

General Microbiology
Lecture 18
(Protozoa)
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Reproduction

Asexual reproduction

Simple fission

The nucleus & the cytopl. divide into equal parts forming two cells

Ex. amoebae, flagellates (longitudinal) & ciliates (transverse)

Multiple fission

The nucleus divides into several parts then the cytoplasm

Ex. (malaria)

Endodyogeny

Internal binary fission to 2 daughter cells within the parent cell

Toxoplasma

Sexual reproduction

Conjugation

Exchange of nuclear material between 2 organisms

Ex. Ciliates

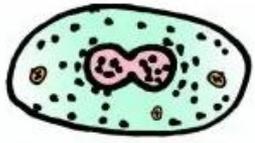
Gametogony

Formation of male & female gametes

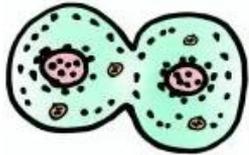
Sporozoa (malaria)

Reproduction in amoebae

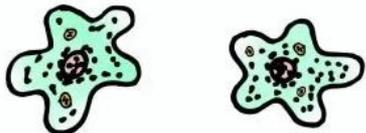
Binary fission



Karyokinesis



Cytokinesis

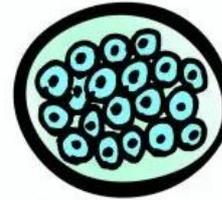
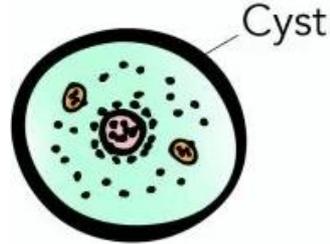


Two daughter cells

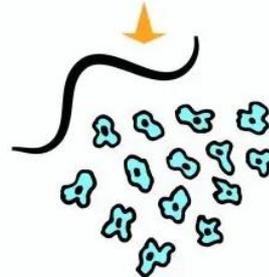
Parent cells



Multiple fission

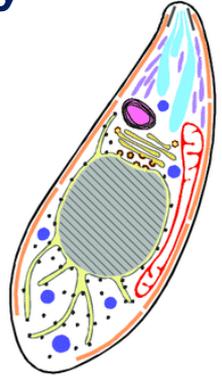


Divides many times



Many daughter cells

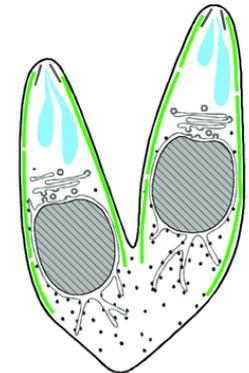
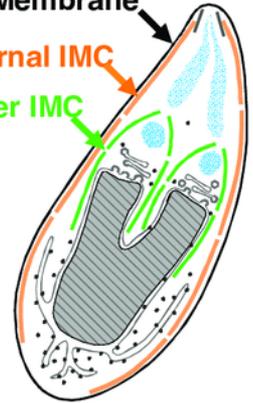
Endodyogeny



Plasma Membrane

Maternal IMC

Daughter IMC



inner membrane complex (IMC)

Class: Rhizopoda (Amoebae)

1- Amoebae of large intestine

- *Entamoeba histolytica*
(The only pathogenic)
- *Entamoeba coli*.

✎ N.B. Other species of amoebae are commensals in the large intestine such as *E. hartmani* & *E. dispar* & are morphologically similar to *E. histolytica*. So PCR is required to differentiate bet. amoebae species.

2- Amoeba of buccal cavity

Entamoeba gingivalis

3- Free living amoebae

Pathogenic
free living amoebae

Naegleria fowleri &
Acanthamoeba

Non pathogenic free
living amoebae

Coprozoic amoebae

Entamoeba histolytica

- ❖ **Geographical distribution:** Worldwide especially in the temperate zone and more common in areas with poor sanitary conditions.
- ❖ **Habitat:** Large intestine (caecum, colonic flexures and sigmoidorectal region).
- ❖ **D.H:** Man
- ❖ **R.H:** Dogs, pigs, rats and monkeys.
- ❖ **Disease:** Amoebiasis or amoebic dysentery

Entamoeba histolytica

Morphological characters

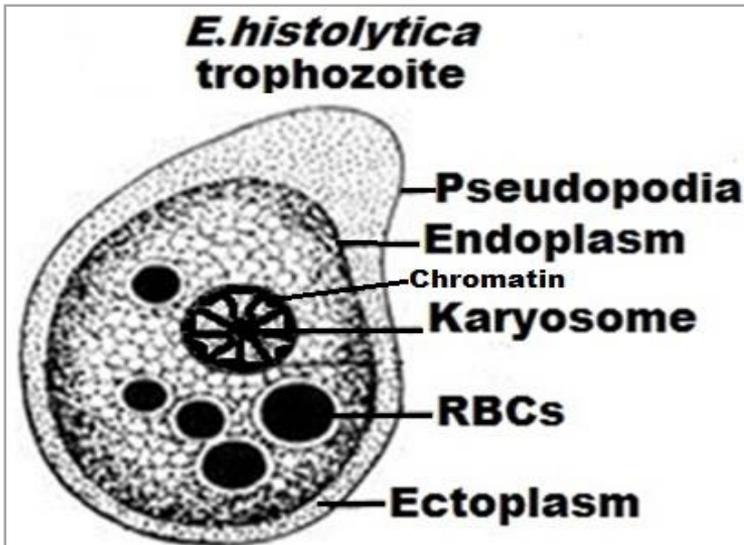
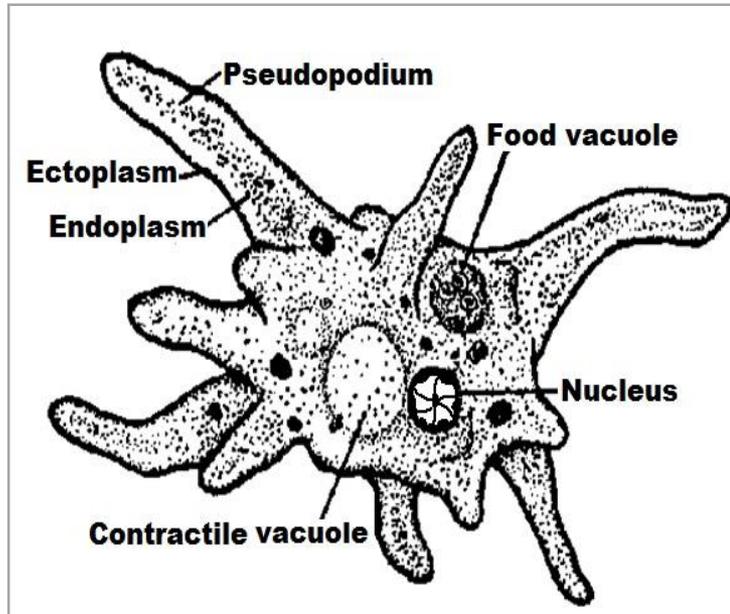
1- Trophozoite stage (Vegetative form or tissue form):

-Size: 20µm.

-Shape: Irregular.

-Cytoplasm: Differentiated into ectoplasm and endoplasm.

➤ **Ectoplasm (Outer):** Clear with a single finger like pseudopodia



2- Cyst stage (Luminal form):

(a) Immature cyst (Uninucleate cyst and Binucleate cyst):

❖ Uninucleate cyst (one nucleus)

❖ Binucleate cyst (2 nucleus)

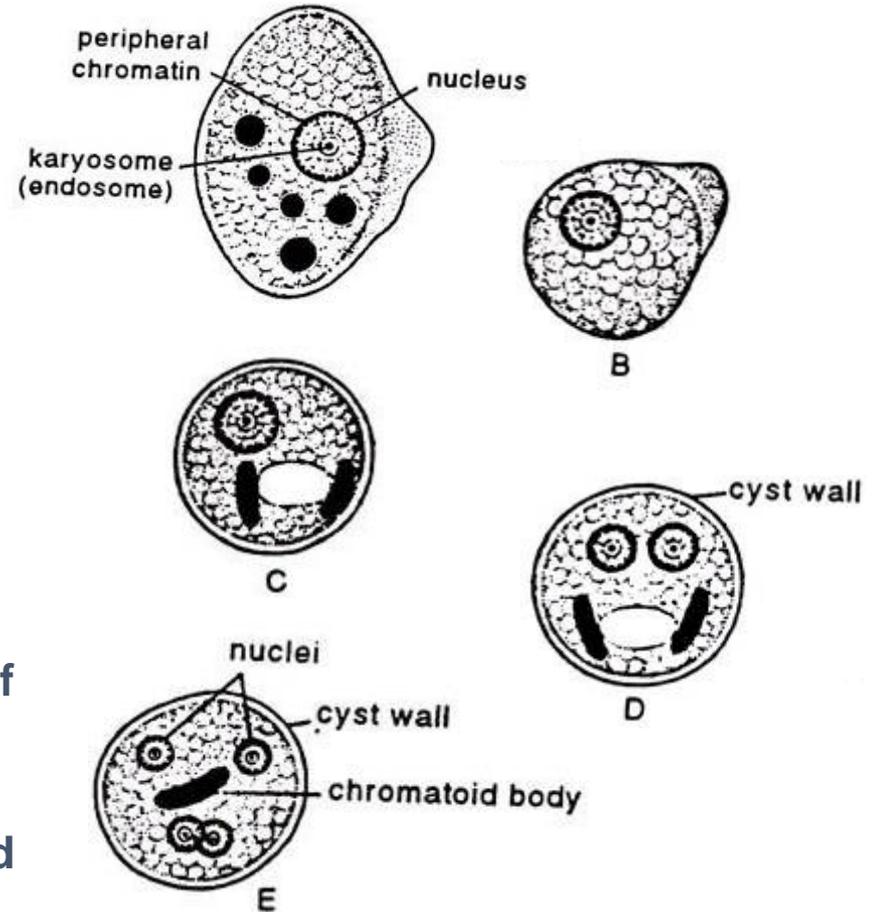
b) Mature cyst (Quadrinucleate cyst) (I.S):

-Size: 15 μm .

-Shape: Rounded with thick cyst wall.

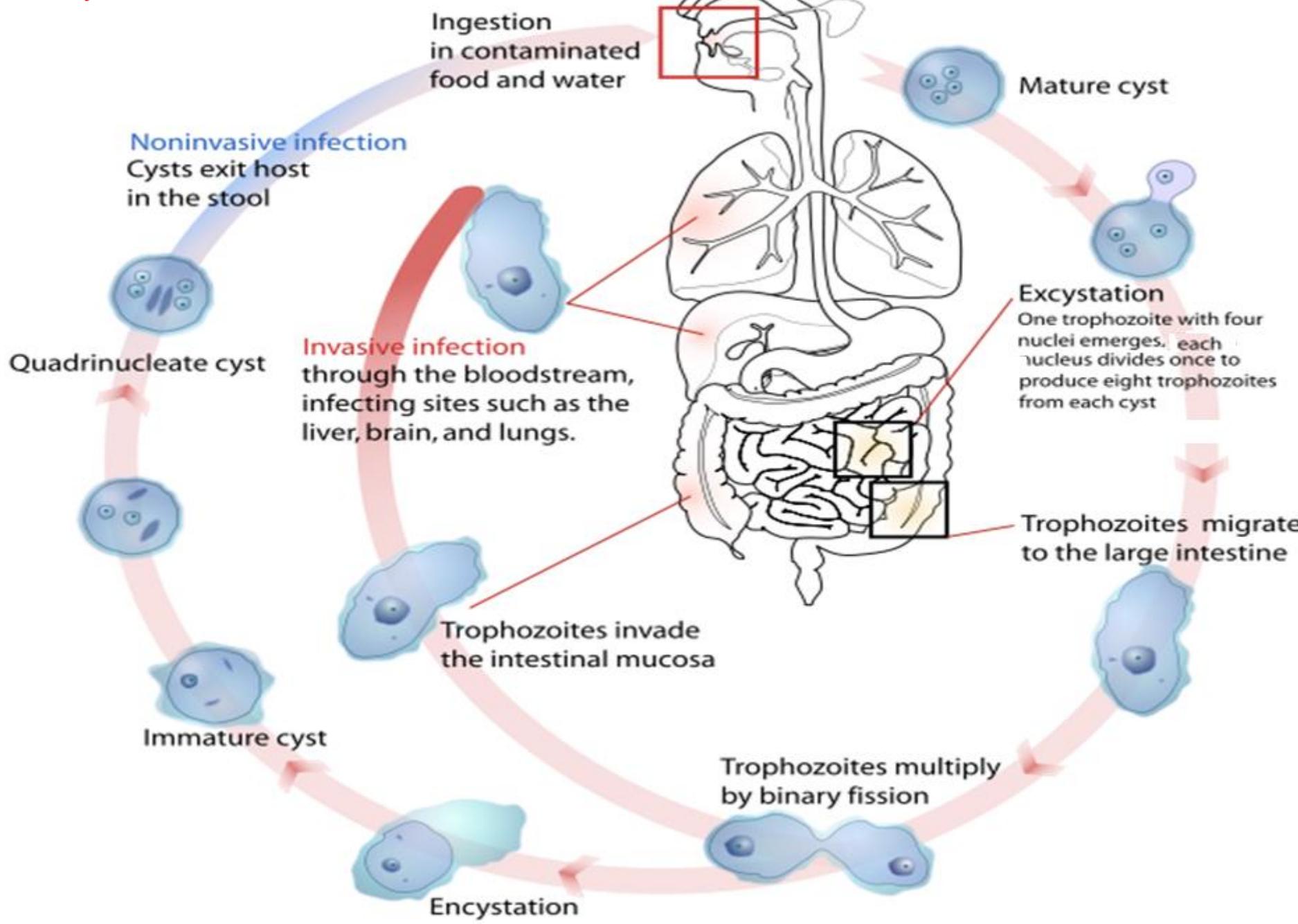
-Contents:

- 4 nuclei similar to the nucleus of trophozoite but smaller in size.
- Glycogen vacuoles and chromatoid bodies (stored food).



Entamoeba histolytica. A. Trophozoite stage. B. Precystic stage. C-E. Cysts, C. Uninucleate. D. Binucleate. E. Quadrinucleate stage

Life cycle of *Entamoeba*



Mode of infection

- 1- Contaminated foods (ex. green vegetables) or drinks or hands with human stool containing mature cyst.
- 2- Handling food by infected food handlers as cooks and waiters.
- 3- Flies and cockroaches that carry the cysts from faeces to exposed food.
- 4- Autoinfection (faeco-oral or hand to mouth infection).
- 5- Homosexual transmission.

Pathogenesis

Resistance of the host

Depends on

- 1-Host immunity.
 - 2-Presence of debilitating diseases.
- **Infection is severe in young children, pregnant women, elderly and immunodeficient patients.**

Virulence of the parasite

Depend on

- Type of the strain.
- Invasiveness .
- Number of the amoebas.

GIT condition

Invasion ↑

- By carbohydrate diet.
- Injury of the mucosa (chemical).
- Stasis.

With heavy infection and lowering of host immunity

The trophozoites of *E. histolytica* invade the mucosa and submucosa of the large intestine by secreting lytic enzymes → amoebic ulcers

The ulcer is flask-shaped with deeply damaged edges containing cytolysed cells, mucus and trophozoites.



The most common sites of amoebic ulcers are caecum, colonic flexures and sigmoidorectal regions due to decrease peristalsis & slow colonic flow at these sites that help invasion.

Clinical pictures

I) Intestinal amoebiasis

1-Asymptomatic infection

Most common and trophozoites remain in the intestinal lumen feeding on nutrients as a commensal without tissue invasion
(Asymptomatic patient known as a healthy carrier and cyst passers)

2-Symptomatic infection

a) Acute amoebic dysentery

Presented with fever, abdominal pain, tenderness, tenesmus (difficult defecation) and frequent motions of loose stool containing mucus, blood and trophozoites.

b) Chronic infection

-Occurs if acute dysentery is not properly treated.
-With low grade fever, recurrent episodes of diarrhea alternates with constipation.
- Only cysts are found in stool.

3-Complications

- Haemorrhage due to erosion of large blood vessels.
- Intestinal perforation → peritonitis.
- Appendicitis.
- Amoeboma (Amoebic granuloma) around the ulcer → stricture of affected area.

II) Extra-intestinal amoebiasis

Due to invasion of the blood vessels by the trophozoites in the intestinal ulcer → reach the blood → to spread to different organs as:

→ **Liver** →

- Amoebic liver abscess or diffuse amoebic hepatitis.
- Affect commonly **right lobe** either due to spread via portal vein or extension from perforating ulcer in right colonic flexure.
- CP:** include fever, hepatomegaly and pain in right hypochondrium.

→ **Lung** →

- Lung abscess → pneumonitis with chest pain, cough, fever.
- Amoebic lung abscess usually occur in the **lower part of the right lung** due to direct spread from the liver lesions through the diaphragm or very rarely trophozoites may reach the lung via blood.

→ **Brain** → Brain abscess ⇔ encephalitis (fatal).

→ **Skin** → **Cutaneous amoebiasis due to either extension of acute amoebic colitis to the perianal region or through rupture on the abdominal wall from hepatic, colonic or appendicular lesions.**

Laboratory diagnosis

I) Intestinal amoebiasis

a) Direct

• **Macroscopic:** Offensive loose stool mixed with mucus and blood.

• **Microscopic:**

1-Stool examination: Reveals either trophozoites (in loose stool) or cysts (in formed stool) by direct smear, iodine stained & culture.

2-Sigmoidoscopy: To see the ulcer or the trophozoites in aspirate or biopsy of the ulcer.

3-X-ray after barium enema: to see the ulcer, deformities or stricture.

b) Indirect

- **Serological tests:** CFT, IHAT, IFAT, ELISA and GDPT (gel-diffusion precipitin test).

These serological tests are positive only in invasive intestinal amoebiasis but negative in asymptomatic carriers.

II) Extra- intestinal amoebiasis

According to the organ affected

a) Direct

- 1- X- ray:**
In liver → space occupying lesion.
In lung → pleuritis with elevation of the diaphragm
- 2- Ultrasonography, CT scan & MIR:**
For liver abscess.
- 3- Aspiration of abscess content:**
For liver abscess to detect trophozoites.

b) Indirect

- 1- Serological tests:** As intestinal amoebiasis. They are positive and can persist for years.
- 2- Molecular by PCR.**
- 3- Blood examination:** Leucocytosis.
- 4- Liver function tests:** Increased in amoebic liver abscess.

Treatment

**1) Asymptomatic
intestinal carrier**

Luminal amoebicides

**Paromomycin or
Diloxanide furoate**

**2) Intestinal
amoebiasis**

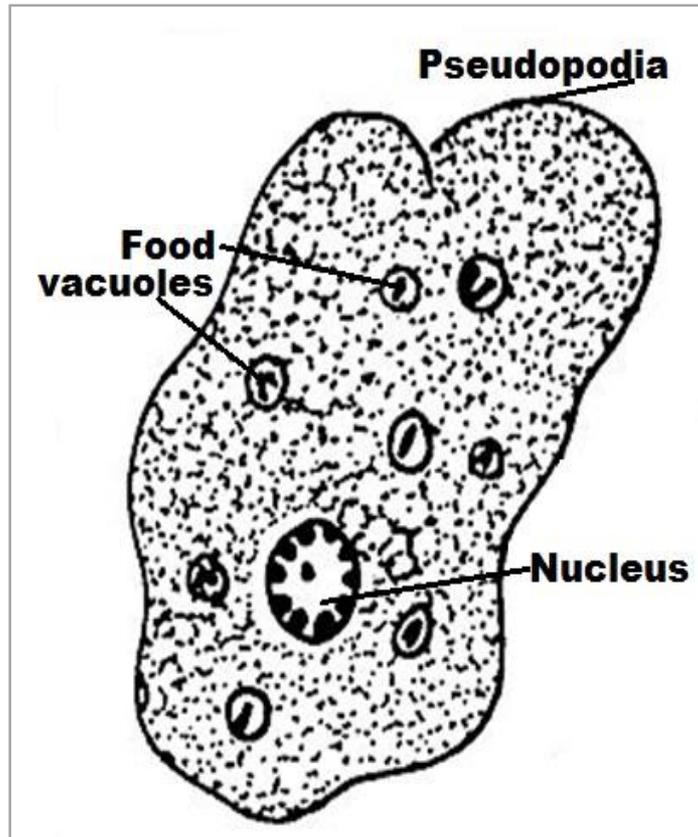
**Tissue & luminal
amoebicides**

**Metronidazol
(Flagyl) is the drug
of choice +
Paromomycin or
Diloxanide furoate**

**3) Extra-intestinal
amoebiasis**

**Tissue & luminal
amoebicides**

**Metronidazol
(Flagyl) +
Paromomycin or
Diloxanide furoate**



***E. Coli* trophozoite**



***E. Coli* cyst**

