Univ. of Mustansiriya
College of Pharmacy
Branch of Clinical Laboratory Sciences

# Medical Parasitology

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## Lec. 2 Protozoa

## Introduction

**Protozoa** are unicellular eukaryotic organisms, have all the essential organelles that help them in their essential activities. All of them are microscopic, most of them live singly but many others are living in colonies. Each cell unit performs all the necessary functions of the life.

Thousands of species of protozoa have been described, the majority of which are free-living; yet many representatives of the subgroups **Sarcomastigophora** and **Ciliophora** are **parasitic**, and all species of the subgroups **Apicomplexa** and **Microsporidia** are **parasitic**. The main groups of parasitic protozoa are **Amebae**, the **Flagellates** and **Ciliates**.

## I-Amebae

The member of amebae group is move by means of cytoplasmic extensions that are projected and retracted in response to external stimuli, these extensions called pseudopodia (the single pseudopodium). All amebae have a trophozoite stage in which they multiply by binary fission as long as the environmental conditions are favorable. Many species have an encysted stage that is more resistant to unfavorable conditions and that provides an opportunity for transfer from one host to the next.

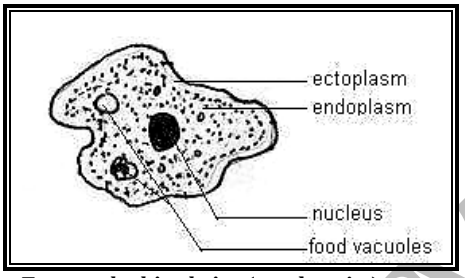
**Classification of Amoebae group:**

**-Kingdom : Animalia**
**-Phylum : Protozoa**
**-Sub-phylum: Sarcodina**
**-Class : Rhizopodea**

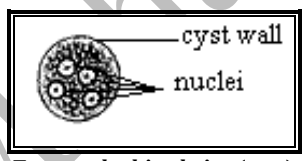
### 1. *Entamoeba histolytica*

It is called dysentery ameba because it causes amebic dysentery. It has a cosmopolitan distribution (worldwide distribution) especially the warm area. It infects the human as well as cats, pigs and monkeys.

The parasite has 2 distinct stages (trophozoite and cyst) which are commonly recognized in the feces of the patient, but only the trophozoite is present in the tissue. The trophozoite lives in the last part of the small intestine and in the large intestine stuck with mucosa, especially in the caecum, sigmoidorectal area; it varies from (12-30µ) in diameter, however, trophozoite up to (90µ) in diameter have been observed in the dysenteric stool (or feces). Under the microscope, it has finely granular, somewhat viscous endoplasm and a clear ectoplasm, pseudopodia are broadly finger-like (lobopodia) extends from the ectoplasm. In addition, there are many food vacuoles containing parts of epithelial cells, Bacteria and sometimes many R.B.Cs. The nucleus rounded, vesicular, surrounded by a delicate nuclear membrane which is studded on its inner surface with minute regular chromatin granules. In the center of the nucleus, there is a single dense bead-like chromatin body, the karyosome (centric karyosome).




***Entamoeba histolytica*** **(trophozoite).**




***Entamoeba histolytica*** **(cyst).**

The trophozoite grow and multiply continuously in the intestine, but sometimes it is encysting in the intestine, whenever, the trophozoite will discharge the undigested food and become spherical, and then it secretes a delicate, solid membrane. The cyst contains a nucleus (the same one of the trophozoite), glycogen mass and some chromatoid bars or bodies with hazy margin and rounded ends. The nucleus will divide into 2 nuclei then each of the two daughter nuclei divides once again, so the mature cyst typically has 4 nuclei. The cyst ranges between (5-10µ) in diameter, spherical or may have an oval shape.

A viable cyst is soon killed by drying, bacterial putrefaction of the medium, hypertonicity, direct sunlight and heat but it resists the freezing and water chloride.

## Life cycle

When the cyst swallowed with the foods or drinks, excystation occurs and the freeing of the young trophozoites will occur in the duodenum where the pH is neutral or weakly alkaline, as well as the effects of the digestive enzymes, all these factors will destroy the cyst wall. These young freeing trophozoites will arrive then to the large intestine and some of them will be in contact with the mucosa. When these cysts evacuated in the feces of the infected patient it will arrive to the environment and the cycle would be repeated again, see Fig.1.

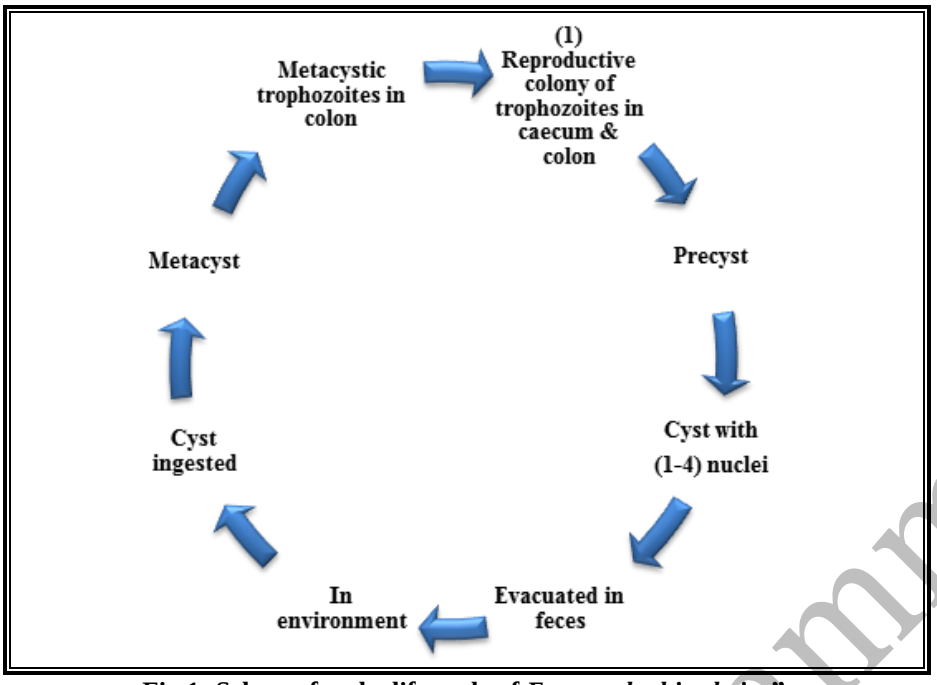
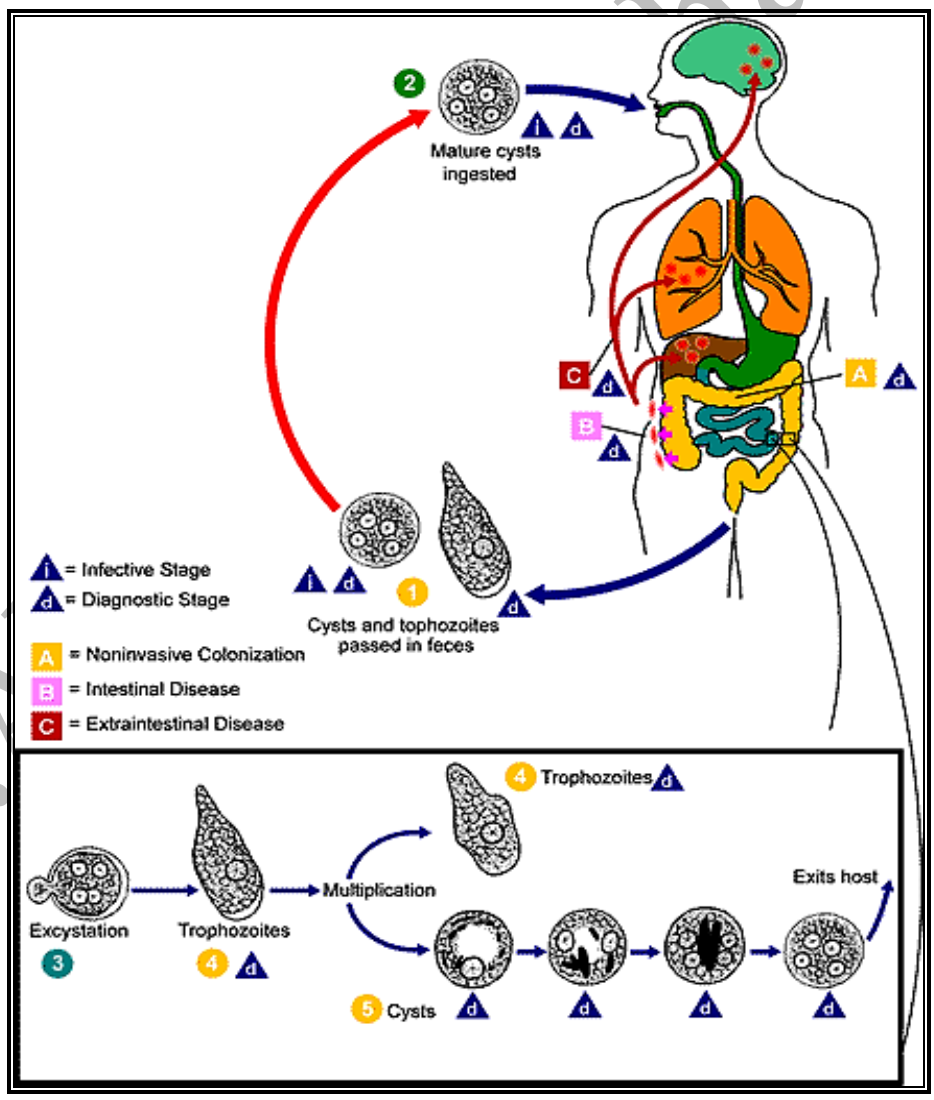



**Fig.1: Scheme for the life cycle of *Entamoeba histolytica*".**



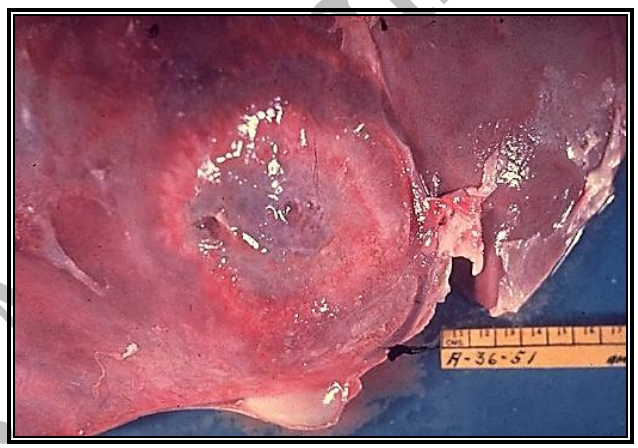

**"Diagram for the life cycle of *Entamoeba histolytica*".**

## Pathology

The trophozoite can destroy the host epithelial cells and causes the lysis for them (the cause of the name); it may also reach to the submucosa, start in feeding and attack the blood capillaries and feed on the R.B.Cs. This blood will then follow to the lumen of the intestine and exit with the stool; this is the 1st important symptom of the infection (the bloody stool).

After a period, the organism may invade other body organs, produces abscesses there, such as the liver causes abscesses called hepatic **amebiasis** and liver dysfunction, or it reaches to the lungs and causes pulmonary **amebiasis** and **pneumonitis**, to the brain and causes **encephalitis**, and to the spleen, heart, joints, bones, muscles, urogenital system and even the skin.

***Entamoeba histolytica*** **(flask shaped ulcer in the intestine).**



***Entamoeba histolytica*** **(amebic-abscess).**

## Symptoms

A wide spectrum from asymptomatic infection "luminal amebiasis" to invasive intestinal amebiasis (dysentery, colitis, appendicitis, toxic megacolon, amebomas), to invasive extraintestinal amebiasis (liver abscess, peritonitis, pleuropulmonary abscess, cutaneous and genital amebic lesions).

**Chronic**: Abdominal discomfort or soft stool for variable periods, may be suddenly developed to dysentery or acute abdominal pain. Recurrent episodes of dysentery with blood and mucus in the feces. Interfering gastrointestinal disturbances and constipation. Cysts can be found in the stool.

**Acute**: Frequent dysentery with necrotic mucosa and abdominal pain.

## Diagnosis

The typical stool in amebic dysentery consists of exudates, mucous, blood and may be little fecal material and we are mainly looking for the cyst stage. In the liquid stool, the trophozoite may also be found, but only the cyst stage is present in the solid stool.

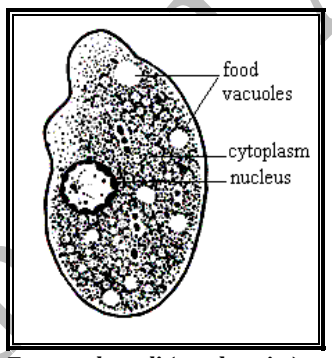
For the diagnosis procedure, the fresh stool sample is required to prepare the wet mounts. Concentrates from fresh stool can be used for the wet mounts, with or without iodine stain. For permanently stained preparations we use trichrome stain. Concentration procedures, however, are not useful for demonstrating trophozoites.

In addition, ***E. histolytica*** trophozoites can also be identified in aspirates or biopsy samples obtained during colonoscopy or surgery.

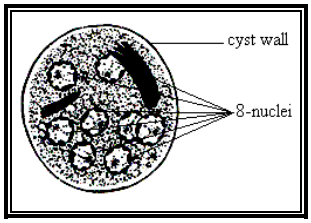
**Treatment:** Metronidazole (Flagyll)**.**

## 2. *Entamoeba coli*

It has a cosmopolitan distribution, two stages trophozoite and cyst. The diameter of the trophozoite is (15-50µ), it has a spherical shape, the ectoplasm couldn't recognize from the endoplasm, the food vacuoles contain bacteria and other enteric microbes. The nuclear membrane studded from the inner surface with large irregular chromatin granules with eccentric and large karyosome. The trophozoite has a sluggish movement, shortly extended pseudopodia.




***Entamoeba coli*** **(trophozoite).**



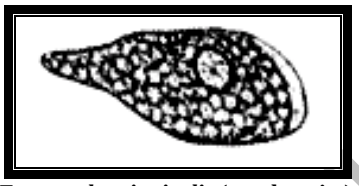

***Entamoeba coli*** **(cyst).**

The mature cyst has a diameter of (10-35µ), 8 nuclei, the chromatoid bodies have an irregular sharp ended (splinter-like). It lives in the lumen of the caecum and lower level of the large intestine.

The life cycle is similar to that of ***E. histolytica***, except that the trophozoite in this example doesn't attack the mucosa of the intestine, so that it is described as non-pathogenic (commensal) ameba. Its presence is evidence that the host has ingested fecal material.

## 3. *Entamoeba gingivalis*

It is a parasite of the mouth of man and other mammals, including several species of monkeys and of dogs and cats. It lives in/on the teeth, gums, and sometimes tonsils, only the trophozoite stage has been described which is measure (5-35µ) in diameter. In most respects it closely resembles ***E. histolytica***, with a few to several fingerlike pseudopodia, finely granular endoplasm, and clear ectoplasm. The nucleus contains a small karyosome that is central or slightly eccentric in position. Endocytotic vacuoles are often numerous and the parasite will ingest bacteria, leukocytes and erythrocytes although it is not itself invasive. No cysts are formed and transmission is entirely by oral to oral contact. Multiple samplings reveal the parasite to colonize the oral cavity of nearly all adult humans.

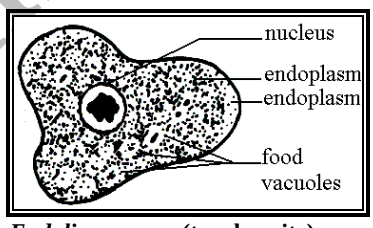


***Entamoeba gingivalis* (trophozoite).**

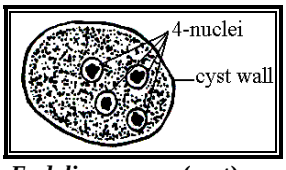
## 4. *Endolimax nana*

It has a worldwide distribution, Commensal in the lumen of the caecum and the lower level of the large intestine, feeding on the bacteria. Its presence indicates that contaminated material has been ingested.

It appears in 2 stages, trophozoite and cyst. The trophozoite is (6-18µ) in diameter (the cause of the name). The endoplasm finely granular with numerous minute vacuoles (so it has a foggy appearance), the ectoplasm is hyaline and almost transparent. The food vacuoles contain bacteria, vegetable cells and some crystals. The nucleus is ovoid or subspherical surrounds by a nuclear membrane with relatively large karyosome, commonly eccentric. The trophozoite has a sluggish movement with shorter fingerlike pseudopodia.




***Endolimax nana* (trophozoite).**



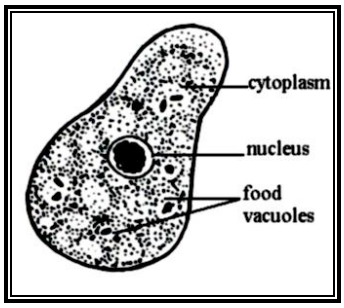

***Endolimax nana* (cyst).**

The cyst is (5-14µ), spherical or ovoid surrounded by a delicate membrane. It has 4 nuclei. The life cycle as it is in ***E. coli***.

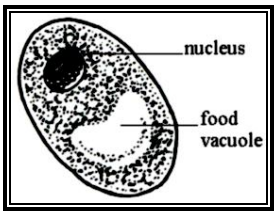
## 4. *Iodamoeba butschlii*

The parasite has a cosmopolitan distribution, but it is seldom as common as *E. coli* and *E. nana*. It is commensal, lives in the lumen of the large intestine especially the

caecum. It has 2 stages, trophozoite and cyst. The trophozoite movement is sluggish, the ectoplasm not easily distinguished from the endoplasm. It measures (8-20µ) in diameter, the vacuoles contain bacteria. The nucleus is spherical, vesicular and has rather a thick membrane and large karyosome (centric or somewhat eccentric in position).

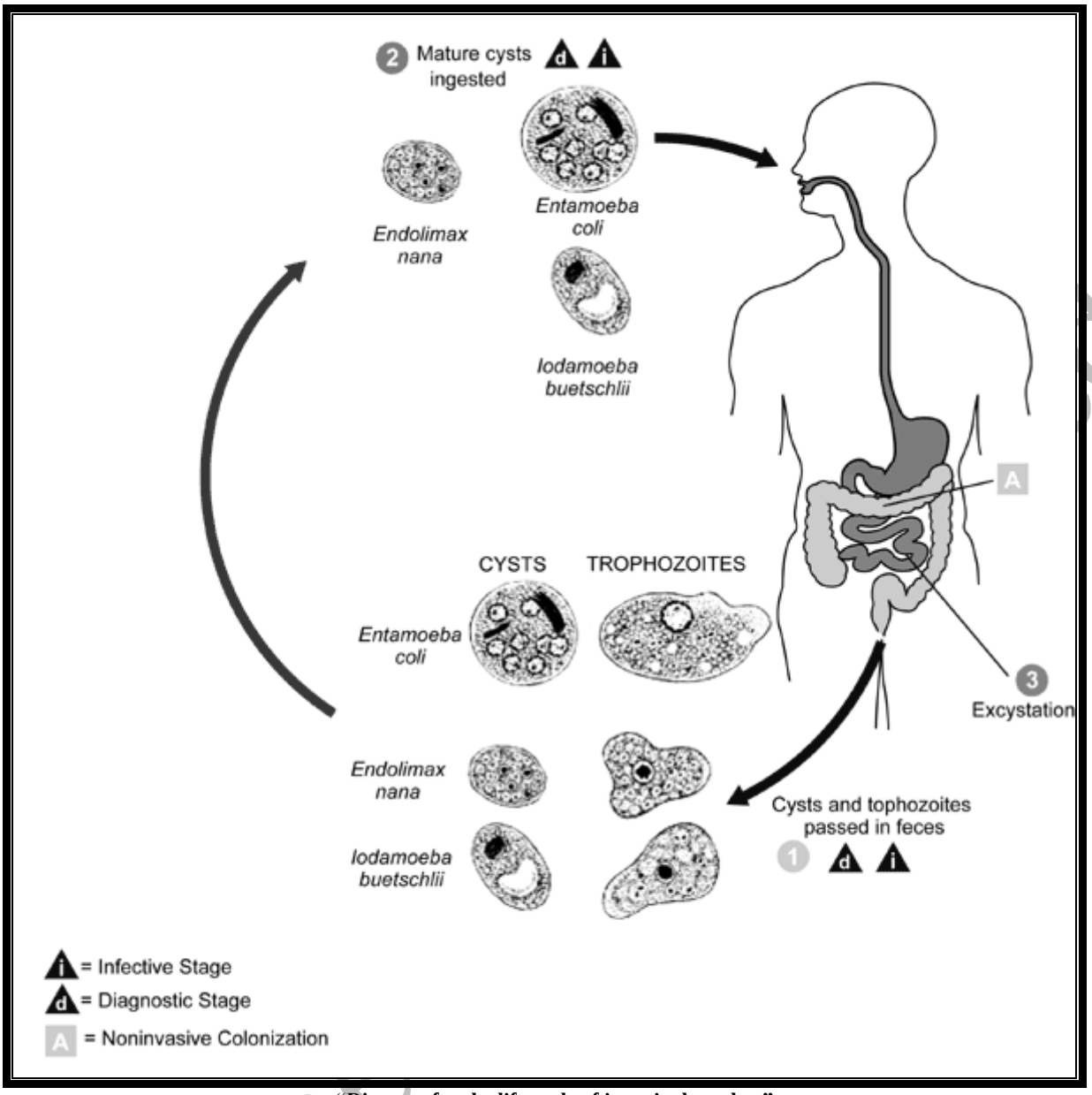



***Iodamoeba butschlii* (trophozoite).**




***Iodamoeba butschlii* (cyst).**

The cyst is variable in shape, usually irregular rounded (ovoid), and (5-18µ) in diameter, usually contain one nucleus. There is a relatively big mass of glycogen that stains deep brown with iodine [the cause of the name ***Ioda.***], and also help in the differentiation of this parasite from other intestinal amebae.




**"Diagram for the life cycle of intestinal amebae".**