

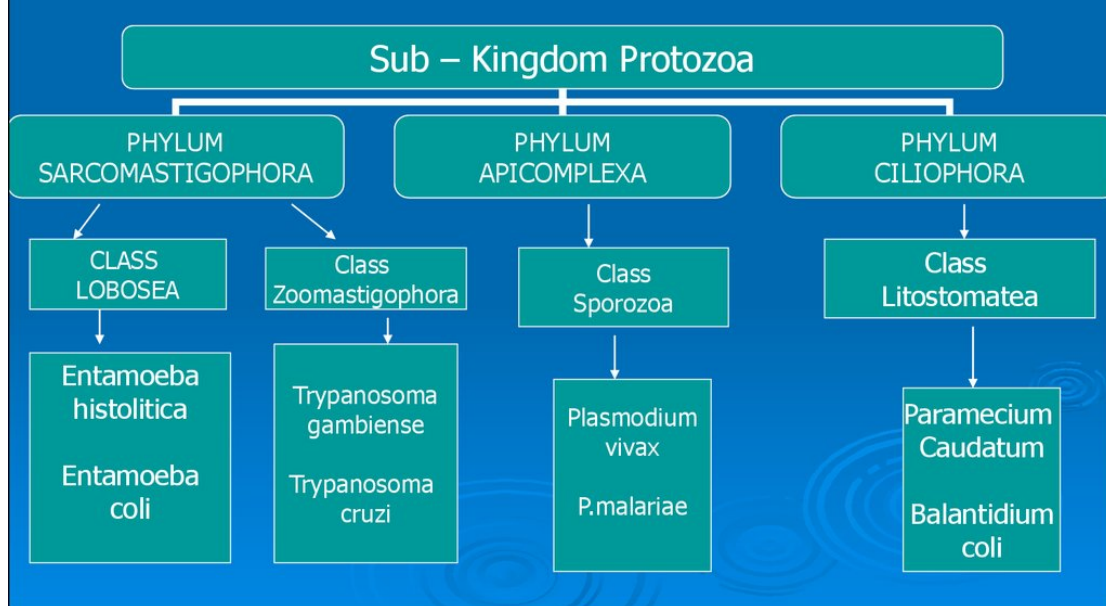
Protozoa

Protozoa are microscopic, single-celled eukaryotic microorganisms belonging to kingdom Protista, that can be free-living or parasitic in nature. Its cytoplasm is made up of ectoplasm and endoplasm. The nucleus is usually single but may be double or multiple. Reproduction can be asexual (binary fission, schizogony) or sexual (gametogony).

Protozoa that are infectious to humans can be classified into four groups:-

- 1- Sarcodina:** Utilize pseudopodia for movement. Includes amoebas such as *Entamoeba* and *Acanthamoeba*
- 2- Mastigophora:** Utilize flagella for movement, and include *Giardia*, *Trypanosoma*, *Leishmania* and Trichomoniasis
- 3- Apicomplexa:** Use an apical complex to move. Includes: *Plasmodium* and *Toxoplasma*
- 4- Ciliophora:** These move with cilia and include *Balantidium*, a large ciliated protozoan.

PROTOZOA TAXONOMY



Phylum: Sarcomastigophora

Subphylum: Sarcodina

Class: Lobosea (Amoeba)

Entamoeba histolytica

It is cosmopolitan in distribution but more prevalent in areas of overcrowding and poor sanitation. It is found in the human colon, **pathogenic parasite** cause disease called amoebic dysentery or amoebic liver abscess.

Morphology

Entamoeba histolytica occurs in 3 forms:-

1. Trophozoite
2. Precyst
3. Cyst

1- Trophozoite stage: is the vegetative form of the parasite and the only form present in tissues. It is irregular in shape and varies in size from 12 to 60 μm ; average being 20 μm . It has a cytoplasm which consists of

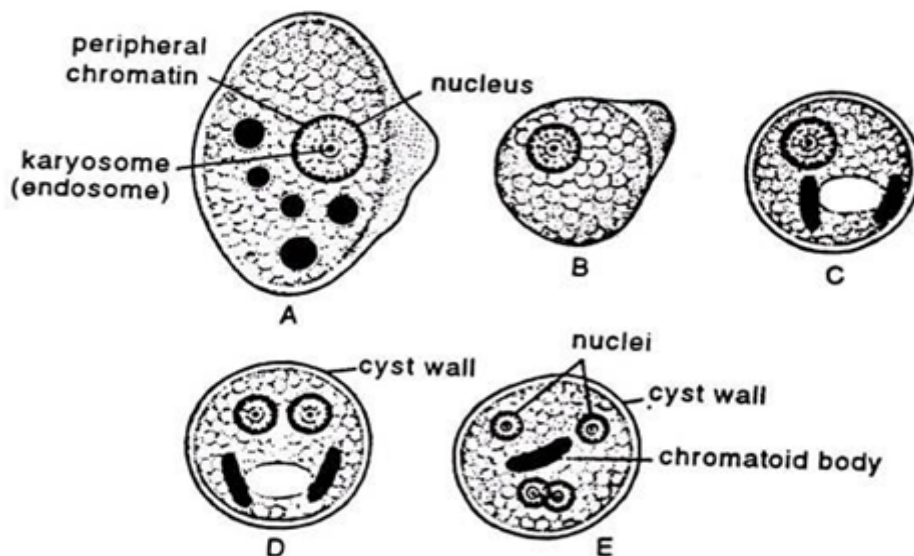
ectoplasm and endoplasm. Ectoplasm is clear and transparent. Endoplasm is finely granular and contains nucleus, food vacuoles and phagocytosed erythrocytes. Pseudopodia are finger-like projections formed by movements of ectoplasm in one direction. Its nucleus is spherical and contains **central karyosome**. The nuclear membrane is lined by a rim of evenly distributed chromatin granules. It reproduces by binary fission.

2- Precyst stage: It is round or oval shape and smaller than trophozoite stage, has a single nucleus and lacks a cyst wall and food vacuoles, it contains a large glycogen vacuole and chromatoid bars. It secretes a cyst wall to become cyst.

3- Cyst stage: The cyst is spherical in shape. Immature cyst contains a single nucleus, a glycogen vacuole and chromatoid bars which are **cigar shaped with rounded ends**. Mature cyst contains **4 nuclei**. It measures 10–20 μm in size. The glycogen vacuole and chromatoid bars disappear in mature cyst. The cyst wall is highly resistant to gastric juice.

Life Cycle:

(1) The cysts (usually found in formed stools) and trophozoites (in loose stools) are passed out in faeces of infected human. (2) Cysts are ingested via contaminated food or water. (3) In the intestine, the cysts undergo excystation and form trophozoites(4). (5) As the trophozoite passes down the intestine, it undergoes encystation and is excreted in the faeces.



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

Pathogenesis and Clinical Features

Entamoeba histolytica causes intestinal and extraintestinal amoebiasis.

The lumen-dwelling amoebae do not cause any illness. They cause disease only when trophozoites invade the intestinal tissues. The trophozoite penetrates the epithelial cells in the colon, aided by its movement and tissue lytic enzyme, which damages the mucosal epithelium. Mucosal penetration produces discrete ulcers with pinhead center and raised edges. The ulcers are multiple and are confined to the colon. The amoebic ulcer is flask shaped in cross-section. Multiple ulcers may fuse to form large necrotic lesions with ragged edges.

Clinical manifestations are diarrhoea, dysentery, abdominal pain and tenderness. Stool contains blood, mucus, fragments of necrotic tissue. Liver involvement is the most common extraintestinal complication of intestinal amoebiasis.

Diagnosis

(a) Microscopic examination: Demonstration of cysts or trophozoites in stool sample.

(b) Sigmoidoscopy for mucosal scrapings: Direct wet mount and iron haematoxylin staining to demonstrate trophozoites.

(c) Stool culture: Stool culture is a sensitive method in diagnosing chronic intestinal amoebiasis.

Treatment

metronidazole and tinidazole are both luminal and tissue amoebicides, neither of them reach adequate levels in the gut lumen.

Entamoeba coli

It is **non-pathogenic parasite** lives in the large intestine. It resembles *E. histolytica* but differs in :-

- 1- Average size of trophozoite is larger.
- 2- More granular endoplasm containing ingested bacteria **but no red cells**.
- 3- Narrower and less differentiated ectoplasm.

- 4- Broader and blunter pseudopodia.
- 5- Peripheral chromatin granules of the nucleus are more coarse and irregular.
- 6- Karyosome is large and **eccentric**.
- 7- Cysts are larger with slender splinter – like chromatoid bodies, glycogen vacuole and **8 nuclei** similar to those of the trophozoite stage.

***Acanthamoeba* Species (Pathogenic Free-Living Amoebae)**

Granulomatous Amoebic Encephalitis(GAE)

It is an opportunistic pathogen found worldwide in the environment, water and soil. In human, it is found in the CNS and eye.

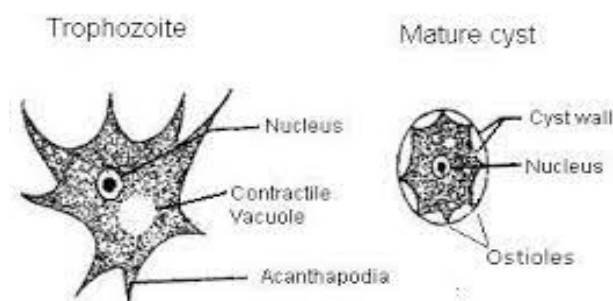
Morphology

It occurs in 2 forms:

1. Trophozoite
2. Cyst

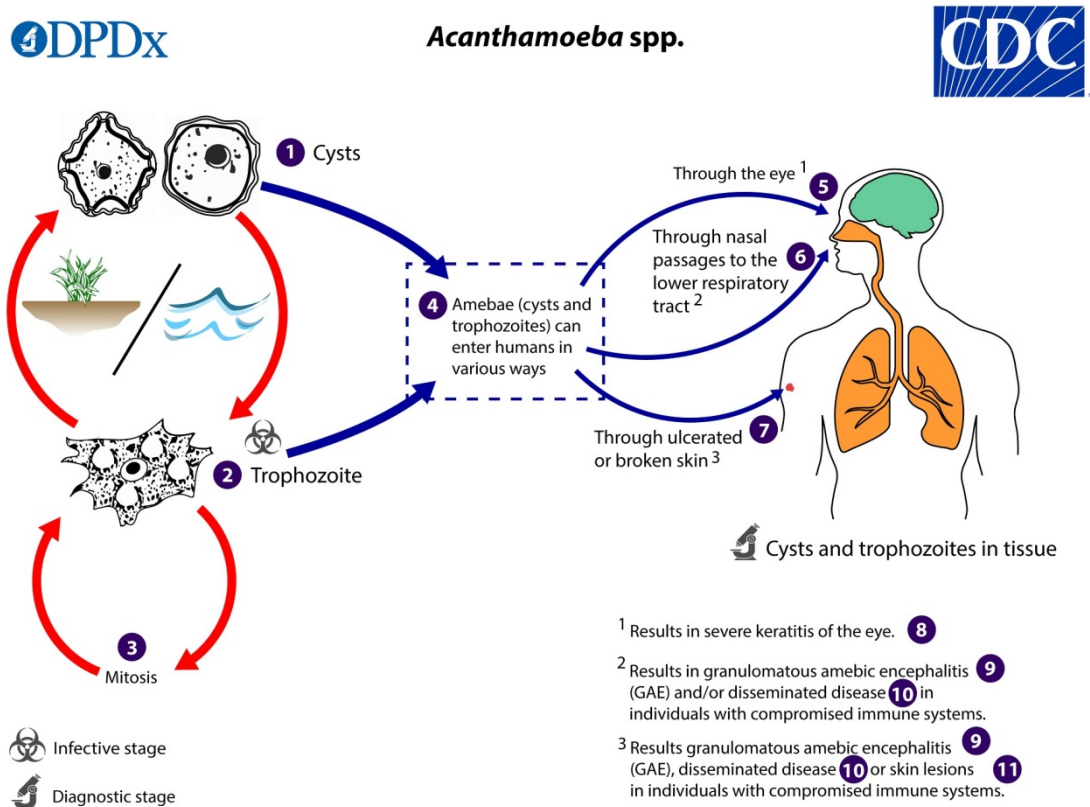
1- Trophozoite stage: measures 20–50 μm in size and is characterized by spine-like pseudopodia (acanthopodia), and single nucleus with a large dense central karyosome surrounded by a halo.

2- Cyst stage: The cyst has a double walled and single nucleus. It measures 10–20 μm , characterized by its irregular outline and wrinkled surface. This stage is highly resistant, found in brain tissue.



Life Cycle

(1) Cyst. (2) Trophozoite showing spinous acanthopodia. (3) The trophozoite replicates by mitosis. (4) The cyst and trophozoite enter humans (5) through the eye, (6) through nasal passages and (7) through ulcerated or broken skin. Both trophozoites and cysts are infective. Humans acquire infection by inhalation of cyst or trophozoite, or via broken skin or eyes. Upon reaching the lungs after inhalation, the trophozoites enter the blood circulation and invade the CNS, producing granulomatous amoebic encephalitis (GAE).



Pathogenesis and Clinical Features

1. Granulomatous amoebic encephalitis (GAE)

GAE usually occurs in patients who are immunodeficient. The parasite spreads haematogenously to the CNS. Invasion of the connective tissue and induction of proinflammatory responses lead to neuronal damage that can be fatal within days. Clinical features are that lesions with seizures, paresis and mental deterioration.

2. *Acanthamoeba keratitis*

An infection of the eye that occurs in healthy persons and develops from the entry of the amoebic cyst through abrasions on the cornea. Most cases have been associated with the use of contact lenses. The clinical features resemble that of severe herpetic keratitis. The eye is severely painful in amoebic infection. Keratitis can result in permanent visual impairment or blindness.

Diagnosis

1. Diagnosis of GAE

Demonstration of trophozoites and cysts in brain biopsy, CSF examination can reveal motile trophozoite forms.

2. Diagnosis of amoebic keratitis

Demonstration of the cyst in corneal scrapings by wet mount, histology or culture.

Treatment

No effective treatment is available for GAE. In *Acanthamoeba keratitis*, therapy involves topical application of biguanide or chlorhexidine. When vision is threatened. Multidrug combinations which include sulfadiazine, rifampicin and fluconazole are being used with limited success.