



# جامعة البصرة كلية التربية القرنة

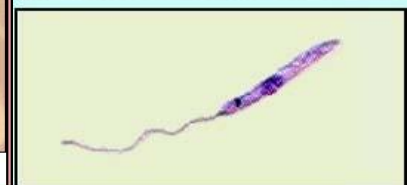
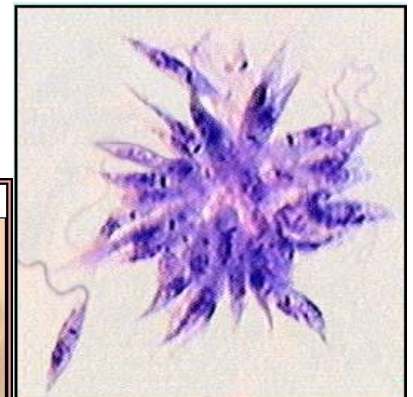
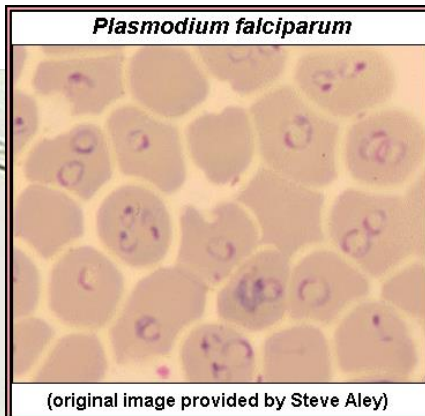
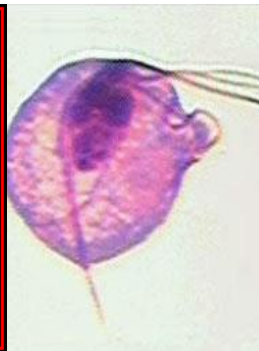
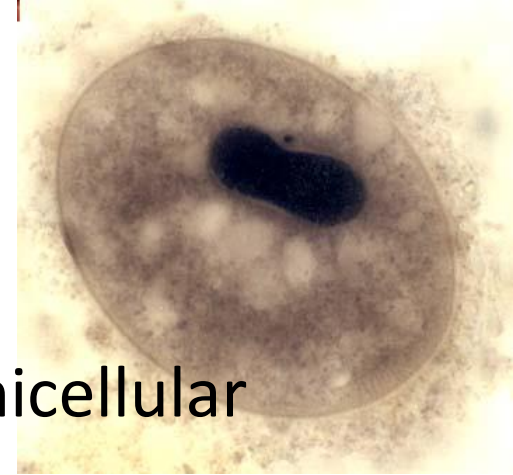
## قسم علوم الحياة

# Protozoa

أ.د. علي ضرب شعبان

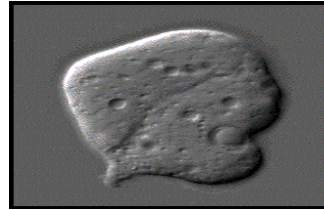
# General fetures

- One-cell animal – monocellular or unicellular organisms with full vital functions
- Species – total named species:65,000; parasitic: around 10,000
- Locomation
- Feeding
- Secretion

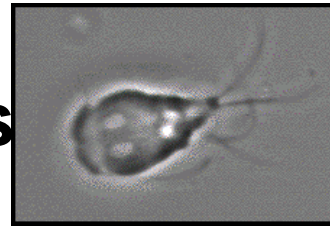


# Classification of protozoa

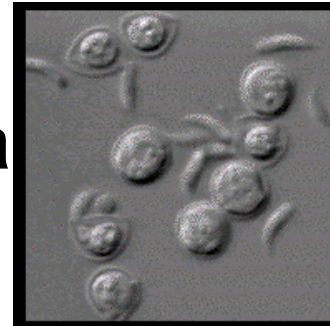
**Amoebae**



**Flagellates**



**Sporozoa**



**Ciliates**





# Life cycle patterns

## One-host form

1. One stage form – Trophozoite
2. Two stage form – Trophozoite & Cyst

## Two-host form

1. Mammals  mammals
2. Mammals  insect vectors

# Mode of Reproduction

- Asexual Reproduction
  - Binary fission – result in 2 daughter cells
  - Schizogony – **multiple fission** result in multiple cells
  - Budding
    - Exogenous budding - by external budding result in multi-cells
    - Endodyogony - by internal budding result in 2 cells
- Sexual Reproduction
  - Conjugation – exchange of nuclear material of 2
  - Gametogony – sexually differentiated cells unite -- zygote

# Pathogenesis

- Host Resistance
  - Innate immunity
  - Acquired immunity
- Parasite Invasion
  - Toxin
  - Mechanically damage
  - Immune impair
    - Immune inhibition
    - hypersensitivity



**Opportunistic & Accidental  
(protozoa) infections**

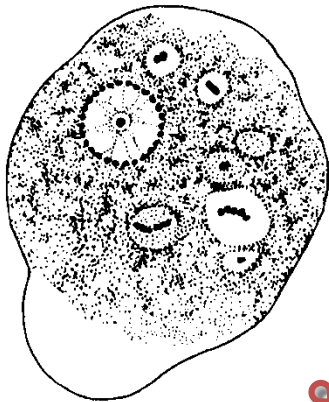
# Opportunistic parasites

- **Opportunistic infection**
  - **An infection by a microorganism that normally does not cause disease but becomes pathogenic when the body's immune system is impaired and unable to fight off infection**

# Amoebic Infections

## Atrial amoeba

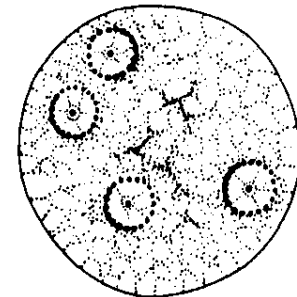
## Intestinal amoebae



⌘ ***Entamoeba histolytica***

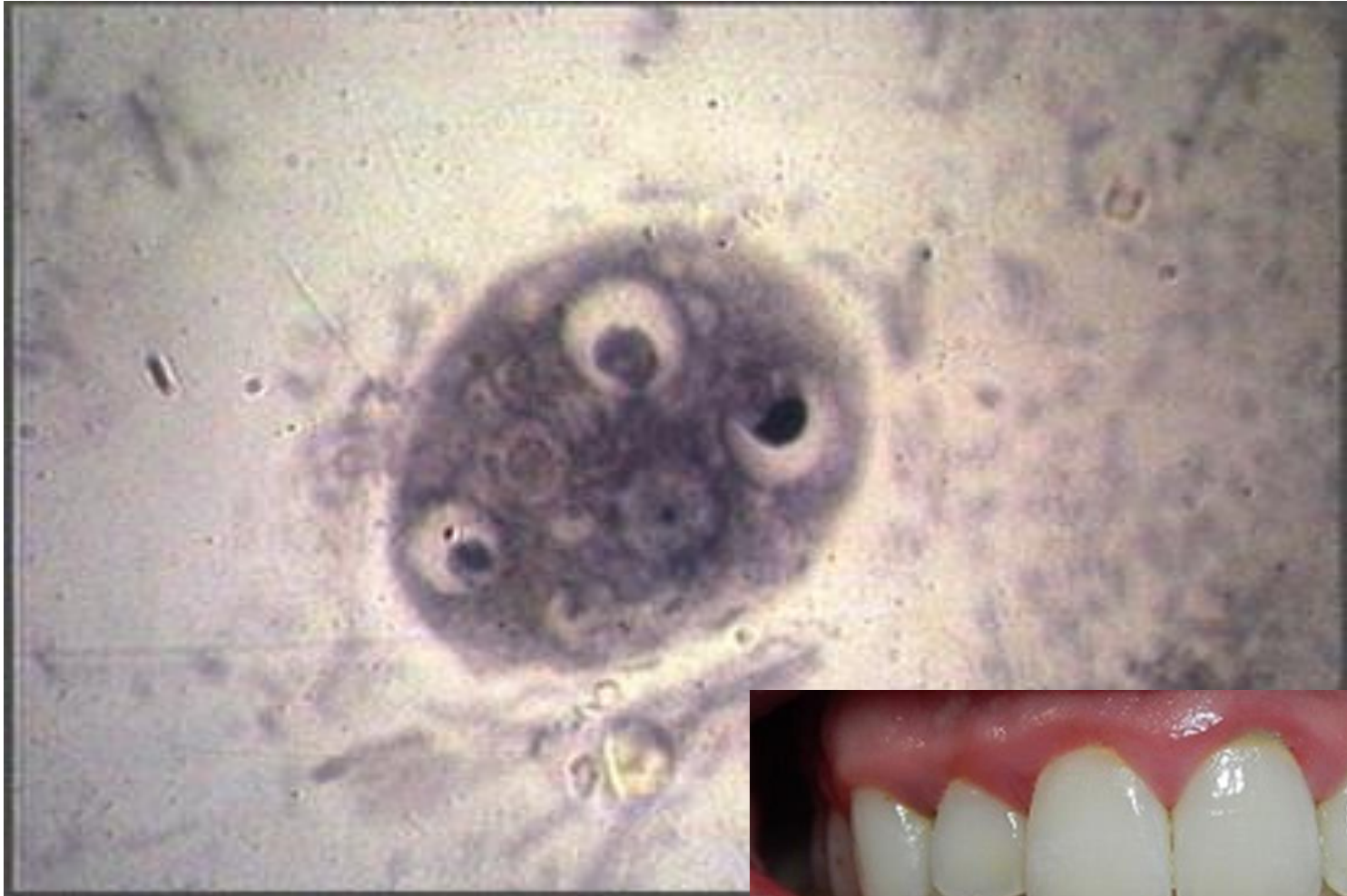
⌘ ***Acanthamoeba***

⌘ ***Naegleria***





# *Entamoeba gingivalis*



# Amoeba in alimentary tract

- Entamoeba

- *E. histolytica* (pathogenic)

- *E. dispar* (non-pathogenic)

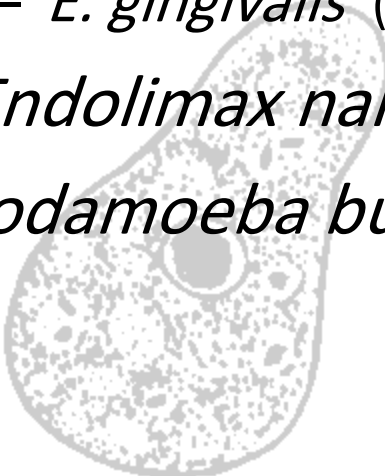
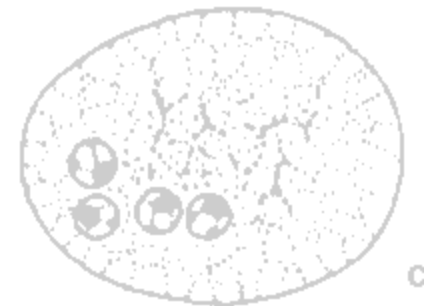
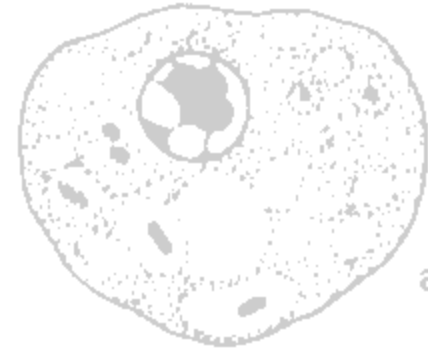
- *E. coli* (big sister)

- *E. hartmani* (little brother)

- *E. gingivalis* (oral)

- *Endolimax nana* (occasionally pathogenic)

- *Iodamoeba butschlii*



# Morphology

## *Entamoeba histolytica*

### Cysts

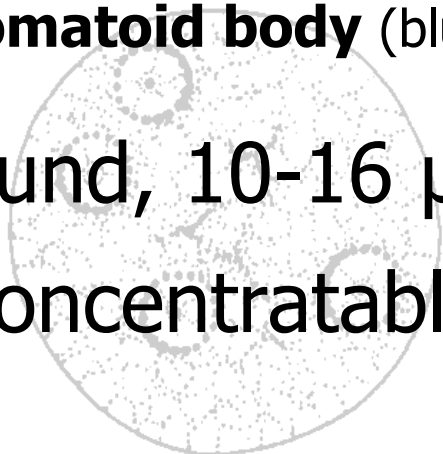
Thick wall

1-4 ring-like nuclei

**Chromatoid body** (blunt)

Round, 10-16  $\mu\text{m}$

Concentratable



### Trophozoites

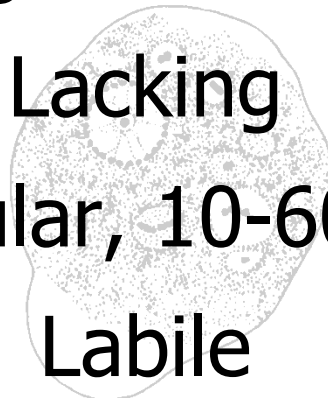
Plasmalemma (thin)

1 ring-like nucleus

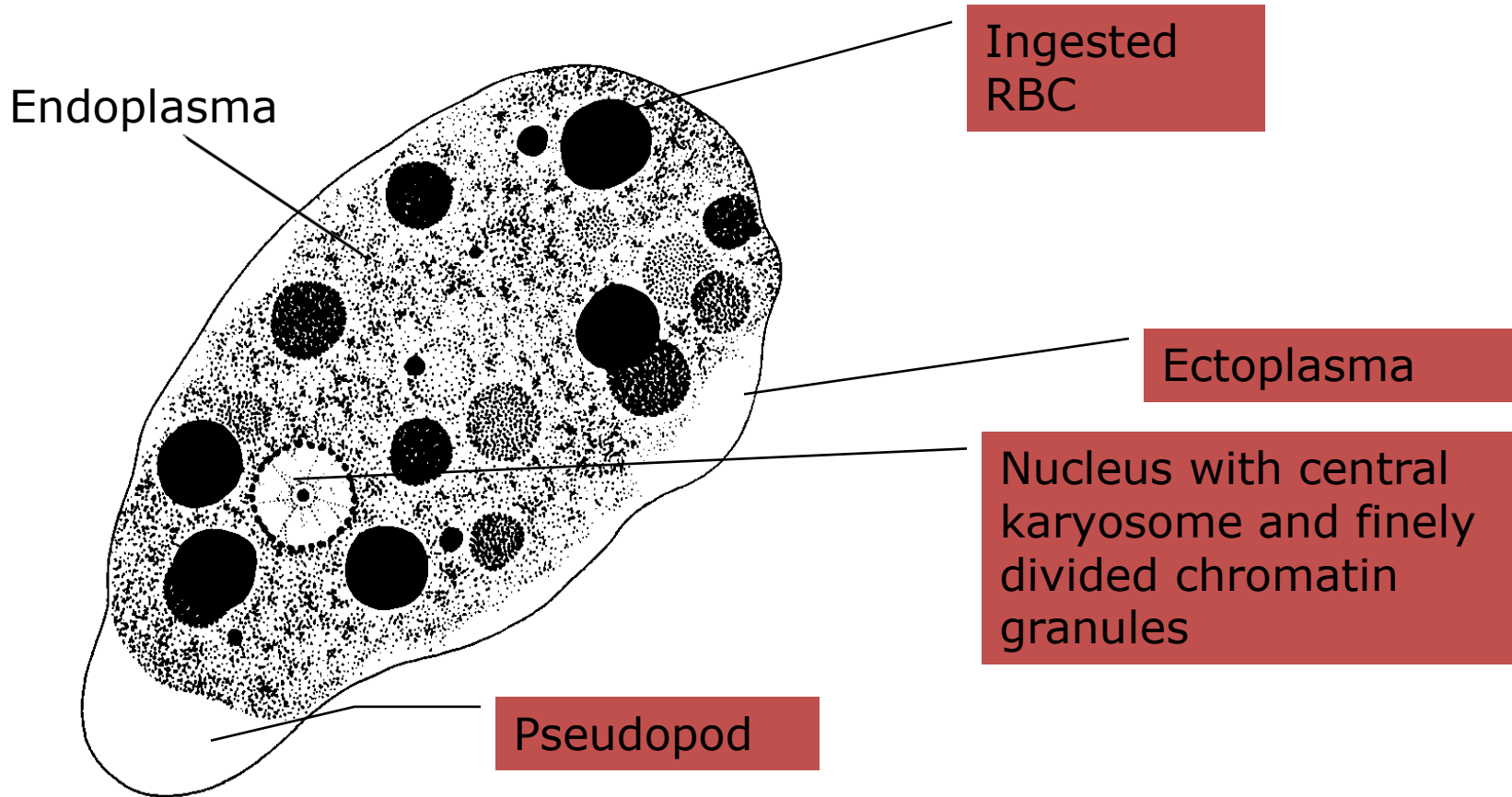
Lacking

Irregular, 10-60  $\mu\text{m}$

Labile

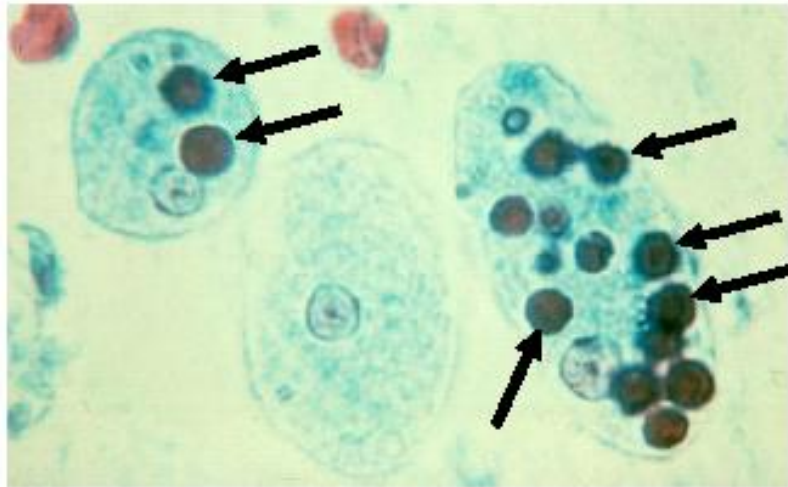


# Morphology

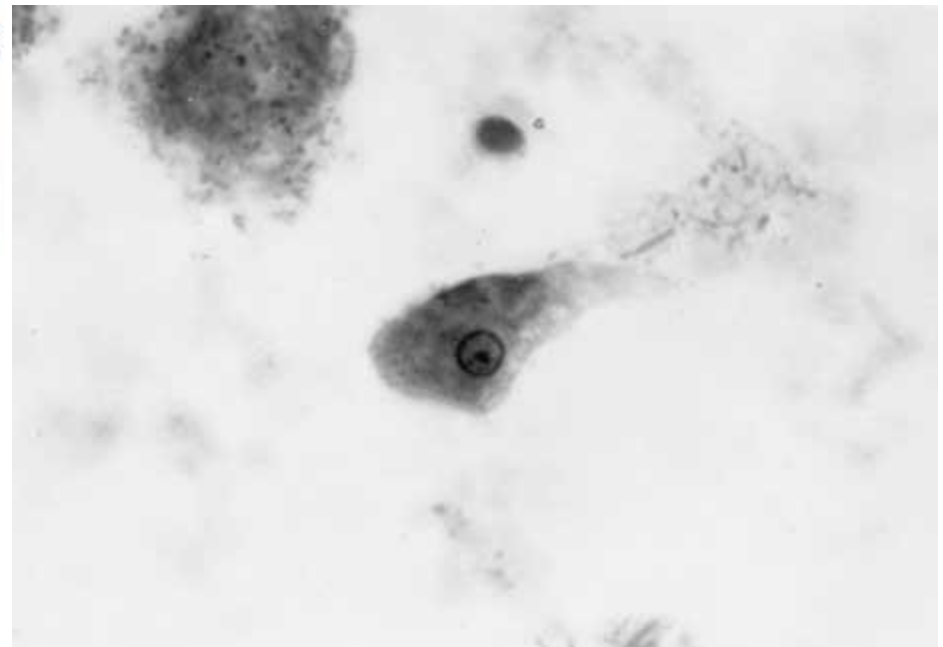


*E. histolytica* trophozoite

# Morphology



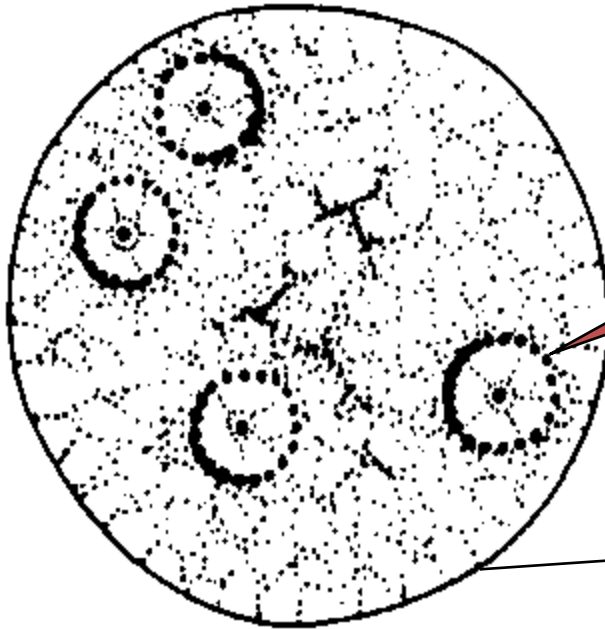
Three *Entamoeba histolytica* trophozoites, two with ingested RBCs (arrows).



## Trophozoites

Single nucleus with a central,  
dot-like karyosome

# Morphology



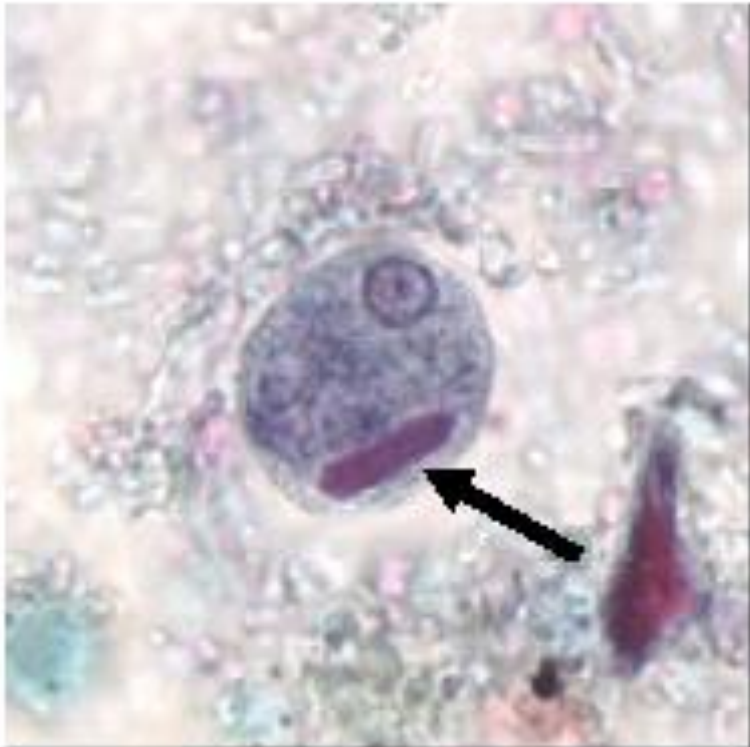
1-4 ring-like nuclei  
with finely divided  
peripheral chromatin

Cyst wall and  
round shape

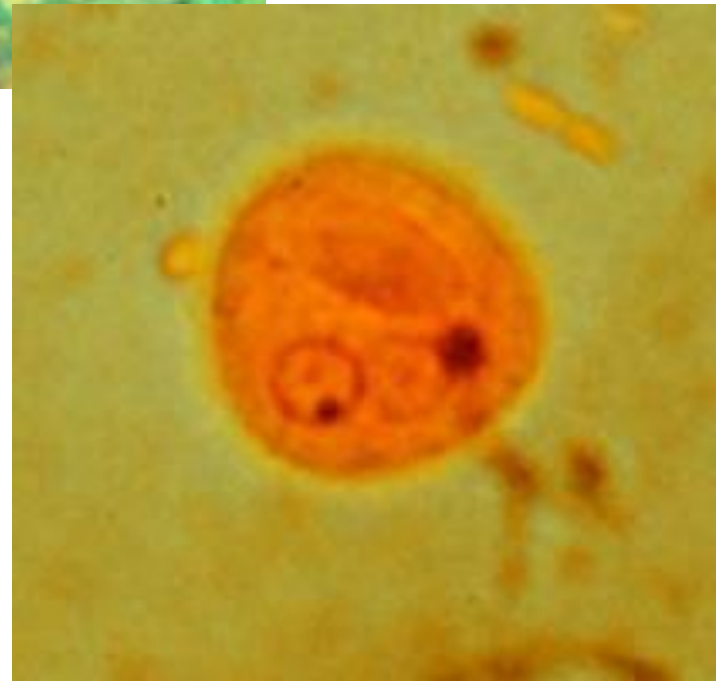
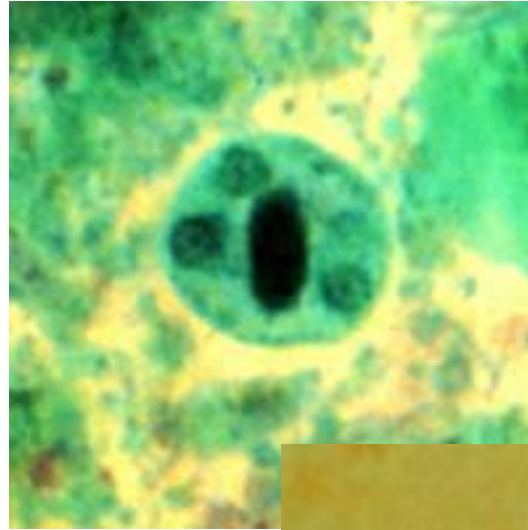
Mature *E. histolytica* **Cyst**



# Morphology



*Entamoeba histolytica/dispar* cyst showing a chromatoid body with bluntly rounded ends (arrow)



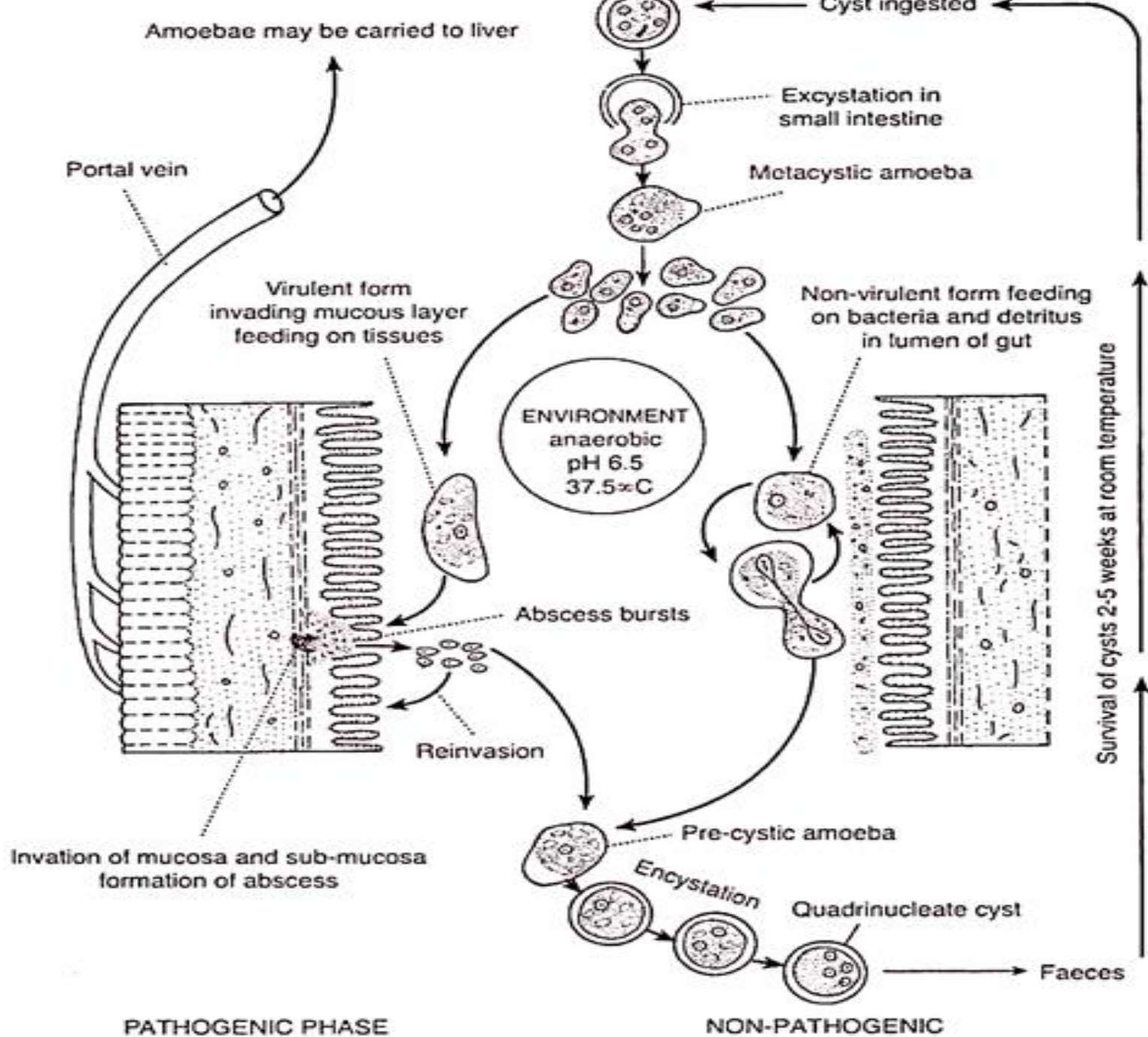
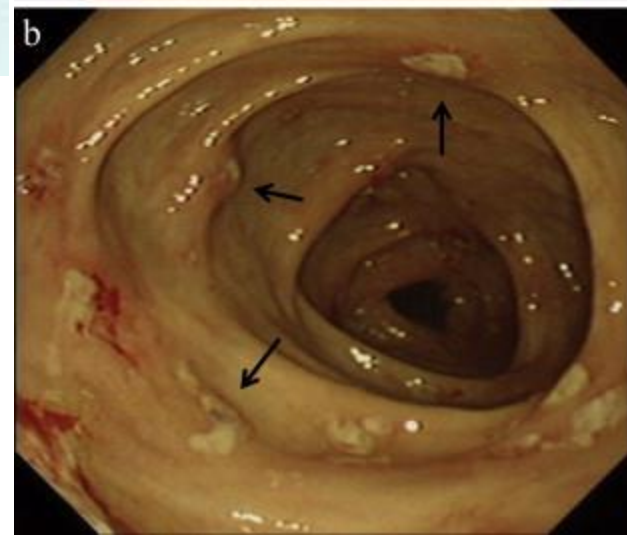
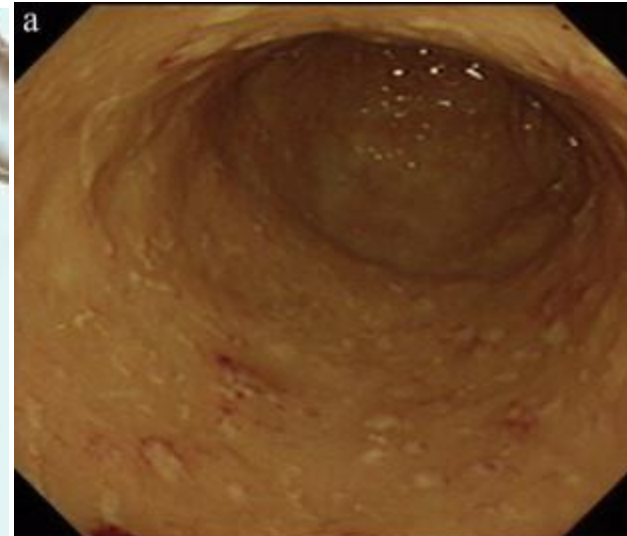
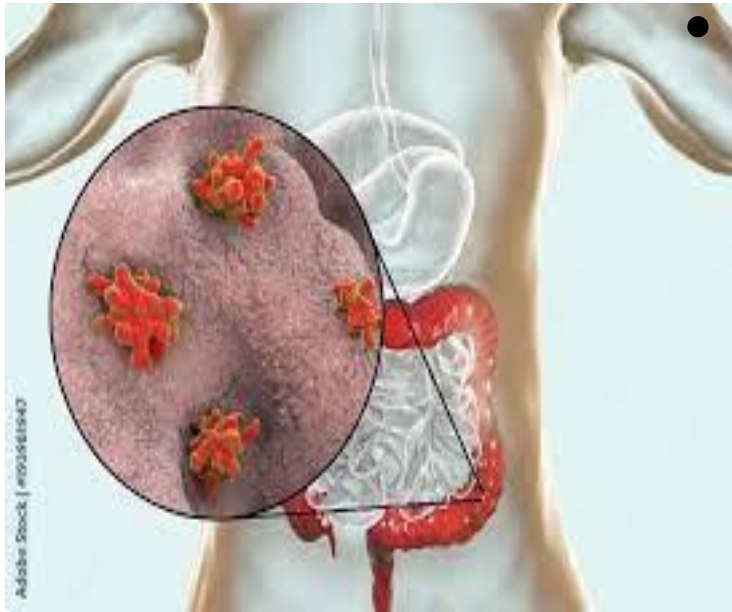


Fig. 6.2: Life cycle of *E. histolytica* in man

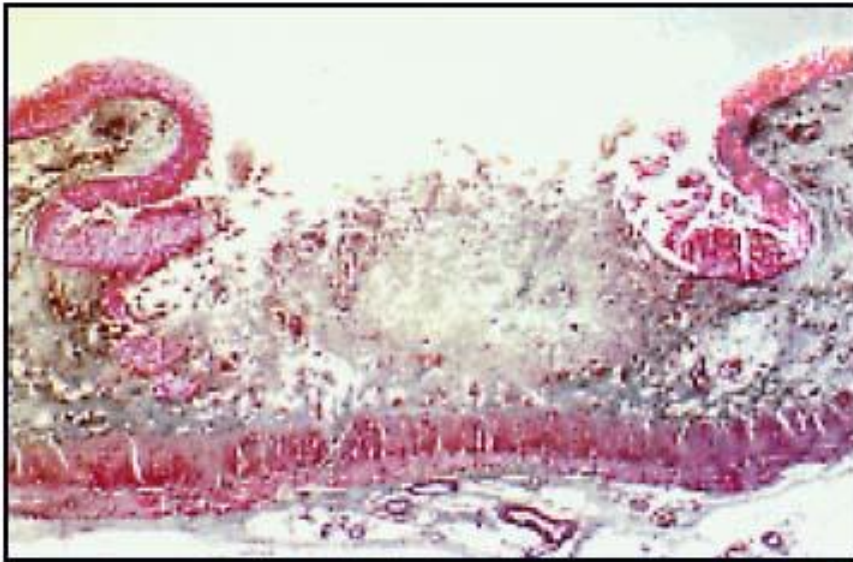


# التاثير المرضي والاعراض

## Pathology and symptomaiology



## *Clinical manifestation*

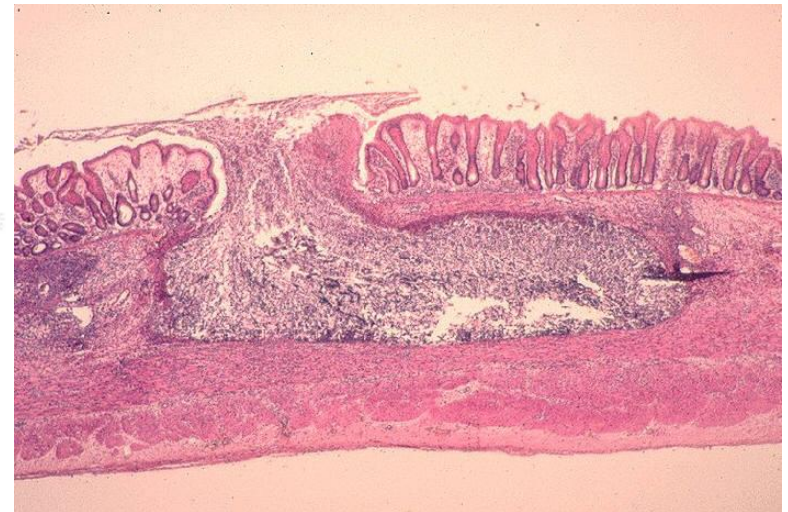


放大

阿米巴痢疾病人肠病理切片

**Characteristic flask-shaped ulcer in the large intestine**

肠溃疡呈烧瓶状, 溃疡区可见坏死组织, 嗜酸性粒细胞及大量滋养体。



**Pathological changes in large intestine**





Ulcers caused by invasion of *E. histolytica* into the liver.

*Clinical manifestation*

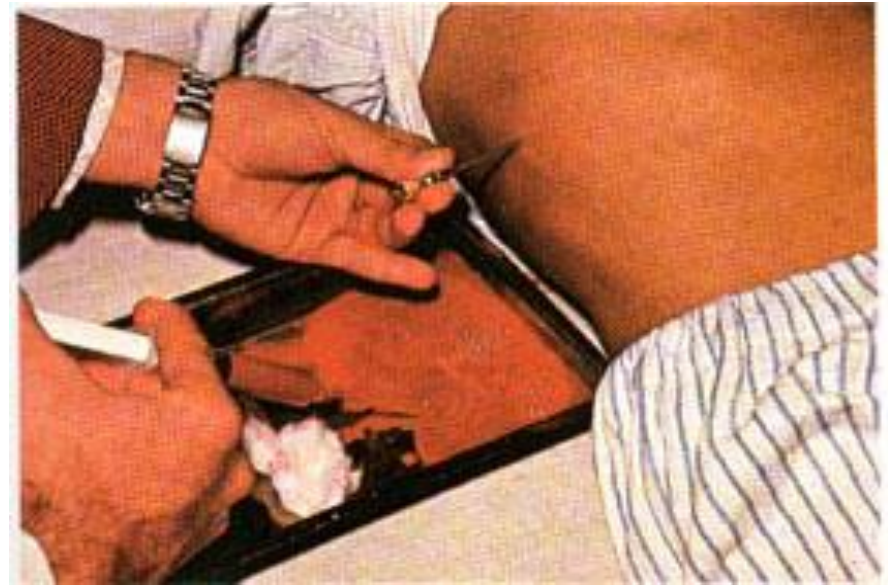


阿米巴肝脓肿破溃部位的皮肤可出现炎症反应，皮肤红肿，甚至破溃。

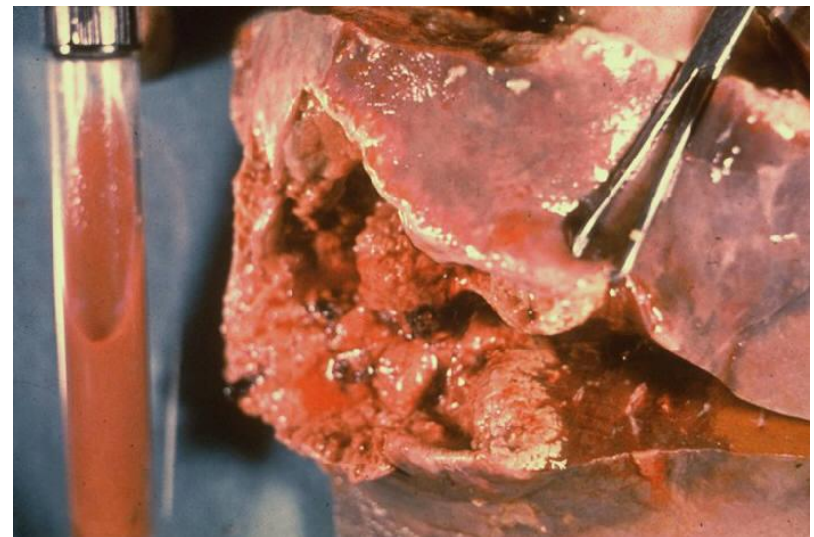
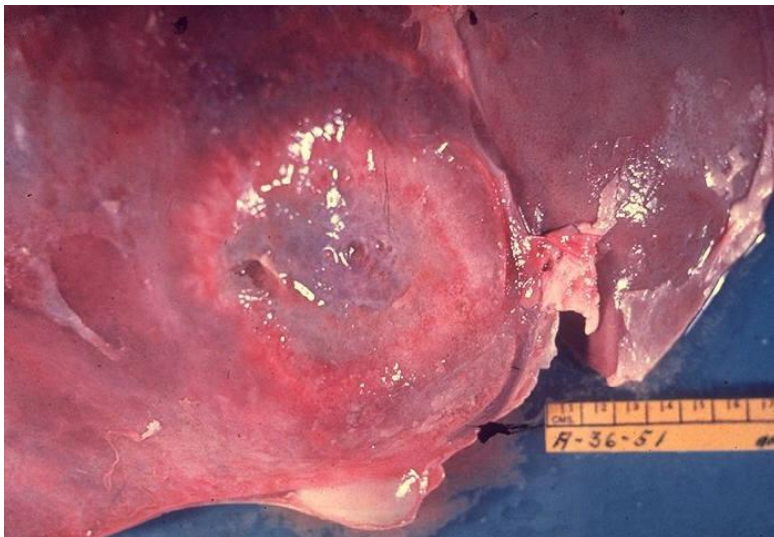
阿米巴肝脓肿病人照片

# An Amoebic Liver Abscess Being Aspirated.

Note the reddish brown color of the pus ('anchovy-sauce'). This color is due to the breakdown of liver cells.



Gross pathology of amoebic abscess of liver.  
Tube of "chocolate" pus from abscess.



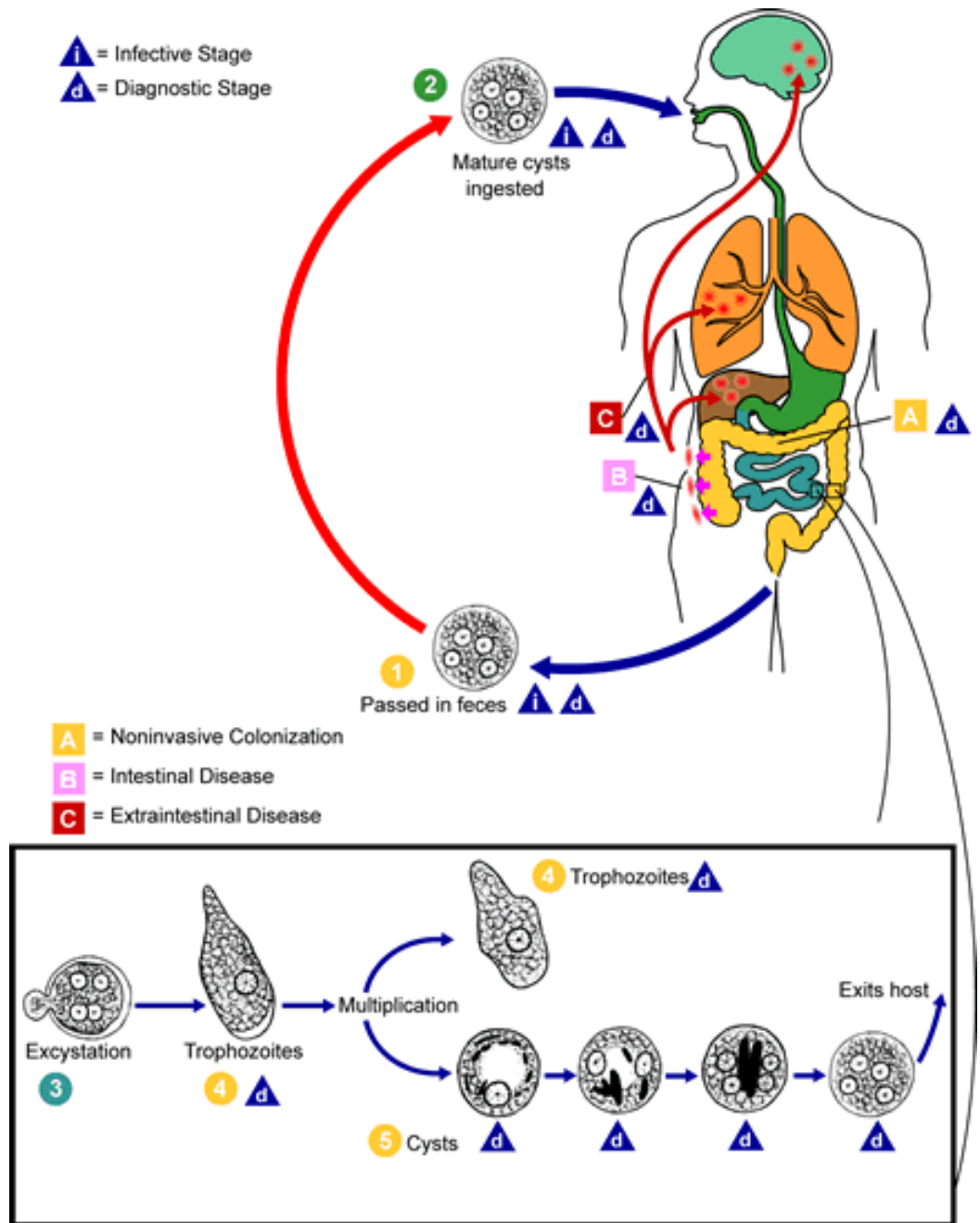


# *E. Coli* cysts

# Morphology

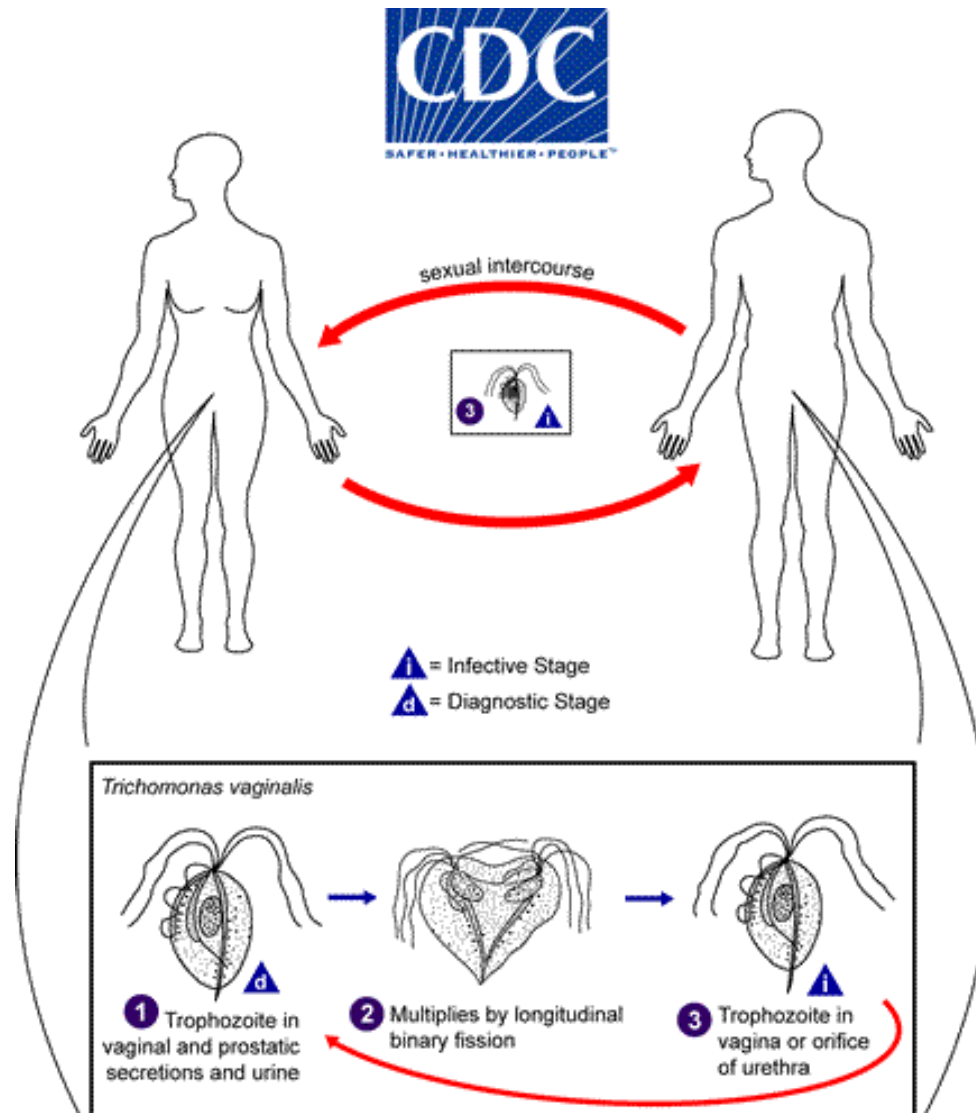


# Life cycle



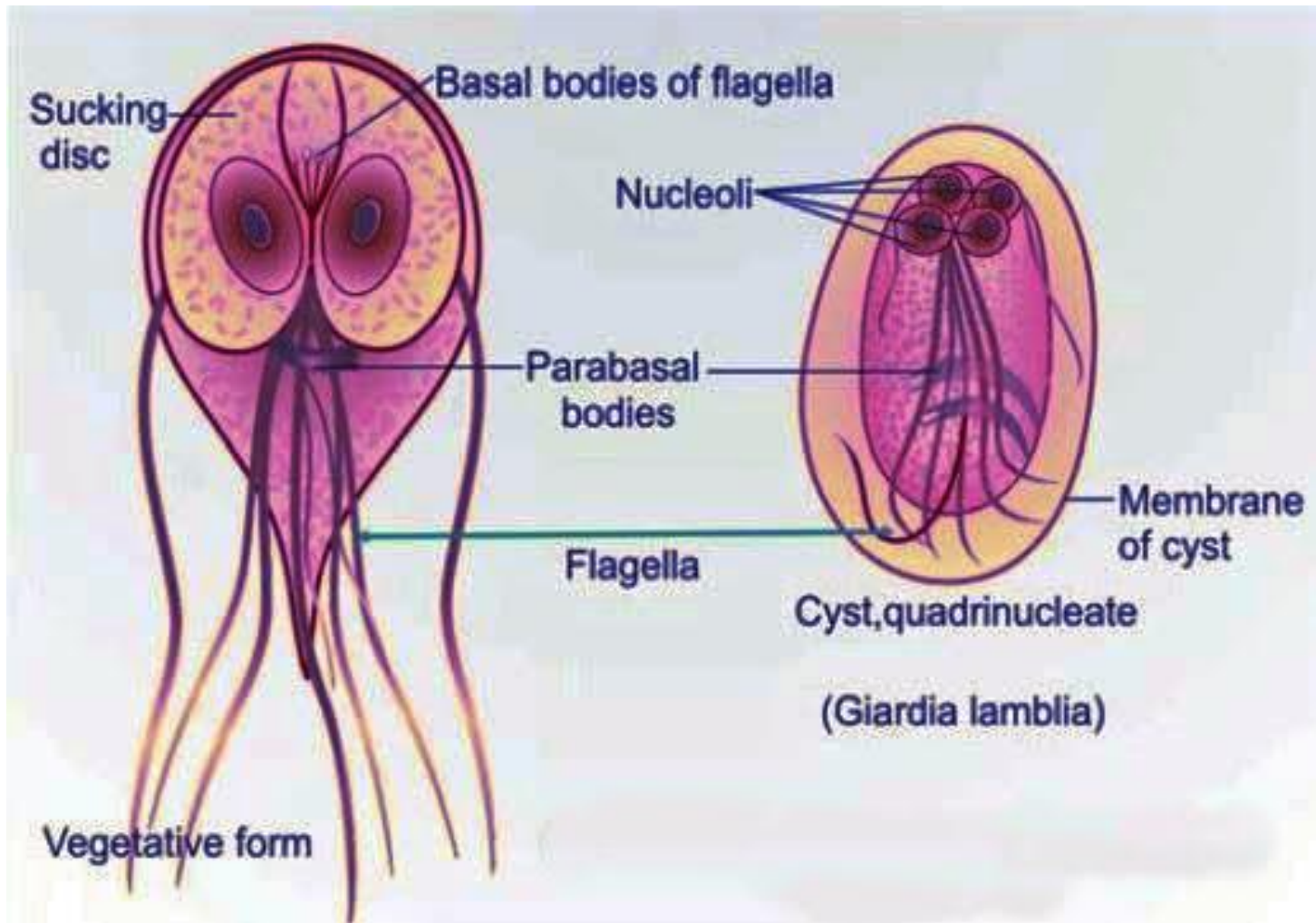
# Parasitic flagelates

## *Trichomonas vaginalis*

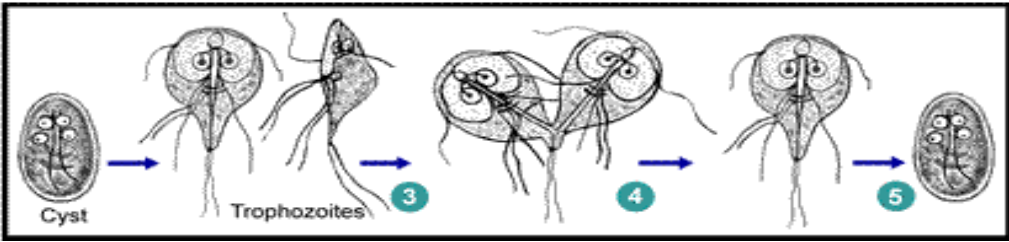
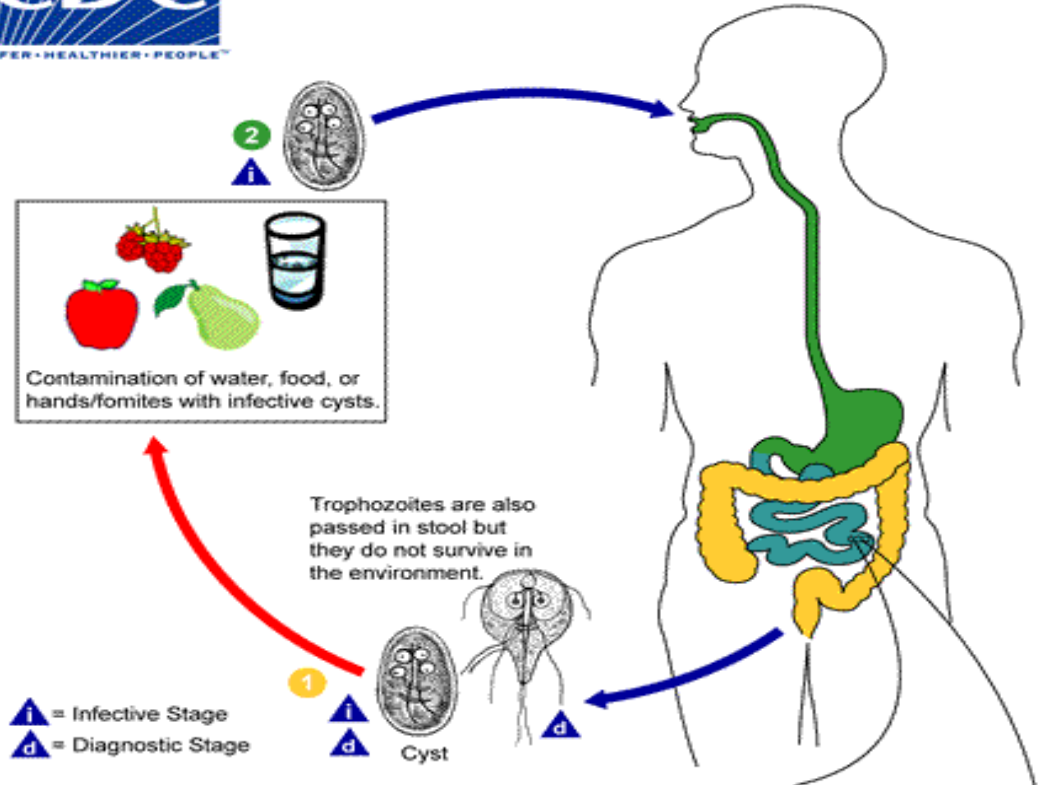


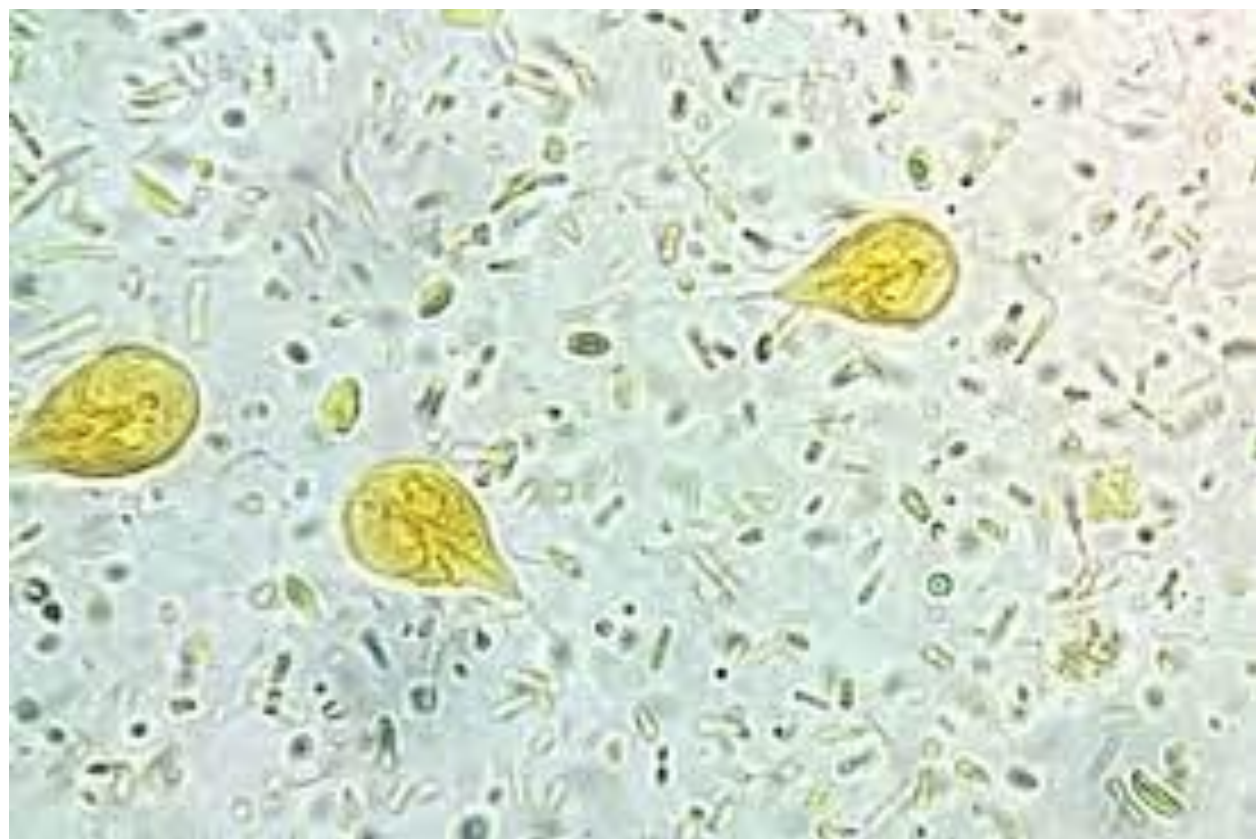


# *Giardia lamblia*

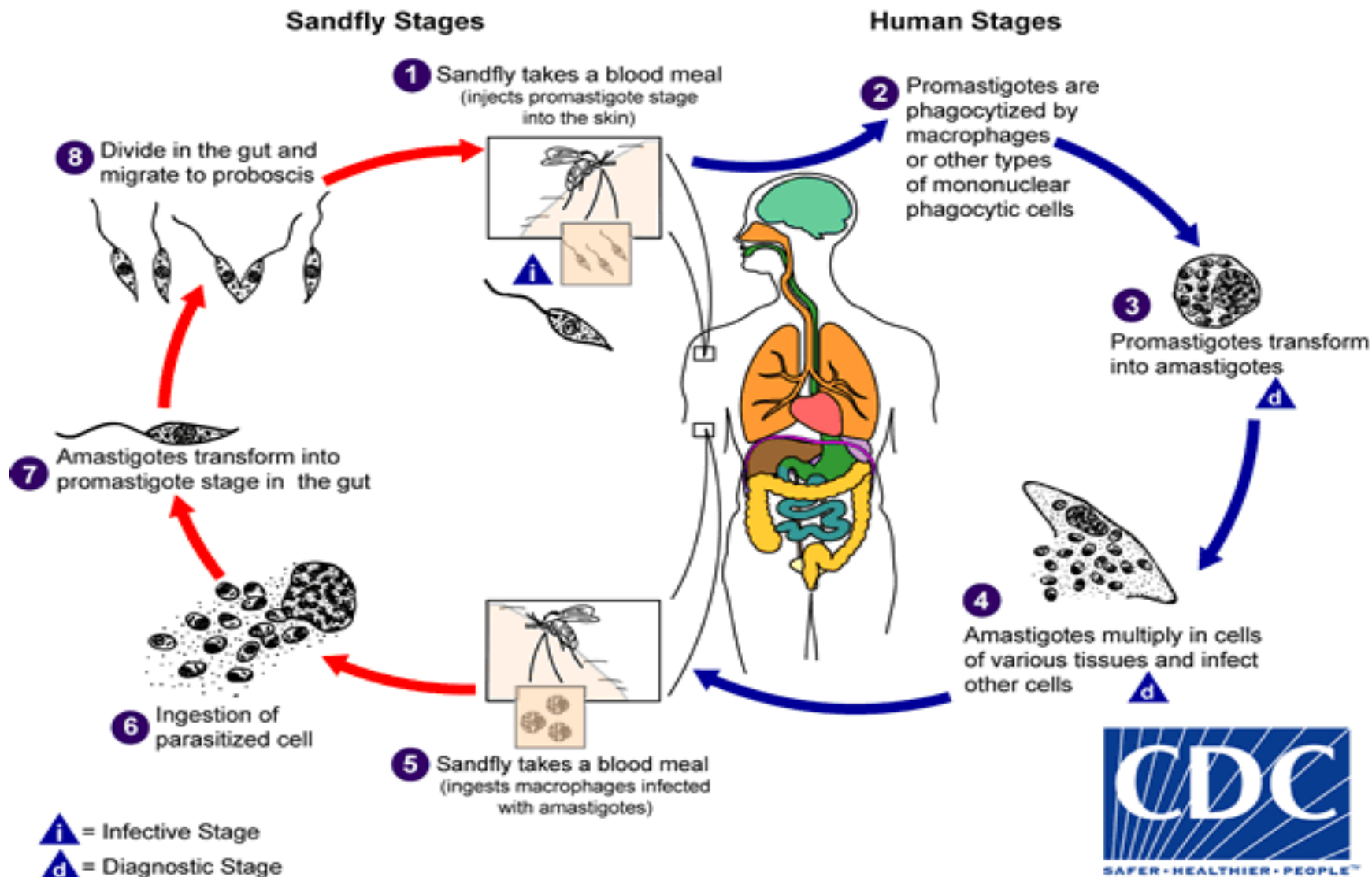


# Life cycle





# Genus *Leishmania*



# *Leishmania donovani*





*Leishmania tropica*



# *Leishmania braziliensis*

## Mucocutaneous Leishmaniasis



nasal mucosa and septum are involved

*Leishmania braziliensis*

# *Trypanosoma*

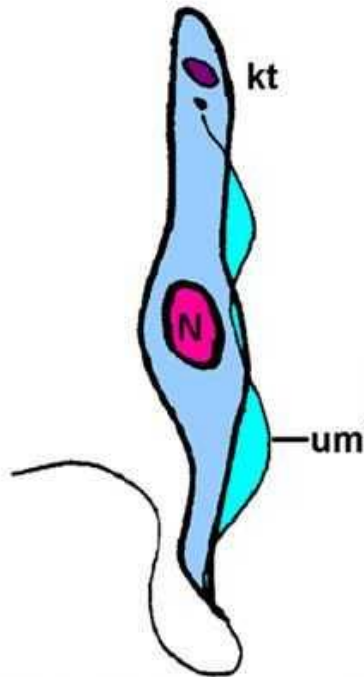
- Amastigota
- Promastigota (leptomonad)
- Choanomastigot (Crithidial)
- Trypmastigota (Trypanosomal)



# Trypanosomatidae

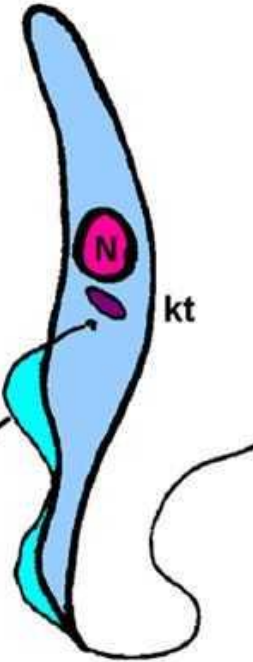
Stages:

trypomastigote



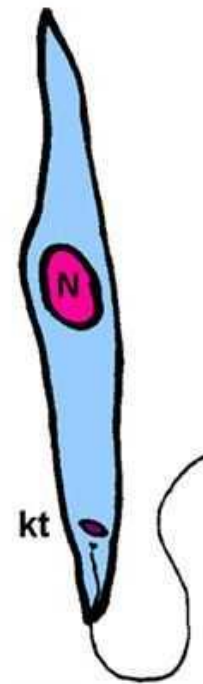
**Trypomastigote:**  
blood stream form;  
infective form  
replicative

epimastigote



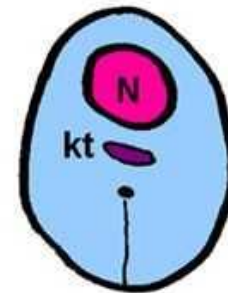
**Epimastigote:**  
replicative stage  
in insect

promastigote



**Promastigote:**  
infective stage of  
*Leishmania* spp.

amastigote

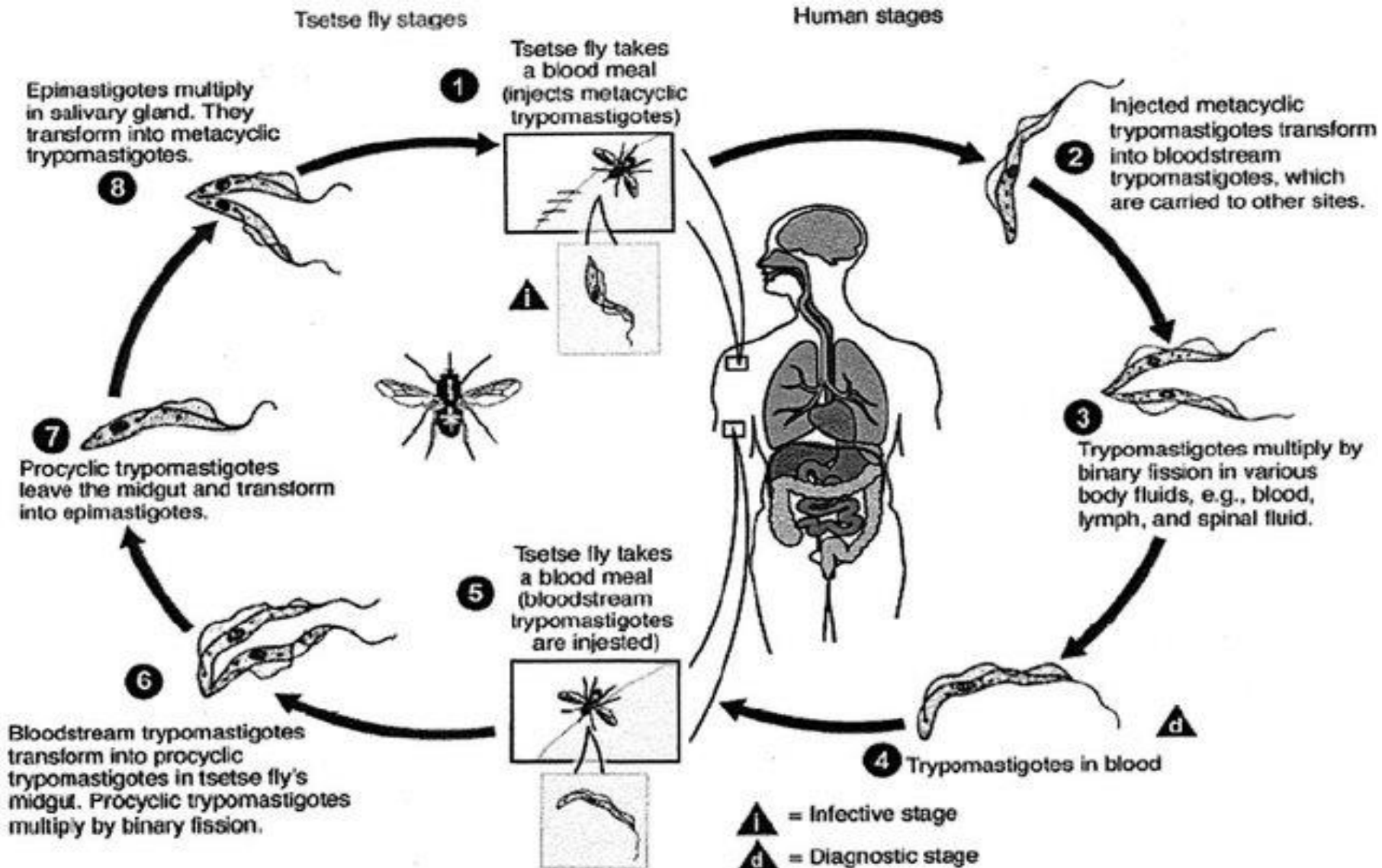


non-motile, intracellular

**Amastigote:**  
non-motile;  
intracellular;

stage in vertebrate [muhadharaty.com](http://muhadharaty.com)

# Trypanosoma gambiense



# العلاج

- Suramin sodium
- Berenil
- Tryparsmide

# Trypanosoma rhodesiense



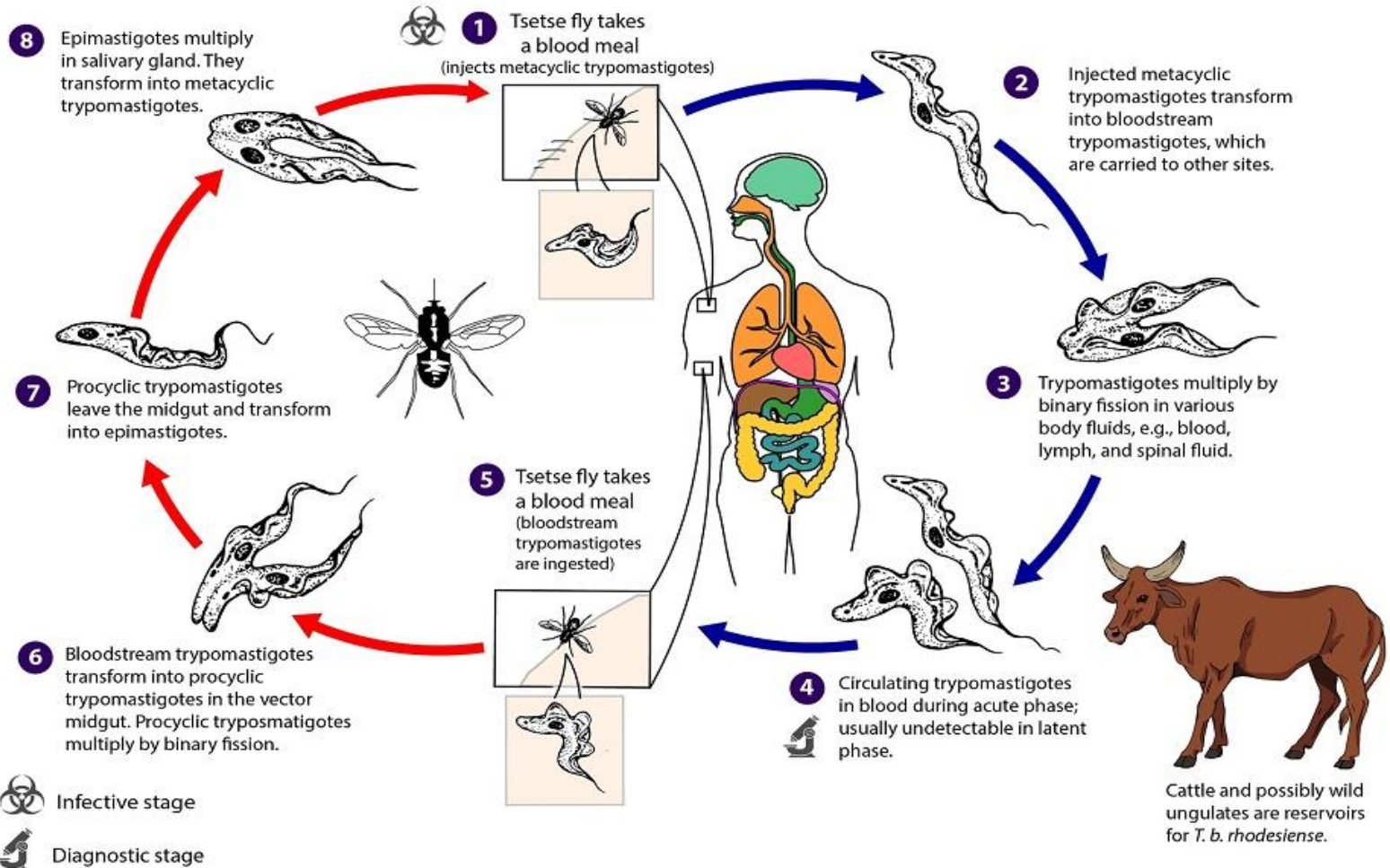
## African Trypanosomiasis

*Trypanosoma brucei gambiense* & *Trypanosoma brucei rhodesiense*



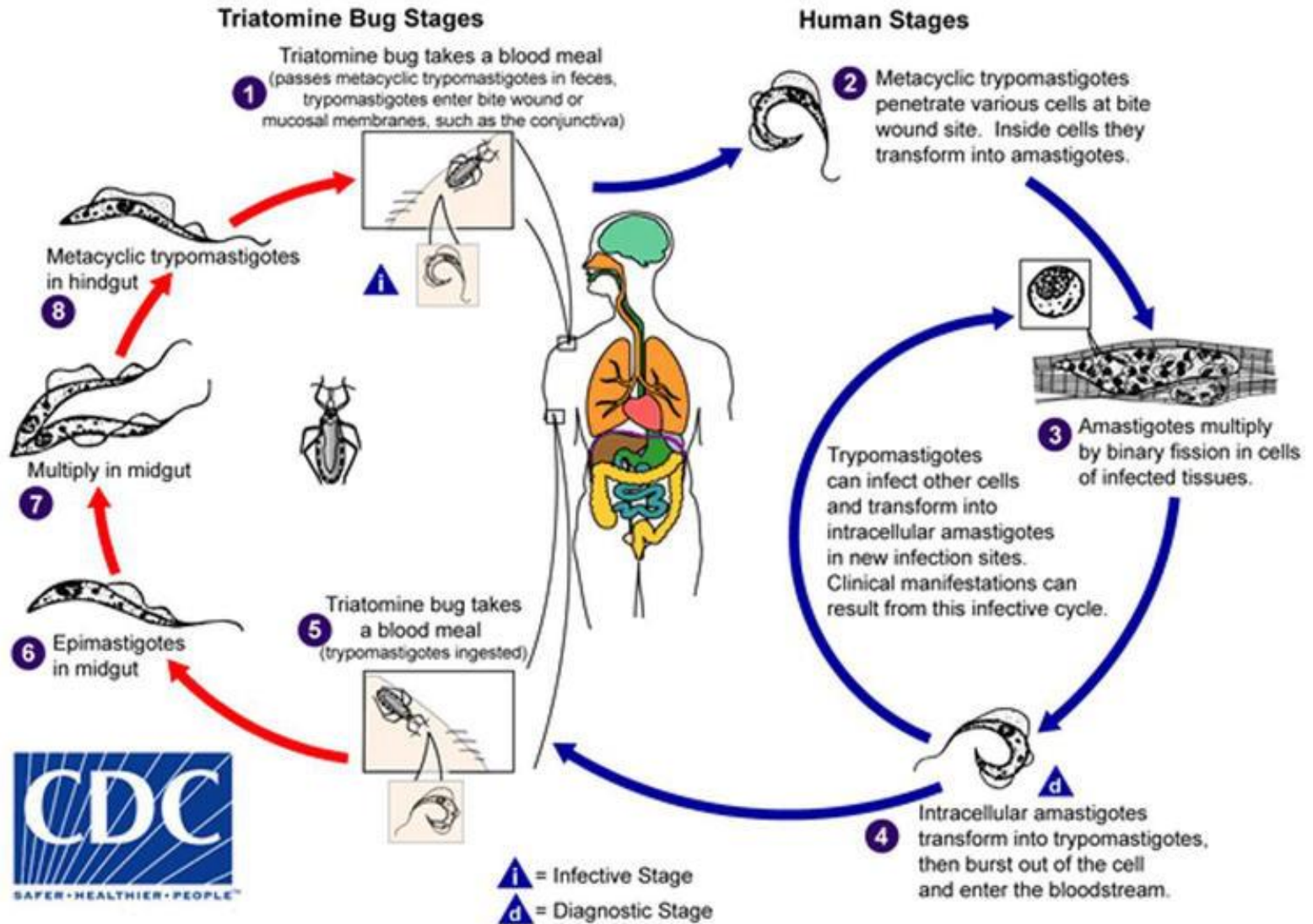
### Tsetse Fly Stages

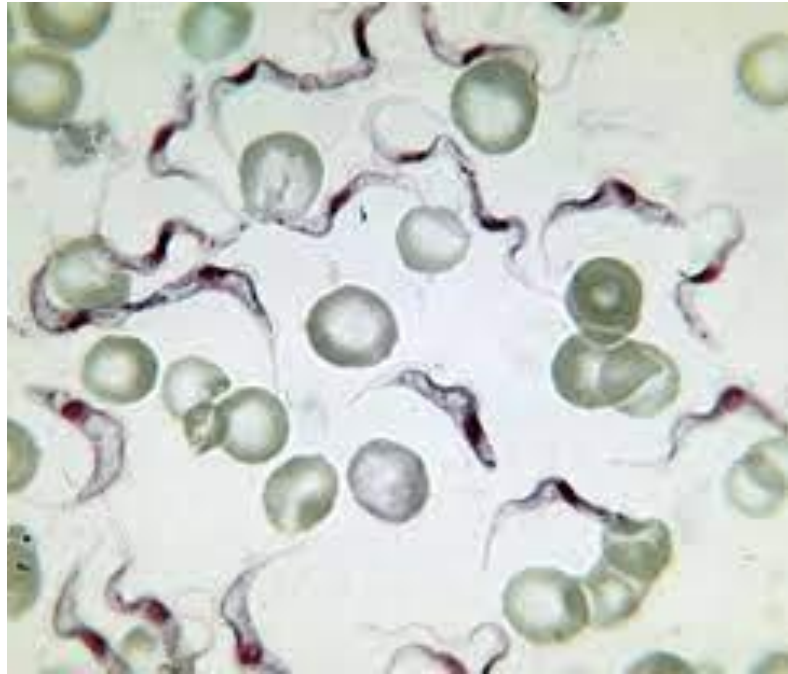
### Mammalian Stages



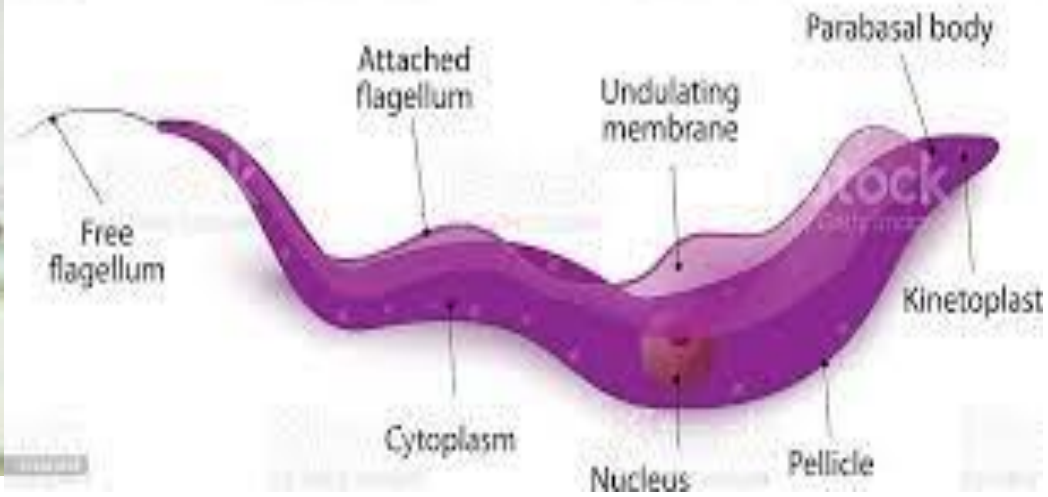


# Trypanosoma cruzi



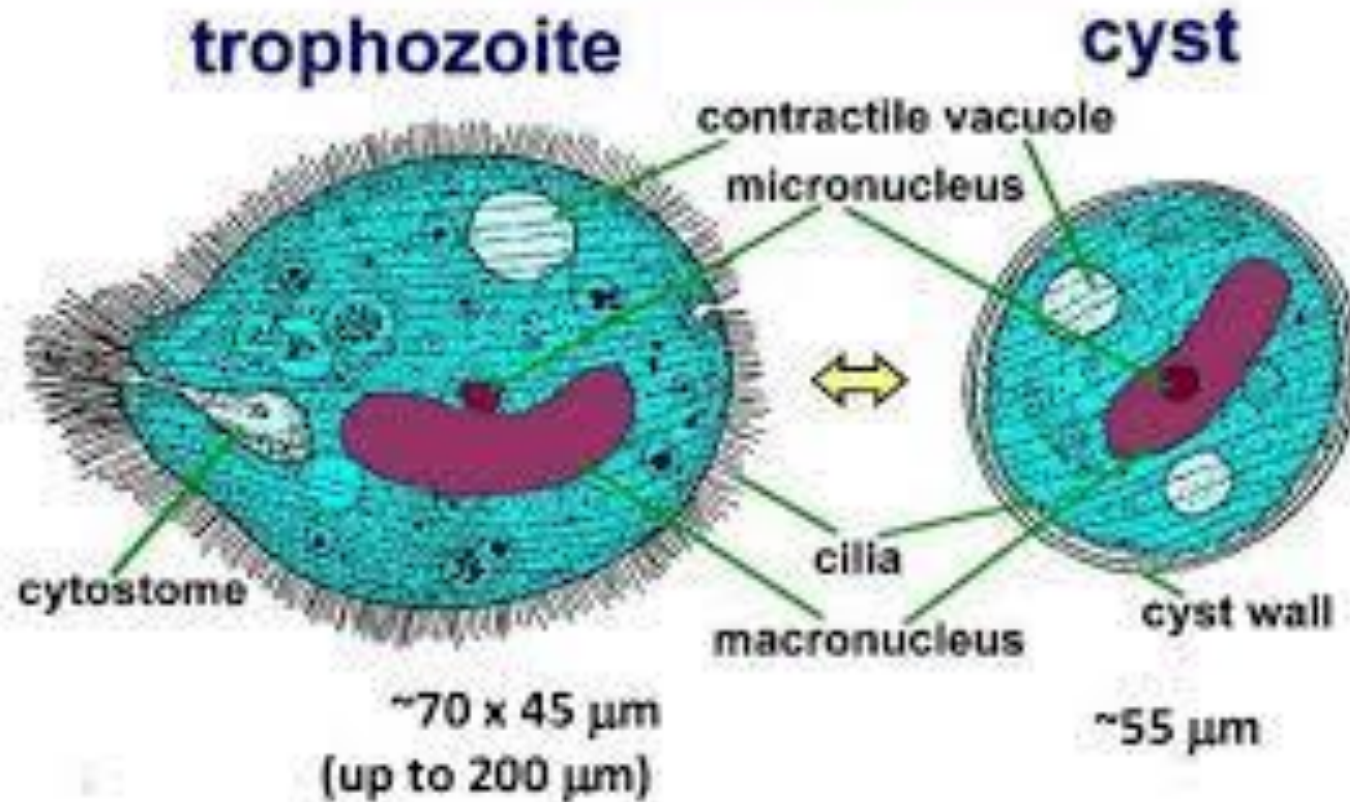


## *Trypanosoma brucei*

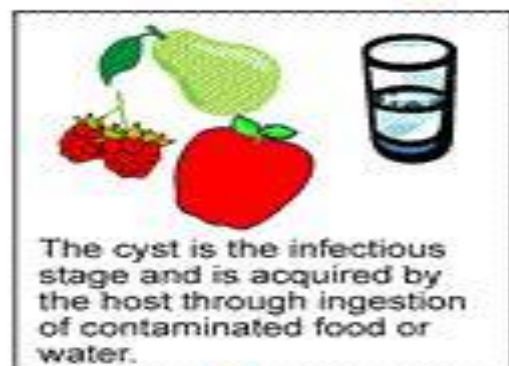


# *Balantidium coli*

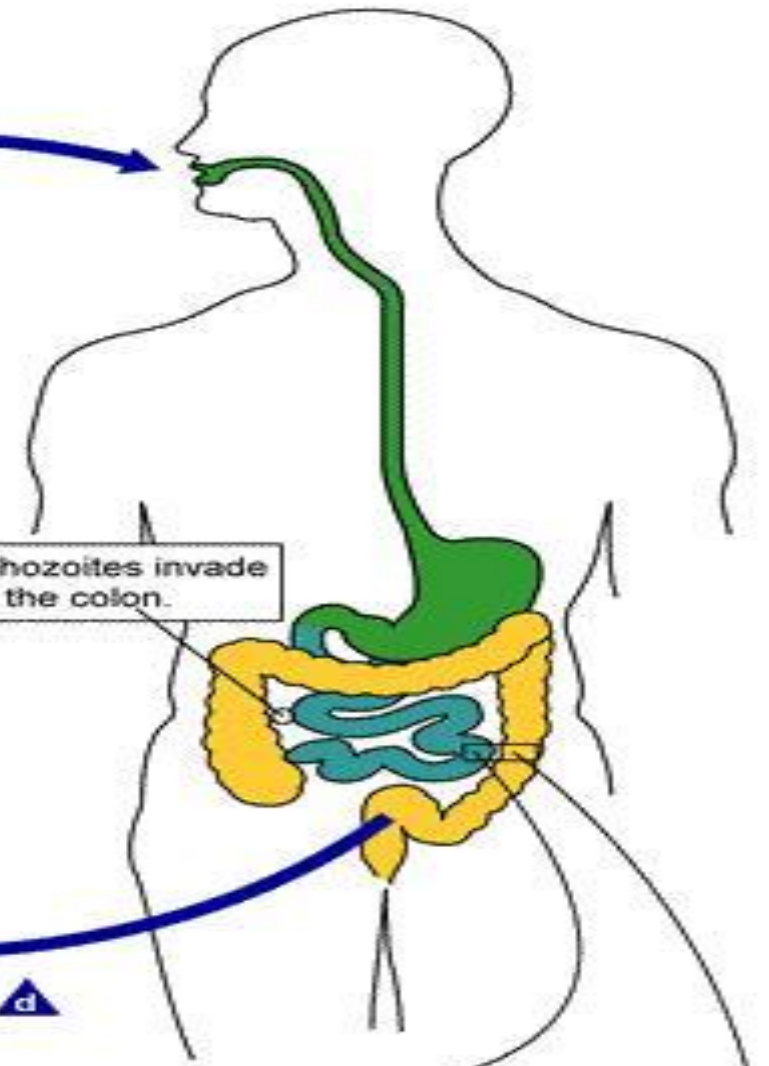
## *Balantidium coli*







2



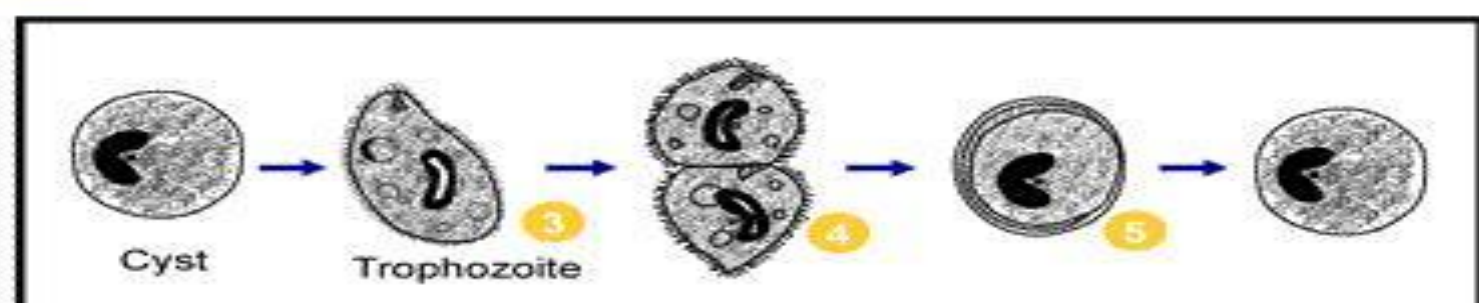
Some trophozoites invade the wall of the colon.



**i** = Infective Stage  
**d** = Diagnostic Stage

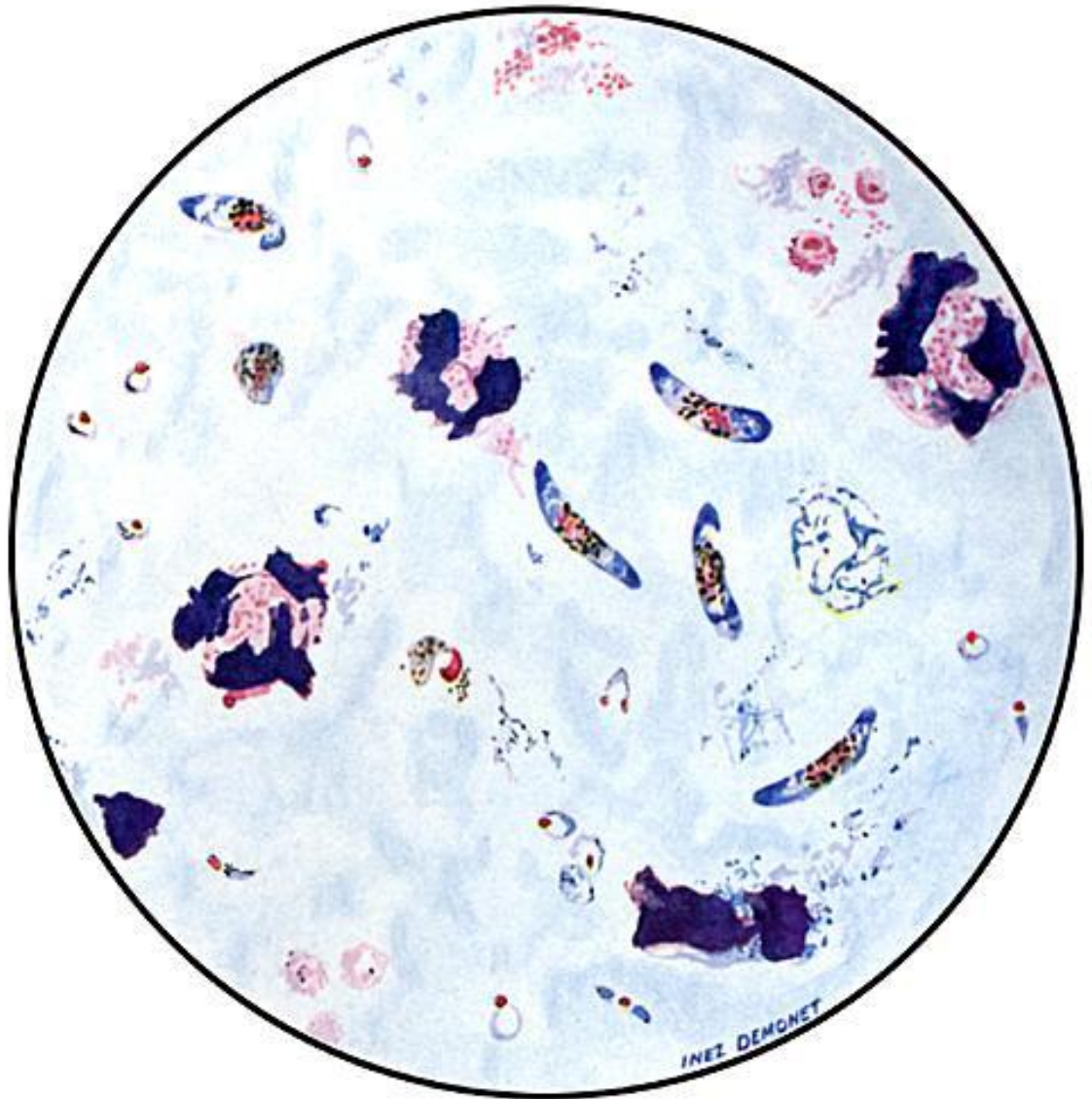
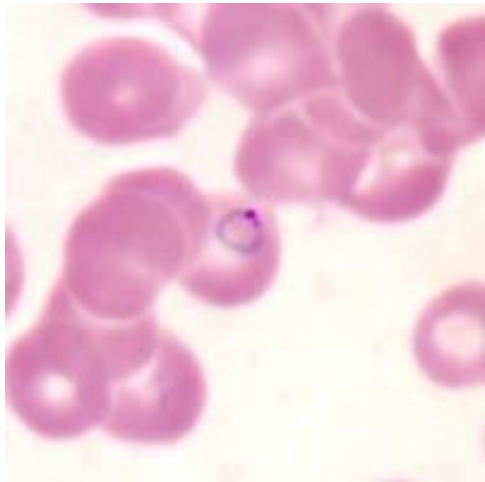
**i** **d**

1 Cyst





# Plasmodium (疟原虫)



# History

Malaria is an old infectious disease. The first ◆  
documentation about it is at 1500BC.

Until the end of the 19th century, it was commonly ◆  
thought that malaria was caused by breathing bad air  
(*mal-aria*) and was associated with swamps



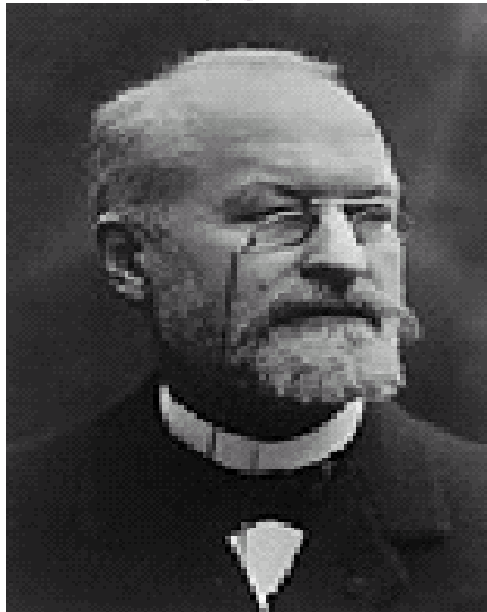
# History

◆ Important application of the knowledge about malaria: W. Gorgas successfully implemented control strategies for malaria and yellow fever during the construction of Panama Canal

# Important Discoveries in Malaria Research

## The Nobel Prize in Physiology or Medicine

1907



1880: Charles Louis Alphonse Laveran observed parasite development in erythrocytes and the exflagellation of microgametocytes

1902

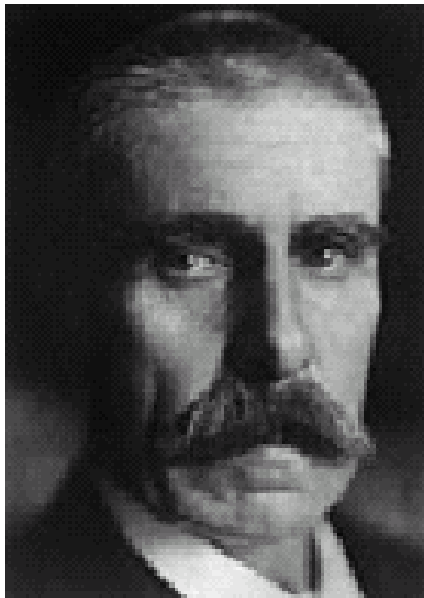


1897: Ronald Ross observed the mosquito stages of *Plasmodium* (*P. relictum*)

# Important Discoveries in Malaria Research

## The Nobel Prize in Physiology or Medicine

1927



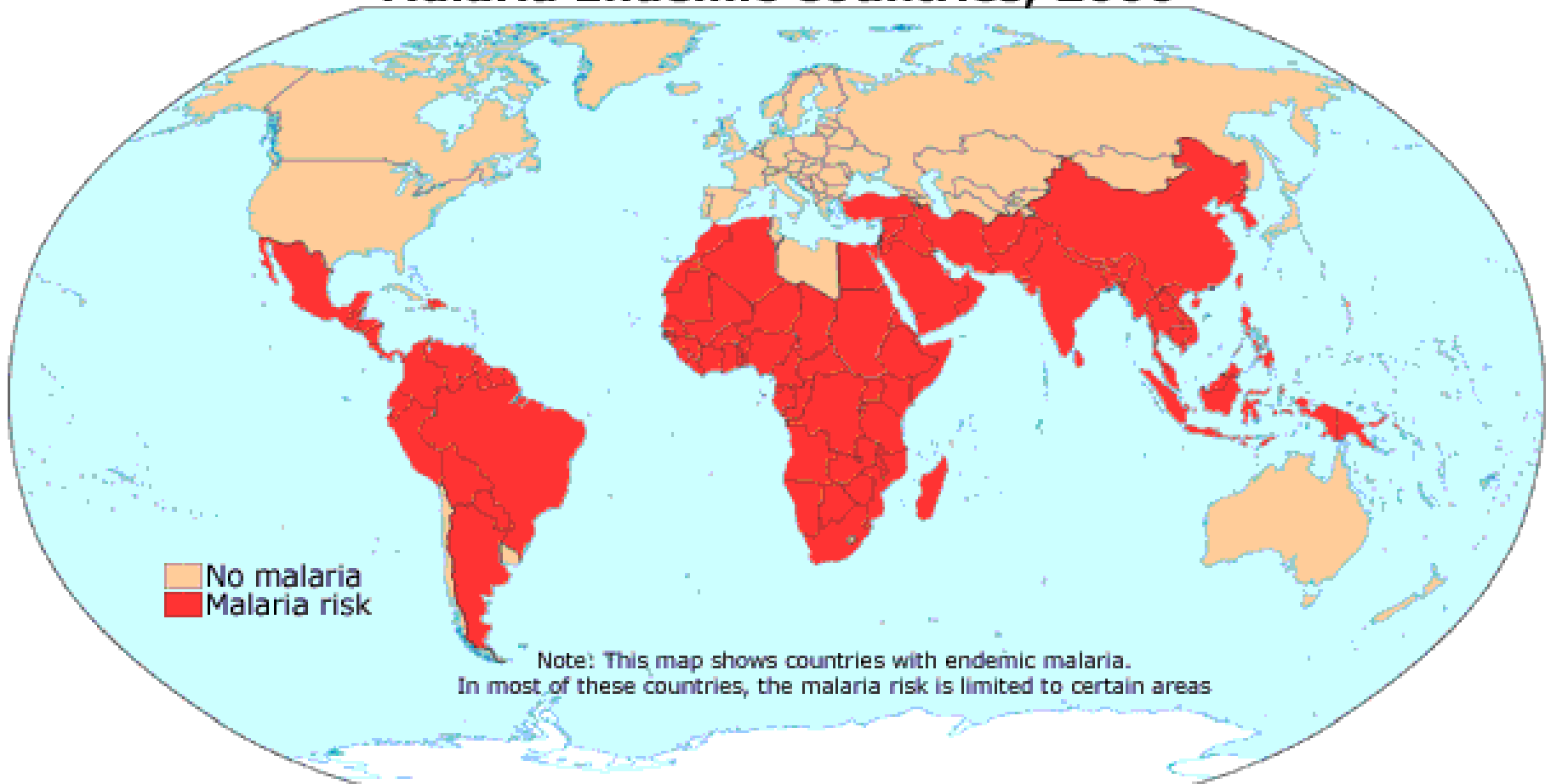
- 1938: James and Tate found exoerythrocytic stage (EE) for *Plasmodium gallinaceum*
- 1948: Shortt and Garnham found EE for *P. cynomolgi* and *P. vivax*
- 1980: W. Krotoski found *P. vivax* hypnozoites (dormozoites) in liver cells

Early 1900s: Julius von Wagner-Jauregg used malaria to treat late stage syphilis



# Global distribution

## Malaria Endemic Countries, 2000



# Plasmodium that infect human

**Human malaria:** *P. falciparum*-malignant tertian (48 hr): 50%  
*P. vivax*-benign tertian: 43%  
*P. ovale*-mild tertian: <1%  
*P. malariae*-quartan (72 hr): 7%

**Simian parasites infecting humans:**

*P. cynomolgi*-vivax-like

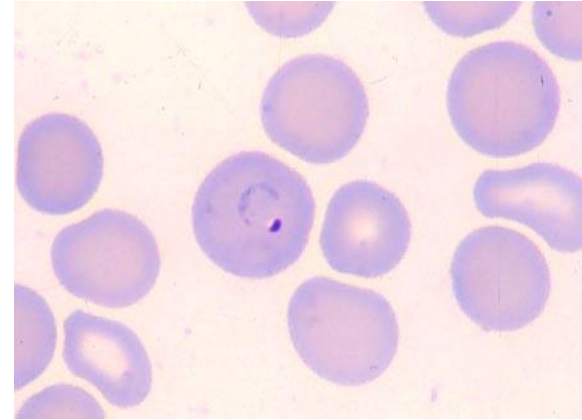
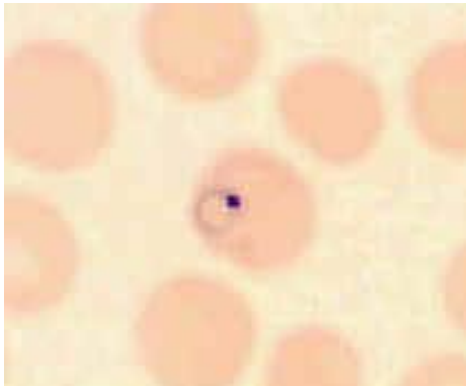
*P. knowlesi*-quotidian (24 hr)

# Trophozoites



**Fig. 1: normal red cell; Figs. 2-5: ring stage parasites (young trophozoites)** •

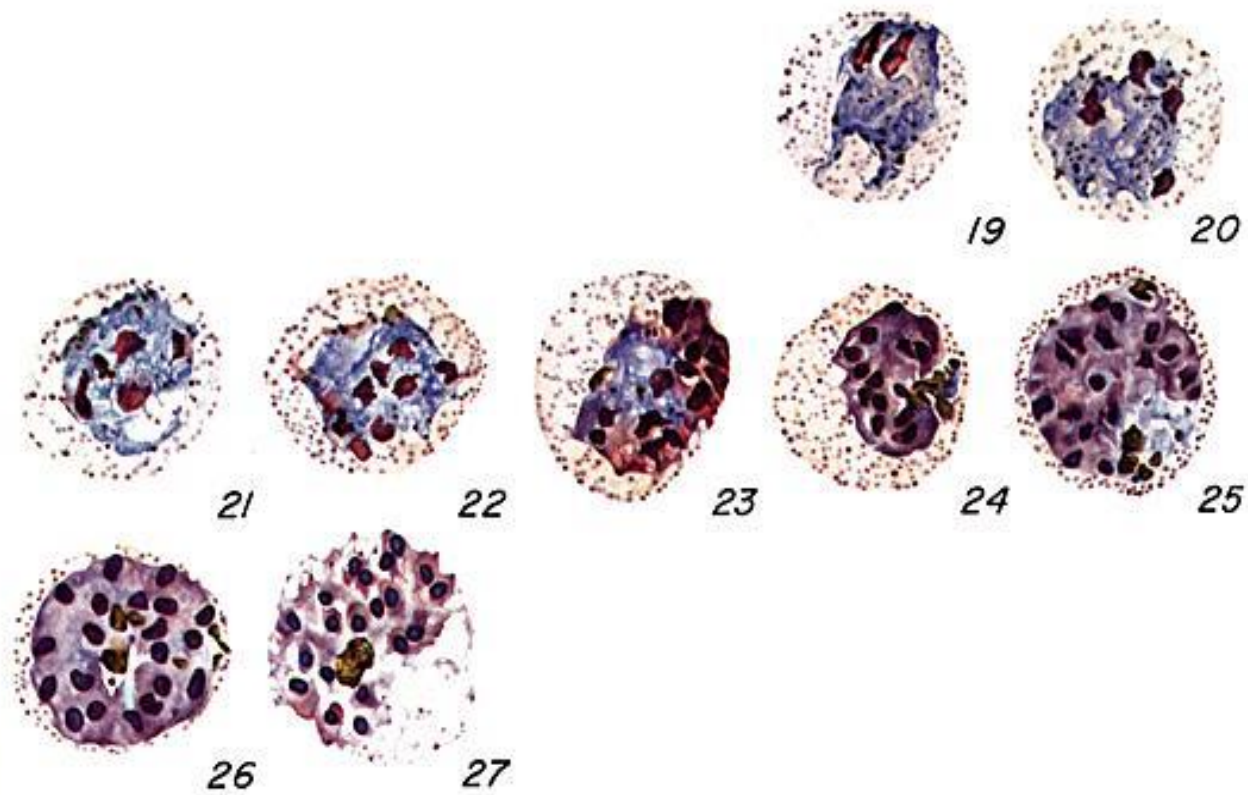
# Ring form trophozoites



Thin blood film (Giemsa stained)

Ring like plasma with one nucleus at one side •

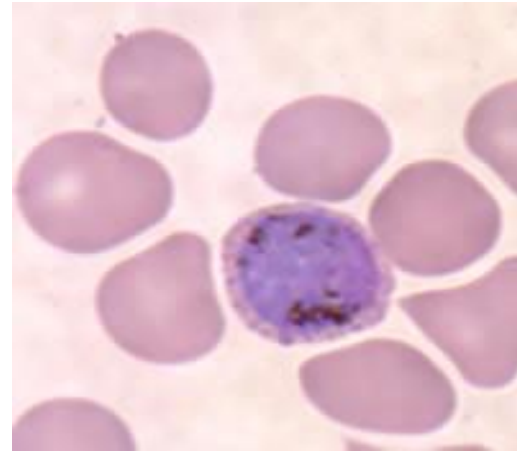
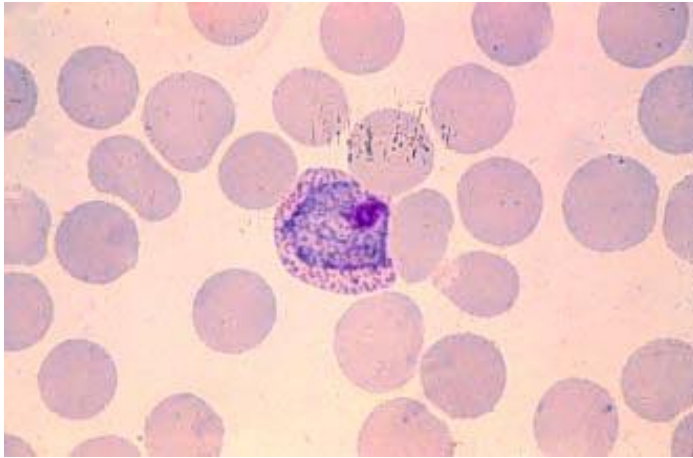
# Schizonts



**Figs.: increasingly mature schizonts •**



# Macrogametocyte (female gametocyte) of *P.v*



- Giemsa staining
- compact nucleus, usually at edge of the parasite
- scattered pigment granules
- The gametocyte is completely filling its host cell

# Microgametocyte (male gametocyte) of *P.v*

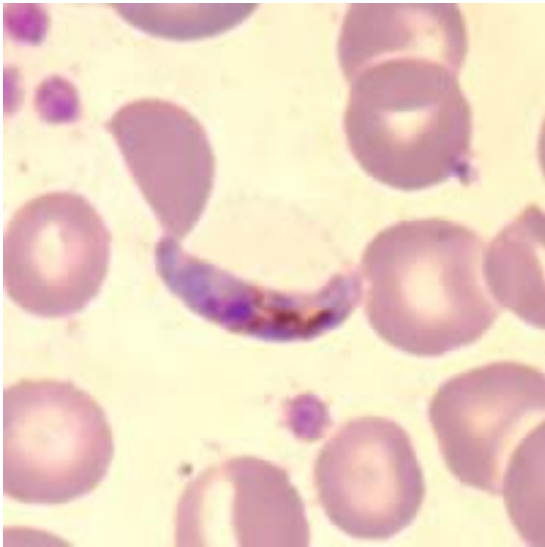


Giemsa stainin

large nucleus at the center of the ce

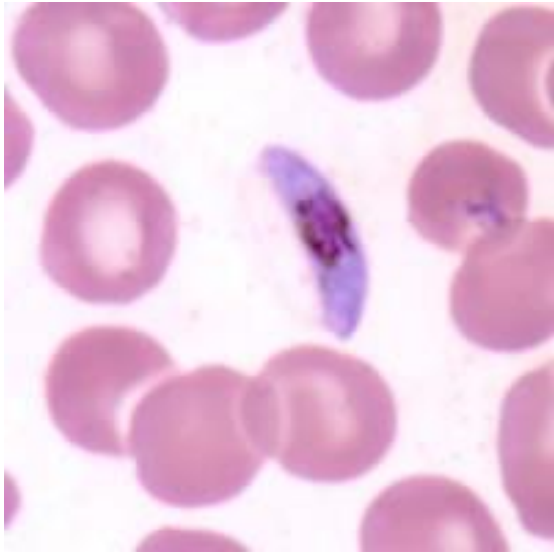
scattered pigment granules

# Macrogametocyte of *P. f*



- The crescent-shaped gametocytes of *P. falciparum* are very distinctive, but tend to only appear late in the infection
- Compact nucleus, red, usually at the center of the cell
- Malarial pigments around the nucleus

# Microgametocyte of *P. f*



- Sausage-shaped with two blunt end
- Large nucleus at the center
- Sometimes hard to distinguish from the female gametocytes

# *P. vivax*



ring form



mature ring form



trophozoite



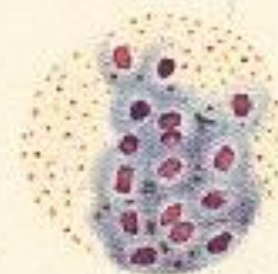
trophozoite



early schizont



schizont



mature schizont



developing gametocyte



female gametocyte



male gametocyte



# *P. falciparum*



marginal form

ring form

double dotted rings

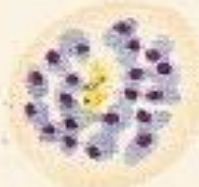


ring form

young trophozoite

trophozoite

early schizont



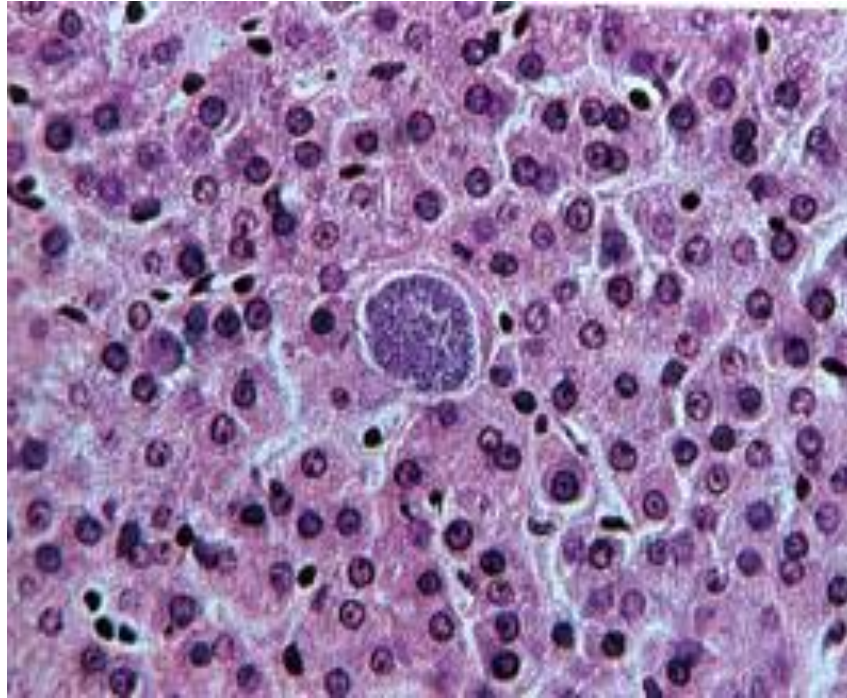
schizont

mature schizont

female gametocyte

male gametocyte

exo-erythrocytic stage—

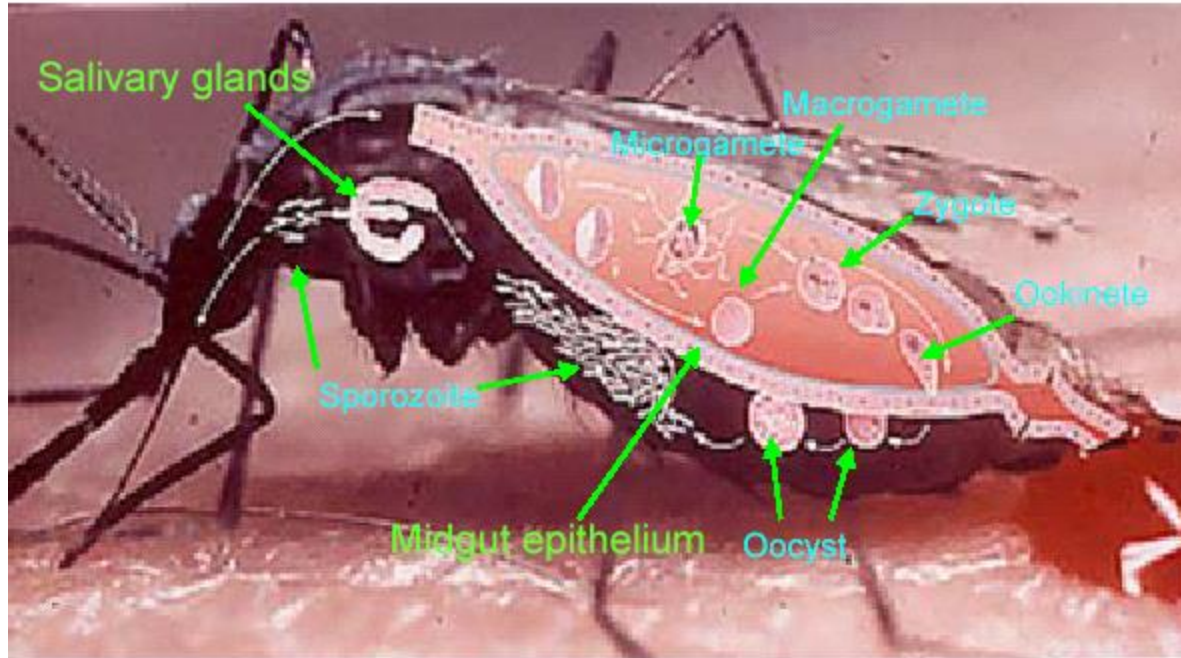


**merozoites in liver cells**

# The vector – female *Anopheles*



# Development in the vector



Gametocytes → zygote → oocyst → sporozoites



# Life Cycle

