

**LECTURE NO. 5**

**Course Name: PARASITOLOGY**

**Course Code: 0520442**

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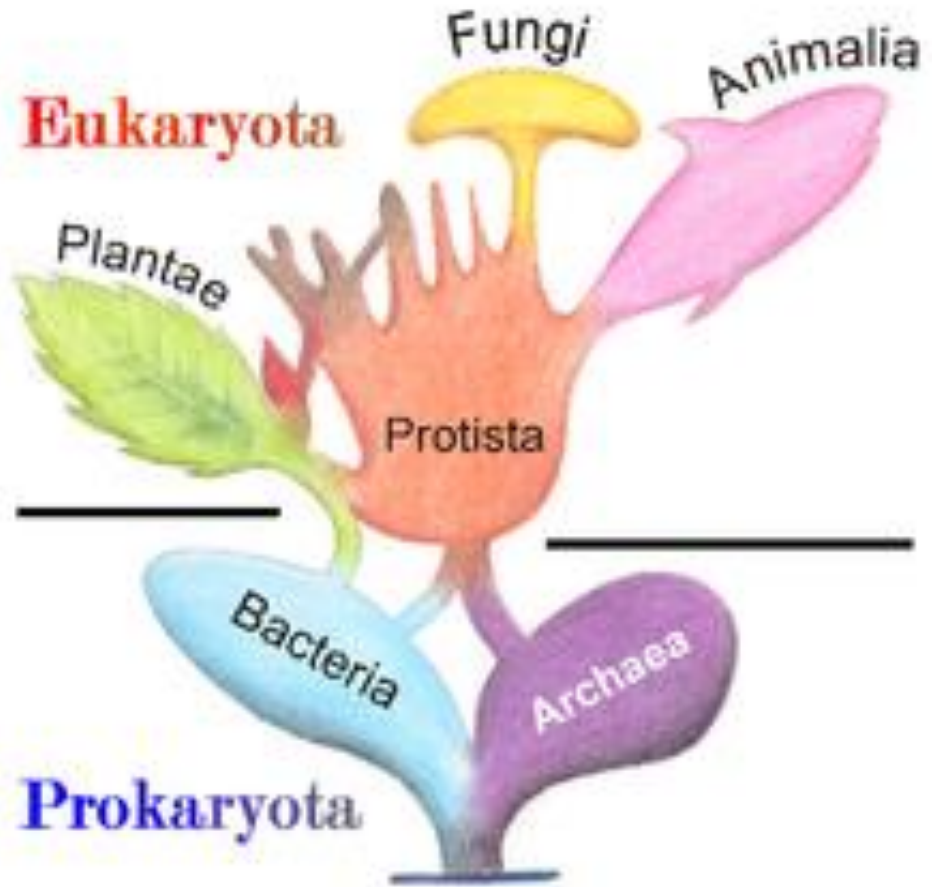
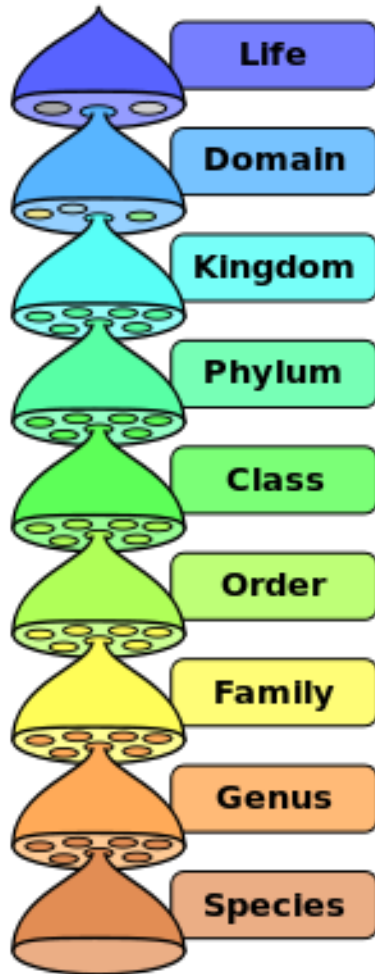
**Faculty Of Pharmacy,**

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# **AMOEBAE**

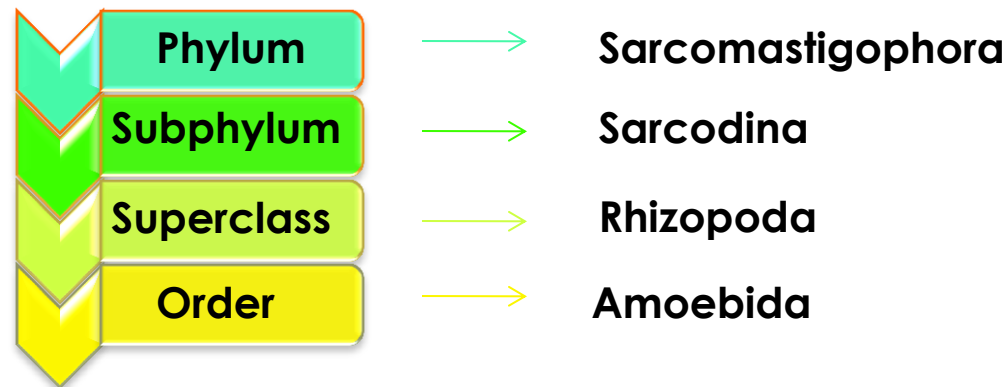
## ***Part 1***

# Kingdoms of life



# Introduction

- Amoebae are **structurally** simple protozoans which have no fixed shape.
- They are classified under:



- The **cytoplasm** of amoeba is bounded by a membrane and can be differentiated into an outer ectoplasm and inner endoplasm.

# Introduction (continued)

- Pseudopodia are formed by the amoeba by thrusting out ectoplasm, followed by endoplasm. These are employed for locomotion and engulfment of food by phagocytosis.
- Reproduction occurs by fission and budding.
- **Cyst** is formed in unfavorable conditions and is usually the infective form for vertebrate host (e.g. *Entamoeba histolytica*).

# Introduction (continued)

- Amoebae are classified as either free-living or intestinal amoebae (Table 3.1).
- Few of the free-living amoebae occasionally act as human pathogens producing meningoencephalitis and other infections, e.g. *Naegleria* and *Acanthamoeba*.
- The parasitic amoebae inhabit the alimentary canal.

## Table 3.1: Classification of Amoebae

Intestinal amoebae	Free-living amoebae
<i>Entamoeba histolytica</i> <i>Entamoeba dispar</i> <i>Entamoeba coli</i> <i>Entamoeba polecki</i> <i>Entamoeba hartmanni</i> <i>Entamoeba gingivalis</i> <i>Endolimax nana</i> <i>Iodamoeba butschlii</i>	<i>Naegleria fowleri</i> <i>Acanthamoeba</i> spp. <i>Balamuthia mandrillaris</i>
<b>Note:</b> All intestinal amoebae are nonpathogenic, except <i>Entamoeba histolytica</i>	<b>Note:</b> All free-living amoebae are opportunistic pathogens

# Entamoeba Histolytica

# Epidemiology- prevalence

- *E. histolytica* is worldwide in prevalence, being much more common in the tropics than elsewhere.
- It has been found wherever sanitation is poor, in all climatic zones from Alaska ( $61^{\circ}\text{N}$ ) to straits of Magellan ( $52^{\circ}\text{S}$ ).
- It has been reported that about 10% of world population and 50% of the inhabitants of developing countries may be infected with the parasite.

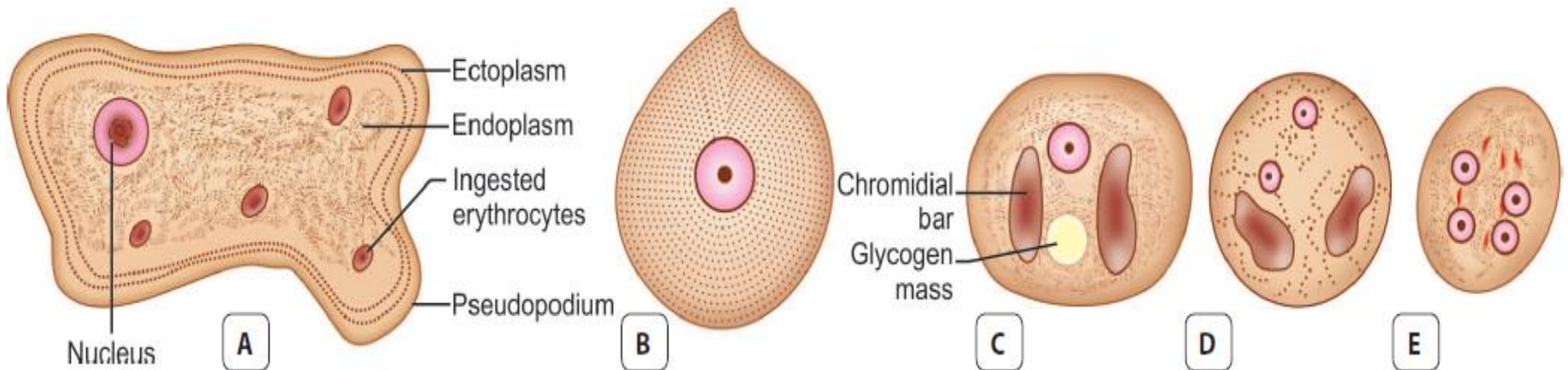
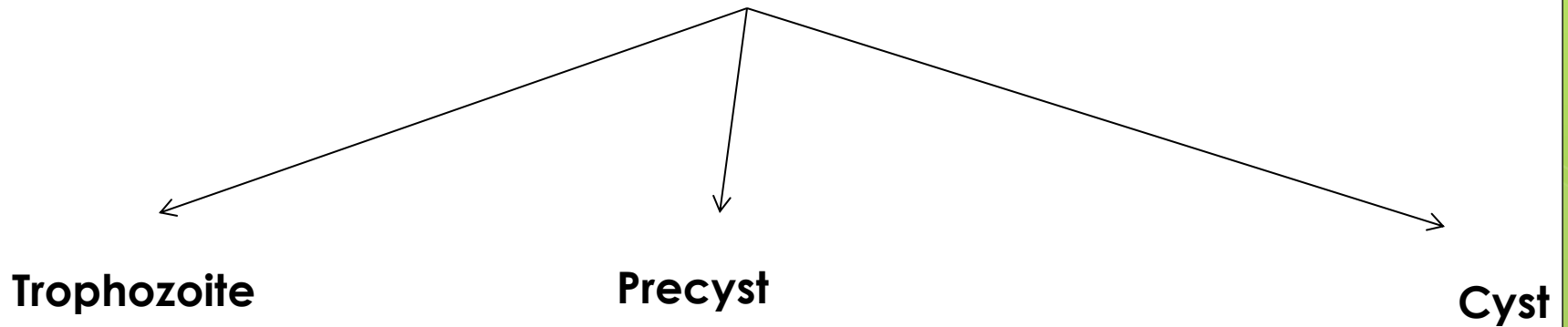


## **Epidemiology- prevalence (continued)**

- The infection is not uncommon even in affluent countries, about 1% of Americans being reported to be infected.**
- While the majority of infected humans (80–99%) are asymptomatic, invasive amoebiasis causes disabling illness in an estimated 50 million of people and causes 50,000 deaths annually, mostly in the tropical belt of Asia, Africa, and Latin America.**
- It is the third leading parasitic cause of mortality, after malaria and schistosomiasis.**

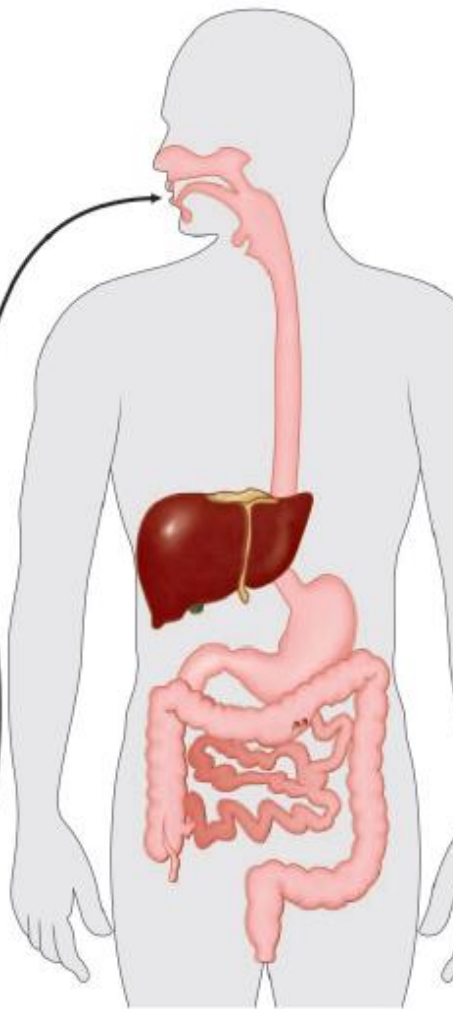
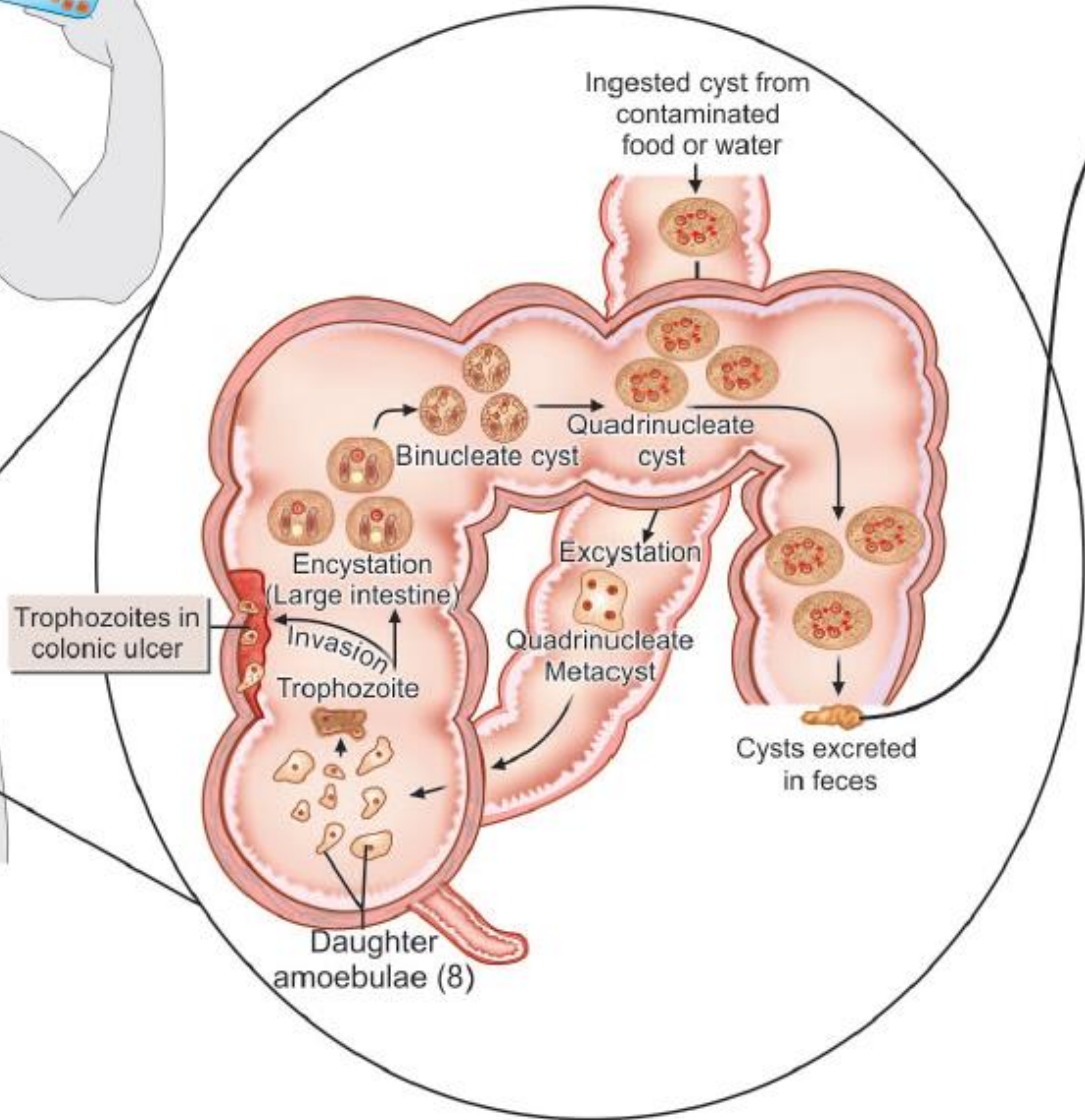
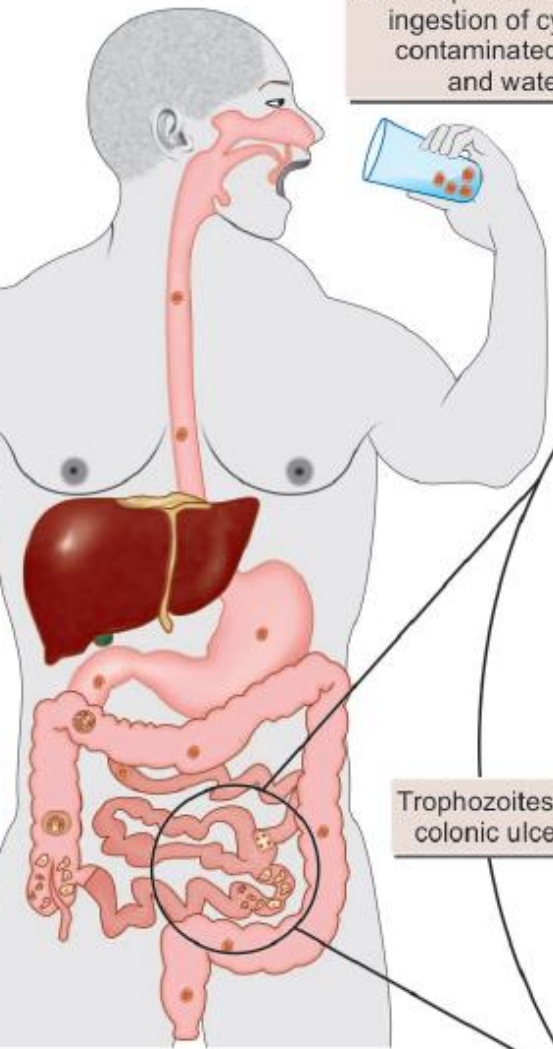
# Morphology

*E. histolytica* occurs in 3 forms (Fig. 3.1).



**Fig. 3.1:** *Entamoeba histolytica*. A. Trophozoite; B. Precystic stage; C. Uninucleate cyst; D. Binucleate cyst; E. Mature quadrinucleate cyst

Man acquires infection by ingestion of cysts in contaminated food and water



**LIFE CYCLE OF ENTAMOEBA HISTOLYTICA**

# Trophozoite

- Trophozoite is the vegetative or growing stage of the parasite (Fig. 3.1A). It is the only form present in tissues.
- The trophozoites from acute dysenteric stools often contain phagocytosed erythrocytes. This feature is diagnostic as phagocytosed red cells are not found in any other commensal intestinal amoebae.
- The trophozoites divide by binary fission in every 8 hours.
- Trophozoites survive upto 5 hours at 37°C and are killed by drying, heat, and chemical sterilization. Therefore, the infection is not transmitted by trophozoites. Even if live trophozoites from freshy-passed stools are ingested, they are rapidly destroyed in stomach and cannot initiate infection present in tissues.

# *Precystic Stage*

- Trophozoites undergo encystment in the intestinal lumen.
- Encystment does not occur in the tissues nor in feces outside the body.
- It then secretes a highly retractile cyst wall around it and becomes cyst.

# *Cystic Stage*

- **The cyst wall is a highly refractile membrane, which makes it highly resistant to gastric juice and unfavorable environmental conditions.**

# Life cycle

- *E. histolytica* passes its life cycle only in 1 host-man (Flowchart 3.1 and Fig. 3.2).
- Infective form: Mature quadrinucleate cyst passed in feces of convalescents and carriers. The cysts can remain viable under moist conditions for about 10 days.
- Mode of transmission: Man acquires infection by swallowing food and water contaminated with cysts.
- As the cyst wall is resistant to action of gastric juice, the cysts pass through the stomach undamaged and enter the small intestine.

# Life cycle (continued)

- Excystation: When the cyst reaches caecum or lower part of the ileum, due to the alkaline medium, the cyst wall is damaged by trypsin, leading to excystation.
- The cytoplasm gets detached from the cyst wall and amoeboid movements appear causing a tear in the cyst wall, through which quadrinucleate amoeba is liberated. This stage is called the metacyst (Fig. 3.2).



# Life cycle (continued)

- Metacystic trophozoites: The nuclei in the metacyst immediately undergo division to form 8 nuclei, each of which gets surrounded by its own cytoplasm to become 8 small amoebulae or metacystic trophozoites.
- If excystation takes place in the small intestine, the metacystic trophozoites do not colonize there, but are carried to the caecum.

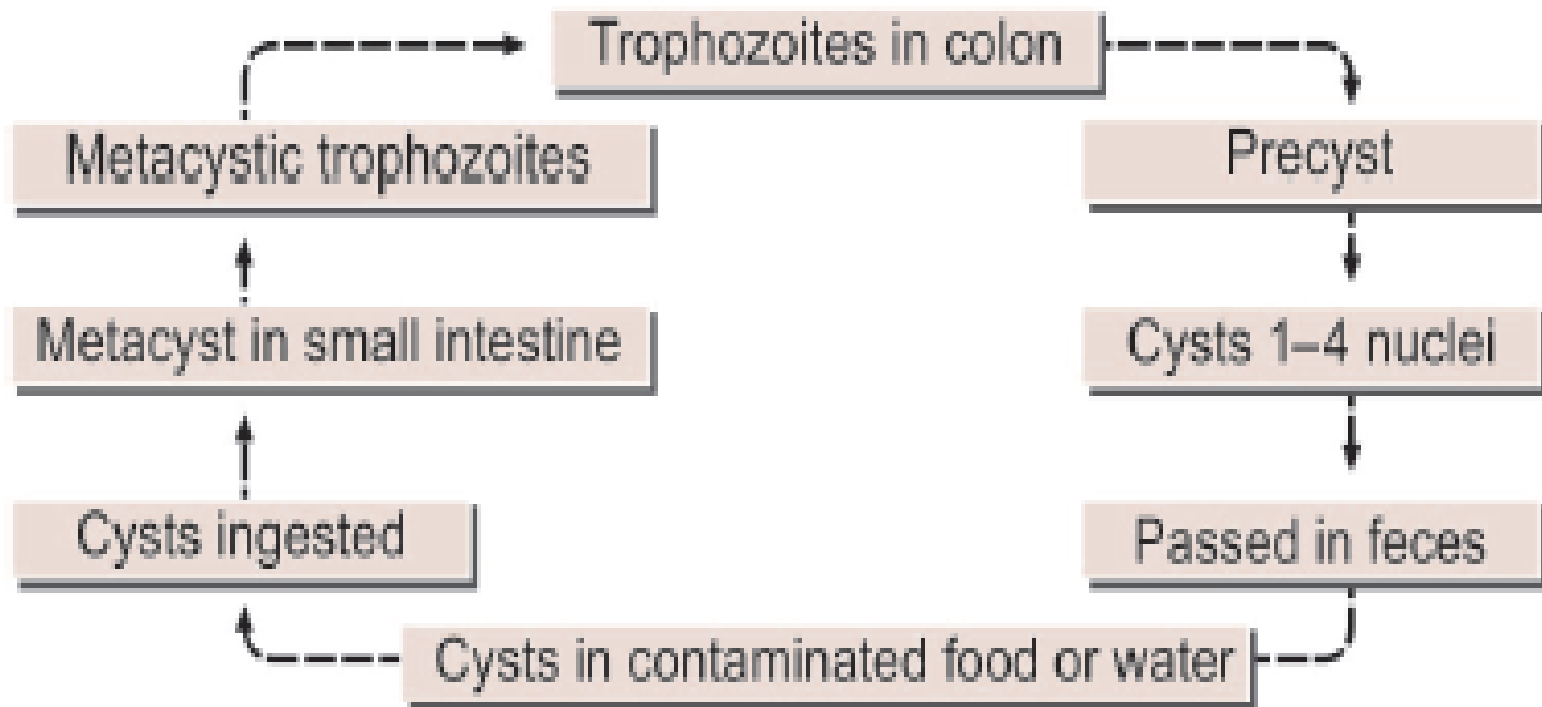
# Life cycle (continued)

- The optimal habitat for the metacystic trophozoite is the submucosal tissue of caecum and colon, where they lodge in the glandular crypts and grow by binary fission (Fig. 3.2).
- Some develop into precystic forms and cysts, which are passed in feces to repeat the cycle.
- The entire life cycle is, thus completed in one host.

# Life cycle (continued)

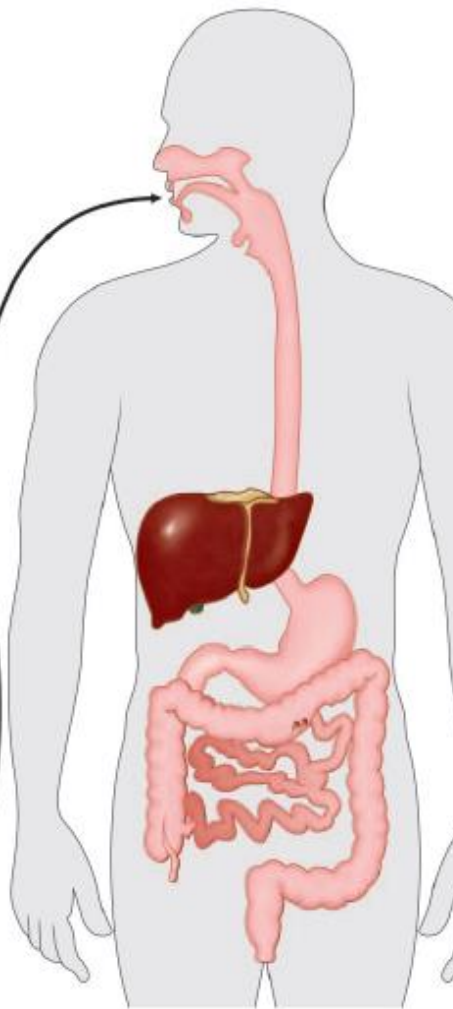
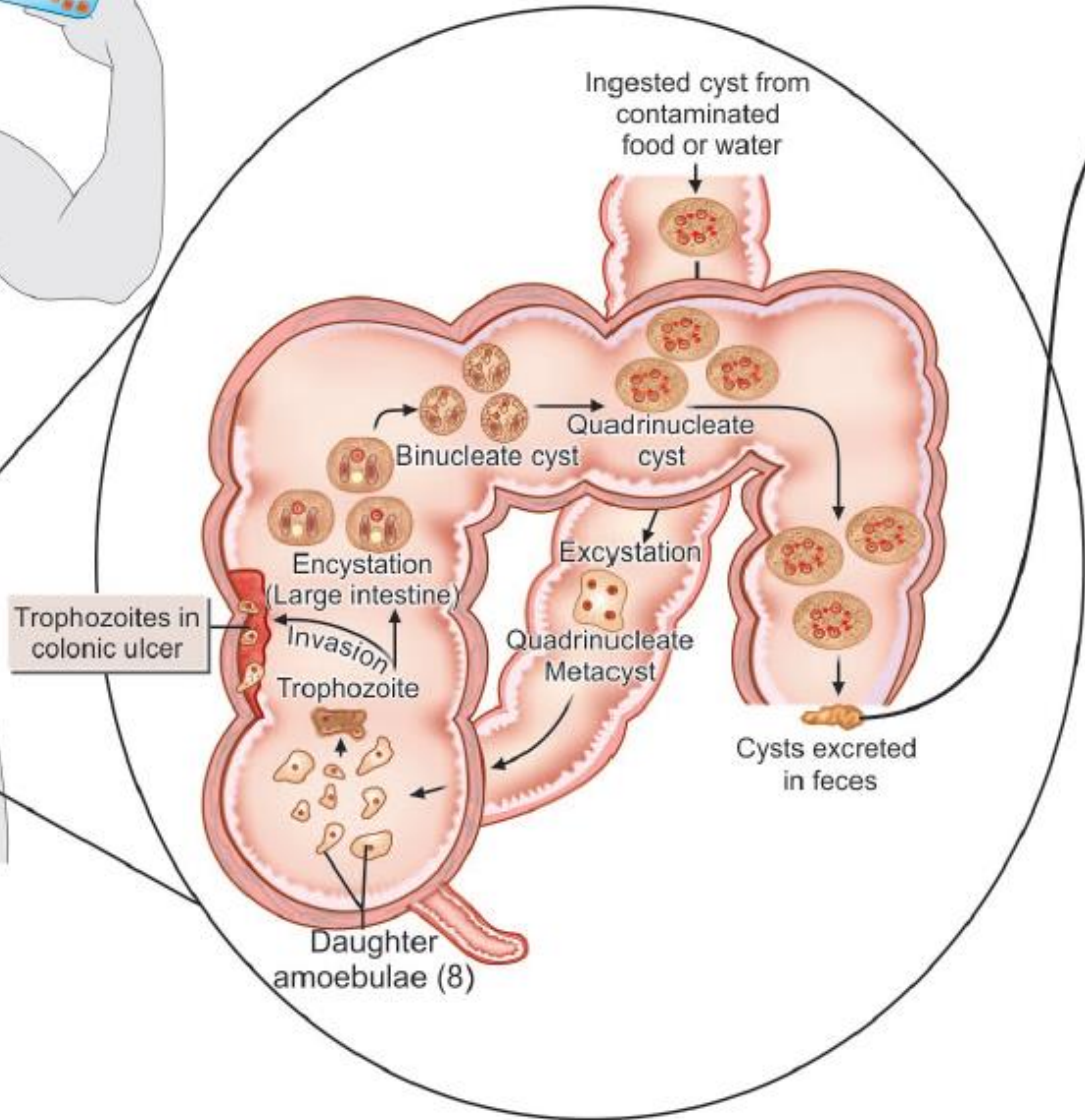
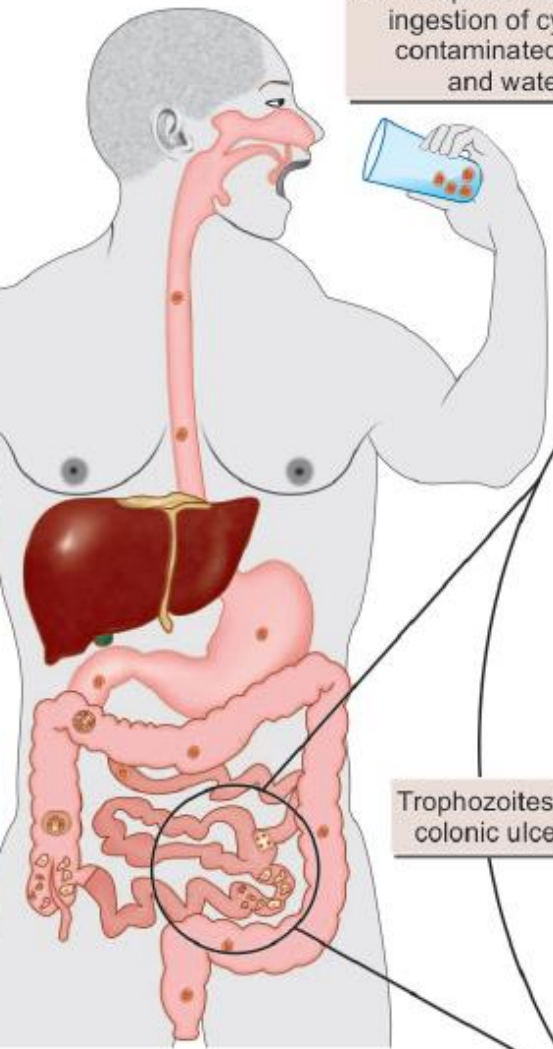
- In most of the cases, *E. histolytica* remains as a commensal in the large intestine without causing any ill effects.
- Such persons become carriers or asymptomatic cyst passers and are responsible for maintenance and spread of infection in the community.
- Sometimes, the infection may be activated and clinical disease ensues. Such latency and reactivation are the characteristics of amoebiasis.

# Life cycle (continued)



**Flowchart 3.1:** Life cycle of *Entamoeba histolytica* (Schematic)

Man acquires infection by ingestion of cysts in contaminated food and water



**LIFE CYCLE OF ENTAMOEBA HISTOLYTICA**

# References

- [https://en.wikipedia.org/wiki/Kingdom\\_\(biology\)](https://en.wikipedia.org/wiki/Kingdom_(biology))
- **Paniker's Textbook of Medical Parasitology.** Paniker CKJ. and Ghosh S. 7<sup>th</sup> ed. Jaypee Brothers Medical Publishers (P) Ltd, 2013. ISBN: 978-93-5090-534-0. **ONLINE REFERENCE:** [https://www.academia.edu/30595207/Panikers\\_Textbook\\_of\\_Medical\\_Parasitology\\_7th\\_Edition\\_2013\\_PDF](https://www.academia.edu/30595207/Panikers_Textbook_of_Medical_Parasitology_7th_Edition_2013_PDF) . Retrieved on October 15, 2018.