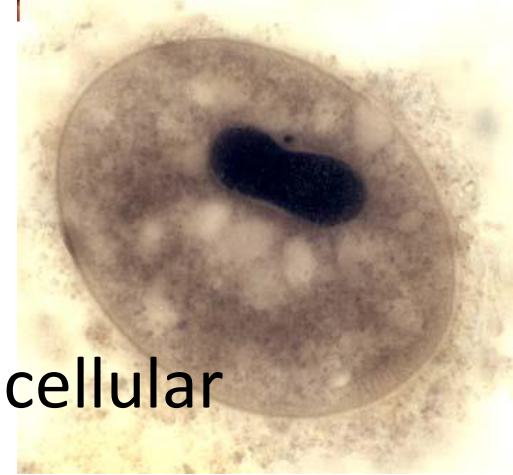


PROTOZOA

AMOEBA

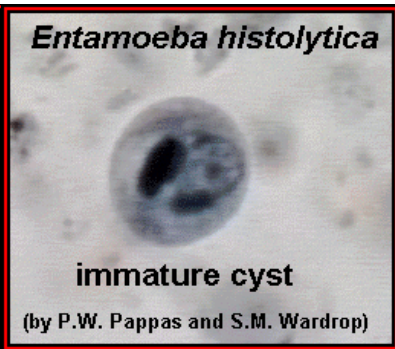
General Account

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



Entamoeba histolytica

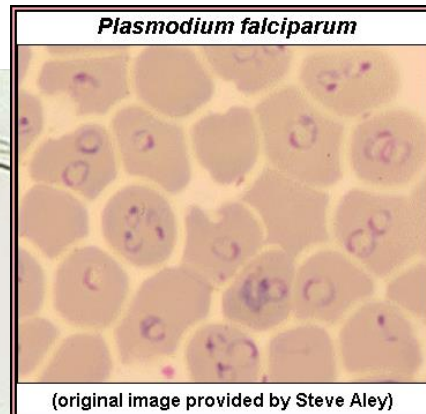
trophozoite



Entamoeba histolytica

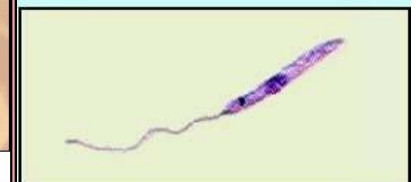
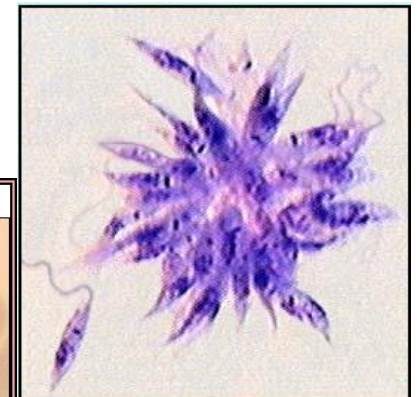
immature cyst

(by P.W. Pappas and S.M. Wardrop)



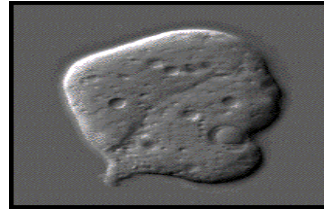
Plasmodium falciparum

(original image provided by Steve Aley)

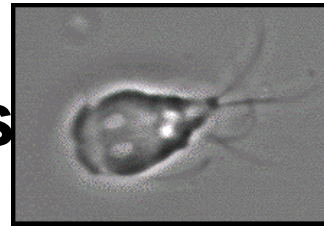


Classification of protozoa

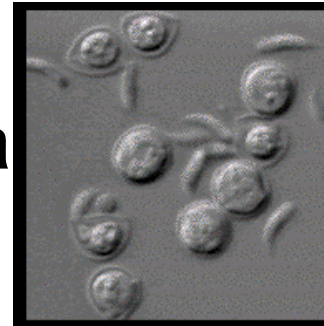
Amoebae



Flagellates



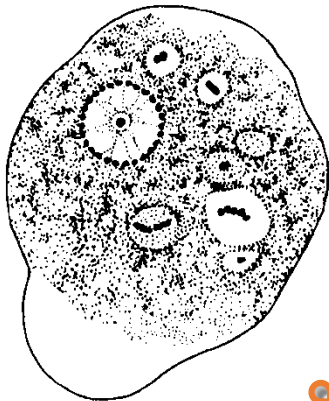
Sporozoa



Ciliates



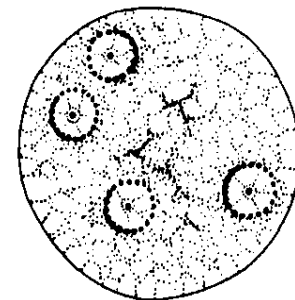
Amoebic Infections



⌘ ***Entamoeba histolytica***

⌘ ***Acanthamoeba***

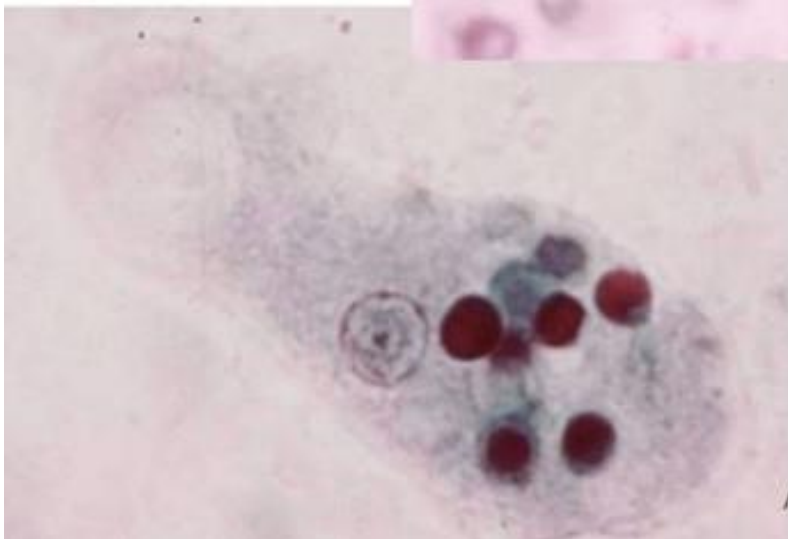
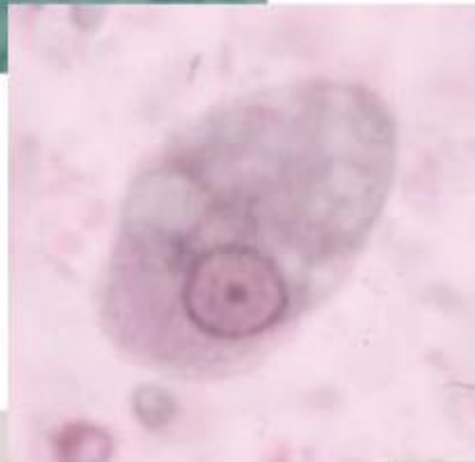
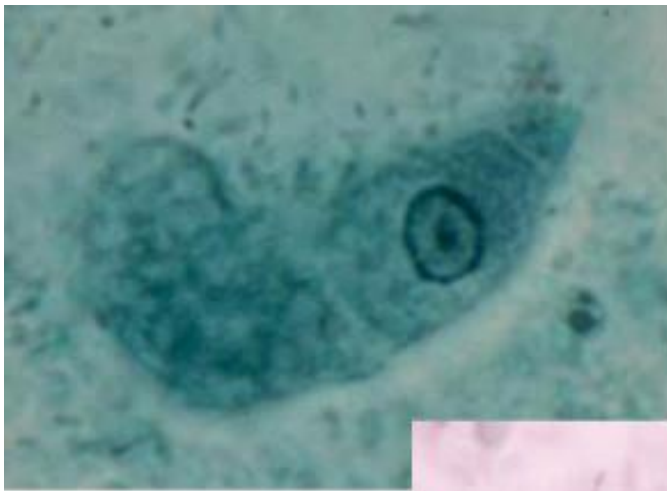
⌘ ***Naegleria***



Entamoeba histolytica

- **cosmopolitan distribution**
- **no animal reservoirs**
- **facultative pathogen**
 - **most clear the infection spontaneous in 6-12 months with mild or no symptoms**
 - **can cause a serious invasive disease**
- **worldwide incidence = 0.2-50%**
 - **estimated that 10% of world's population may be infected**
 - **50 million cases invasive amebiasis/yr**
 - **100,000 deaths/yr**

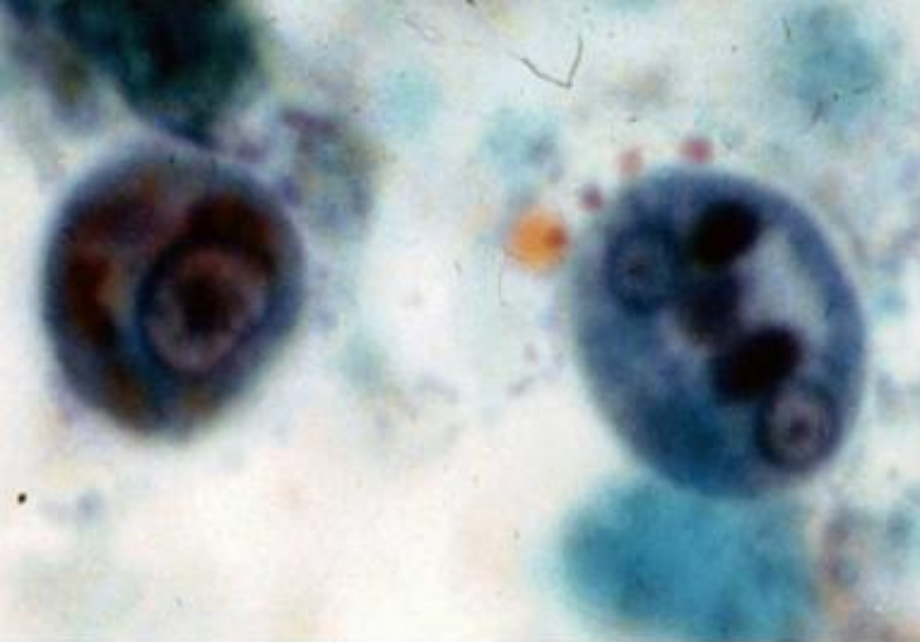
Entamoeba histolytica



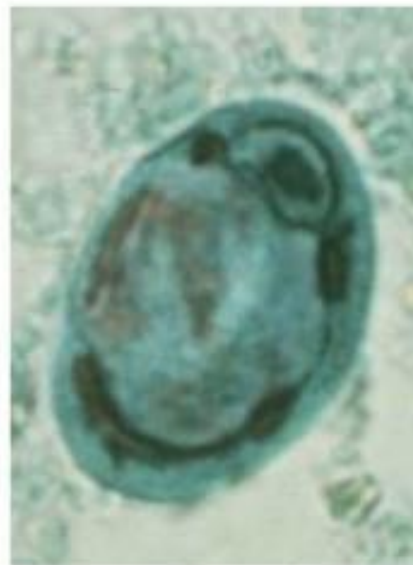
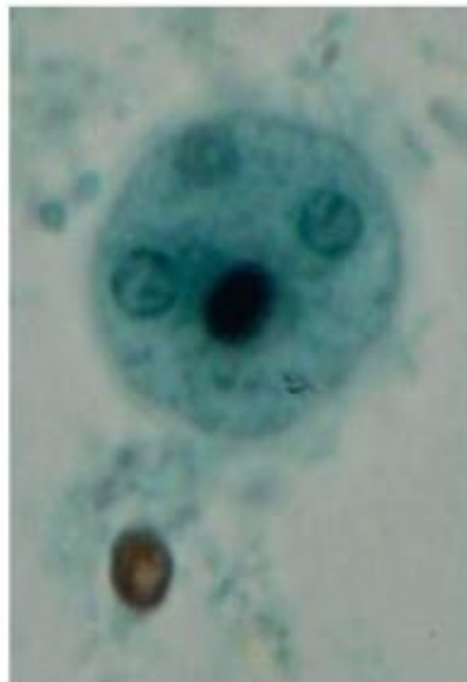
- **cysts**
 - 12-15 μm
 - 4 nuclei (mature)
 - blunt chromatoid bodies
- **trophozoites**
 - 15-20 μm
 - extended pseudopodia
 - progressive movement
 - >20 μm (invasive)
 - (\pm hematophagous)
- **nuclear structure**
 - peripheral chromatin
 - small karyosome



Entamoeba histolytica



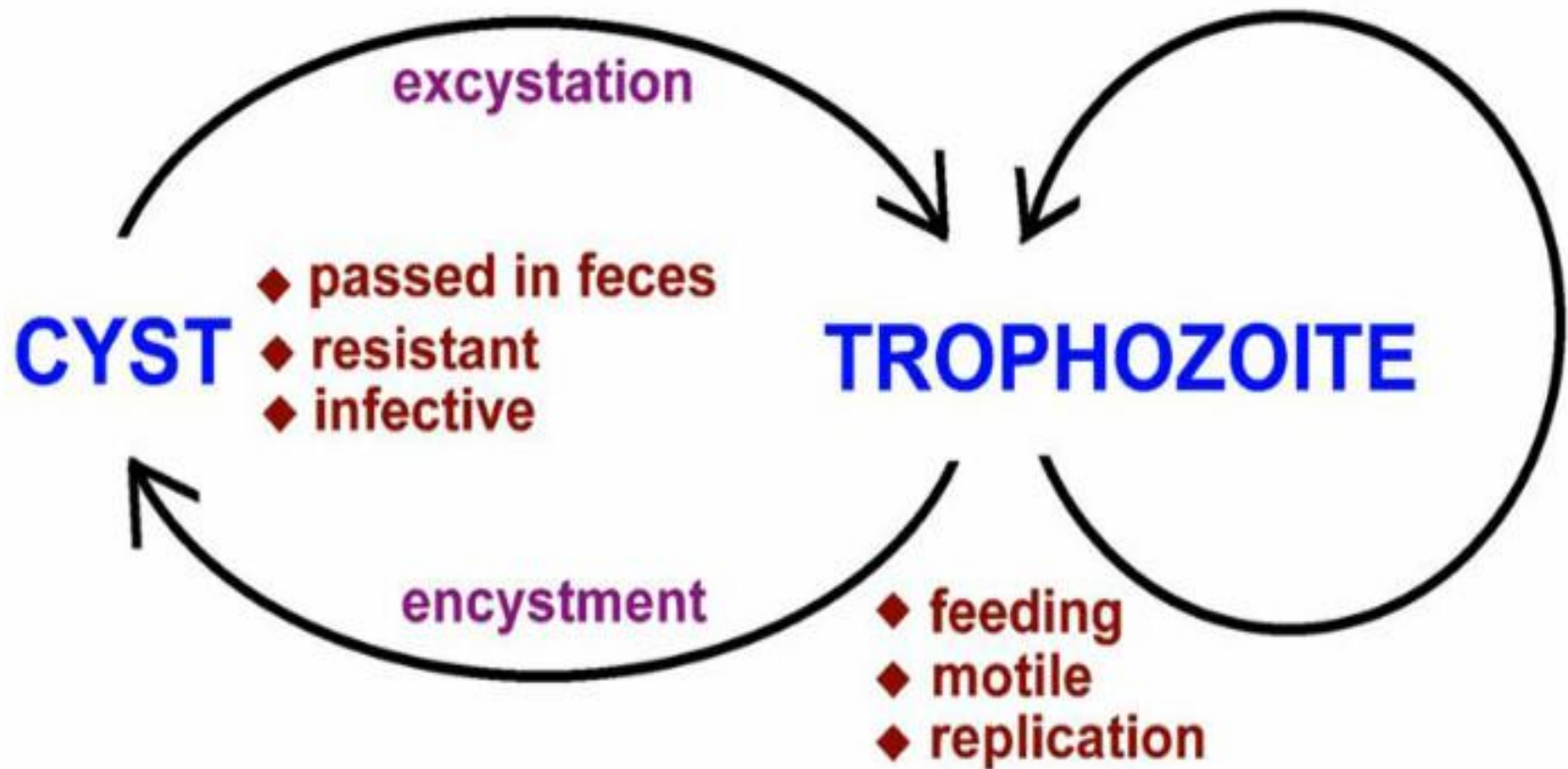
- **cysts**
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 - 15-20 μm
 - extended pseudopodia
 - progressive movement
- **nuclear structure**
 - peripheral chromatin
 - small karyosome



= *E. dispar*

Entamoeba histolytica

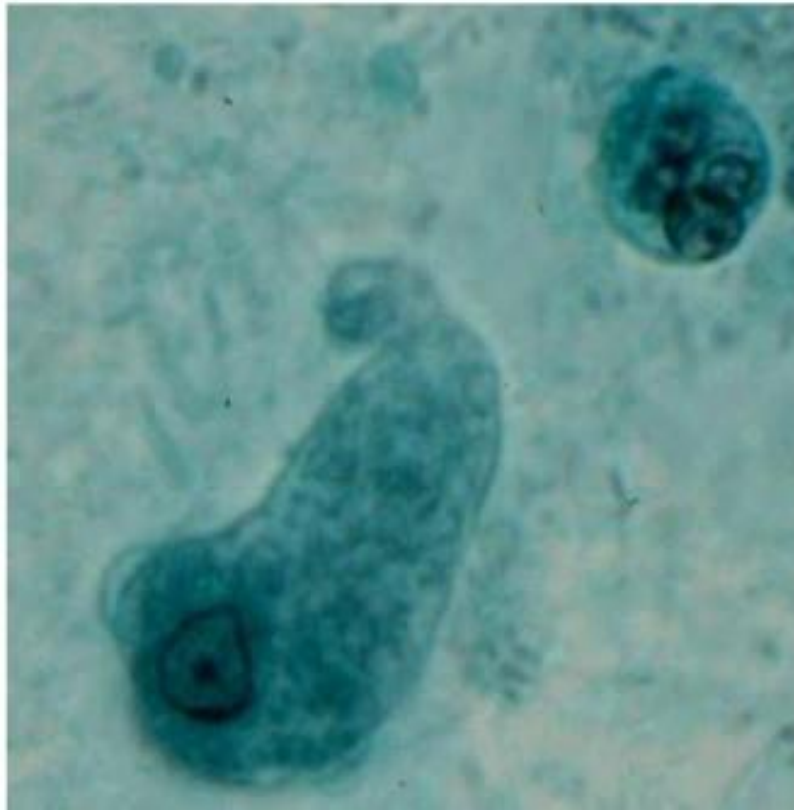
Life Cycle



Excystation

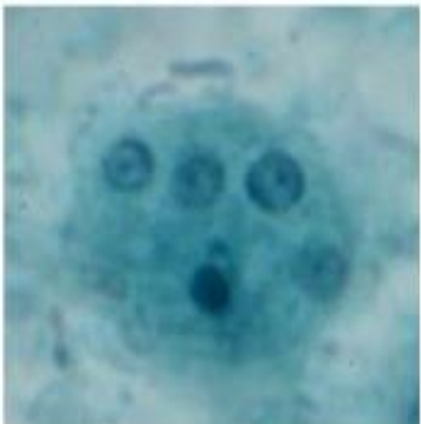
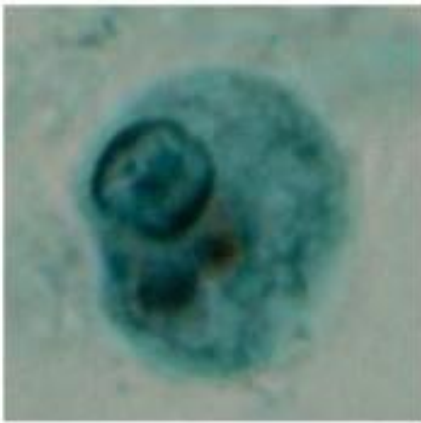


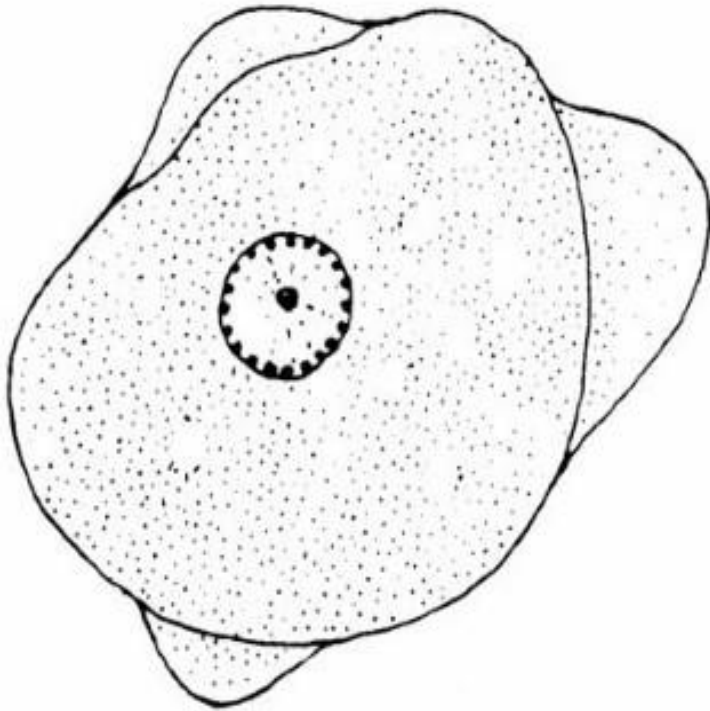
- cyst wall disruption
- ameba emerges
- nuclear division (4→8)
- cytoplasmic division (8 amebala)
- trophozoites colonize large intestine
 - feed on bacteria and debris
 - replicate by binary fission



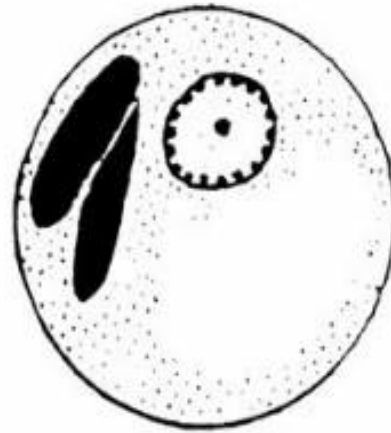
Encystation

- trophozoite rounds up
- secretion of cyst wall
- aggregation of ribosomes (= chromatoid bodies)
- 2 rounds of nuclear division (1 → 4 nuclei)
- survive weeks to months

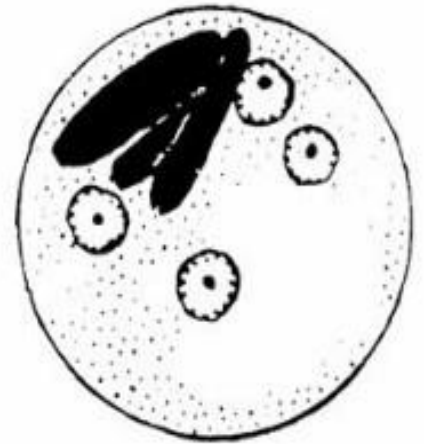




trophozoite



**immature
cyst**

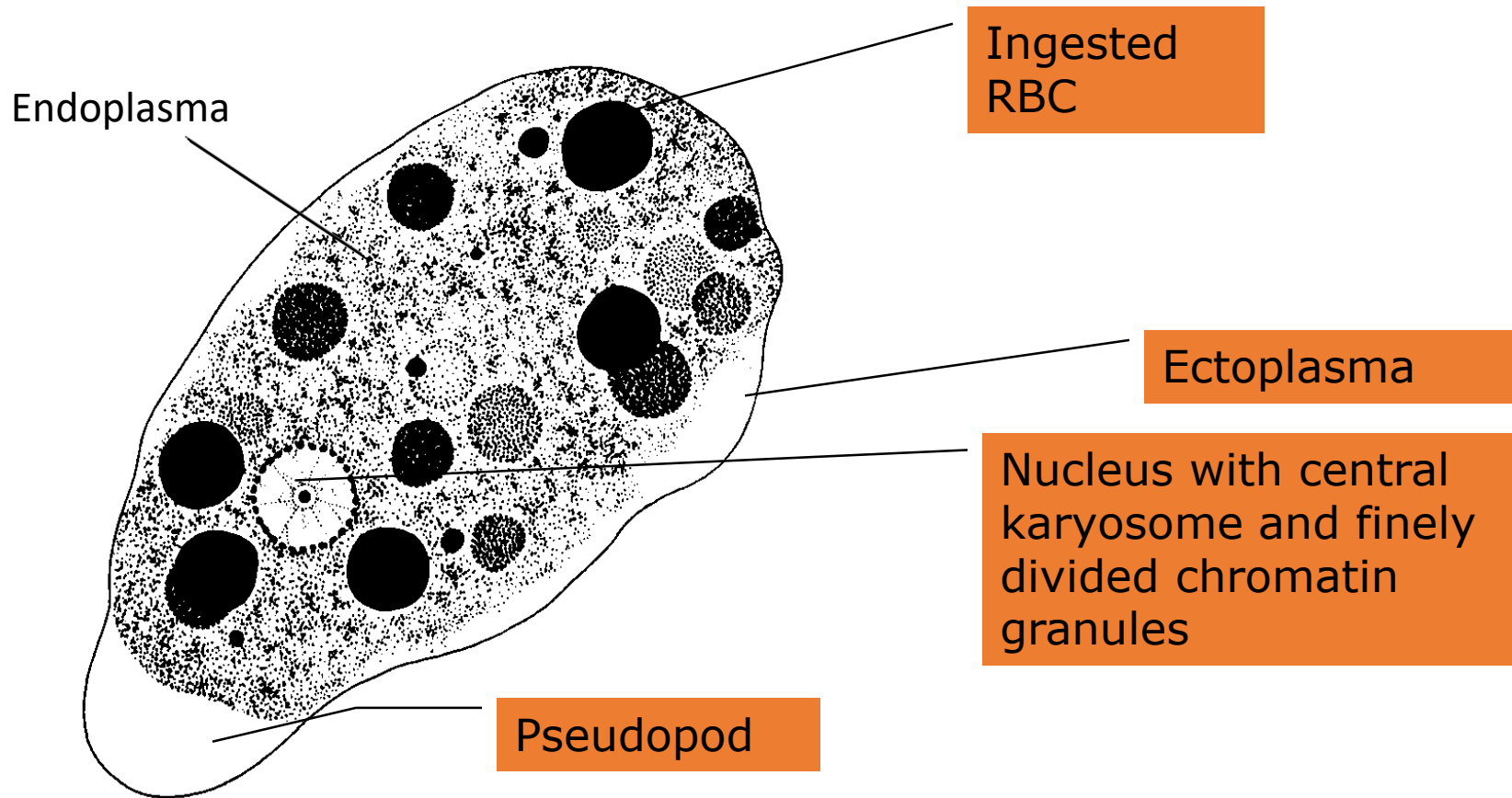


**mature
cyst**

Pathogenesis of Amebiasis

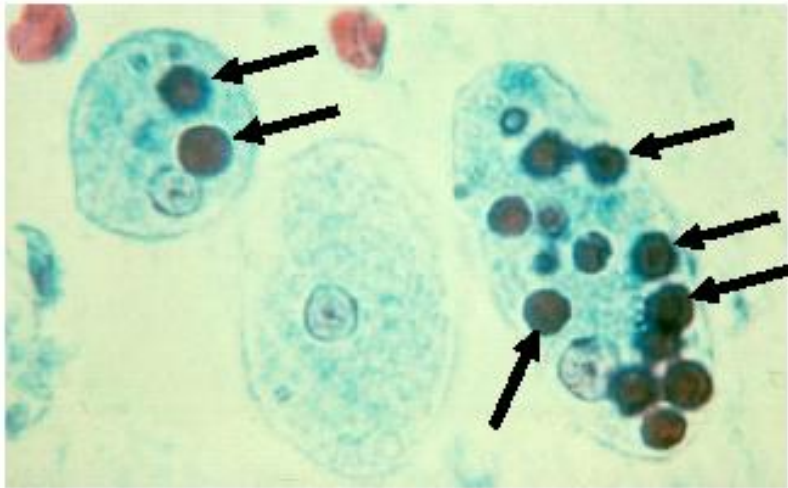
- **NON-INVASIVE**
 - ameba colony on intestinal mucosa
 - asymptomatic cyst passer
 - non-dysenteric diarrhea, abdominal cramps, other GI symptoms
- **INVASIVE**
 - necrosis of mucosa → ulcers, dysentery
 - ulcer enlargement → dysentery, peritonitis
 - metastasis → extraintestinal amebiasis

Morphology



E. histolytica trophozoite

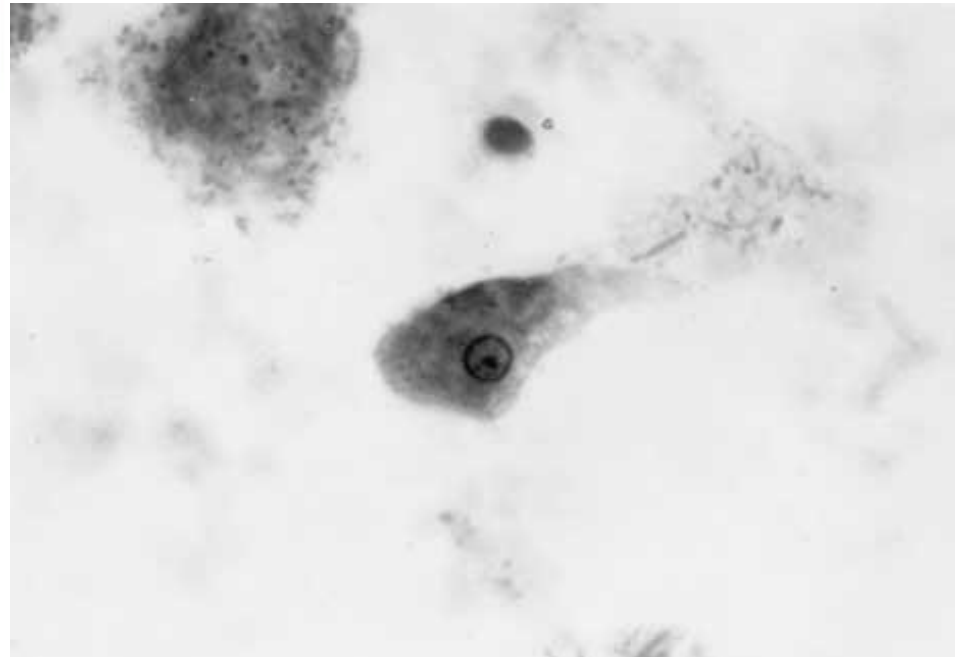
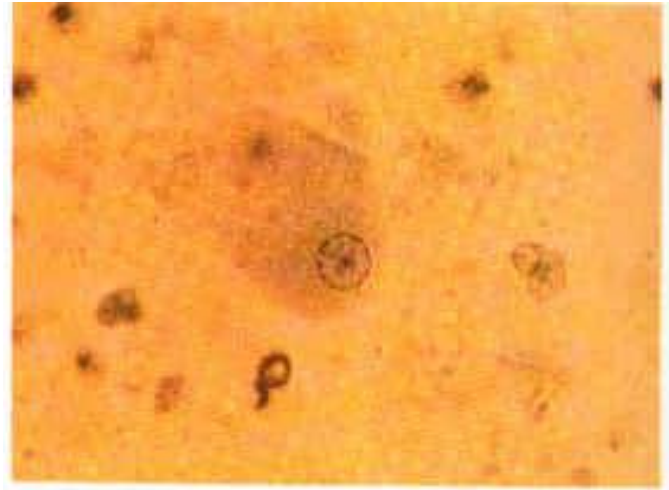
Morphology



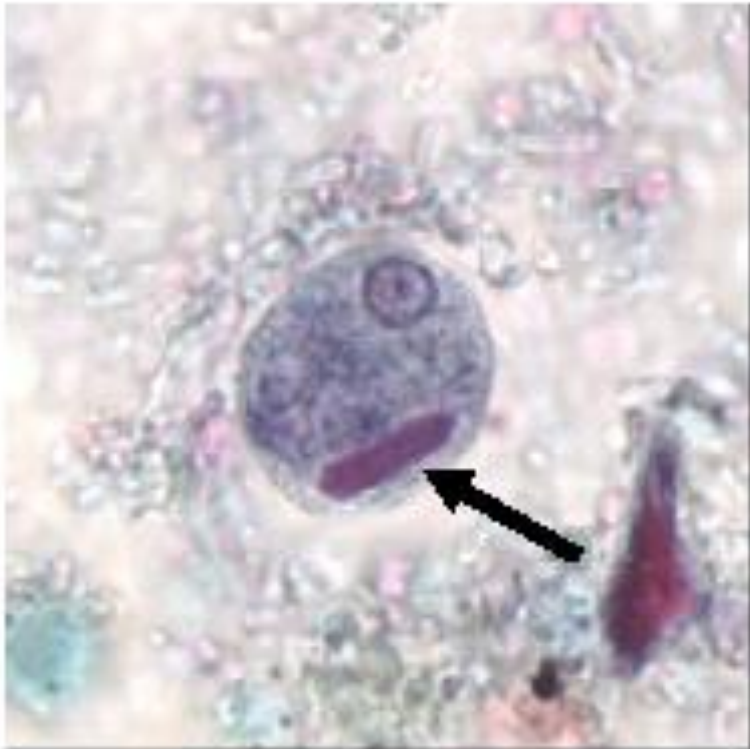
Three *Entamoeba histolytica* trophozoites, two with ingested RBCs (arrows).

Trophozoites

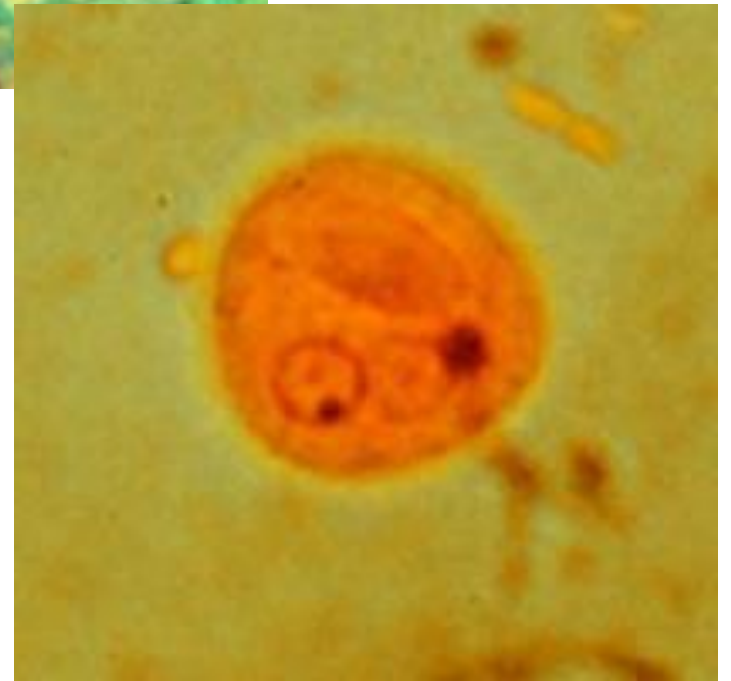
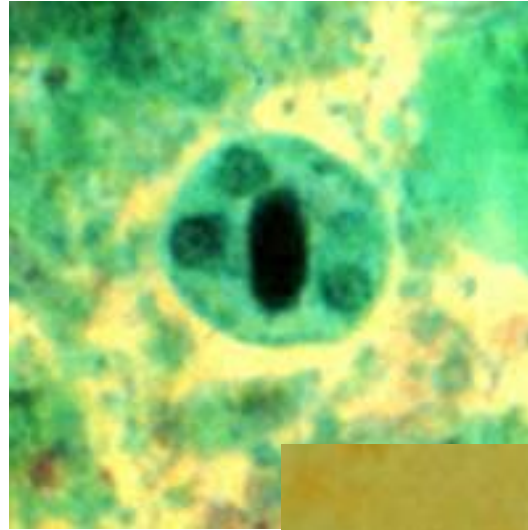
Single nucleus with a central,
dot-like karyosome



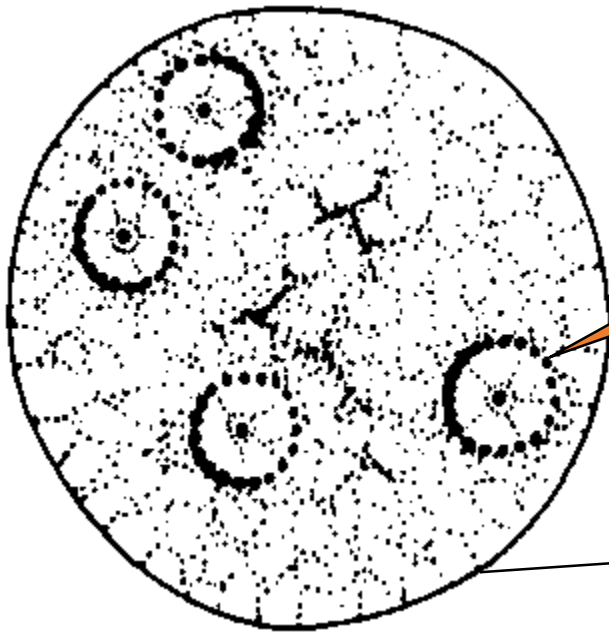
Morphology



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



Morphology

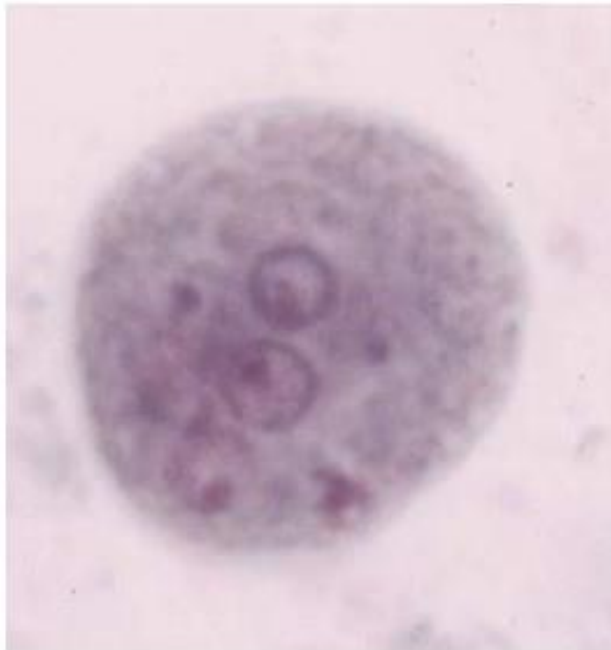
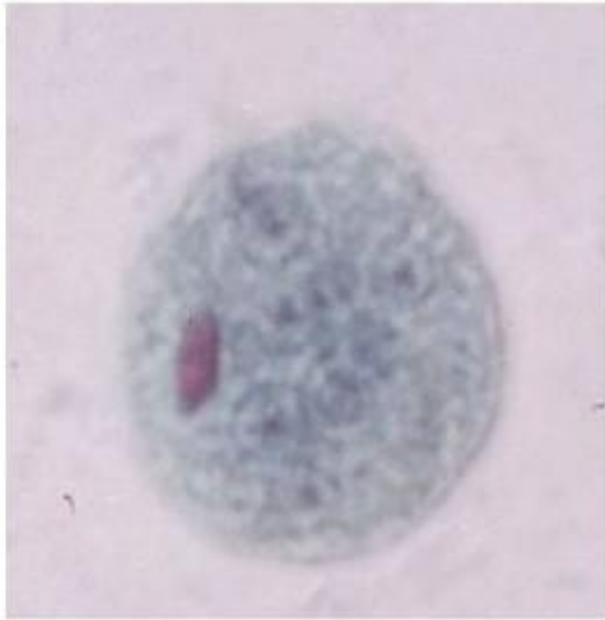


1-4 ring-like nuclei
with finely divided
peripheral chromatin

Cyst wall and
round shape

Mature *E. histolytica* Cyst

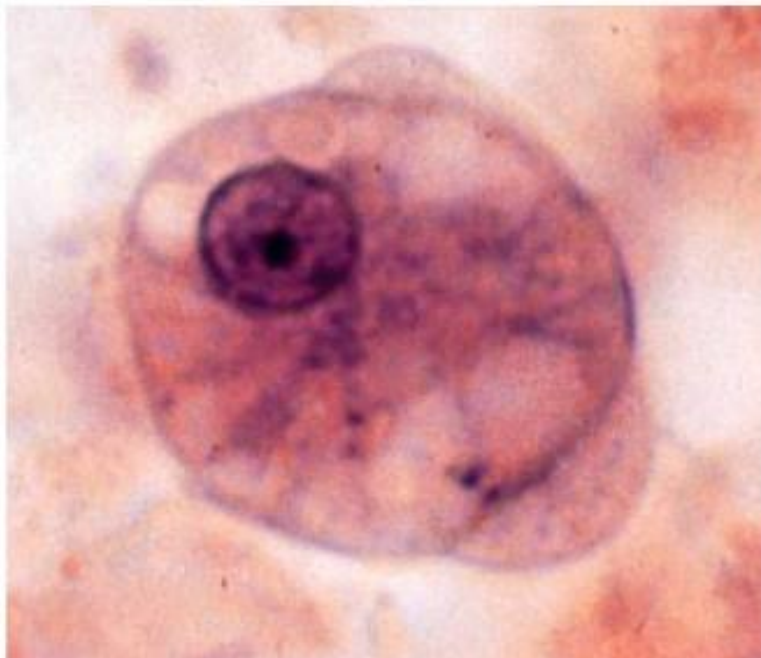
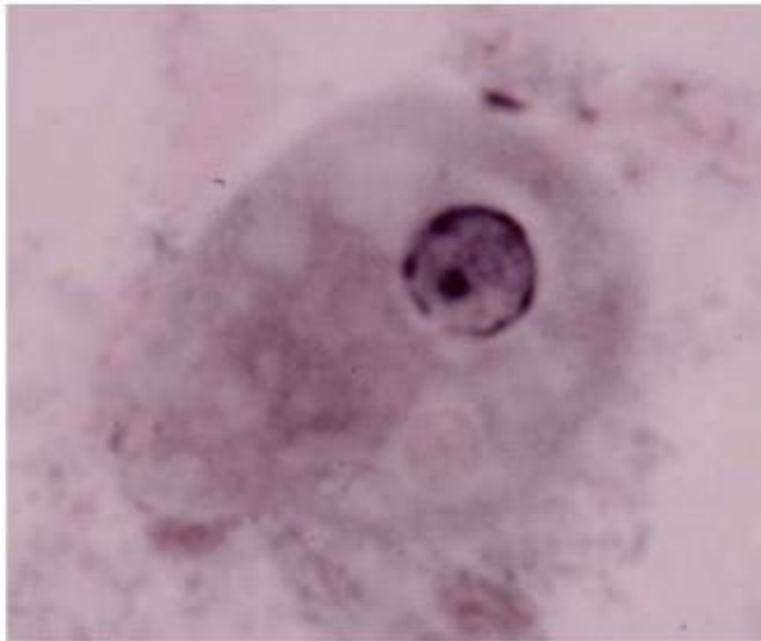
Entamoeba coli



- **cysts**
 - 15-25 μm
 - 8 nuclei (mature)
 - pointed chromatoid bodies (less prominent)
- **trophozoites**
 - 20-25 μm
 - broad blunt pseudopodia
- **nuclear structure**
 - peripheral chromatin
 - small karyosome



Entamoeba coli



- **cysts**
 - 15-25 μm
 - 8 nuclei (mature)
 - pointed chromatoid bodies (less prominent)
- **trophozoites**
 - 20-25 μm
 - broad blunt pseudopodia
- **nuclear structure**
 - peripheral chromatin
 - small karyosome
 - irregular peripheral chromatin?
 - eccentric karyosome?

E. Coli trophozoites

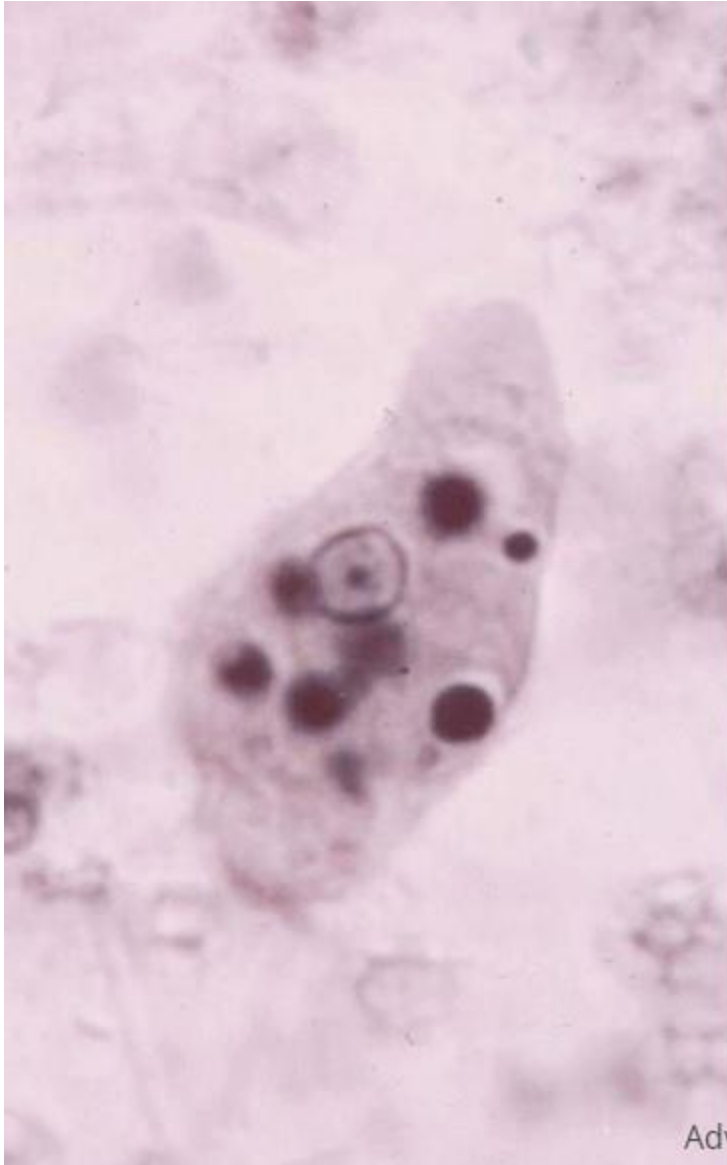
Morphology



E. Coli cysts

Morphology





Other *Entamoeba*

E. gingivalis

- oral cavity
- no cyst stage
- trophozoites nearly identical to *E. histolytica*
- periodontal disease?

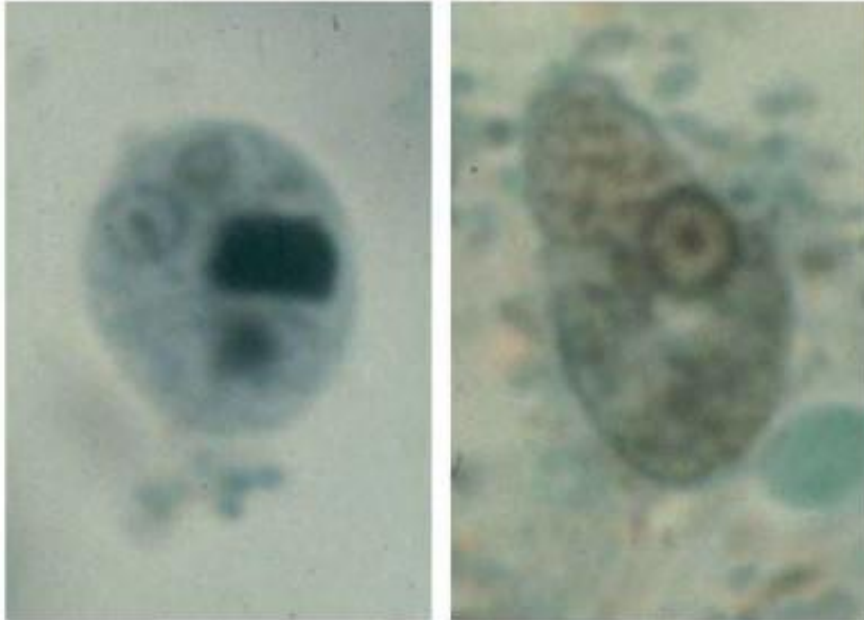
E. polecki

- rarely found in humans
- commensal of pigs & monkeys
- cyst has one nucleus

E. moshkovskii

- identical morphology as *E. histolytica*
- free-living (sewerage)
- cultured at 24°

Entamoeba hartmanni

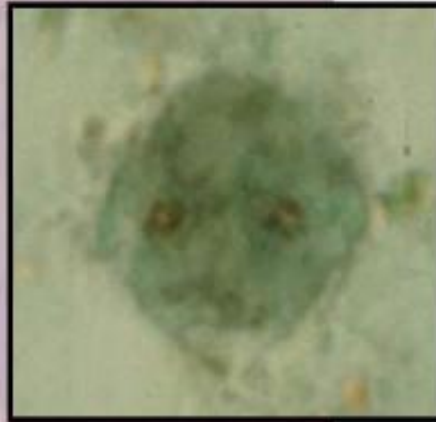


- $< 10 \mu\text{m}$ = *E. hartmanni*
- $> 10 \mu\text{m}$ = *E. histolytica*
- 'small race' of *E. histolytica*
- designated species in 1957

- **cysts**
 - 6-8 μm
 - 4 nuclei (mature)
 - blunt chromatoid bodies
 - CB persist in mature cysts
- **trophozoites**
 - 8-10 μm
- **nuclear structure**
 - peripheral chromatin
 - small karyosome



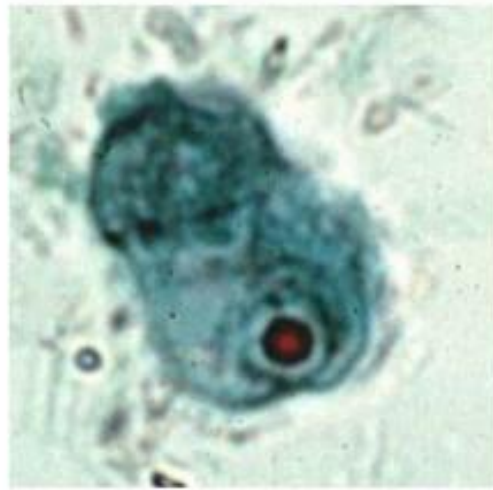
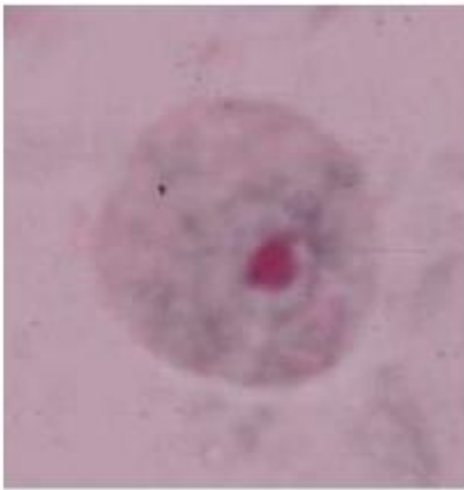
Dientamoeba fragilis



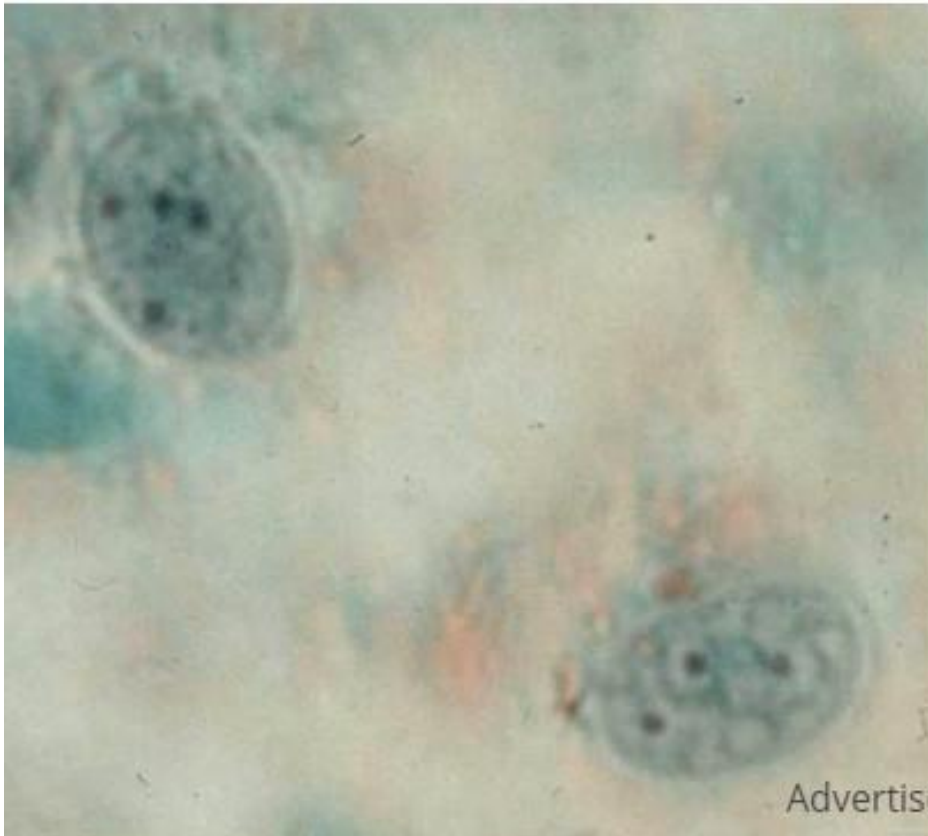
- no cyst stage
- trophozoites
 - 9-12 μm
 - often binucleated
- nuclear structure
 - no peripheral chromatin
 - fragmented karyosome

- related to trichomonads
- no flagella (basal bodies)
- 15-30% of infections associated with diarrhea

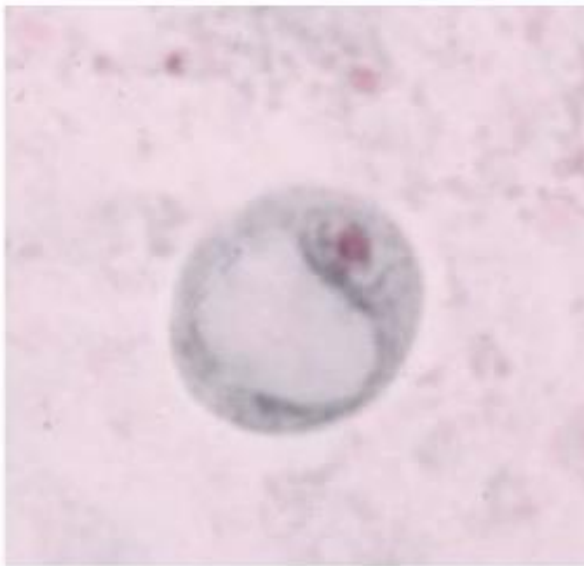
Endolimax nana



- **cysts**
 - 6-8 μm
 - 4 nuclei
- **trophozoites**
 - 8-10 μm
- **nuclear structure**
 - no peripheral chromatin
 - large karyosome



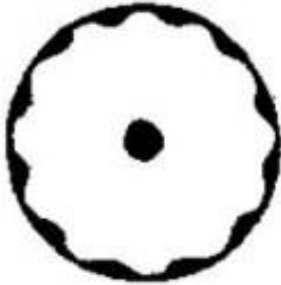
Iodamoeba bütschlii



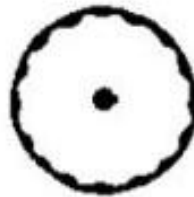
- **cysts**
 - 10-12 μm
 - 1 nucleus
 - glycogen vacuole
- **trophozoites**
 - 12-15 μm
- **nuclear structure**
 - no peripheral chromatin
 - large karyosome

Nuclear Morphology

Entamoeba histolytica



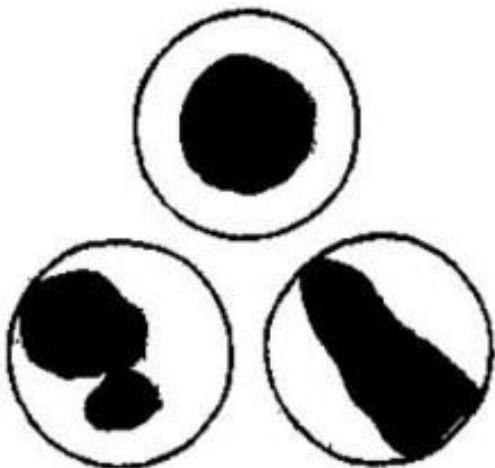
Entamoeba hartmanni



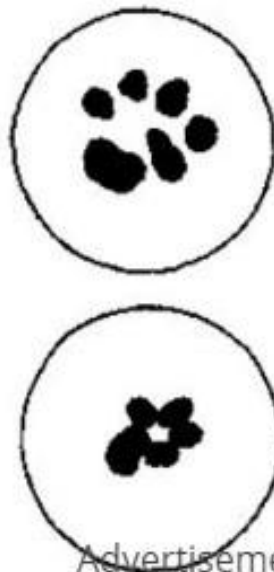
Entamoeba coli



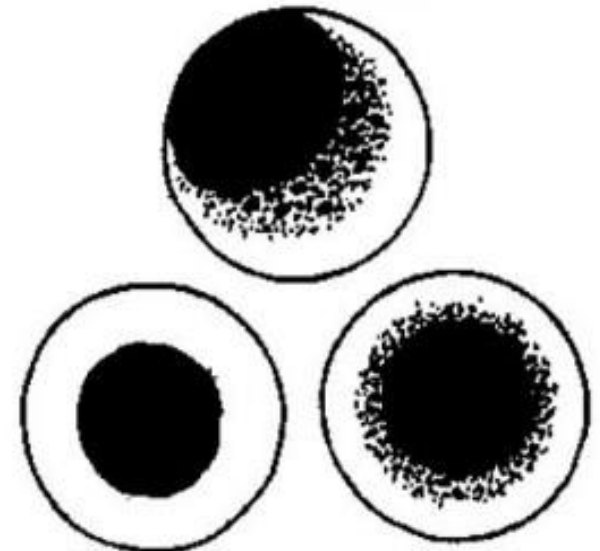
Endolimax nana





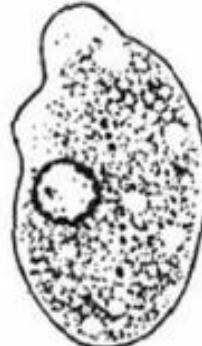
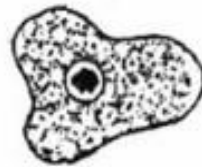
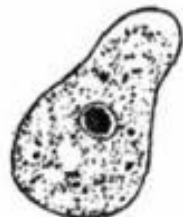

Dientamoeba fragilis



Iodamoeba butschlii



Intestinal Amebae

	<i>Entamoeba histolytica</i>	<i>Entamoeba hartmanni</i>	<i>Entamoeba coli</i>	<i>Endolimax nana</i>	<i>Iodamoeba butschlii</i>	<i>Dientamoeba fragilis</i>
trophozoite						
cyst	