

Mutah University - 2nd year Med.

-Introduction to Parasitology

-Entamoeba

Dr Hamed Al-Zoubi MD, PhD

JBCM

Associate Prof. of Medical Microbiology

❖ **Medical Parasitology:**

It is the science which deals with the parasites that infect man.

❖ **Parasite:**

Is an organism, which lives **on or **within** another organism (**host**) for survival.**

❖ **Host:**

Is a living organism that harbours the parasite.

- *Parasitic kingdom include three phyla*
- 1- Protozoa. 2- Helminths. 3- Arthropods.
- **I- Protozoa:**
- Is a phylum of the animal kingdom consisting of unicellular parasites, divided into 4 classes according to the organ of locomotion:
- **1- Class sarcodina / rhizopoda :** Parasites that move by means of pseudopodia example *Entamoeba histolytica*.
- **2-Class mastigophora :** Parasites that move by means of flagella example *Giardia lamblia*
- **3- Class ciliates :** parasites that move by means of cilia example *Balantidium coli* .
- **4- Class Sporozoa :** parasites have both sexual and asexual reproductive organs, all these parasites are intracellular and they have no organ of locomotion example Plasmodium parasites causing malaria.
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- **II- Helminths:**

- They are metazoa (Multicellular parasite) wormlike parasite, divided into 3 classes:

- **1. Class Trematoda (Flukes):**

- They are flattened leaf- shaped worms e.g: *Schistosoma heamatobium*.

- **2. Class Nematoda (Roundworms) :**

- **a-** Intestinal nematodes, e.g, *Ascaris lumbricoides* .
- **b-** Tissue nematodes, e.g, *Wuchereria bancrofti* .

- **3- Class Cestoda (Tapeworms) :**

- They are flattened and segmented worms e.g: *Taenia saginata* .



- **III- Arthropods :**
- These parasites having exoskeleton and jointed legs, divided into 2 classes:
- **1- Class Insecta** :e.g. Mosquitoes, lice and fleas .
- **2- Class Arachnida** :e.g. Ticks and mites .

Types of parasite

1- Ectoparasite: A parasite that lives on the surface of the host (**infestation**).

Ex : Lice) القمل

2- Endoparasite: A parasite that lives inside the body of its host (**infection**).

Entamoeba Histolytica

3- Obligatory parasite: A parasite that is completely dependent upon a host for its survival.

4- Facultative parasite: A parasite that is capable of living both freely and as a parasite

5- Opportunistic parasite: A parasite that causes disease **only in immunodeficient patients** (AIDS, cancer patients), while in **immunocompetent** individuals, the parasite may exist in a latent form producing no or mild symptoms.

6- Coprozoic or spurious parasite: An organism that passes through the human intestine without causing any disease and is detected in the stool after ingestion.

Types of hosts

- **1- Reservoir host (R.H):** The host which harbours the parasite and considered the source of human **infection**.
- **2- Definitive host (D.H):** It is the host which harbours the **mature adult stage** of the parasite or in which **sexual** reproduction of the parasite takes place. Ex : man in case of Taenia
- **3- Intermediate host (I.H):** It is the host which harbours **larval stage (immature or non-sexually reproducing forms of the parasites)**. Ex : Snail in case of Bilharzia. القوقع.
- **4 Accidental host:** The host which harbours the parasite which is not normally found .
- Ex : the Toxo cara (dog nematode) **الديدان الخيطية** in man .

❖ **The relationship between the organism and its host occurs in the following forms:-**

1- Commensalism: It is a relationship between two living organisms where one gets benefit (commensal), while the other (host) is not harmed. (Entamoeba coli)

2- Parasitism: It is a relationship between two living organisms where one gets benefit (parasite), while the other (host) is harmed.

3- Mutualism: It is a beneficial relationship between two living organisms where both derive a benefit and can successfully live apart.

4- Symbiosis: It is a close and long term beneficial relationship between two living organisms where both derive a benefit and cannot live apart.

❖ Modes of transmission of parasitic infection:-

- 1- **Direct contact** through the skin.
- 2- **Penetration of the skin.**
- 3- **Ingestion of contaminated food or drinking water** containing the infective stage of the parasite.
- 4- **Inhalation of dust** carrying the infective stage of parasite.
- 5- **Congenital** from mother to foetus (transplacental) or may be **transmammary** (mother`s milk).

6- Sexual contact.

7- Autoinfection (either external or internal).

8- Vectors, through bite or feces of infected vector or by swallowing the vector.

9- Blood transfusion or through contaminated syringes.

10- Organ transplantation.

- **Infective stage (I.S):** The stage by which the infection takes place.
- **Diagnostic stage (D.S):** The stage by which we can diagnose the parasitic infection (disease).

Pathogenesis of parasitic infection

❖ Occurs through the following:-

1) **Mechanical:** The parasite may obstruct normal passage like intestine or bile tract.

2) **Traumatic :-**

✓ **External** due to invasion of the skin.

✓ **Internal** by attachment to intestinal mucosa by buccal capsule producing ulcers.

3) **Toxin production:** Circulation of parasitic products (toxins and waste products).

4) **Tissue damage and necrosis:** Due to enzymes secreted by parasites.

5) Cellular destruction: As RBCs or RES damage.

6) Immune stimulation: Parasitic antigens produce humoral /or cellular immune response → cellular proliferation and infiltration → formation of fibrous encapsulation around parasites (ex: hepatic granuloma in *Schistosoma mansonia*).

7) Allergic reaction due to insect bites or parasitic toxins.

□ The pathogenesis of the parasite **depends on** the number, size and morphology of the parasite, its activity (movement and migration), site (habitat), specific toxin and host reaction.

Diagnosis of parasitic infection

I) Clinical diagnosis:-

Depends on the characteristic signs and symptoms related to the parasitic infection.

II) Laboratory diagnosis:-

❖ **Direct methods** (to detect the diagnostic stage):-

Microscopical examination of the tested samples (ex:

1- stool, 2- urine, 3- blood , 4- tissue biopsy, 5- sputum & 6- aspirates).

❖ Indirect methods (detecting antibodies and antigens in patient's serum):-

- Used when parasites are present in tissues or in cases of chronic infection.

e.g

- 1- Detection of antibodies or antigens in the patient's serum by serological test as indirect haemagglutination test (IHAT), complement fixation test (CFT), enzyme linked immunosorbent assay (ELISA) and indirect immunofluorescent antibody test (IFAT).
- 2- Molecular as PCR, Radiology....



Entamoeba histolytica
&
Entamoeba Coli

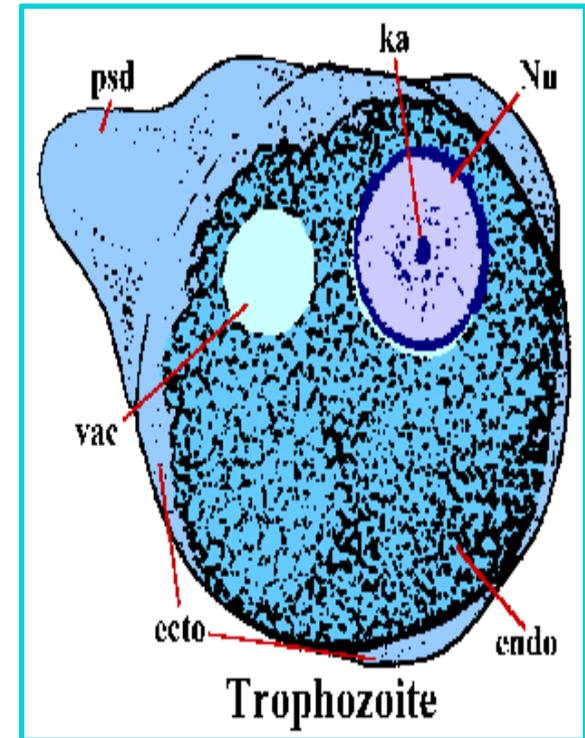
Entamoeba histolytica

- ❖ **Protozoa**
- ❖ **Geographical distribution: Worldwide, 50 million annually infected,**
- ❖ **R.H: Dogs, pigs, rats and monkeys.**
- ❖ **Disease: Amoebiasis or amoebic dysentery**
- ❖ **Exist as trophozoite (1 nucleus+_ RBCs) and cysts (4 nuclei)**

Morphological characters

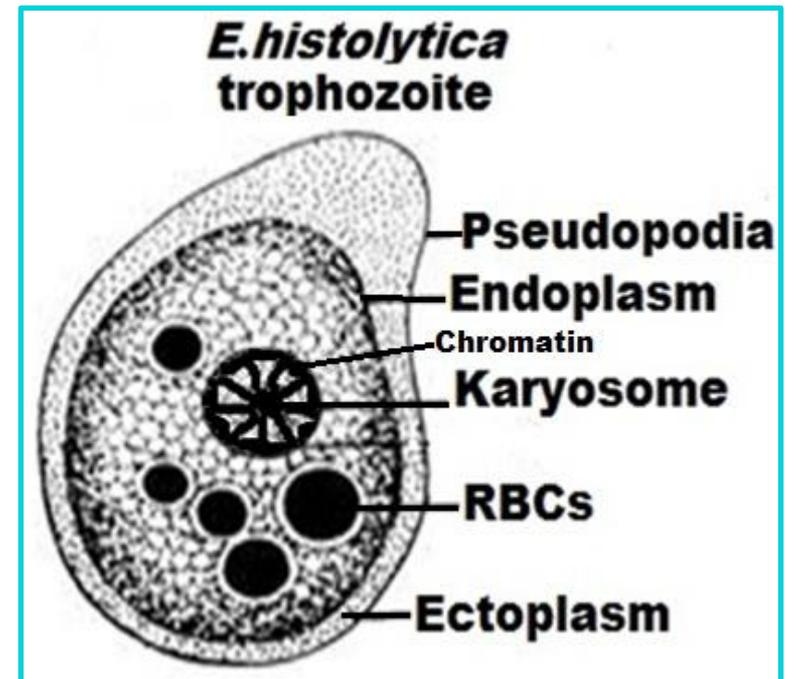
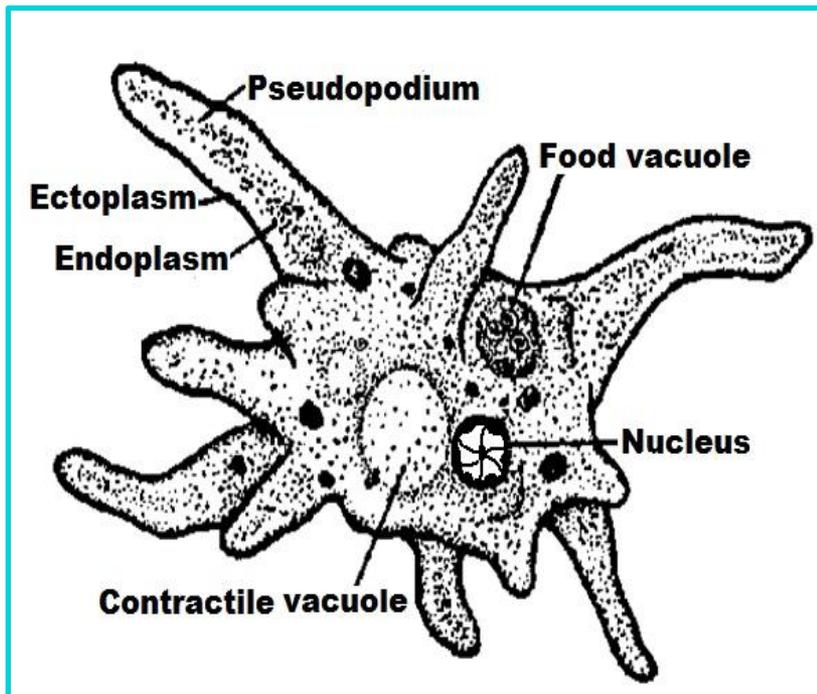
Trophozoite:

- ❖ **Nucleoplasm.**
- ❖ **Cytoplasm which consists of:**
 - **Outer thin hyaline ectoplasm.**
 - **Inner granular endoplasm.**



Morphological characters

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



- **E. histolytica**
- **Trophozoite:**
- 1- Large finger – like **pseudopodia**
- 2- Its size (12-30 μm), **Clear ectoplasm.**
- 3- The **endoplasm is granular and may contain RBCs.**
- 4- It has **one nucleus**, contain small central karyosome and fine chromatin granules arranged regularly beneath nuclear membrane.
- **Cyst:**
- 1- Small (10 – 20 μm) , spherical in shape, smaller than that of *E. coli*, containing **1-4 nuclei** is usually found in feces . Each nucleus contain similar nuclear morphology like the trophozoite.

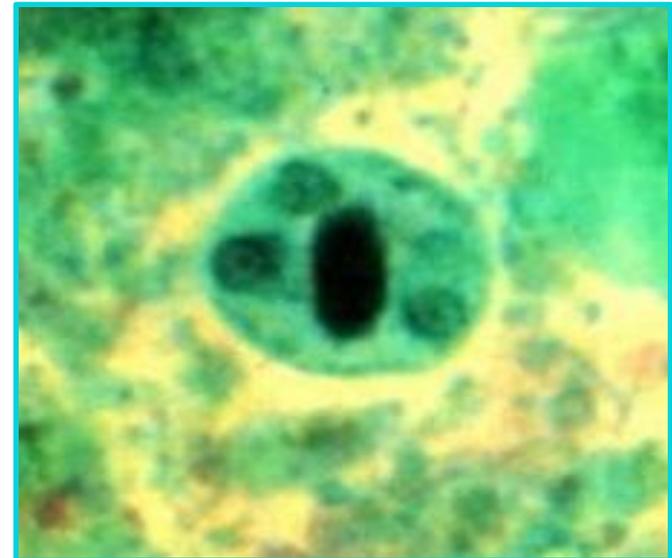
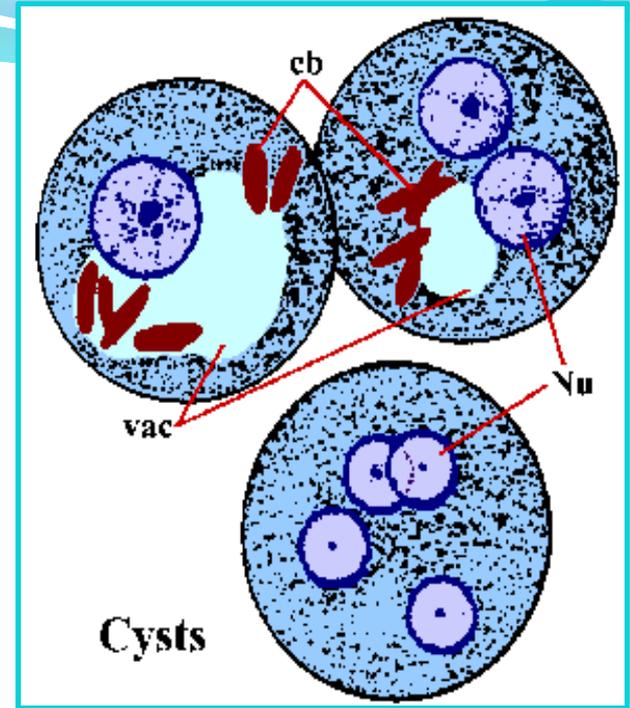
2- Cyst stage (Luminal form):

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

❖ Uninucleate cyst (one nucleus)

❖ Binucleate cyst (2 nucleus)

b) Mature cyst (Quadrinucleate cyst)

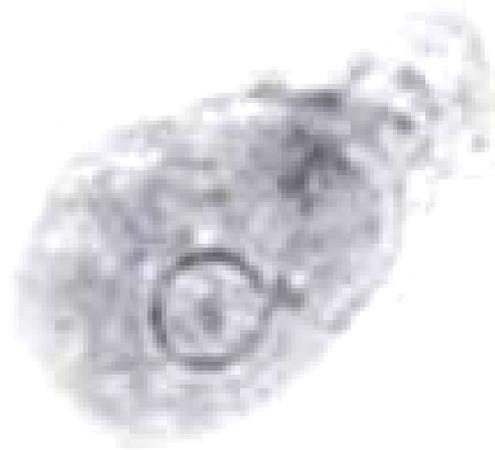
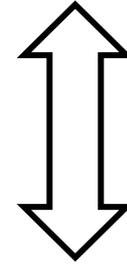


Life cycle of *E. histolytica*:

- Infection by *E. histolytica* occurs by ingestion of mature cysts in fecally contaminated food, water, or hands.
- Excystation occurs in the small intestine and trophozoites are released which migrate to the large intestine.
- The trophozoites multiply by binary fission and produce cysts , which are passed in the feces .

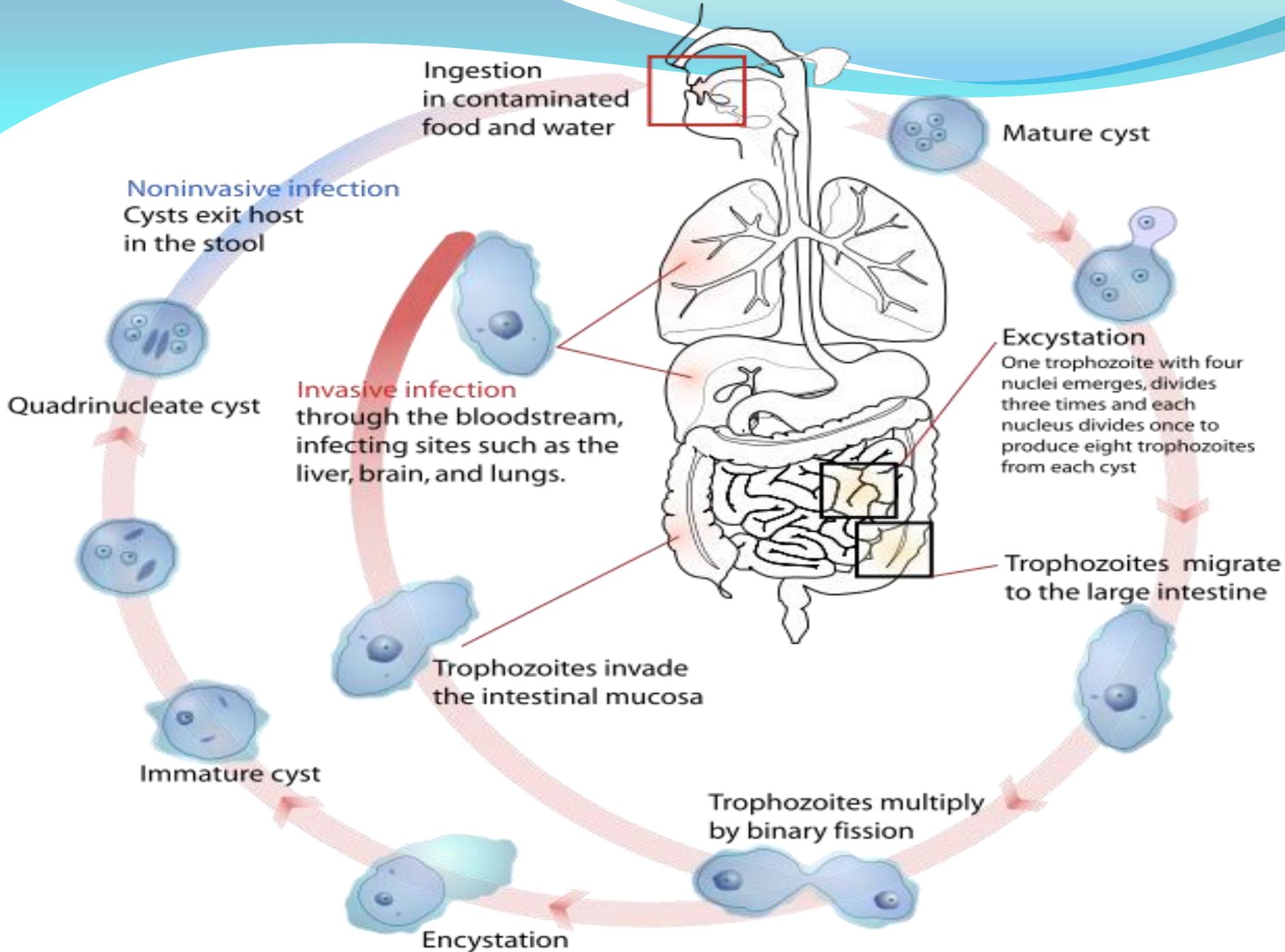


cyst



trophozoite

- Because of the protection conferred by their walls, the cysts can survive days to-weeks in the external environment and are responsible for transmission of infection.
- Trophozoites can also be passed in diarrheal stools, but are rapidly destroyed once outside the body, and if ingested rapidly destroyed by gastric juice.
- In many cases, the trophozoites remain in intestinal lumen as noninvasive infection of individuals who



Mode of infection

Fecal oral: e.g

- 1- Contaminated foods (ex. green vegetables) or drinks or hands with human stool containing mature cyst.
 - 2- Flies and cockroaches that carry the cysts from faeces to exposed food.
- The incidence of Amebiasis is common and high in tropical & subtropical areas especially in areas of lower socioeconomic status due to:
 - 1- poor sanitation(2) overcrowding & (3) malnutrition
 - Incubation period: 2-4 w

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 undermined edges containing cytolysed cells, mucus and trophozoites (may go to blood).



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.

→ **Fatal brain abscess**

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:** antigen detection

Diagnosis: other tools for complications

- Radiology: CT, XR, MRI, US
- Serology
- Sigmoidoscope and biopsy
- Culture

Treatment

1) Asymptomatic intestinal carrier

Luminal amoebicides

Paromomycin or
Diloxanide furoate

2) Intestinal amoebiasis

Tissue & luminal amoebicides

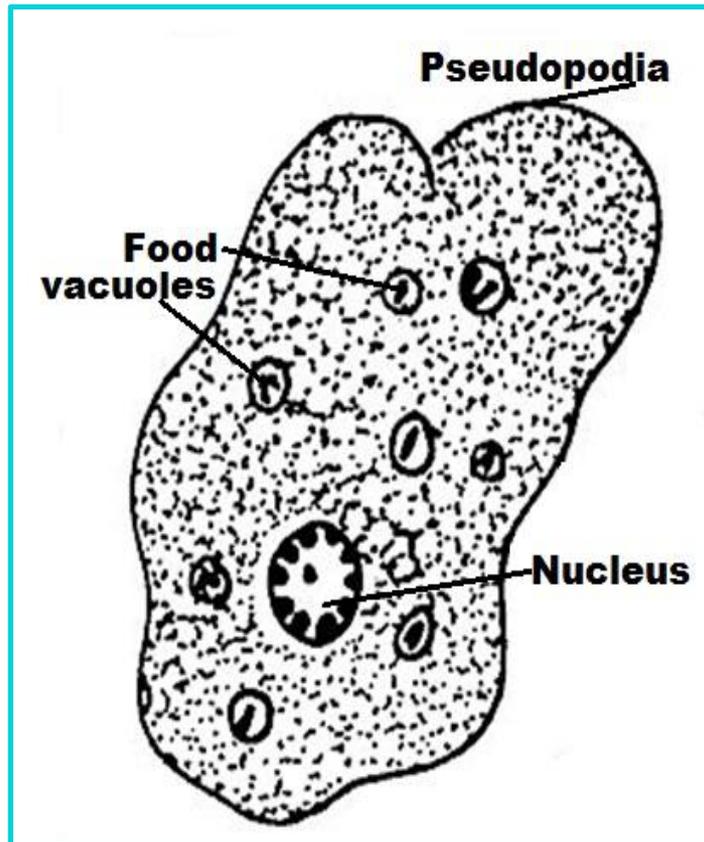
Metronidazol
(Flagyl) **is the drug of choice** +
Paromomycin or
Diloxanide furoate

3) Extra-intestinal amoebiasis

Tissue & luminal amoebicides

Metronidazol
(Flagyl) +
Paromomycin or
Diloxanide furoate

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- ***Entamoeba coli*** :
- It is a parasite of the large intestine and Its life cycle is similar to that of *E.histolytica*.
- It is of medical importance only because it may be mistaken for *E.histolytica*.
- It has two stages (trophozoite& cyst).
- The important morphological features are :



***E. Coli* trophozoite**



***E. Coli* cyst**

- **Trophozoite:**
- 1- Its size (10-35 μm), it has **granular endoplasm** containing ingested bacteria and debris (**no RBCs**) .
- 2. The **ectoplasm** is not clear and it has small pseudopodia.
- 3. It has one nucleus contain large eccentric karyosome, and large chromatin granules arranged irregularly beneath nuclear membrane.
- **The cyst** : is large oval in shape , 10 – 30 μm and it has **1 - 8 nuclei**, the characters just like that of trophozoite.

Entamoeba coli

Trophozoite

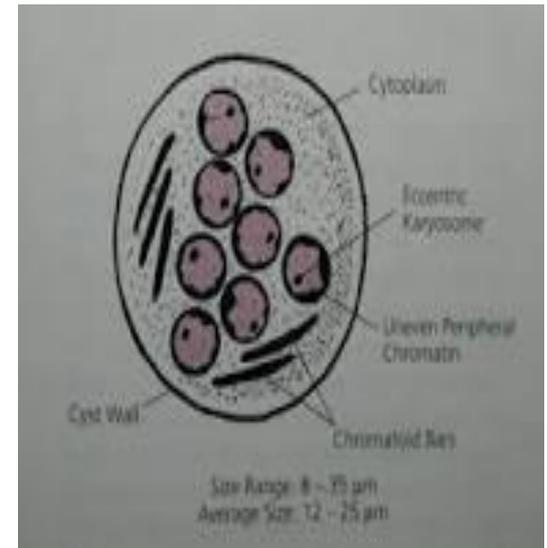


Cyst



10µm

Peter Darben





- The End