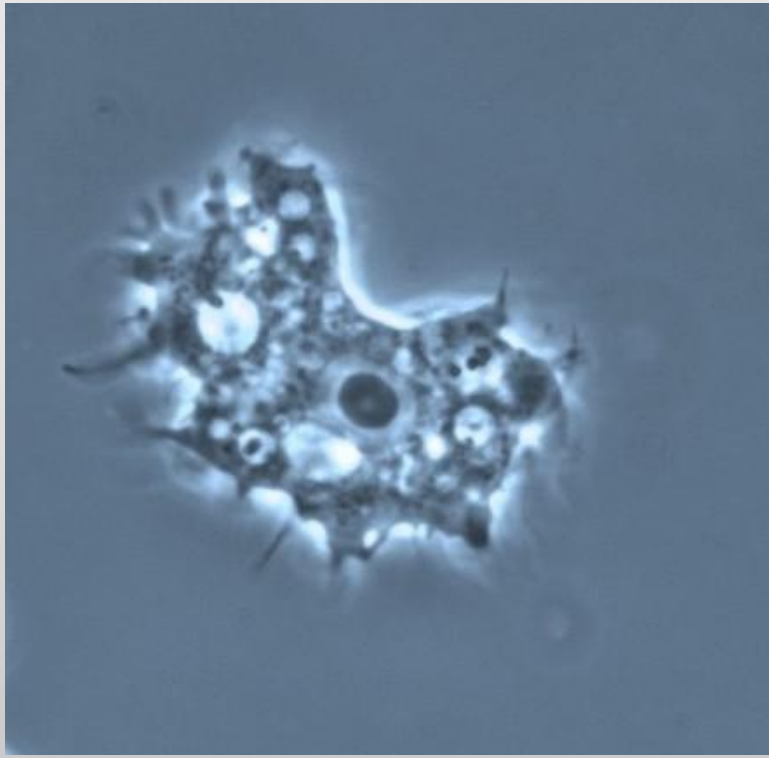




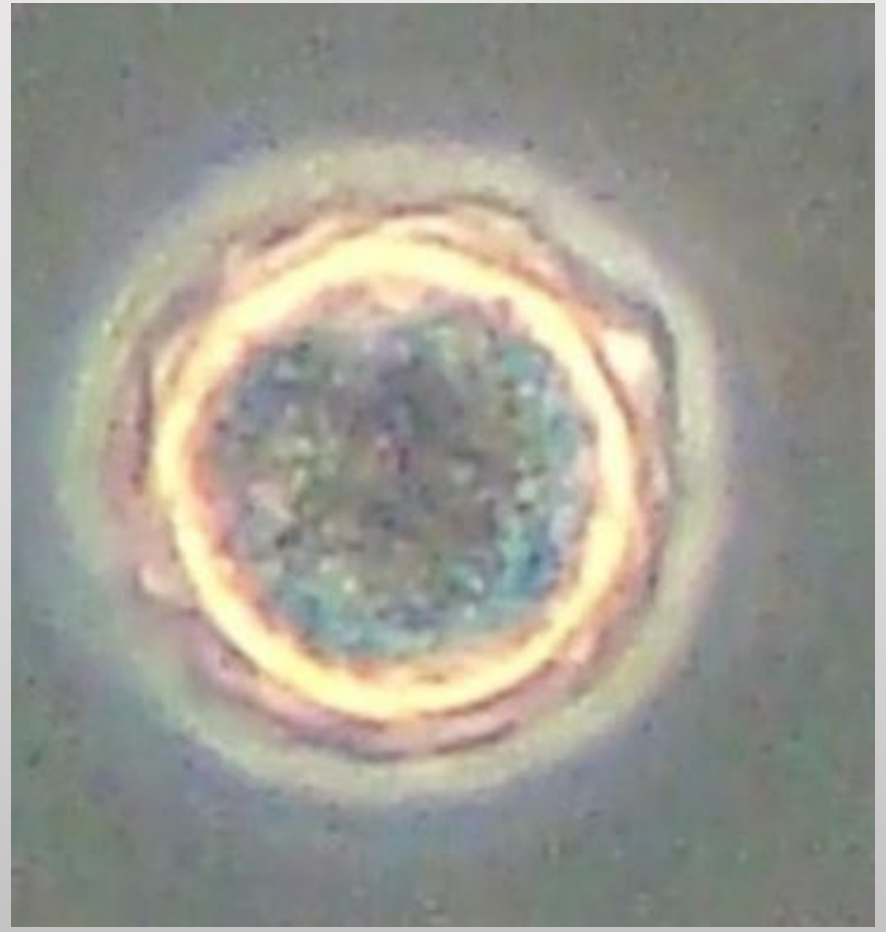
Acanthamoeba castellani Trophozoite:

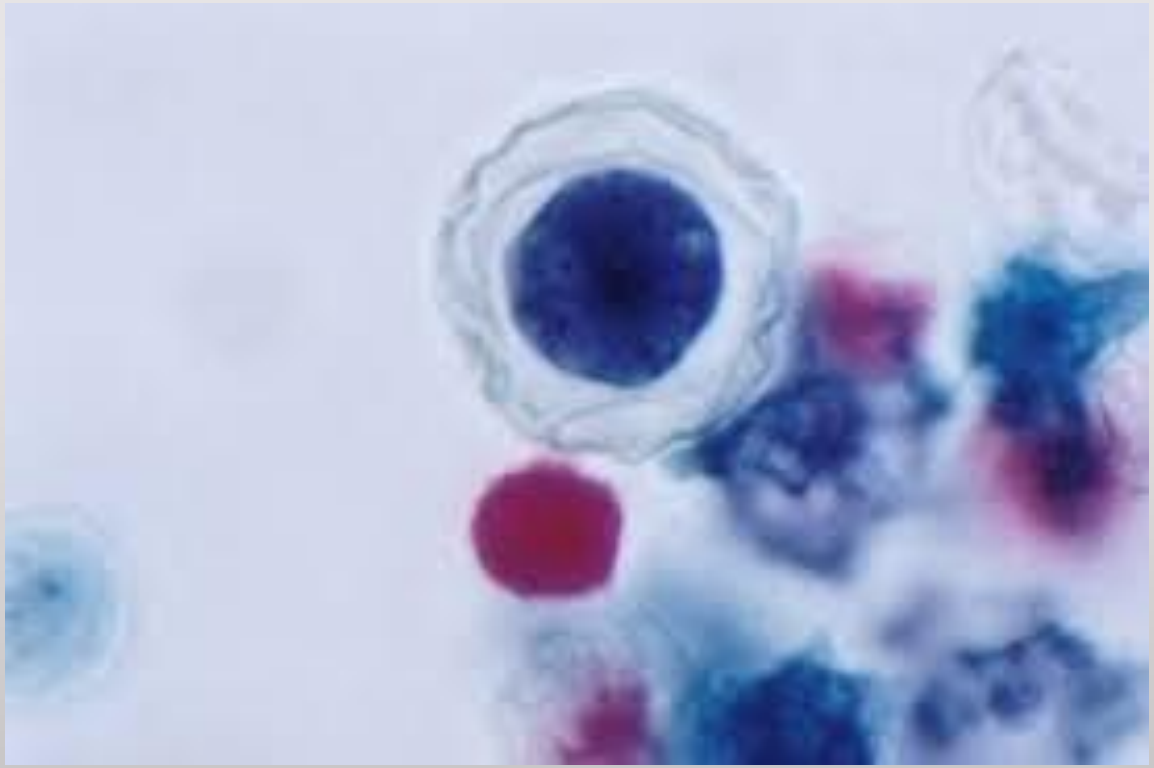


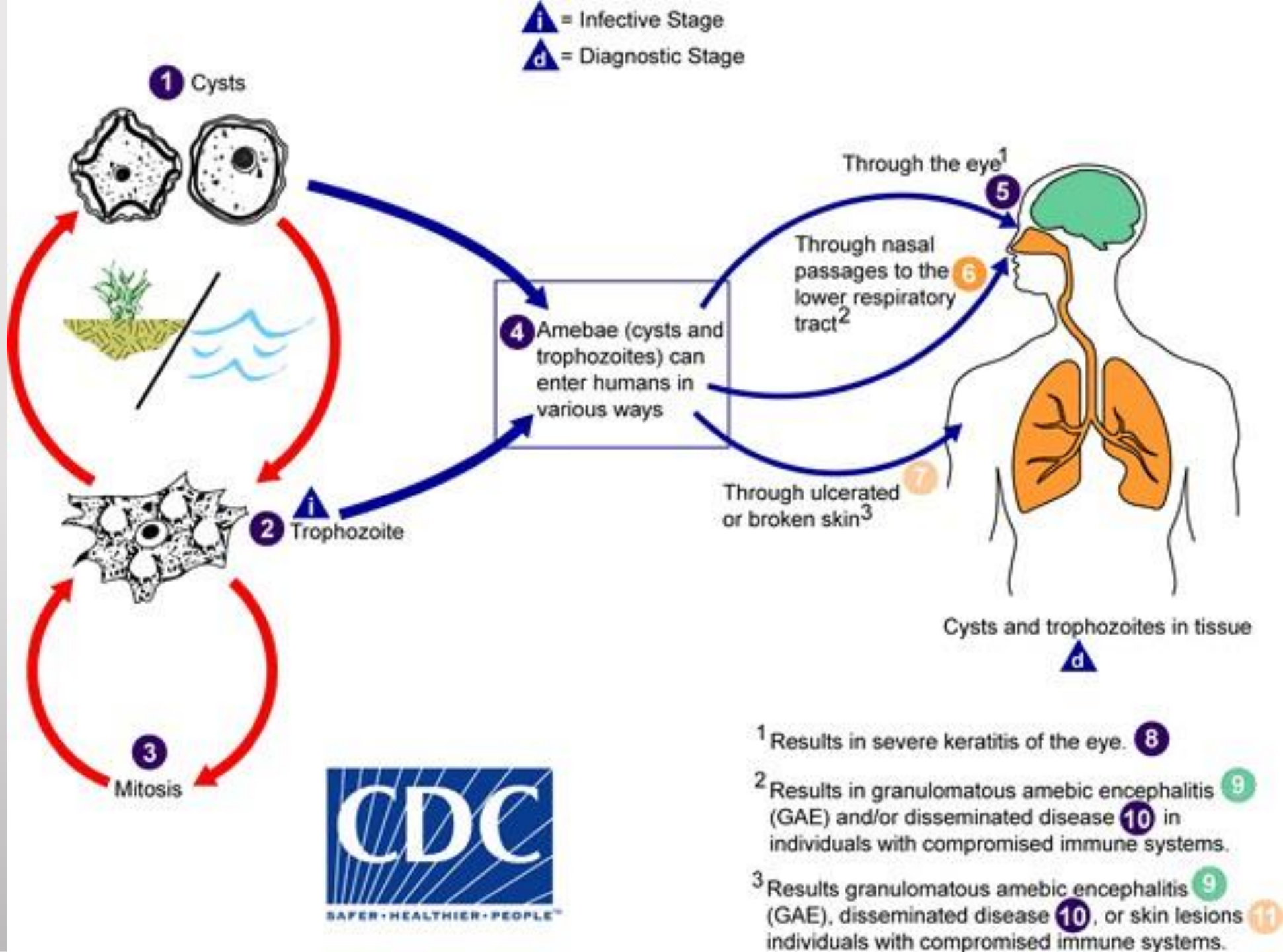




Acanthamoeba castellani cyst:






i = Infective Stage
d = Diagnostic Stage
1 Cysts
2 Trophozoite
3 Mitosis
4 Amebae (cysts and trophozoites) can enter humans in various ways
Through the eye[1] 5
Through nasal passages to the lower respiratory tract[2] 6
Through ulcerated or broken skin[3] 7
Cysts and trophozoites in tissue
d
CDC
SAFER·HEALTHIER·PEOPLE™
[1] Results in severe keratitis of the eye. 8
[2] Results in granulomatous amebic encephalitis (GAE) and/or disseminated disease 10 in individuals with compromised immune systems. 9
[3] Results granulomatous amebic encephalitis (GAE), disseminated disease 10, or skin lesions individuals with compromised immune systems. 9 11

Life Cycle of *Acanthamoeba castellani*

- **Habitat: free living in soil, stagnant water and dust.**

Or infect Human host (Brain, eye, skin)

- **Infective stage: Trophozoite & Cyst**
- **Source of infection: dust, stagnant water and contact lens fluid.**
- **Portal of entry (Mode of infection):**

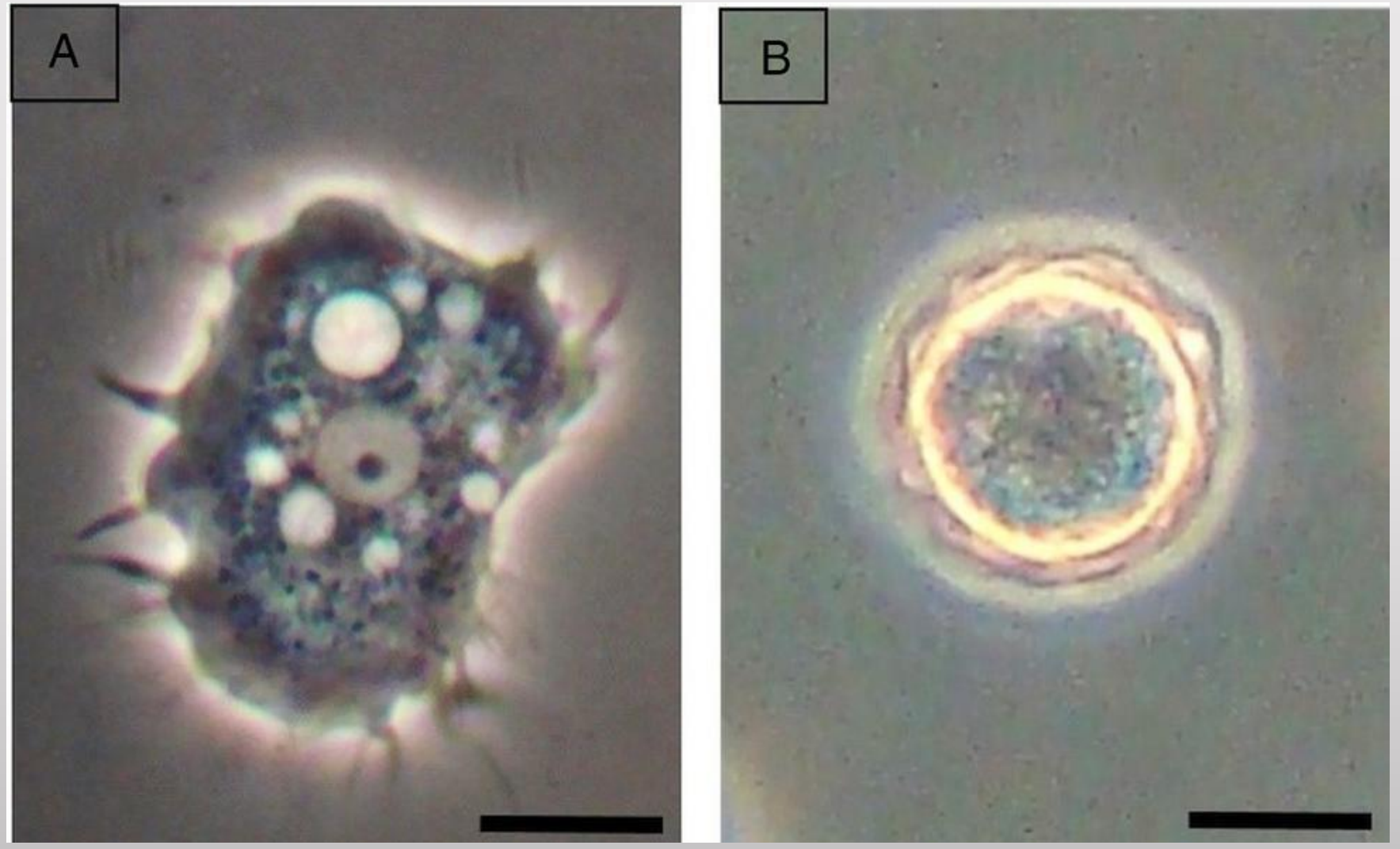
  -Through skin and mucosal ulcers,

  -Inhalation into the lungs,

  -Through cornea (contaminated contact lenses)

(A).....?

(B).....?



3) African Trypanosomiasis
Sleeping sickness

African Trypanosomiasis (Sleeping sickness)

DH: Man

IH: Glossina fly

RH: Animals

Habitat: Blood → RES (liver, spleen, LNs, BM) → CNS

Stages of life cycle: Trypomastigote, Epimastigote, Metacyclic trypomastigote

IS: Metacyclic trypomastigote

DS: Polymorphic Trypanosomes

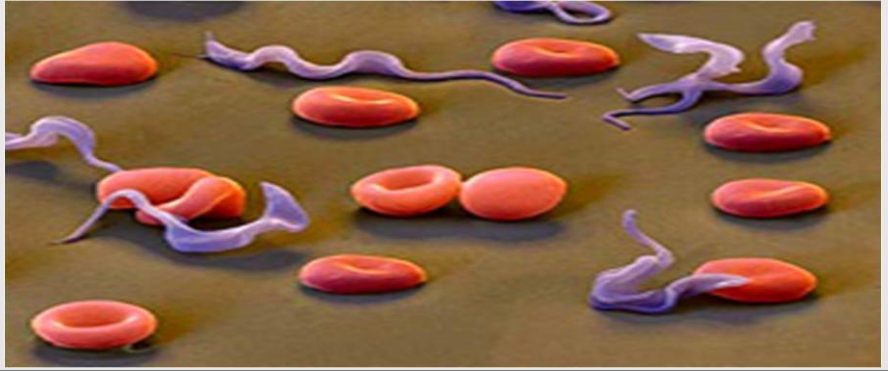
Mode of infection: Bite of fly carrying IS, Blood transfusion, Organ transplantation, Congenital

Most C/P: chancre, Winterbottom's sign

Most Complications: Coma & death

D.Specimens: blood, aspirate (chancre, LN, BM) & CSF

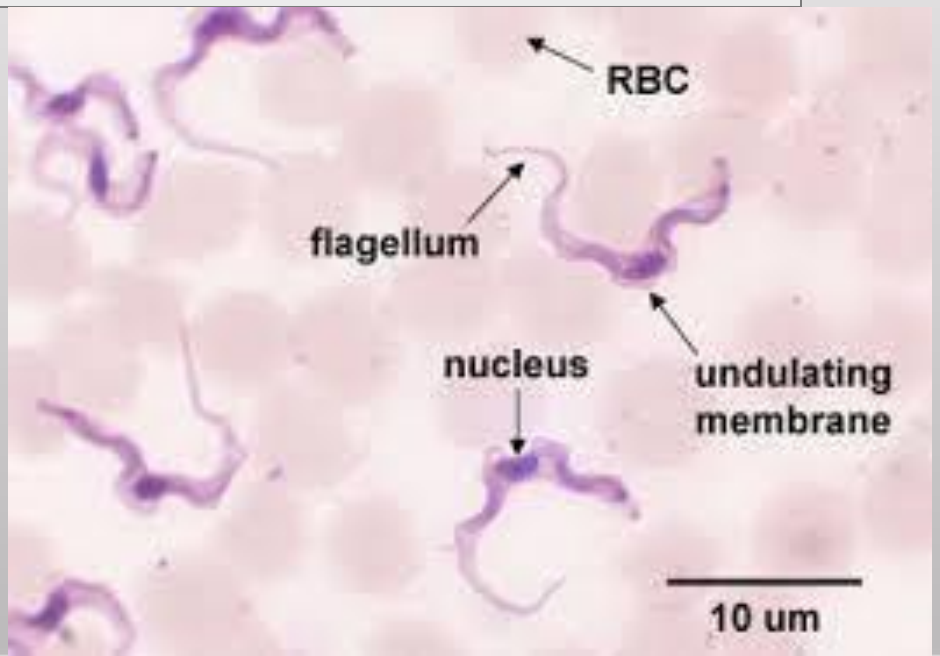
Treatment: Early → Suramin & Pentamidine, Late → Melarsoprol



Parasitic diseases caused by *Trypanosoma brucei*. There are 2 main forms:

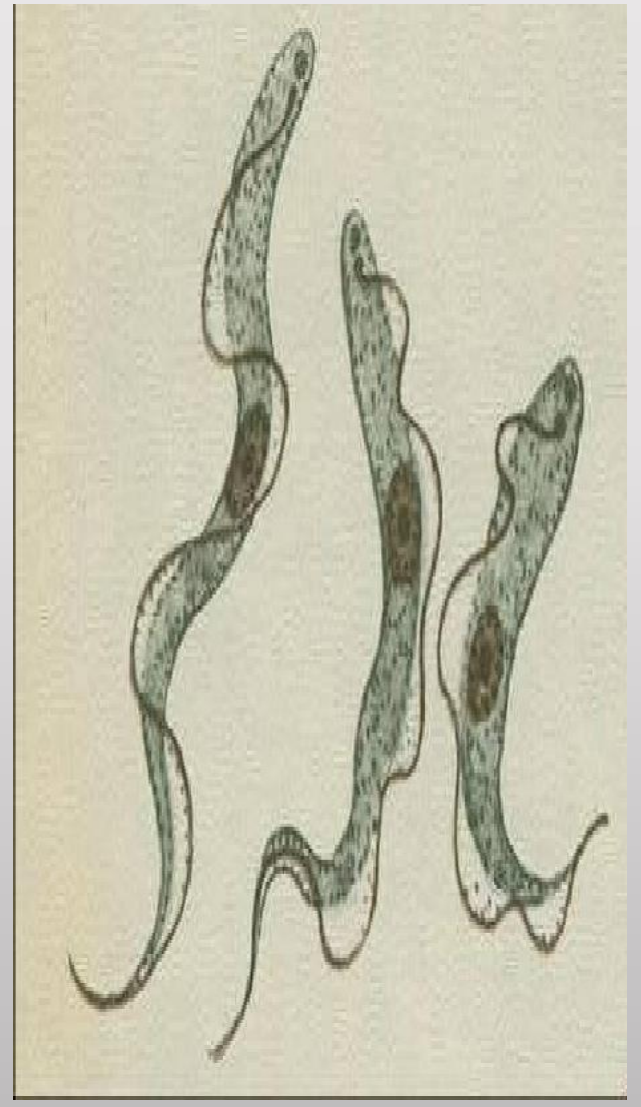
- **Chronic Sleeping sickness: caused by *Trypanosoma brucei gambiense***
- **Acute Sleeping sickness: caused by *Trypanosoma brucei rhodesiense***

Trypomasitogtes (flagellated form): Motile (with anterior flagellum & undulating membrane).



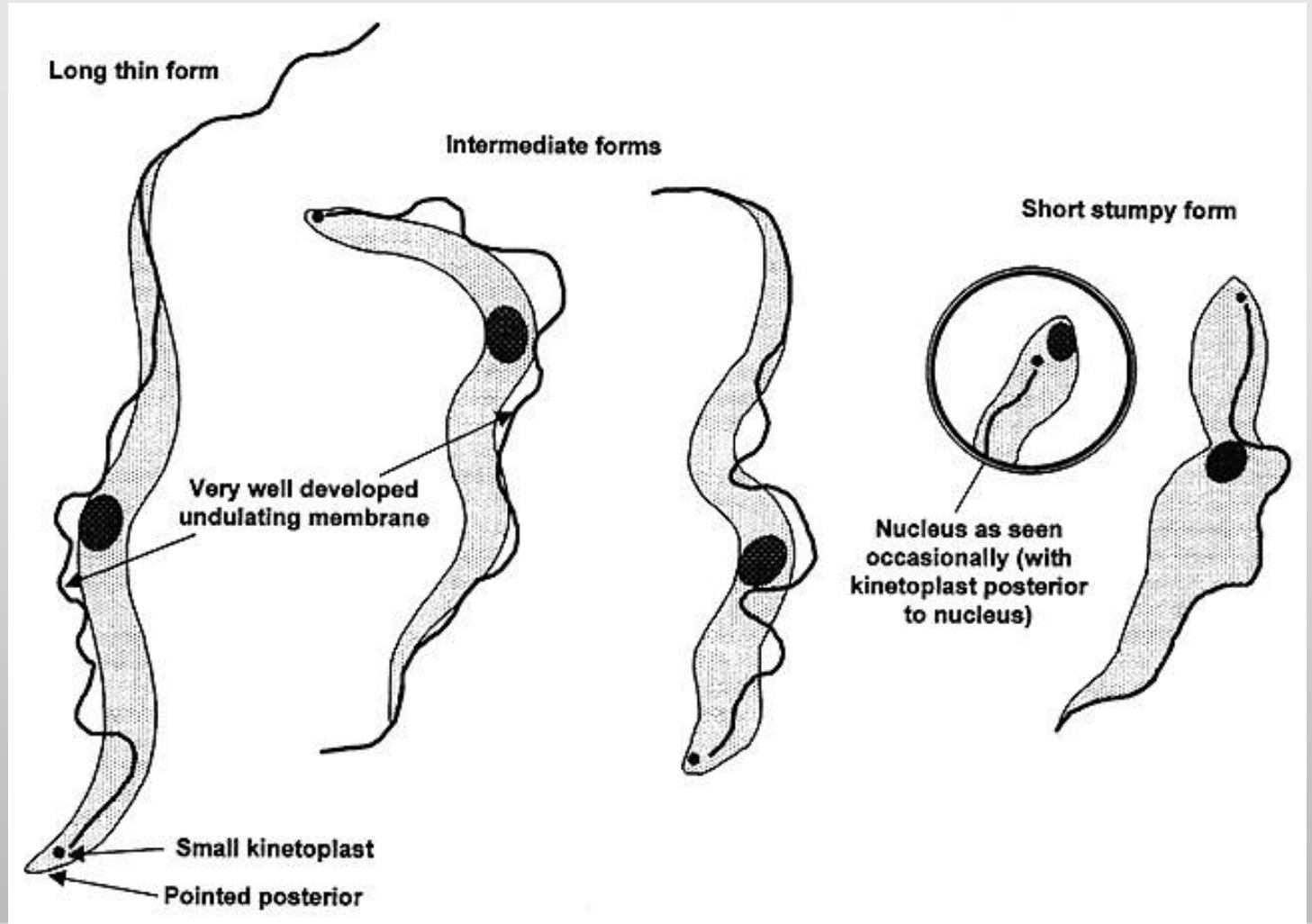
Trypomastigote has 3 forms in vertebrate host

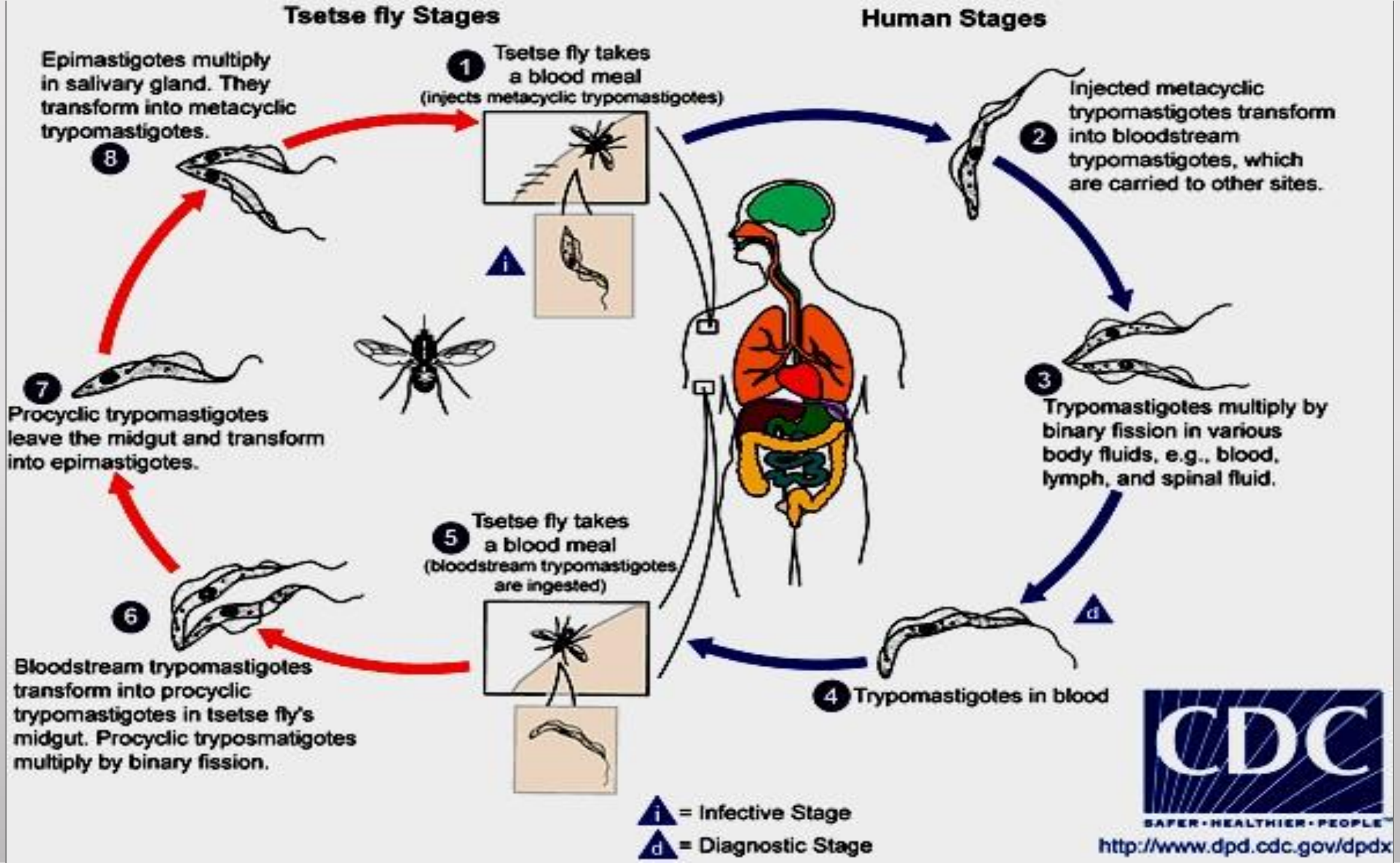
Morphological form	Characters
1- Long slender form	30 u in length, with a free flagellum& actively motile
2- Intermediate form	22 u in length, with a short free flagellum
3- Short stumpy form	15 u in length, without a free flagellum



- **In Vector (Glossina fly)→ Metacyclic trypomastigote**

(infective stage) in salivary gland.




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

Life Cycle:

- **Habitat**
- During the early stages of the disease; *Trypanosomes* are found extracellular in the peripheral blood. Then, RECs (Liver, Spleen, Lymph nodes, Bone marrow).
- In the terminal stages; in CNS

D.H. (**man**)

R.H. (**animals**) **as, antelopes, pigs, goats, dogs.**

I.H. (Vector) **Glossina fly.**

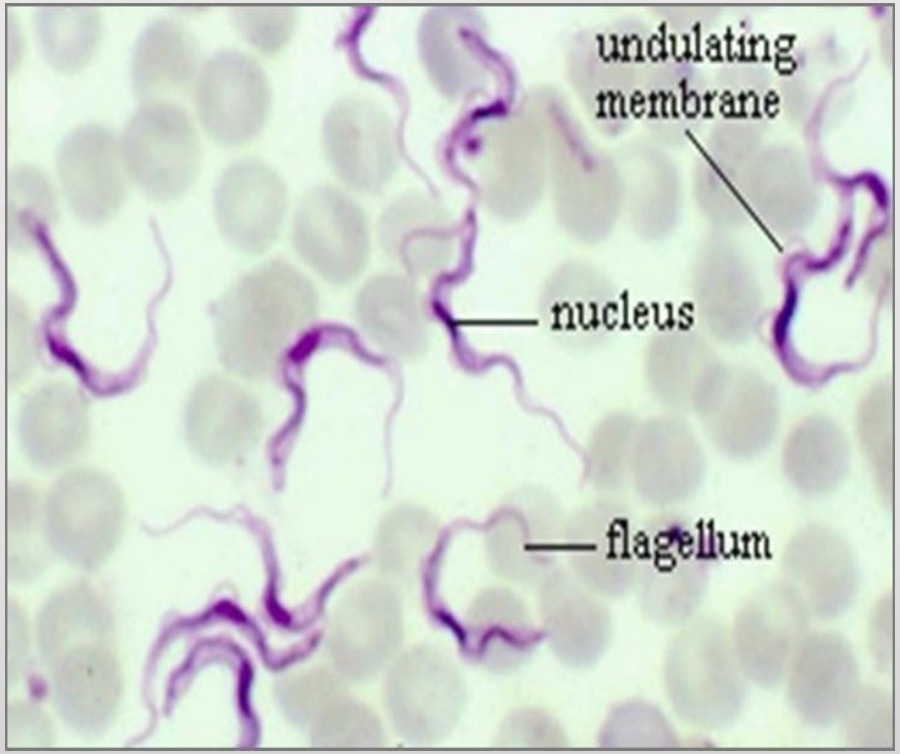
Mode of transmission:

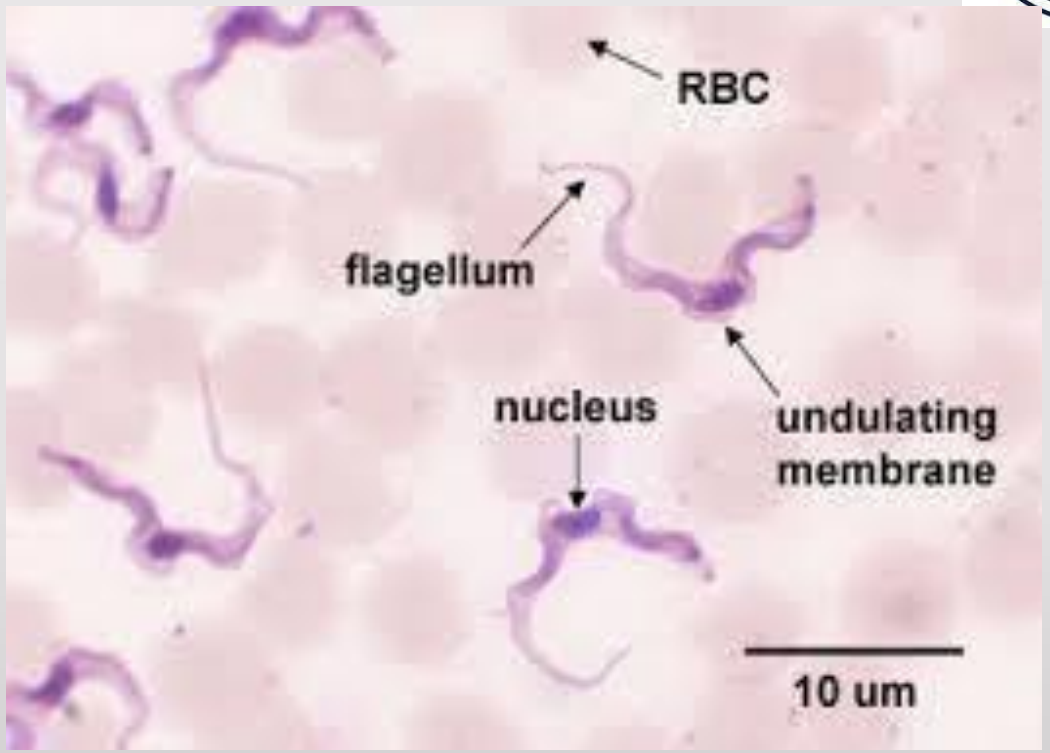
1 Bite of the fly, infective stages in the Saliva of infected vector.

2 Blood transfusion

3 Organ transplantation

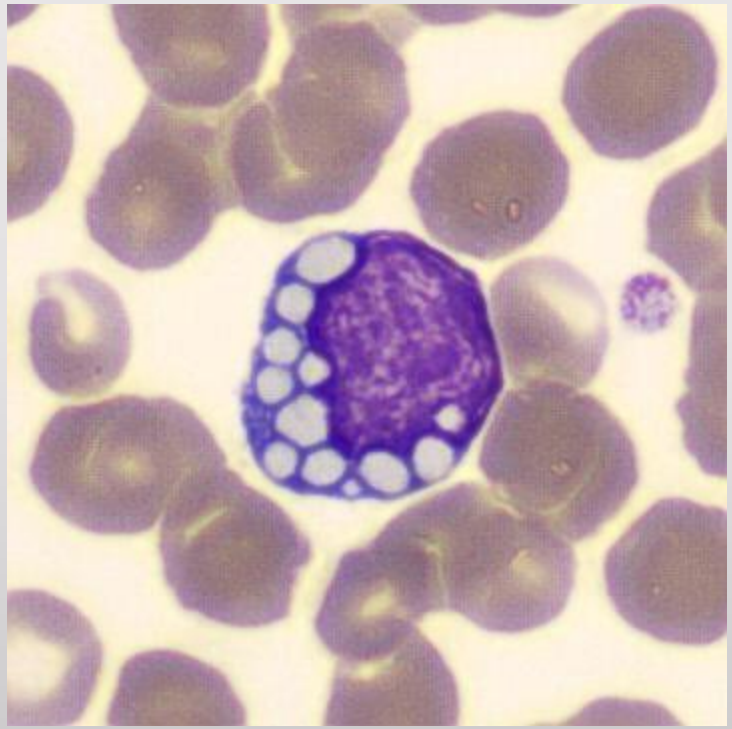
4 Congenital

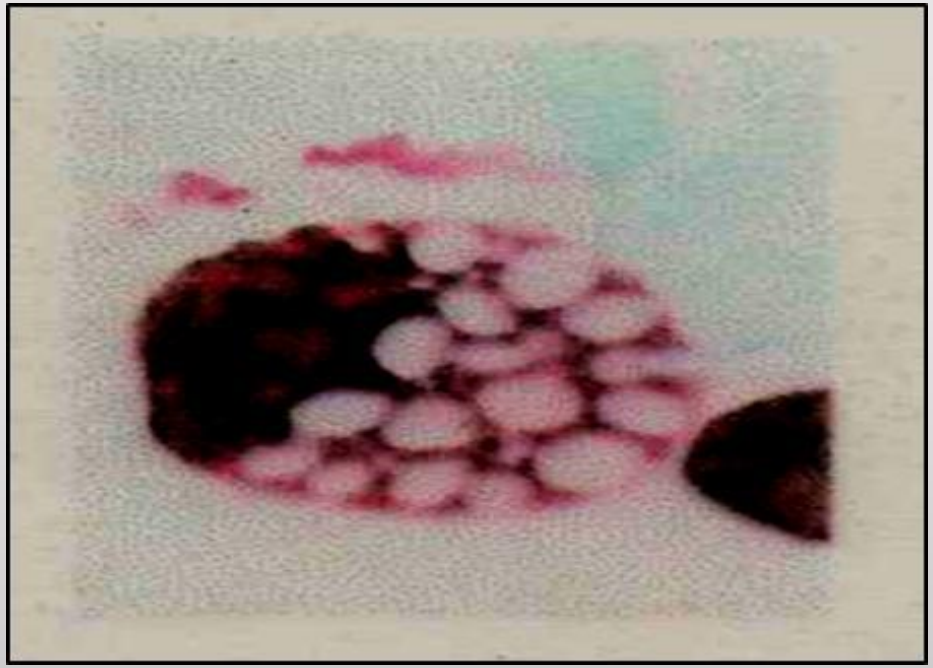




Polymorphic Trypanosomes in blood film

➢ CSF examination: Trypomastigotes, and Morula cells of Mott (Vacoulated cytoplasm)





Vector
(Glossina fly)

Onchocerciasis

Onchocerca volvulus (Onchocerciasis - River Blindness)

DH: Man

IH: Simulium fly

RH: No

Habitat: Adult worms live in fibrous subcutaneous nodules

Stages of life cycle: Microfilariae, Larva, Adult

IS: Filariform larvae

DS: Microfilariae or Adult

Mode of infection: Bite of infected Simulium

Most C/P: Skin → Onchocerca nodule, Severe dermatitis, pigmentation

Eye → River blindness (Sudan blindness) conjunctivitis with photophobia

Most Complications: Blindness

D.Specimens: Skin snip, conjunctival biopsy

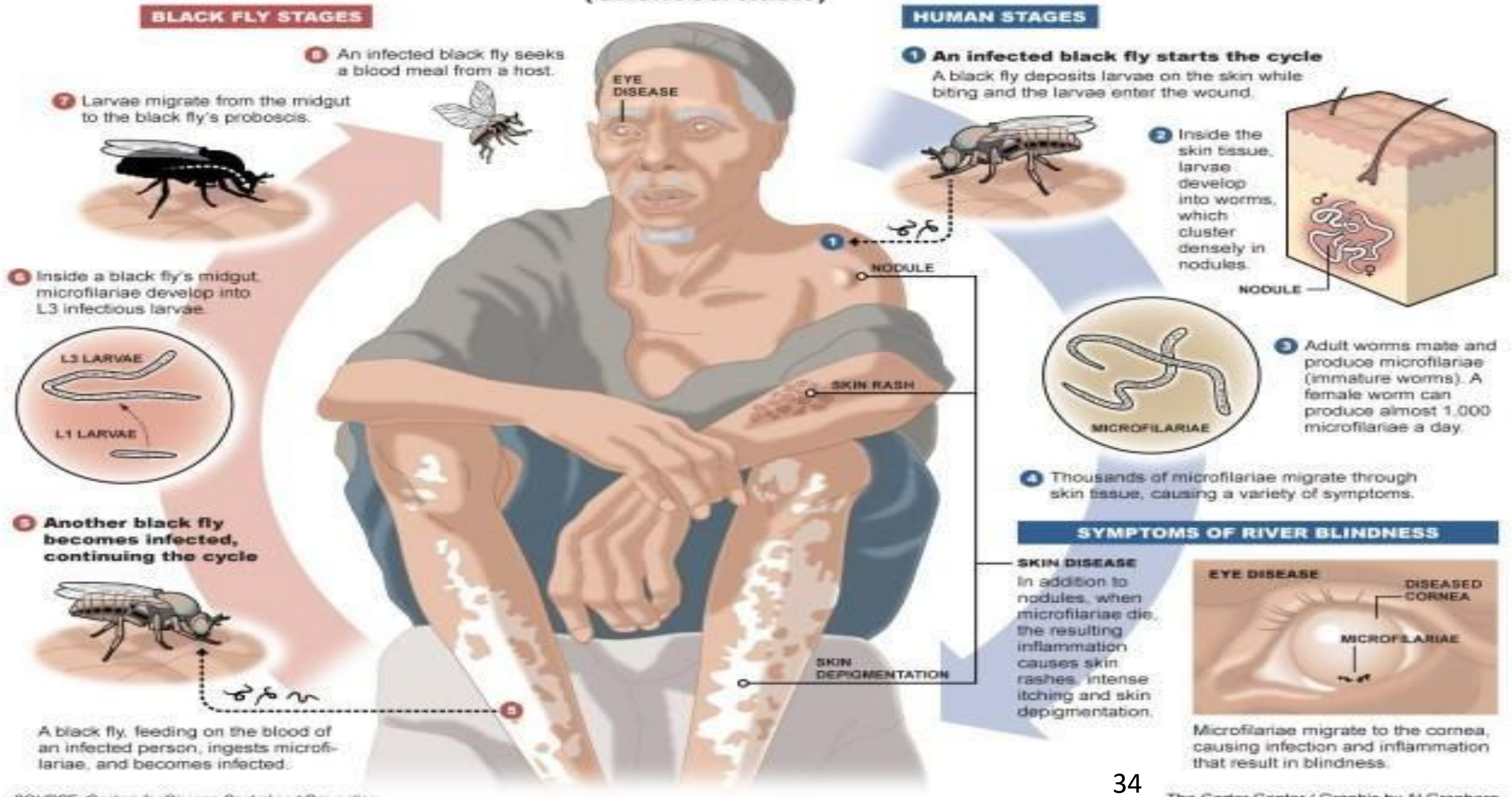
Treatment: Ivermectin for microfilaria, Doxycycline for adult worm

- Infection of human skin and subcutaneous tissue by ***Onchocerca volvulus*** adult and microfilaria (Nematode).

- **Mode of infection**: through inoculation of the **infective filariform larva** (**Infective stage**) present in the mouth of intermediate host (*Simulium* fly) into skin bite.

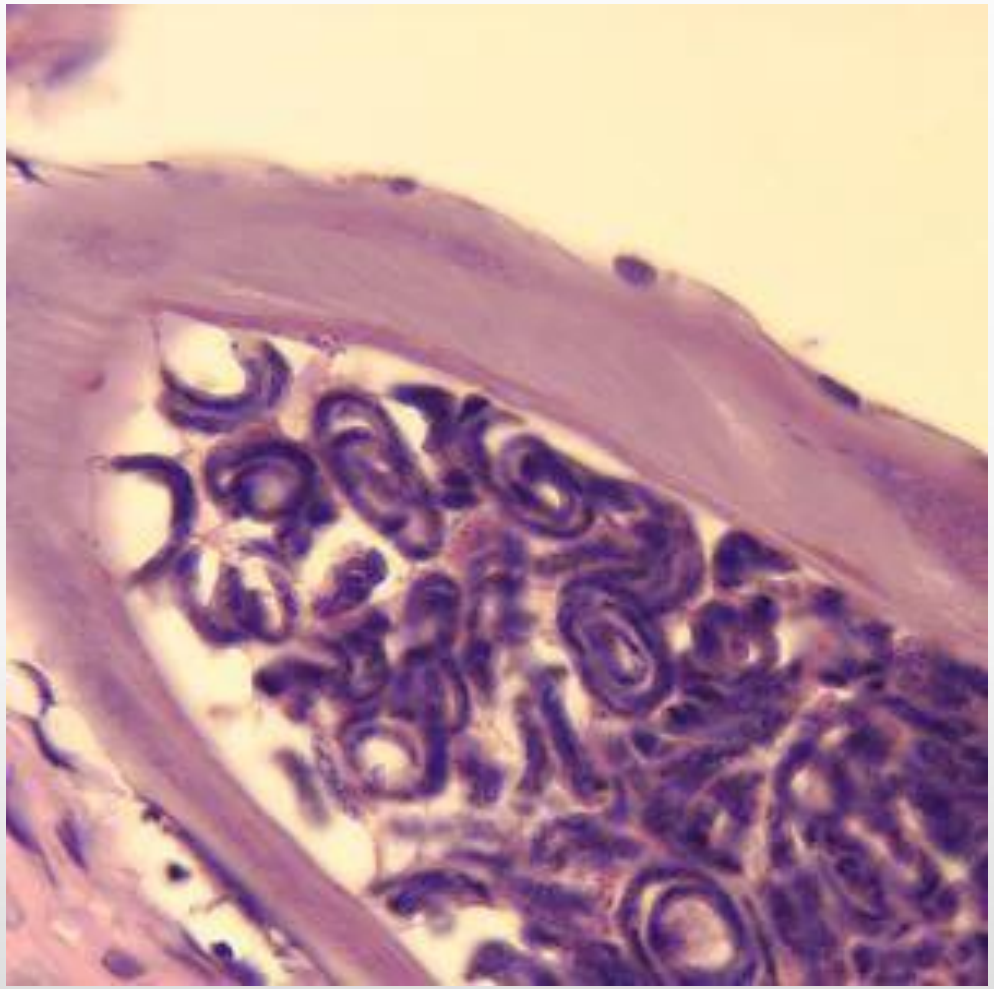
- Adult worms live in fibrous subcutaneous nodules from the host reaction (not tender).

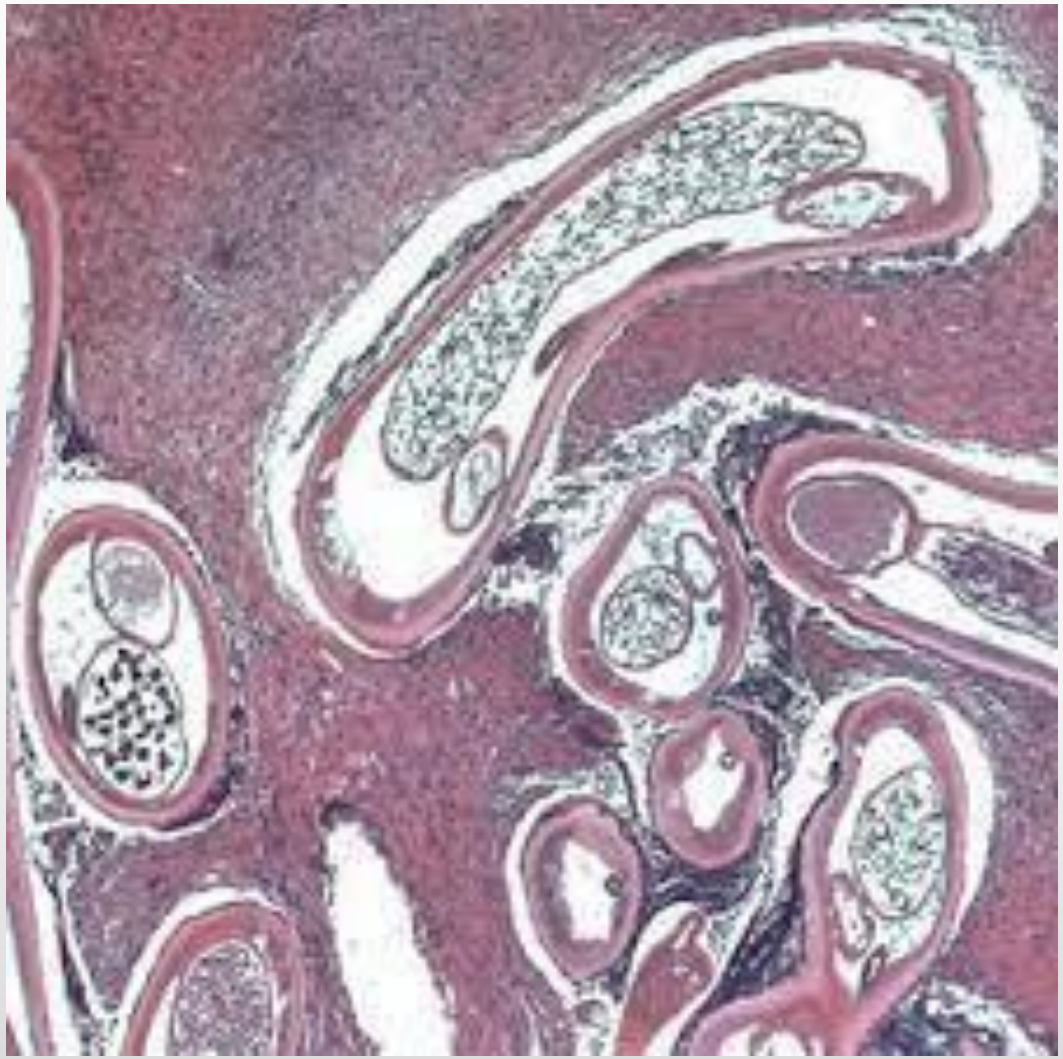
The Life Cycle of River Blindness
(Onchocerciasis)



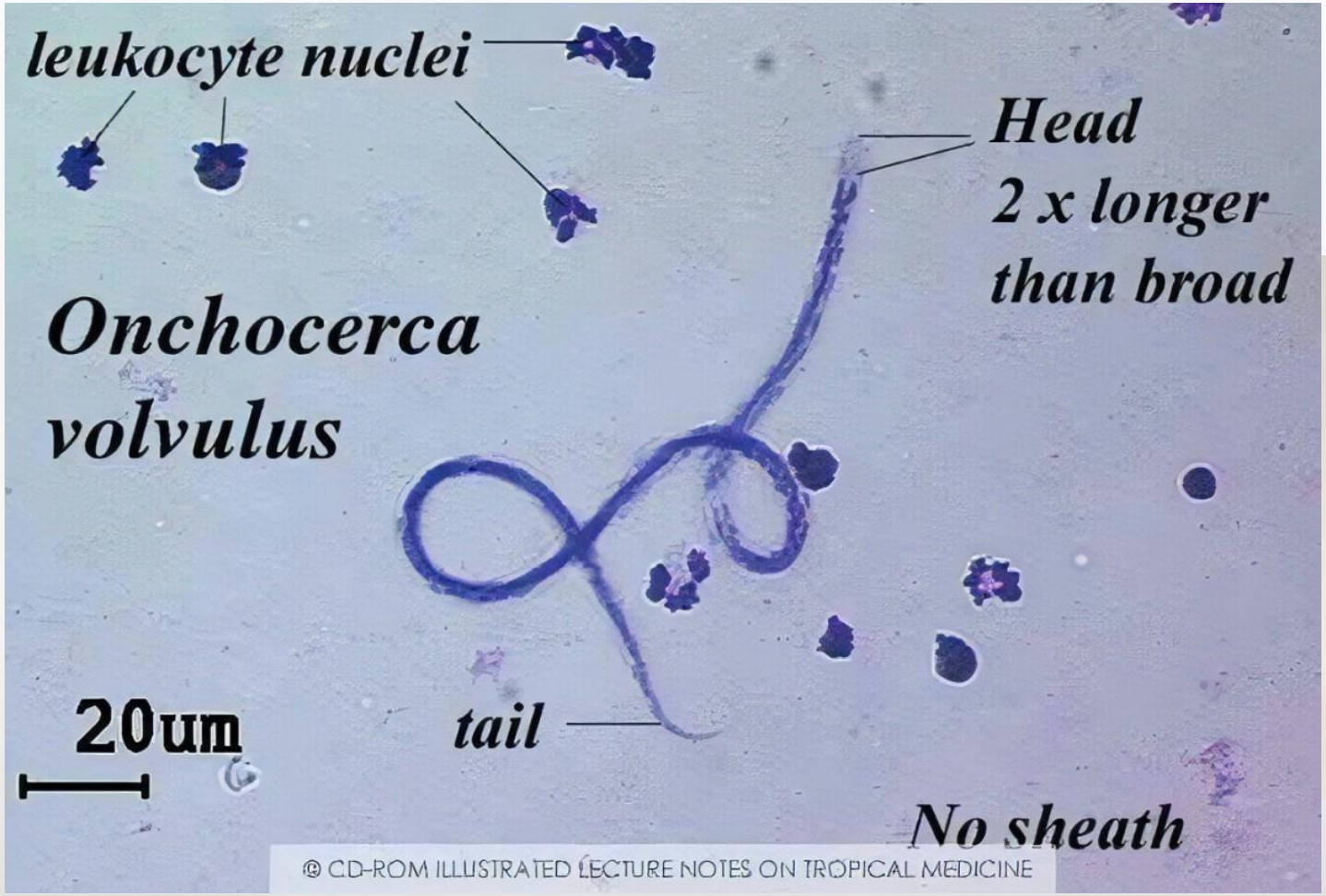
SOURCE: Centers for Disease Control and Prevention

The Carter Center / Graphic by Al Granberg





***Onchocerca volvulus* nodule (onchocercoma) cut section:**



Onchocerca volvulus

Microfilaria

Discussion & Feedback

3 minutes