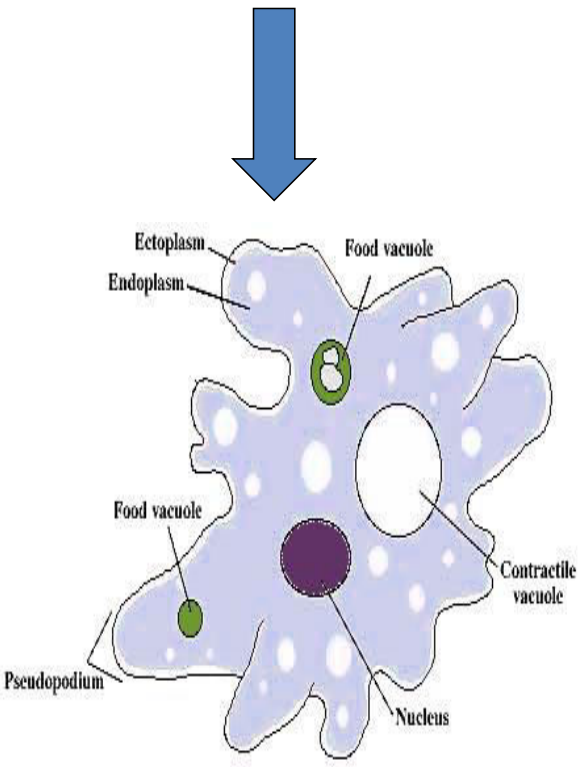
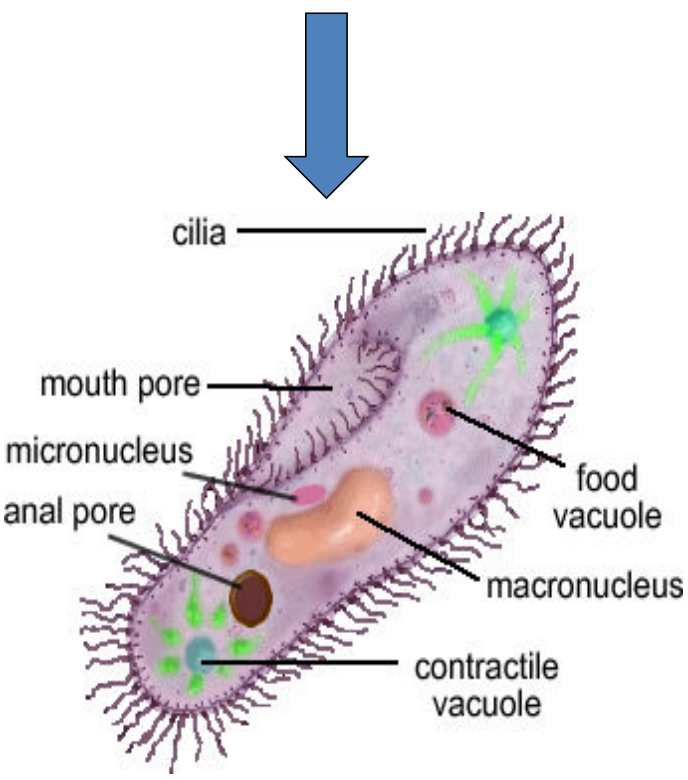
Classification Of Protozoa

- All medical parasites classified among two kingdoms:
- Subkingdom A: Protozoa (unicellular micro-organisms).
- 1-Phylum: Sarcomastigophora.
- <u>Subphylum</u>:
- a- Sarcodina. Ex. ***Entamoeba histolytica*** and ***E.Coli*** .
- b- Mastigophora ex. ***Leishmania*** Spp.
- 2-Phylum: Ciliphora (carrying cilia) Ex. ***Balantidium coli.***
- 3-Phylum: Apicomplexa: Like Genus: ***Plasmodium*** (Malaria).
- All these 3 phyla are unicellular <u>Protozoa Protista</u>.
- Subkingdom B: Metazoan (helminthes) multicellular.

BOTH ARE UNICELLUAR (PROTOZOA) PROTESITA

Amoeba **Paramecium**





The Parameters of this study

We can study for each parasite

- **Morphology of the organism.**
- **Life cycle, hosts and Vectors.**
- **Disease, symptoms, pathogenesis.**
- **Diagnosis, Prevention and control.**
- **Treatment.**

Protozoa (PR0TO = PRMITIVE) (ZOA = ANIMAL)

- **Morphology of protozoa:**
- **They are made up of a mass of protoplasm differentiated into cytoplasm and nucleoplasm.**
- **The cytoplasm consists of an outer layer of hyaline ectoplasm and an inner granular endoplasm.**
- **The ectoplasm functions in protection, locomotion, and ingestion of food, excretion, and respiration.**
- **In the endoplasm there are:**

- Nucleus: which is formed of nuclear membrane and chromatin material.

- Chromatin may be condensed in a single mass (karyosome) giving vesicular nucleus, or differentiated into masses diffusely filling the nucleus.

- The nucleus also functions in reproduction and maintaining life.

- Protozoa may secrete
  - Toxin.
  - Lytic enzymes.
  - Digestive enzymes.
  - Antigenic substances.
  - Material for cyst wall formation.

General Morphology:

Most of intestinal protozoa have the following features in general

A-Trophozoite stage:(Trophos: nourishment)

- It is **active, motile, feeding stage of parasite**.
- It derives nutrition from the **environment by diffusion, pinocytosis, and phagocytosis.**
- It is the **pathogenic stage of parasite**.
- It is the **diagnostic stage in case of acute infection**.

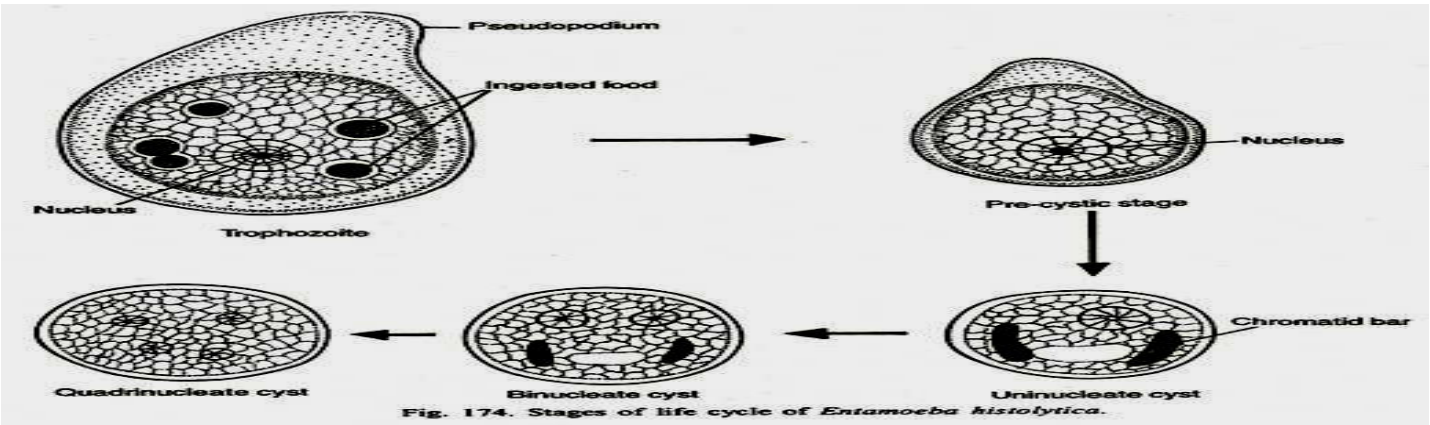


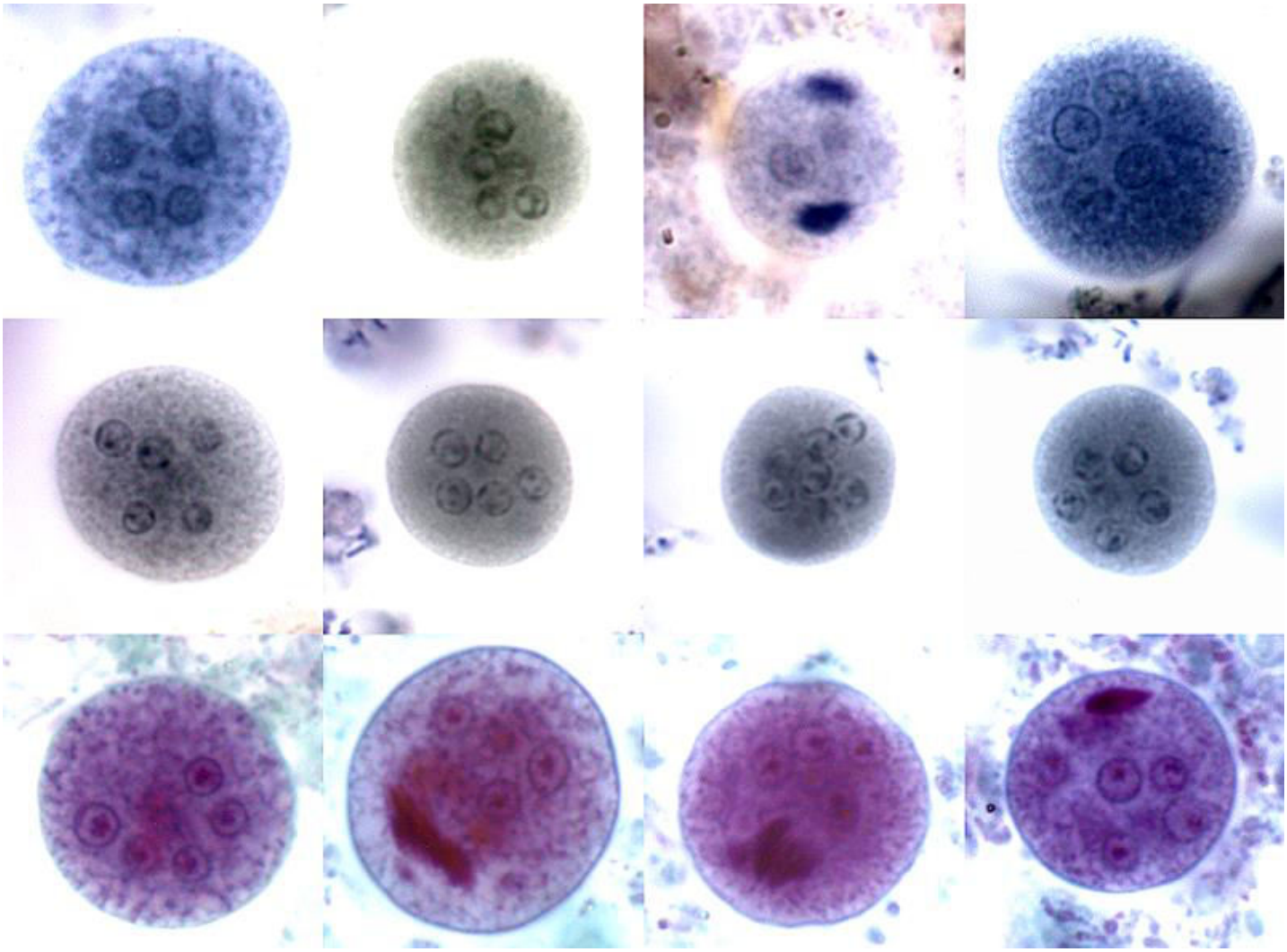
Fig. 174. Stages of life cycle of *Entamoeba histolytica*.

B-cyst stage

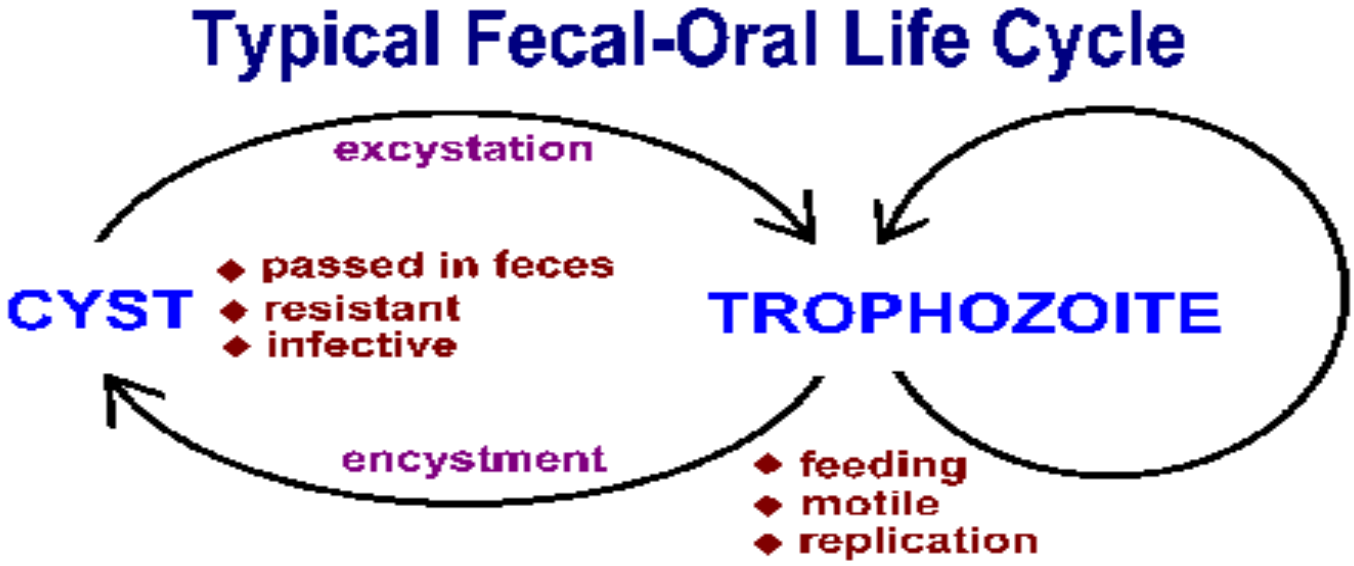
- It is **non-motile, non-feeding, non-active stage**.
  - It is the **infective stage**
  - **Survives in adverse environmental conditions**, such as desiccation,
  - Low nutrients supply, and even anaerobiosis **because cysts are with a protective membrane or thickened wall.**
- If the parasite has trophozoite and cyst stages in the life cycle, **it is diagnostic stage in case of chronic infection.**
- Transmitted to the human by food and water contamination.

C-Only trophozoite

Some parasites have only trophozoite without cyst stage, this trophozoite is the pathogenic, infective and diagnostic stage.



GENERAL LIFE CYCLE OF INTEST.PROTOZOA

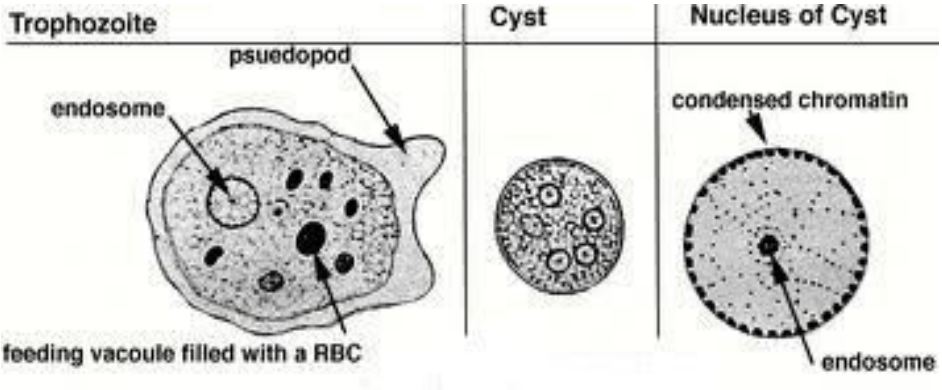


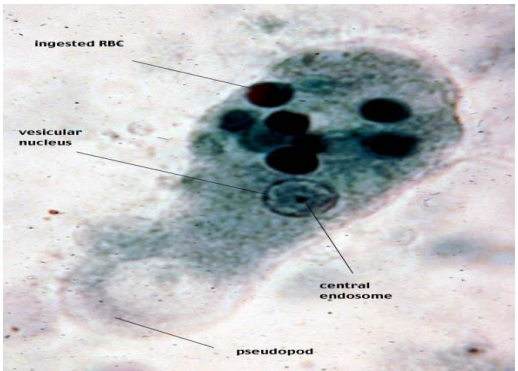
Entamoeba histolytica Morphology

MOROPHOLOGY:

1- Trophozoite: has no fixed shape small active, motile by pseudopodia.

- **Cytoplasm divided into two portions ; a clear ectoplasm and a granular endoplasm.**
- **Movement is directional and pseudopodium is finger shape.**
- **The granular endoplasm may contain ingested RBC by food vacuoles.**
- **The organism has a single nucleus with a distinctive small central karyosome.**
- **Trophozoite is the only form present in tissues, it is also found in fluid feces during amebic dysentery.Trophozoite also known active vegetative stage.**

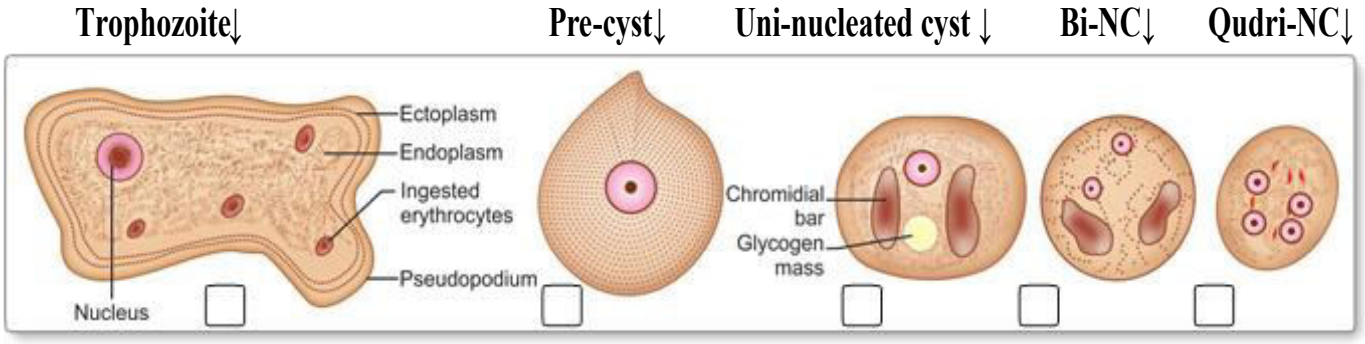




- The trophozoites divide by binary fission in every 8 hours.
- Trophozoites killed by drying, heat, and chemical sterilization.
- Therefore, the infection is not transmitted by trophozoites. Even if alive trophozoites from freshly-passed stools are ingested, they are rapidly destroyed in stomach and cannot initiate infection

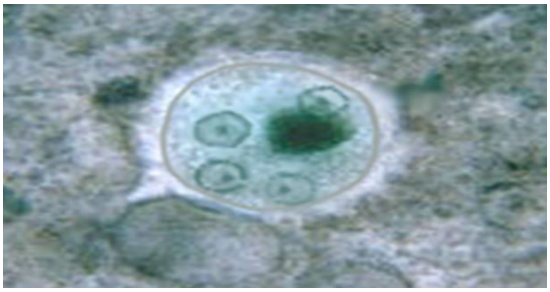
2-Precyst Stage:

- Trophozoites undergo encystment in the intestinal lumen. Encystment does not occur in the tissues nor in feces outside the body.
- the trophozoite extrudes its food vacuoles and becomes round or oval, It contains a large glycogen vacuole and two chromatid bars.
- It then secretes a highly retractile cyst wall around it and becomes cyst.

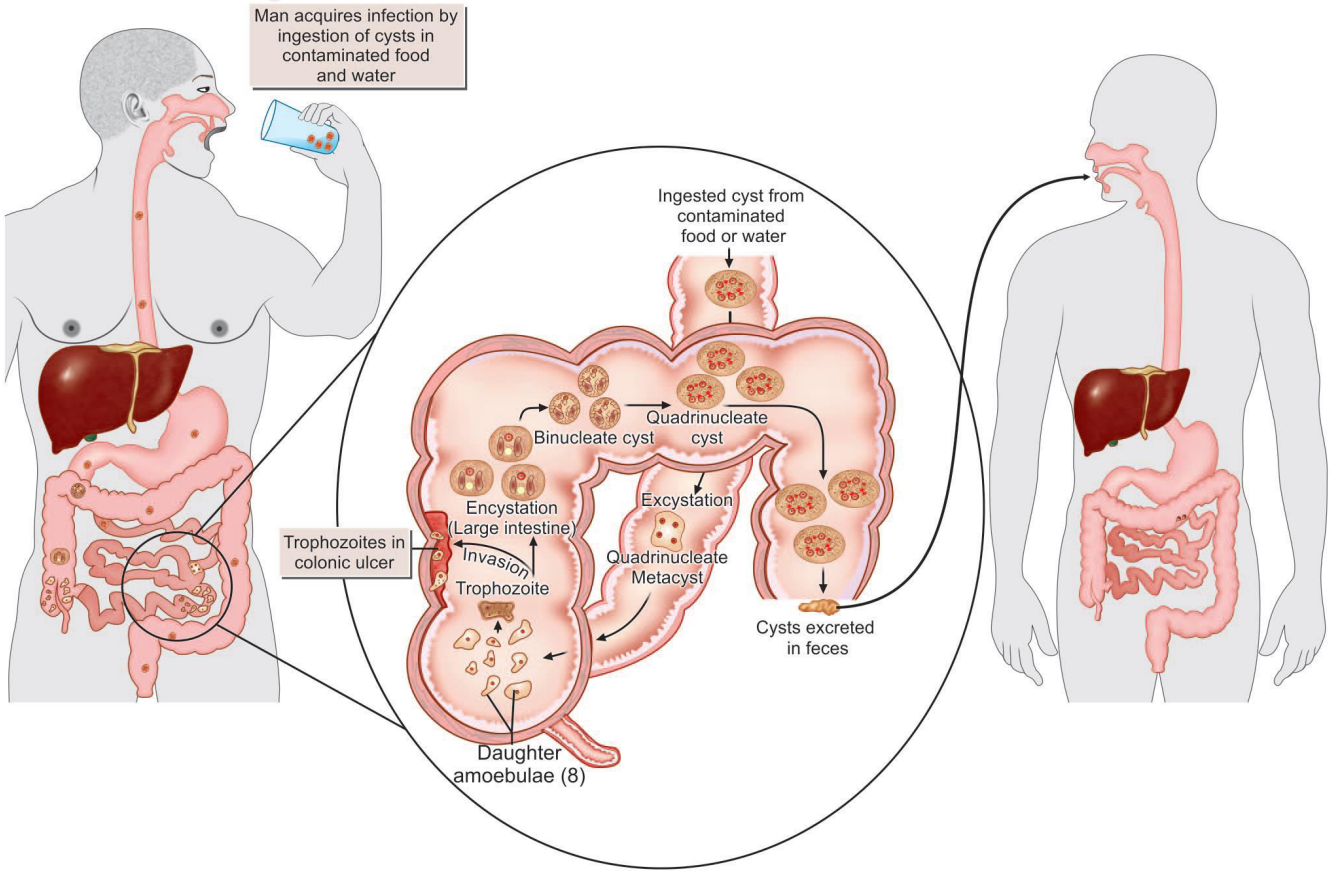


3-Cystic Stage:

- The cyst is spherical in shape
- The early cyst contains a single nucleus and two other structures—a mass of glycogen and 1–4 chromatoid bodies which are cigar-shaped with rounded ends.
- As the cyst matures, the glycogen mass and chromatoid bars disappear and the nucleus undergoes 2 successive mitotic to form mature cyst called quadrinucleate.
- This is the infective stage of the parasite.
- The cyst wall is highly resistant to gastric juice and unfavorable environmental conditions.



Life cycle



LIFE CYCLE OF ENTAMOEBA HISTOLYTICA

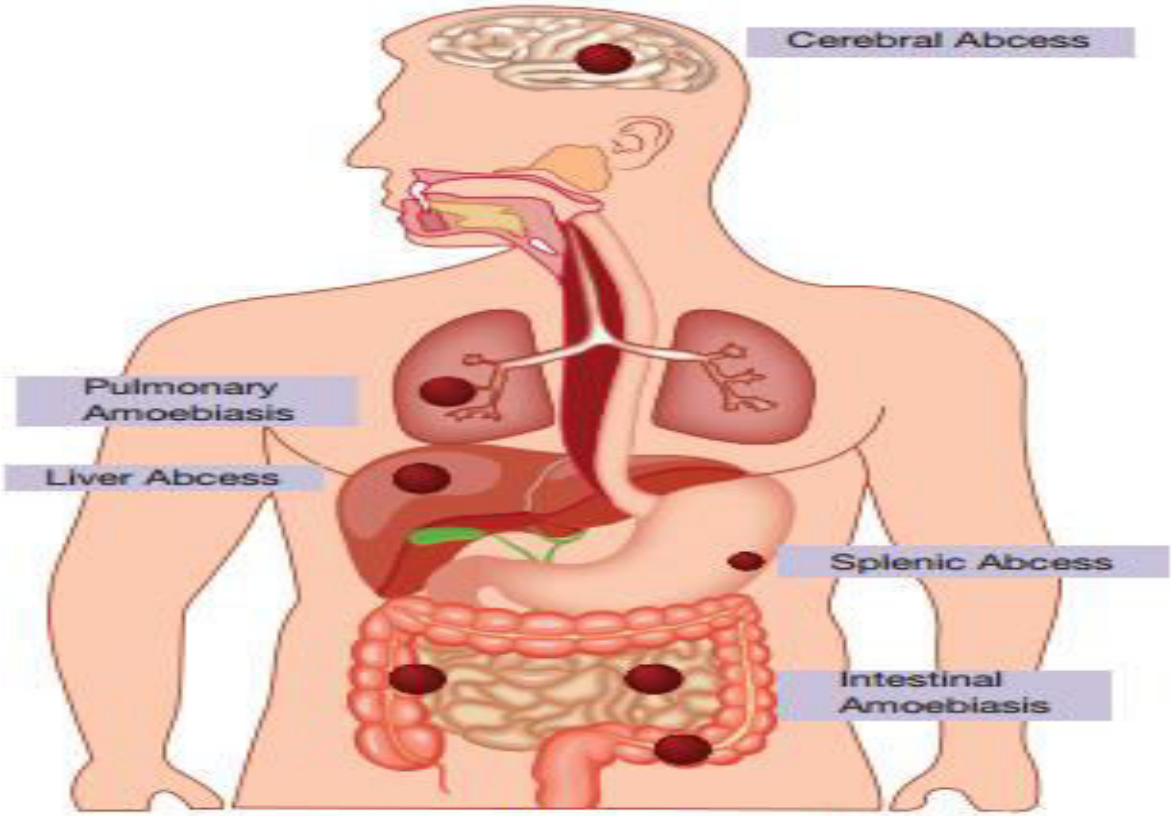
1-Intestinal infection:

- **Infection occurs orally by food &water or by hands contaminated with mature cyst stage.**
- **The cyst wall resistant to action of gastric juice, the cysts pass through the stomach undamaged and enter the small intestine**
- **Excystation: occur in caecum or lower part of the ileum, due to the alkaline medium, the cyst wall is damaged by trypsin, leading to excystation→ giving →four and then eight small amoebae which move to the large intestine.**
- **A certain number of trophozoites come from tissues into lumen of bowel and are first transformed into pre-cyst forms.**

- **Pre-cysts secret a cyst wall and become a uni-nucleated cyst and bi-nucleated and eventually, mature quadri-nucleated cysts, these are the infective forms.**
- **Both mature and immature cysts may be passed in feces.**
- **Immature cysts can mature in external environments and become infective.**
- **Encystation →→formation of cyst happens in the rectum.**
- **There is no intermediate or reservoir host. It can be transmitted by mechanical V**

2-Extra-intestinal infection:

- **Invasion into the deeper mucosa cause "flask-shaped" lesions with extension into the peritoneal cavity may occur.**
- **This can lead to secondary involvement of other organs, liver, lungs, brain, and heart.**
- **Extra intestinal amebiasis is associated with trophozoites.**



Extra-intestinal amoebiasis

Entamoeba histolytica

- **Disease: AMEBIASIS (Amebic dysentery, amebic hepatitis).**
- **Epidemiology: Worldwide and more in underdeveloped country**
- **Habitat: trophozoite in 1-large intesine 2 extraintesinal infection, cyst only in the large intestine**
- **Life cycle: direct no intermediate host.**
- **Infective stage: is mature quadrinucleated cyst.**
- **Pathogenic stage: only Trophozoite which seen in diarrheic acute dysentery stool.**
- **Diagnostic stage: cyst in chronic infection and trophozoite in acute diarrhic infection.**
- **Mode of infection: contamination of food and water**
- **Humans are the principal host, although dogs, cats and rodents may be infected**

Clinical classification of amoebiasis:

1-Asymptomatic infection:

The most common form where the parasite causing no symptoms

2-Symptomatic infection:

A-Intestinal amoebiasis or Amoebic dysentery:

It is characterized by extensive intestinal ulceration, it divided into:

Acute dysenteric amebiasis:

may have explosive liquid stools daily, containing much blood and mucus and may be accompanied with fever, dehydration, abdominal cramps, tenesmus, painful spasm of the anal sphincter, is a sign of rectal ulceration.

Chronic dysenteric amoebiasis:

mild gastrointestinal disturbances with recurrent attacks of dysentery with alternation of constipation and localized abdominal tenderness.

- **B-Extra intestinal amoebiasis:**

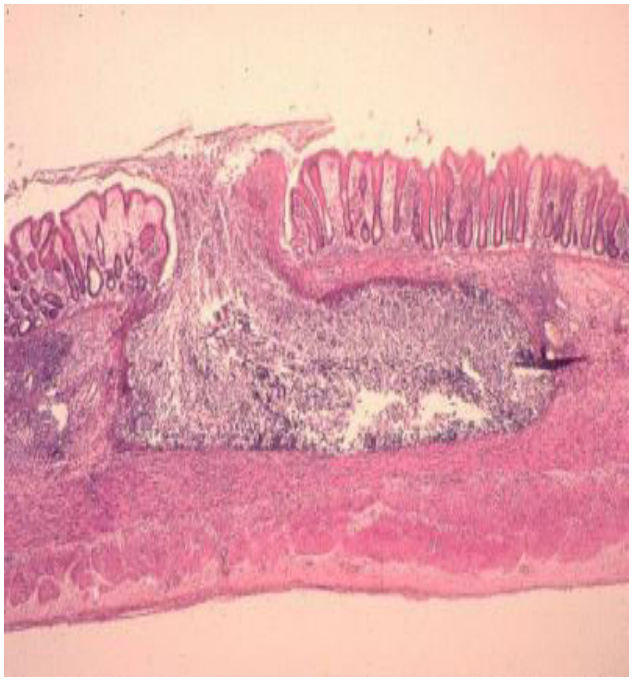
that occurs as a result of metastasis by Invasion of blood stream by trophozoites, and Direct spread of trophozoites to other organs.

They may cause

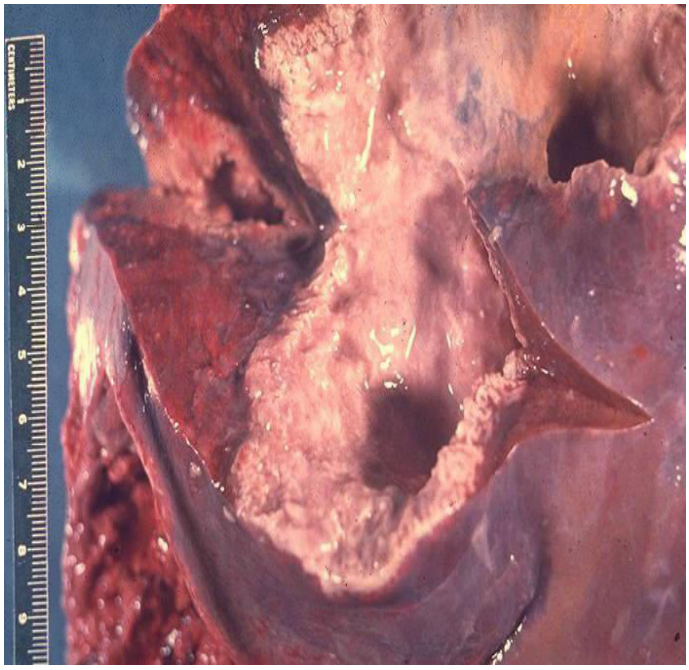
- **1. Hepatic amoebiasis**
- **2-Pulmonary amoebiasis,**
- **3-Other Extra intestinal amoebiasis, from the liver, *E. histolytica* may enter the general circulation involving other organs of the body like, brain, pericardium, kidney, spleen, skin and other sites.**
- **In brain causing Amoebic Meningoencephalitis.**

PATHOLOGY

FLASK-SHAPED ULCER



LIVER ABSCESS



CLINICAL MANFESTATION IN SUMMARY

AMOEBIASIS

ASYMPTOMATIC 85-95%

SYMPTOMATIC 5-15%

Intestina amoebiasis

***Amoebic dysentery**
***Non -dysenteric colitis**
***Amoebic appendicitis**
***Posit-dysenteric colitis**
***Complication of all above**

Extraintestina amoebiasis

(5% of symptomatic cases)
***Amoebic hepatitis**
***Amoebic liver abscess**
***Pulmonary amoebiasis**
***Cerebral amoebiasis**
***Cutaneous amoebiasis**
***Splenic abscess**
***Urogenital tract amoebiasis**

- **LAB. DIAGNOSIS:**

- **In intestinal amoebiasis:**
  - **Examination of a fresh dysenteric faecal specimen (GSE) or rectal scraping for trophozoite stage.**
  - **Distinct from bacillary dysentery due to lack and absence PMN.**
  - **Examination of formed or semi formed faeces for cyst stage.**
- **Extraintestinal amoebiasis**
  - **Diagnosed by the use of scanning procedures for liver and other organs.**
  - **Serologic tests, together with microscopic examination of the abscess material, can confirm the diagnosis**

Prevention and control:

Determine:

- ✓ **The source of infection by lab. Tests.**
- ✓ **Symptomatic cyst carriers detection.**
- ✓ **Diagnose and treat the cases.**
- ✓ **Improvement water supply and sewages.**
- ✓ **Good health education.**

Treatment

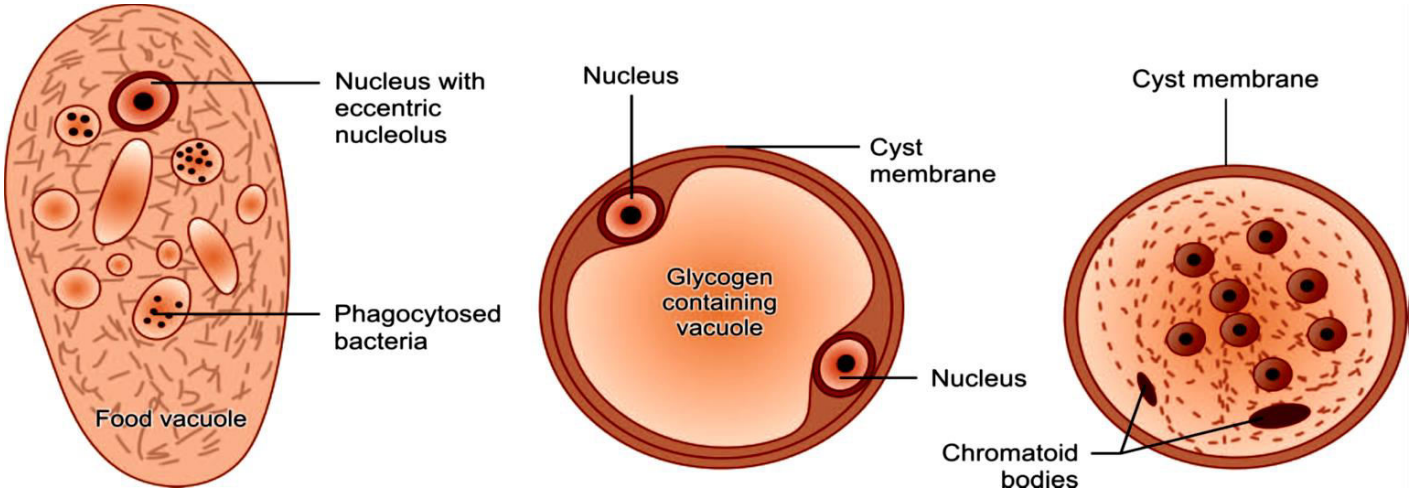
- **Iodoquinol and tetracycline is the drug use for (luminal amoebiasis) asymptomatic infections**
- **Metronidazole(FLAGYLE) for symptomatic and chronic amebiasis including extra intestinal disease (liver abscess), but Chloroquine or dehydroemetine are less desirable alternatives.**

The dose depends on:

1. **Severity of the infection**
2. **Age of patients.**
3. **Infected organ.**

Entamoeba coli:

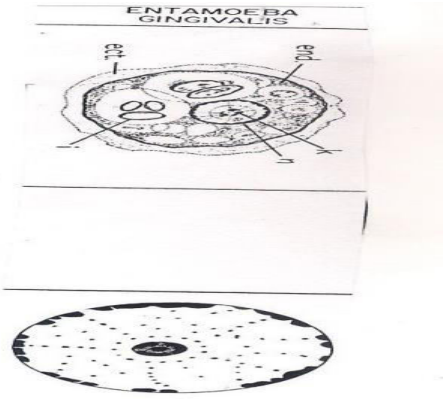
- ✓ **This parasite is non- pathogenic and**
- ✓ **live commensally in large intestine of human**
- ✓ **has the same life cycle of *E.histolytica***
- ✓ **but it differ in some properties**



Differences between Entamoeba histolytica and E. coli

Trophozoite	Entamoeba histolytica	E. coli
Motility	Active	Sluggish
Pseudopodia	Finger-shaped, rapidly extruded	Short, blunt slowly extruded
Food vacuole	RBCs present, no bacteria	Bacteria and other particles, no RBCs
Karyosome	Small, central	Large, eccentric
Nuclear membrane	Delicate, with fine chromatin dots.	Thick, with coarse chromatin granules
Cyst	Small	Large
Nuclei in mature cyst	Number 4 (Quadri. N.C)	Number 8 (Octa.N.C) -16
chromidial bodies	1-4 with rounded ends	Splinter like with angular end

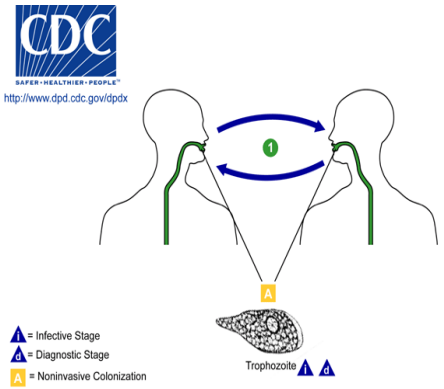
Small amoeba



1-Entamoeba gingivalis

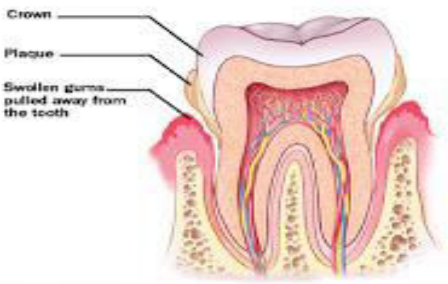
- The amoeba **lives in gingival tissues and is abundant in unhygienic mouths**. It is a **commensal** and is not considered to cause any disease.

- **Unable to form the cyst stage**, so **it's direct transmitted through direct contact or other personal tools like teeth brushes.**



Morphology

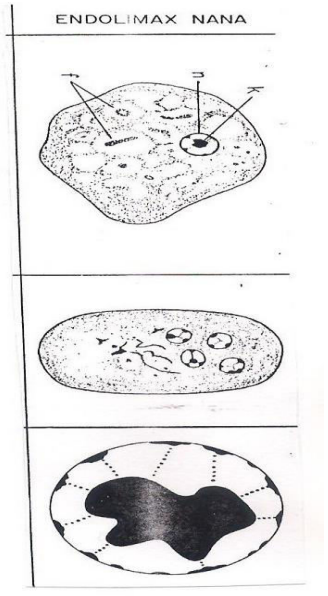
The cytoplasm contains food vacuoles with ingested bacteria, leukocytes, and epithelial cells.



Diagnosis

Mouth swab taken from the patient to see the trophozoite of this parasite

Small amoeba



2-Endolimax nana (nana means dwarf or small)

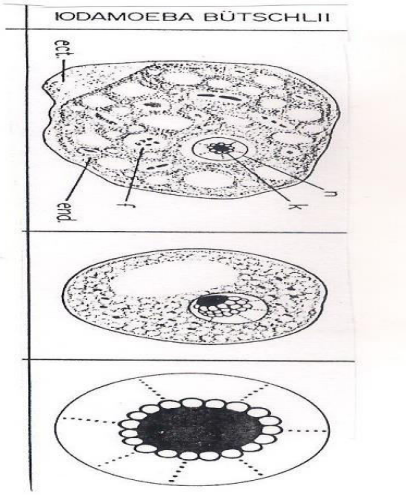
- **live in the human large intestine (commensal), very small in size , has direct life cycle, also have two stages trophozoite and cyst**

- **The trophozoite characteristic by a large blot-like karyosome, and the lack of peripheral chromatin.**

- **The cysts are mature, they contain four nuclei with glycogen mass and chromidial bars, which are unclear or absent.**

- **It is non pathogenic**

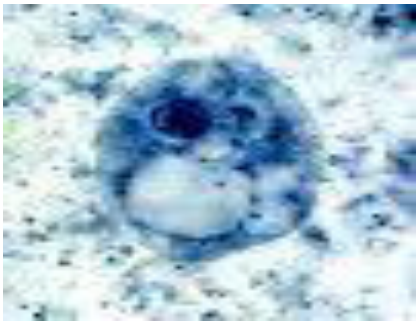
Small amoeba



3.Iodamoeba butschilli

- **nonpathogenic , live in the human large intestine, small in size , has direct life cycle, also have two stages trophozoite and cyst .**

- **Morphology**
- **Trophozoite size range between 9 – 13 micron , the nucleus semispherical , have large karyosome surrounded by chromatic granules.**



- **The cyst size is 8 – 13 micron oval or poly morph , have only one basket shape nucleus in all stages and a large mass of glycogen pushes the nucleus aside.**

- **Has prominent iodine staining glycogen mass (iodophilic body), Hence, the name '*Iodamoeba*'..**

Phylum: Ciliphora *Balantidium coli*

Disease: Balantidiasis or Balantidial dysentery*:*

✓ ***Balantidium coli* : is the only ciliate known to parasitize humans. Ciliates represent a phylum of protozoa characterized by simple or compound ciliary organelles on the surface of their membranes that are used for locomotion.**

✓ **Reproduce by transverse binary fission or by conjugation.**

✓ ***Balantidium coli* : has 2 contractile vacuoles. Although contractile vacuoles are common to ciliates, they are rare in parasitic protozoa, which suggests that *Balantidium coli* has a unique osmoregulatory capacity.**

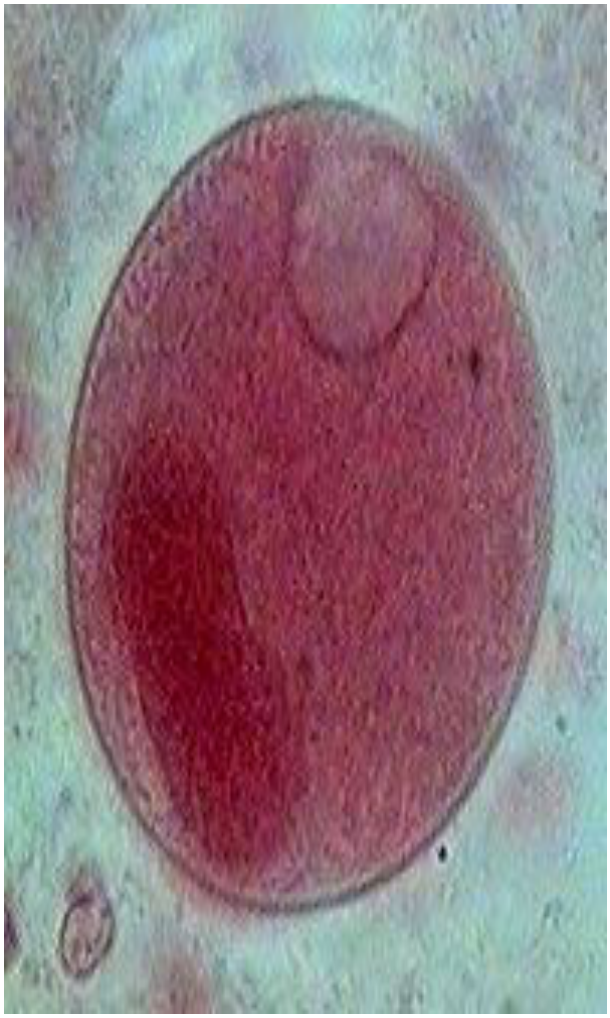
✓ ***Balantidium coli* : has 2 developmental stages: a trophozoite stage and cyst stage.**

Trophozoite stage:

It has 2 nuclei (one macronucleus and other micronucleus).

- **Reproduce by transverse binary fission or by conjugation.**
- ***Balantidium coli* has 2 openings, one anterior opening is called peristome which lead to cytostome for feeding and posterior opening cytopyge for excretion.**
- ***Balantidium coli* has 2 contractile vacuoles for a unique osmoregulatory capacity.**

Cysts:

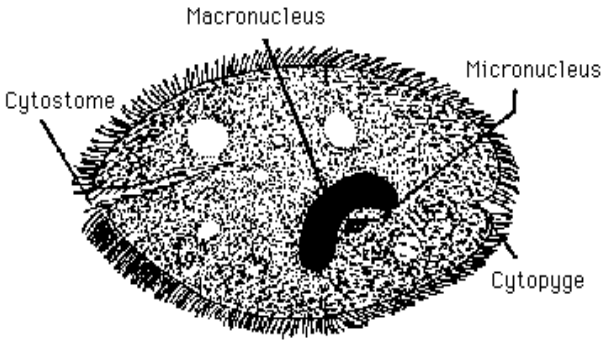


Are smaller than trophozoites, round and have a tough, heavy cyst wall made of one or two layers.

Usually only the macronucleus and sometimes cilia and contractile vacuoles are visible in the cyst.

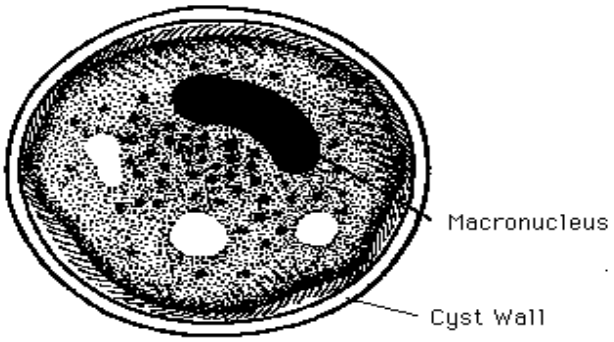
Living trophozoites and cysts are yellowish or greenish in color.

Balantidium coli
Trophozoite stage

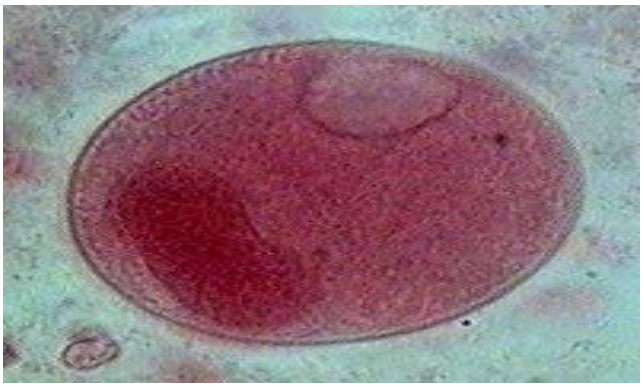


Trophozoite
50 x 70 µ

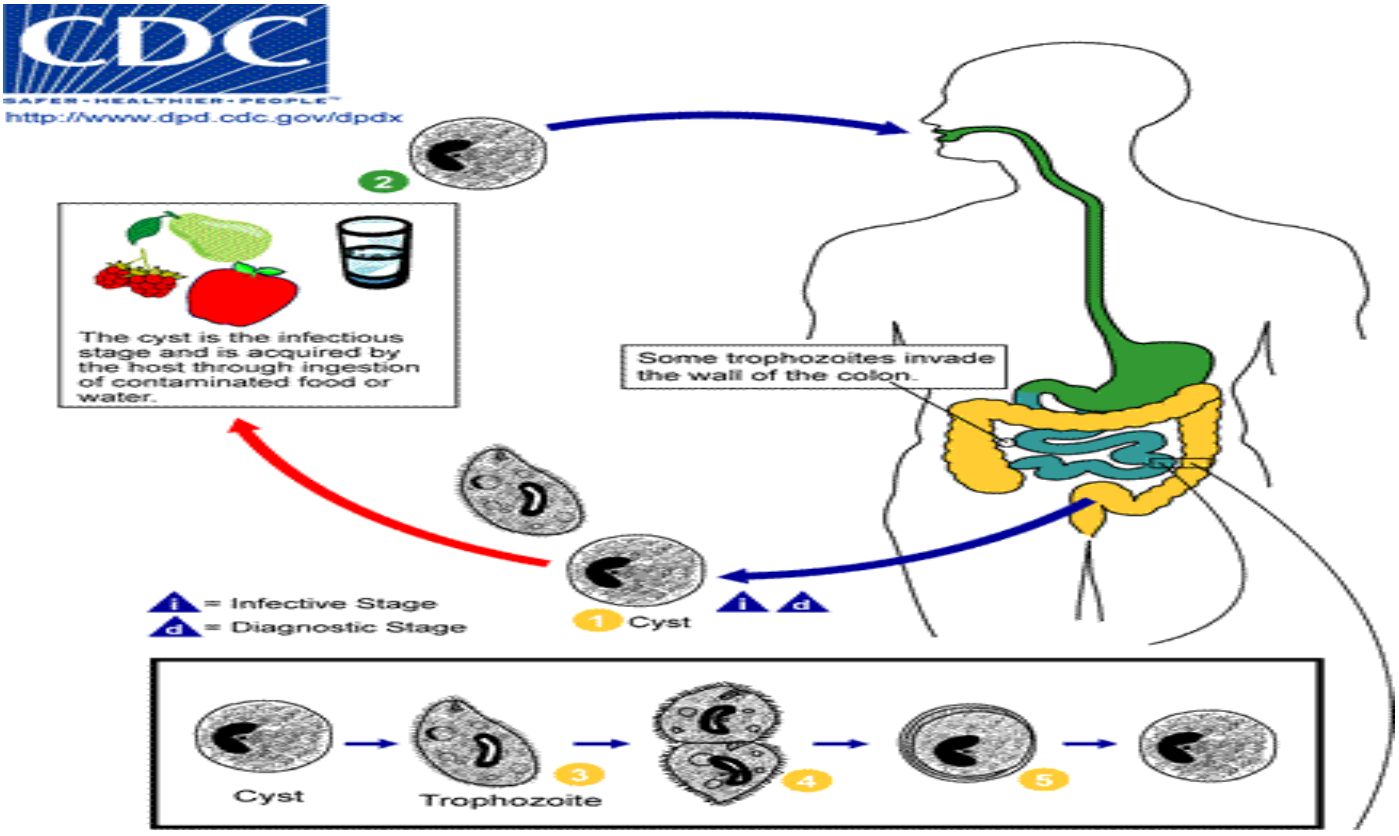
Cyst stage



Cyst
50 x 60µ



Life cycle



Symptoms

- Symptoms and Pathogenesis of balantidiasis are similar to those seen in amoebiasis including intestinal epithelial erosion, bloody diarrhea, nausea, vomiting and anorexia.
- Unlike *E. histolytica*, B. coli do not invade liver or any other extra intestinal sites.
- mucosal ulcers and sub mucosal abscesses, resembling lesions in amoebiasis
- The bloody diarrhea may persist for long periods of time resulting in acute fluid loss.
- *B. coli* also has ability to penetrate the mucosa resulting in ulceration.
- Extra-intestinal disease has also been reported but rarely.
- Treatment: Tetracycline 500 mg 4 times /day for 10 days Or Metronidazole750 mg 3 times/day.

Diagnosis:

- Microscopic examination of faeces for trophozoite and cysts is performed.