

## GENERAL PARASITOLOGY

**Parasitology** is the study of parasites, their hosts, and the relationship between them.

A **parasite** is a living organism, which takes its nourishment and other needs from a host; the **host** is an organism which supports the parasite. The parasites included in medical parasitology are protozoa, helminthes, and some arthropods. The hosts vary depending on whether they harbor the various stages in parasitic development.

### DIFFERENT KINDS OF PARASITES

1. **Ectoparasite** – a parasitic organism that lives on the outer surface of its host, e.g. lice, ticks, mites etc.
2. **Endoparasites** – parasites that live inside the body of their host, e.g. *Entamoeba histolytica*.
3. **Obligate Parasite** - This parasite is completely dependent on the host during a segment or all of its life cycle, e.g. Plasmodium spp.
4. **Facultative parasite** – an organism that exhibits both parasitic and non-parasitic modes of living and hence does not absolutely depend on the parasitic way of life, but is capable of adapting to it if placed on a host. E.g. *Naegleria fowleri*
5. **Accidental parasite** – when a parasite attacks an unnatural host and survives. E.g. *Hymenolepis diminuta* (rat tapeworm).
6. **Erratic parasite** - is one that wanders in to an organ in which it is not usually found. E.g. *Entamoeba histolytica* in the liver or lung of humans.

Most of the parasites which live in/on the body of the host do not cause disease (non-pathogenic parasites). In Medical parasitology we will focus on most of the disease causing (pathogenic) parasites.

### DIFFERENT KINDS OF HOSTS

1. **Definitive host** – a host that harbors a parasite in the adult stage or where the parasite undergoes a sexual method of reproduction.
2. **Intermediate host** - harbors the larval stages of the parasite or an asexual cycle of development takes place. In some cases, larval development is completed in two different intermediate hosts, referred to as first and second intermediate hosts.

3. **Paratenic host** – a host that serves as a temporary refuge and vehicle for reaching an obligatory host, usually the definitive host, i.e. it is not necessary for the completion of the parasites life cycle.
4. **Reservoir host** – a host that makes the parasite available for the transmission to another host and is usually not affected by the infection.
5. **Natural host** – a host that is naturally infected with certain species of parasite.
6. **Accidental host** – a host that is under normal circumstances not infected with the parasite.

**Parasitism** - an association where one of the partners is harmed and the other lives at the expense of the other. E.g. Worms like *Ascaris lumbricoides* reside in the gastrointestinal tract of man, and feed on important items of intestinal food causing various illnesses.

## **Amebiasis**

Amoebiasis is an infection caused by *Entamoeba histolytica* with or without symptoms (WHO 1969). Synonyms include entamoebiasis, amoebiosis, amoebic dysentery or bloody flux. *Entamoeba dispar* is a harmless commensal, which is indistinguishable from *E. histolytica*. The other members of the group infecting humans are *E. moshkovskii*, *E. hartmannii*, *E. gingivalis*, *Endolimax nana* and *Iodamoeba butschlii*.

### **Epidemiology**

Amoebiasis occurs worldwide, but is mostly seen in tropical and developing countries, which have bad sanitary and hygienic practices. Ten percent of world's population is estimated to be infected by the parasite (4% in USA) with an estimated annual mortality of 40,000–70,000. However, 90% of those infected are asymptomatic, 1% may develop invasive/extraintestinal amoebiasis.

Spread is mostly through fecal-oral route, by ingestion of cysts and also through contaminated vegetables fertilized by feces and foods and water handled by unclean hands. Fomites and flies also have a role in the transmission. Autoinfection through improper cleaning of hands is also reported.

## Taxonomy

Kingdom	Protista
Subkingdom	Protozoa
Phylum	Sarcomastigophora
Subphylum	Sarcodina
Class	Lobosea
Order	Amoebida
Family	Endamoebidae
Genus	<i>Entamoeba</i>
Species	<i>histolytica</i>

Trophozoite moves with the help of pseudopodia, formed by the flow of ectoplasm followed by the endoplasm, changing its shape. It has a single nucleus, food/contractile vacuole, an excretory vacuole called uroid and rudimentary mitochondria. It is also found to move at a surprising speed of 5 mm/sec.

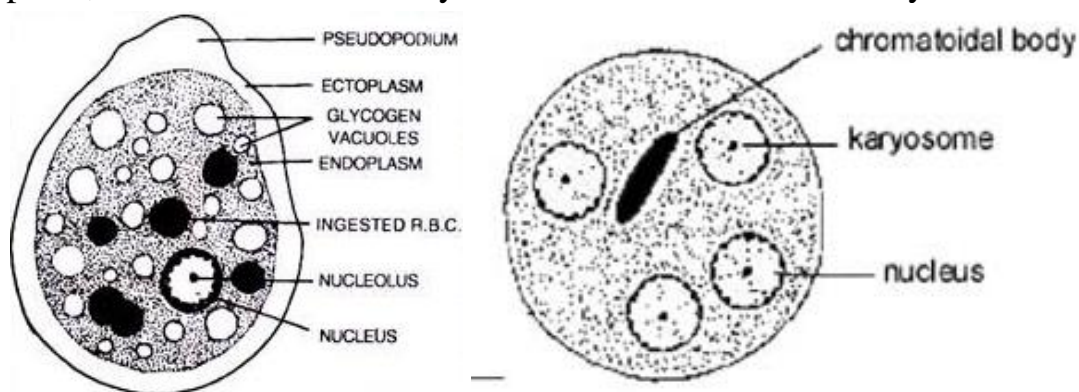
## Morphological features

### (a) Trophozoites

Viable trophozoites vary in size from about 10-60µm in diameter. Motility is rapid, progressive, and unidirectional, through pseudopods. The nucleus is characterized by evenly arranged chromatin on the nuclear membrane and the presence of a small, compact, centrally located karyosome. The cytoplasm is usually described as finely granular with few ingested bacteria or debris in vacuoles. In the case of dysentery, however, RBCs may be visible in the cytoplasm, and this feature is diagnostic for *E.histolytica*.

### (b) Cyst

Cysts range in size from 10-20µm. The immature cyst has inclusions namely; glycogen mass and chromatoidal bars. As the cyst matures, the glycogen completely disappears; the chromatoidals may also be absent in the mature cyst.



## Life cycle

Intestinal infections occur through the ingestion of a mature quadrinucleate infective cyst, contaminated food or drink and also by hand to mouth contact. It is then passed unaltered through the stomach, as the cyst wall is resistant to gastric juice.

In terminal ileum (with alkaline pH), excystation takes place.

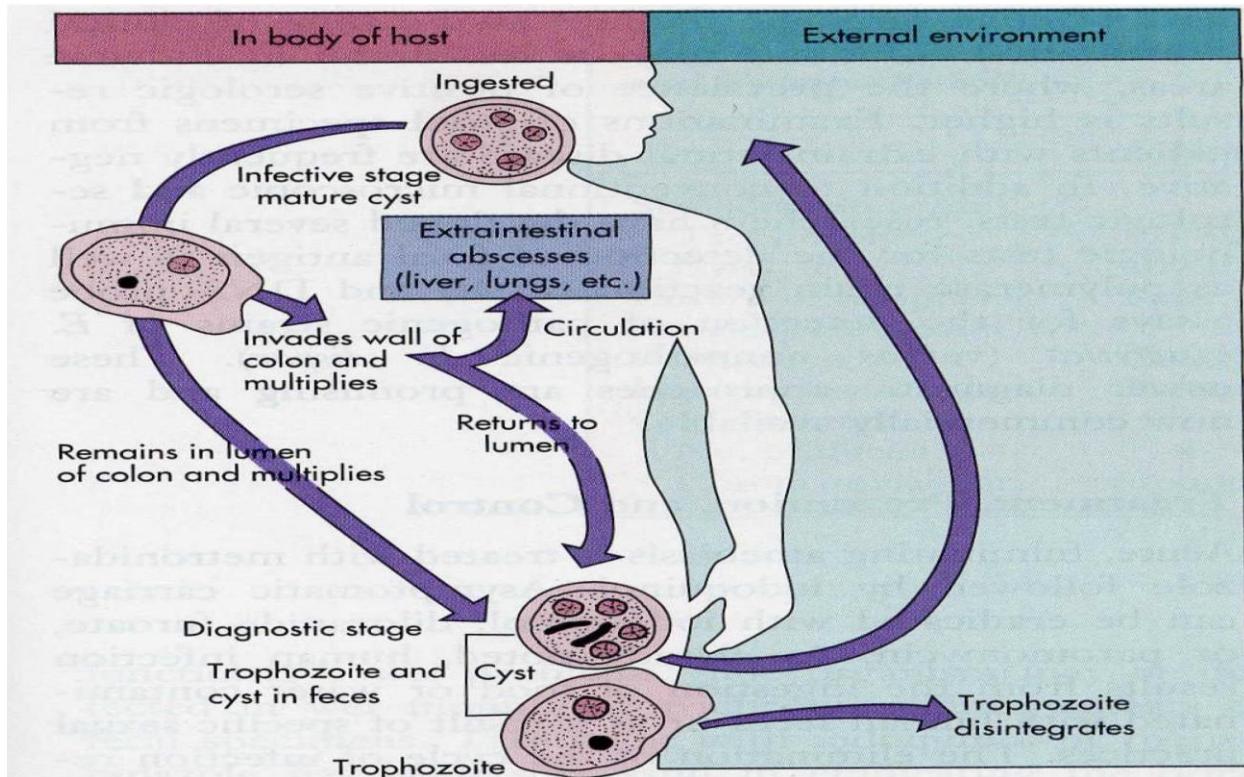
Trophozoites being actively motile invade the tissues and ultimately lodge in the submucous layer of the large bowel. Here they grow and multiply by binary fission. Trophozoites are responsible for producing lesions in amoebiasis. Invasion of blood vessels leads to secondary extra intestinal lesions.

Gradually the effect of the parasite on the host is toned down together with concomitant increase in host tolerance, making it difficult for the parasite to continue its life cycle in the trophozoite phase.

A certain number of trophozoites come from tissues into lumen of bowel and are first transformed into pre-cyst forms.

Pre-cysts secrete a cyst wall and become a uninucleate cyst. Eventually, mature quadrinucleate cysts form. These are the infective forms.

Both mature and immature cysts may be passed in faeces. Immature cysts can mature in external environments and become infective.



## Pathogenesis

Trophozoites divide and produce extensive local necrosis in the large intestine. Invasion into the deeper mucosa with extension into the peritoneal cavity may occur. This can lead to secondary involvement of other organs, primarily the liver but also the lungs, brain, and heart. Extraintestinal amebiasis is associated with trophozoites. Amoebas multiply rapidly in an anaerobic environment, because the trophozoites are killed by ambient oxygen concentration.

## Clinical features

The outcome of infection may result in a carrier state, intestinal amebiasis, or extraintestinal amebiasis. Diarrhoea, flatulence, and cramping are complaints of symptomatic patients. More severe disease is characterised by the passing of numerous bloody stools in a day. Systemic signs of infection (fever, leukocytosis, rigors) are present in patients with extraintestinal amebiasis. The liver is primarily involved, because trophozoites in the blood are removed from the blood by the portal veins. The right lobe is most commonly involved, thus pain over the liver with hepatomegaly and elevation of the diaphragm is observed.

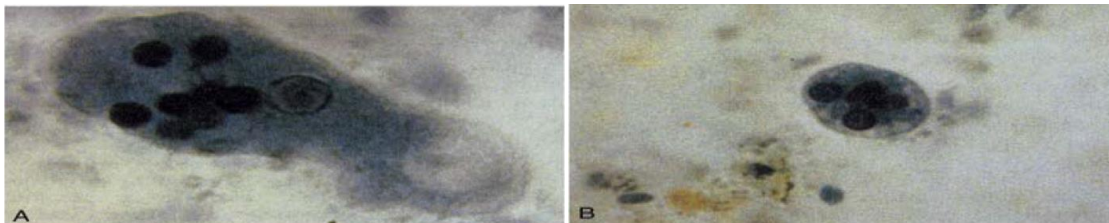
## Laboratory diagnosis

### In intestinal amoebiasis:

- Examination of a fresh dysenteric faecal specimen or rectal scraping for trophozoite stage. (Motile amoebae containing red cells are diagnostic of amoebic dysentery).
- Examination of formed or semiformed faeces for cyst stage. (Cysts indicate infection with either a pathogenic *E.histolytica* or non-pathogenic *E.dispar*.)

### Extraintestinal amoebiasis

- Diagnosed by the use of scanning procedures for liver and other organs.
- Specific serologic tests, together with microscopic examination of the abscess material, can confirm the diagnosis.



*Entamoeba histolytica* (A) Trophozoite (B) Cyst

## **Treatment**

Introduction of nitroimidazole derivatives has revolutionized the treatment of amoebiasis. Usage of cardiotoxic emetine and the relatively less toxic dehydroemetine are now of historical interest.

Though metronidazole and other derivatives are highly toxic to the vegetative forms and to a lesser extent the cysts, a course of luminal amoebicides is recommended for complete cure.

## **Prevention**

- Public education about personal hygiene, especially the sanitary disposal of feces.
- Education of food handlers about proper food and equipment handling and hygiene.
- Advice infected individuals to avoid food preparation.
- Educate about risk of sexual practices that permit fecal-oral contact.
- Test private water supplies for the presence of parasitic contamination.
- Advice infected individuals against using public swimming pools.

Contaminated water can be a source of transmission of enteric pathogens.