



**Medical Analysis
Department**

Introduction to Parasitology

Parasitology (MA301)

Summer School

Lab 1

Lecturer: Mr. Omer Sardar Taha

R. Assistant: Ms. Amnah Mohammad

E-mail: Omer.sardar@tiu.edu.iq

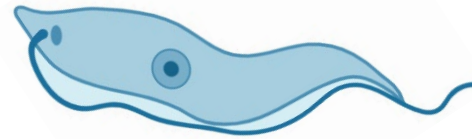
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Introduction

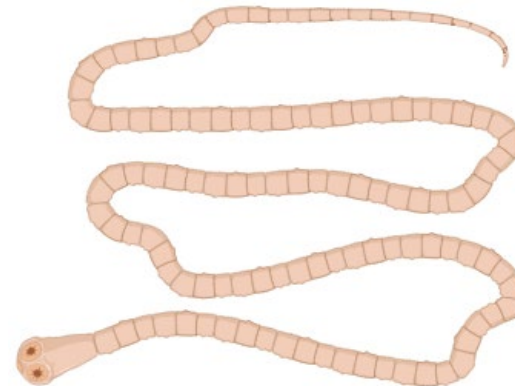
Medical parasitology deals with the parasites that cause human infections and the diseases they produce.

It is broadly divided into two parts:

1. Protozoology (Unicellular)

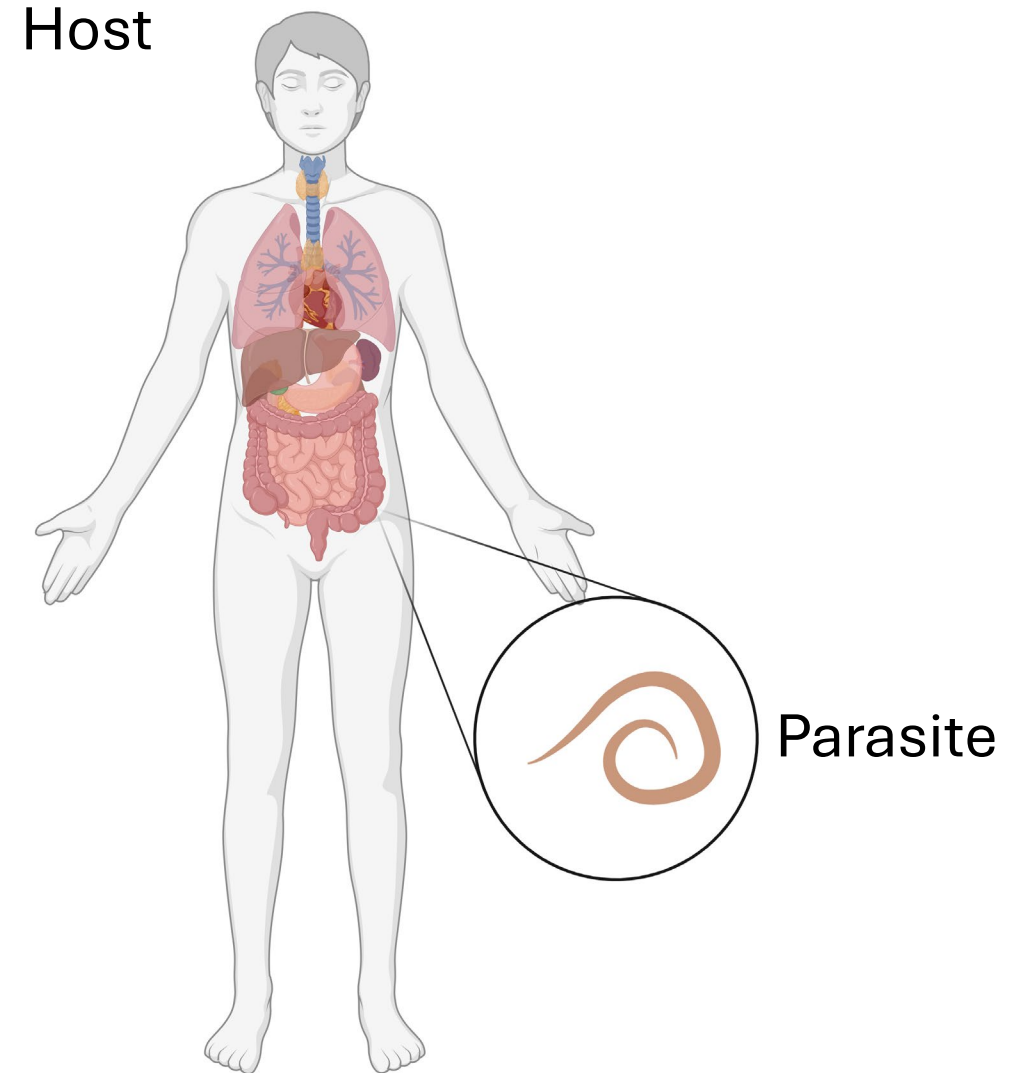


2. Helminthology (Multicellular)



Parasite

Parasites are living organisms, which depend on a living host for their nourishment and survival. They multiply or undergo development in the host.



Parasite

Protozoa
(unicellular)
Kingdom-Protista

Helminths
(multicellular)
Kingdom-Animalia

Amebae

Entamoeba
Naegleria

Flagellates

Giardia
Trichomonas

Sporozoa

Plasmodium
Babesia
Toxoplasma

Ciliates

Balantidium

Nematodes

Ascaris
Ancylostoma

Cestodes

Taenia
Echinococcus

Trematodes

Fasciola
Schistosoma

□ Demonstration of parasite

CLINICAL SPECIMEN	PARASITES
Blood	• <i>Plasmodium</i> spp., <i>Babesia</i> spp. inside the RBCs • <i>L. donovani</i> inside monocytes <i>T.b.rhodesiense</i> and <i>T. cruzi</i> and microfilaria of <i>W. bancrofti</i> and <i>B. malayi</i> in the blood
Stool	Cysts/trophozoites: <i>E. histolytica</i>, <i>G. lamblia</i>, <i>B. coli</i>, <i>I. belli</i> Eggs: Many worms Larvae: <i>S. stercoralis</i> Adult worms: <i>Taenia</i> spp., <i>A. lumbricoides</i>, <i>T. spiralis</i>, <i>E. vermicularis</i>, hookworms

CLINICAL SPECIMEN	PARASITES
Urine	Eggs of <i>S. haematobium</i> Trophozoites of <i>T. vaginalis</i> In the case of Chyluria cause by <i>W.bancrofti</i> , microfilaria in chyluria urine.
Genital specimens	Trophozoites of <i>T. vaginalis</i> may be demonstrated in the vaginal and urethral discharge and in the prostatic secretions
Cerebrospinal fluid (CSF)	Trophozoites of <i>N. fowleri</i> , and <i>Acanthamoeba spp.</i> ,
Sputum	Eggs of <i>P. westermani</i> Rarely migrating larvae of <i>A. lumbricoides</i> , <i>S. stercoralis</i> , <i>A. duodenale</i> , <i>N. americanus</i> Trophozoites of <i>E. histolytica</i>

CLINICAL SPECIMEN	PARASITES
Tissue biopsy and aspiration	1. Scolices and brood capsule in the fluid aspirate of Hydatid cyst 2. Larvae of <i>T. spiralis</i>, <i>T. solium</i> → in muscle biopsy 3. Trophozoites of <i>G. lamblia</i> → duodenum aspirate 4. Trophozoites of <i>E. histolytica</i> → in pus aspirated from amoebic liver abscess and in necrotic tissue obtained from the based of the ulcers in the large intestine.
Culture	Culture of parasites is particularly useful when the number of parasites in the specimens is too small. Diamond broth for <i>T. vaginalis</i> and cell line culture for example HFF cell line
Animal Inoculation	It is useful in the detection of <i>T. gondii</i> and Babesia spp. in the clinical specimens.

Case Scenario

A 32-year-old man presents to the clinic with **abdominal pain** and **bloody diarrhea with mucus** that has persisted for two weeks. He recently returned from a rural area where sanitation conditions were poor. On physical examination, he appears mildly dehydrated and has tenderness in the right lower quadrant of the abdomen.

A stool sample is sent for microscopic examination. Direct wet mount and iodine-stained preparations reveal motile **trophozoites** containing **ingested red blood cells** and **cysts** with **four nuclei**.

Entamoeba histolytica

Intestinal Protozoa

Disease:

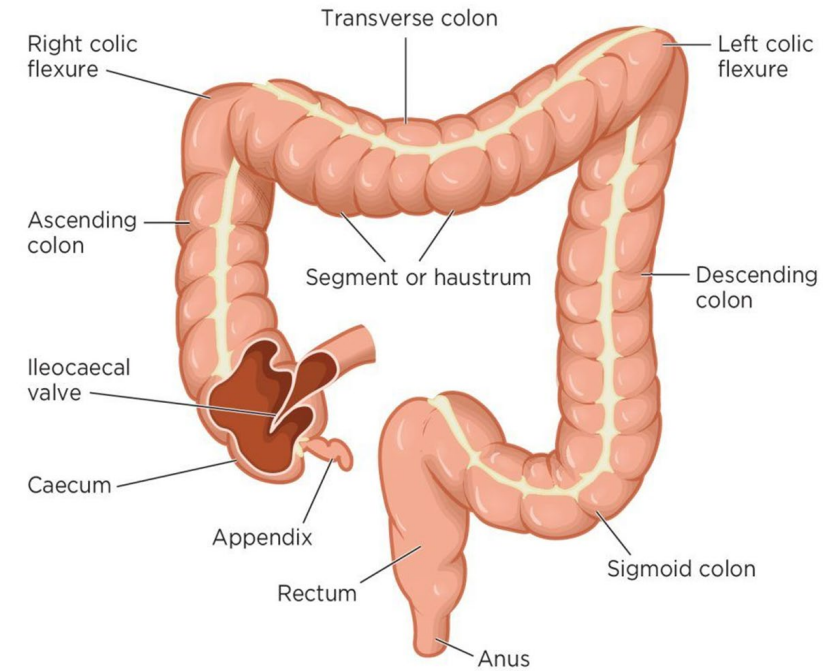
Amebic dysentery and liver abscess

Habitat:

- Intestinal: Large Intestine (It inhabits the colon, caecum)
- Extra-intestinal (liver, lung, brain, skin, etc.)

Mode of Transmission:

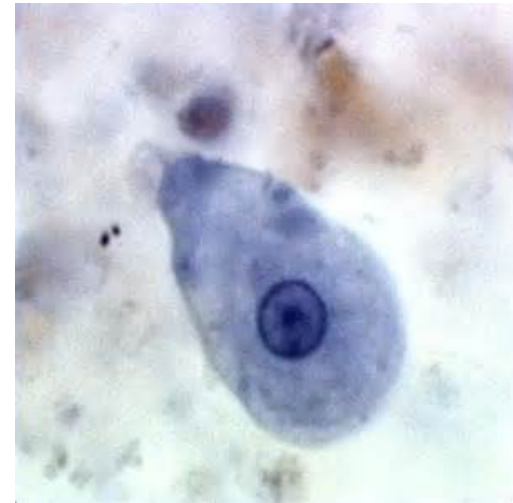
Fecal-oral route



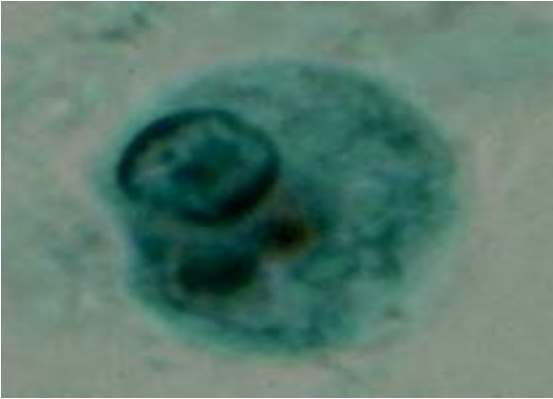
Morphology (Trophozoite)

Trophozoite: This form has an amoeboid appearance, found in diarrheal stool and biopsies, and is usually 15-30 micrometers in diameter, although more invasive strains tend to be larger.

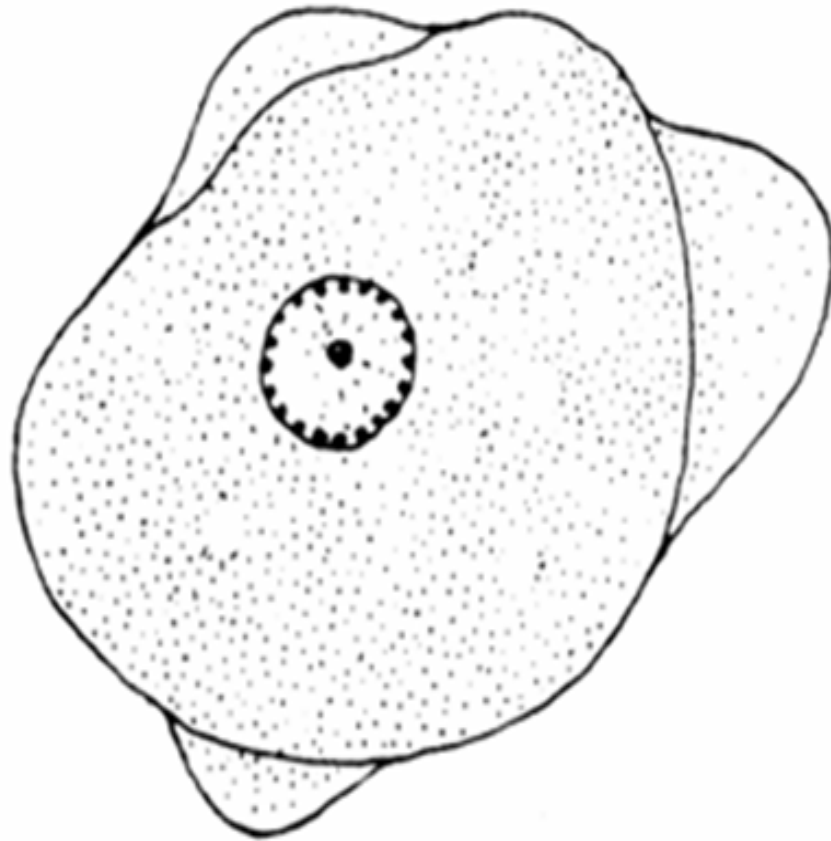
The organism has a single nucleus with a distinctive small central karyosome. The fine granular endoplasm may contain ingested erythrocytes. The nuclear chromatin is evenly distributed along the periphery of the nucleus.



Cyst Form



- Trophozoite rounds up and secretes cyst wall
- aggregation of ribosomes (= chromatoid bodies or chromatoid bar)
- 2 rounds of nuclear division (1→4 nuclei)
- Cyst become survive weeks to months and are spherical, with a retractile wall; the cytoplasm contains dark staining chromatoidal bodies and 1 to 4 nuclei with a central karyosome and evenly distributed peripheral chromatin.
- Cytoplasm with up to four nuclei, often with ingested red blood cells, sometimes with leukocytes, or bacteria.



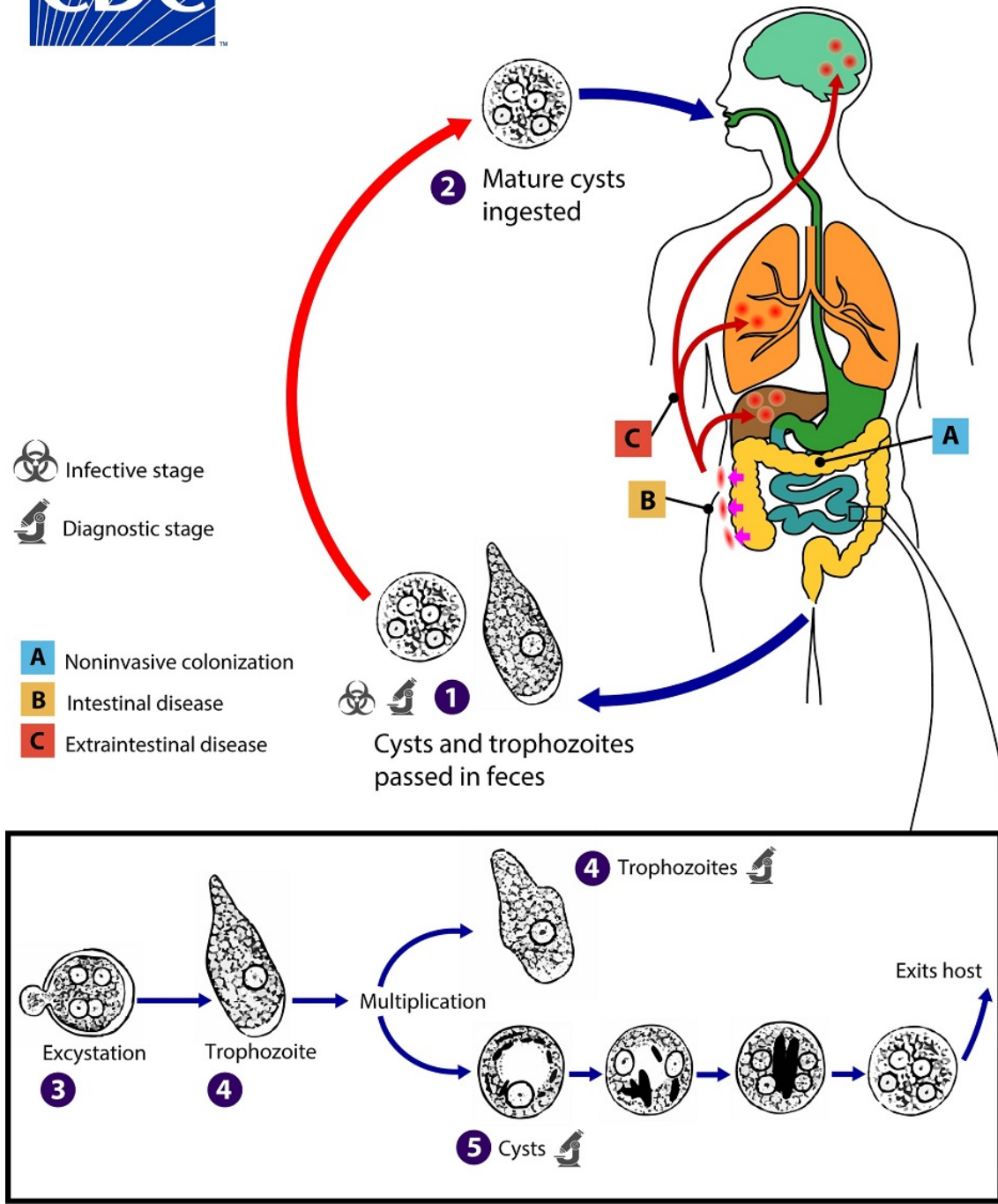
trophozoite



immature cyst



mature cyst



Diagnosis

A/ Intestinal

1. Stool Microscopical examination
cysts and/or trophozoites
2. Sigmoidoscopy
lesions, aspirate, biopsy

B/ Extraintestinal

1. Abscess aspiration (Microscopy)
2. Serology
3. Imaging (CT, MRI, ultrasound)

C/ Molecular methods: PCR, and other DNA techniques

Nonpathogenic intestinal amebae

Entamoeba coli

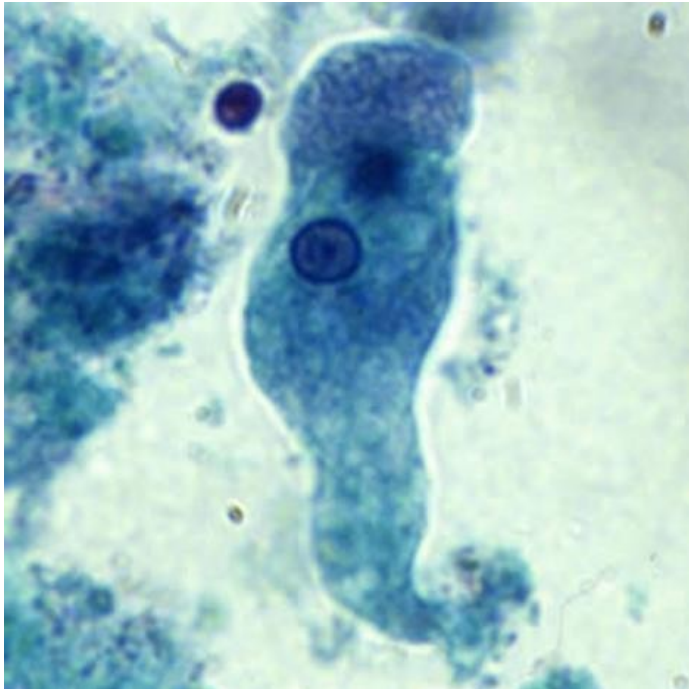
- It is worldwide in distribution and a nonpathogenic commensal intestinal ameba. It is larger than *E. histolytica*, about 20-50 μm with sluggish motility and contains ingested bacteria but no red cells.
- Cysts are large, 10- 30 μm in size, The mature cyst has eight nuclei

Differences between *Entamoeba histolytica* & *Entamoeba coli*



	Entamoeba histolytica (Trophozoite)	Entamoeba coli (Trophozoite)
1	Karyosome is small and situated at the center	Karyosome is larger and usually eccentric
2	Nuclear membrane inner surface has single layer of minute chromatin dots	Nuclear membrane inner surface lined with coarse chromatin dots
3	Food vacuole contain RBC not bacteria	Food vacuole contain bacteria
	Entamoeba histolytica (Cyst)	Entamoeba coli (Cyst)
4	Smaller in size 3.5 - 20	Larger in size 10 - 33
5	It has 4 nuclei with small central karyosome	It has 1 – 8 nuclei, with eccentric karyosome

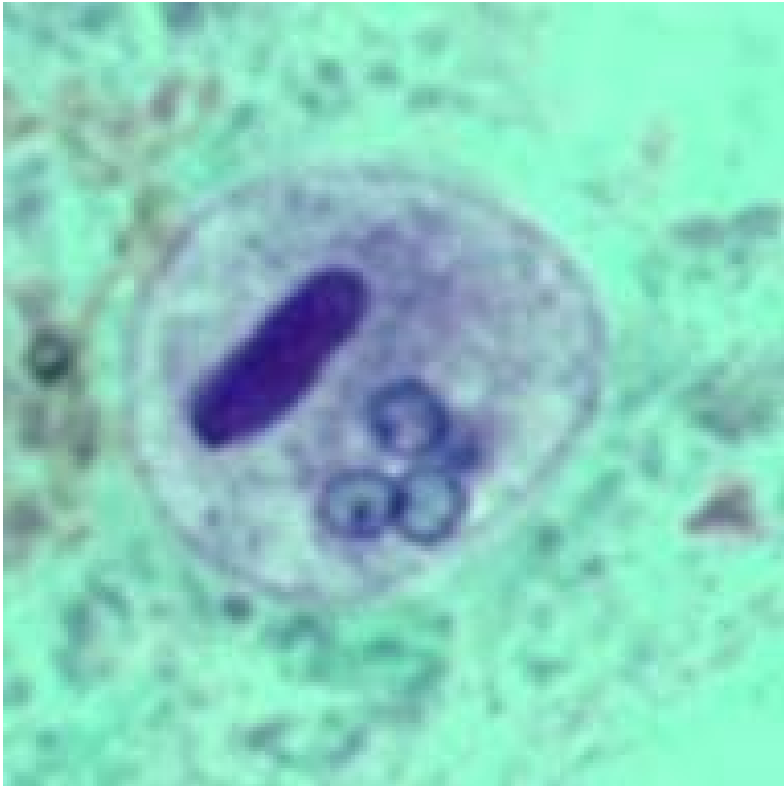
Entamoeba histolytica
(Trophozoite)



Entamoeba coli
(Trophozoite)



Entamoeba histolytica (Cyst)

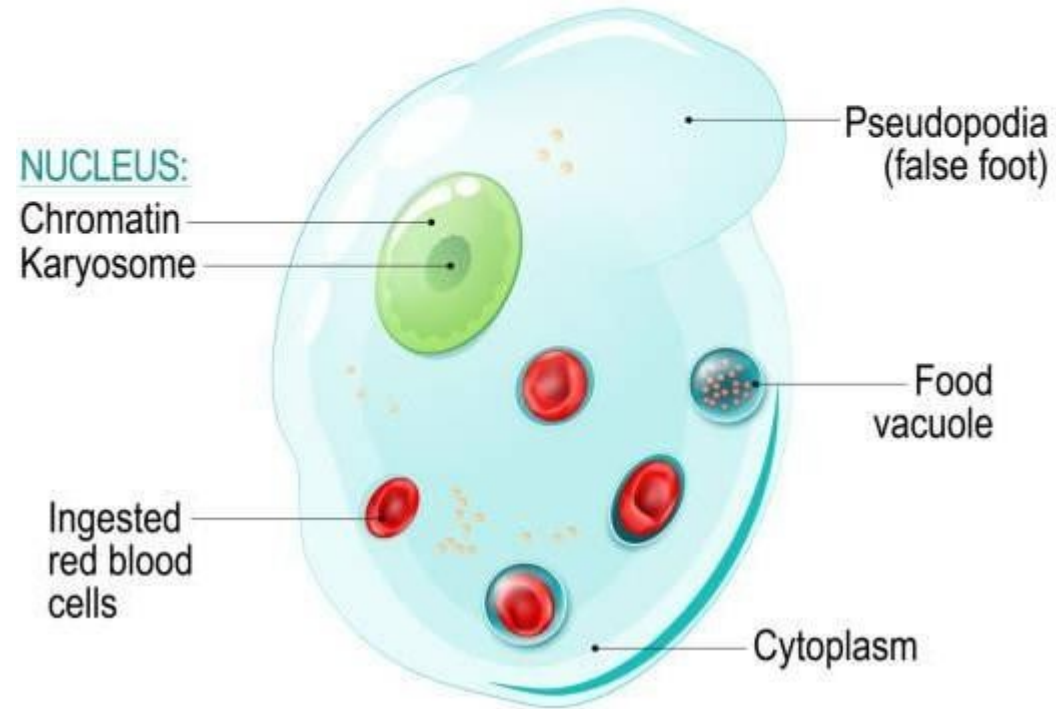


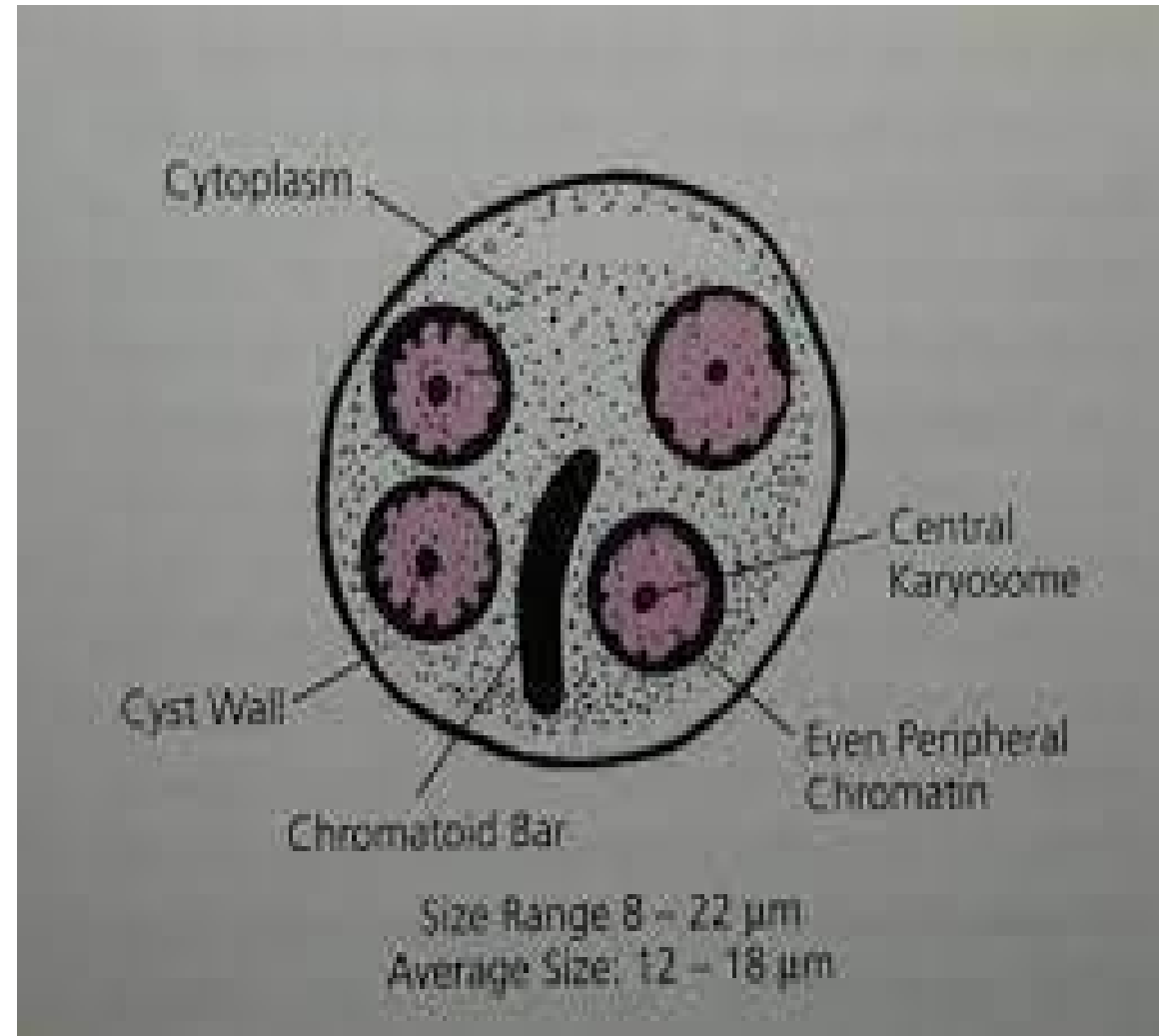
Entamoeba coli (Cyst)



Entamoeba histolytica

(trophozoite)





Diagnostic Methods in Parasitology

Introduction

Laboratory procedures play an important role in the diagnosis of parasitic infections, both for confirmation of clinical suspicion and for identifying unsuspected infections.

Q/ Why the isolation of the infecting agent and detection of specific antibodies are the major methods in bacteriology and virology, but they are of much less importance in parasitology than morphological identification of the parasite by microscopy?

Morphological diagnosis of parasites consists of *two steps*:

1- Detection:

Depends on collection of the appropriate samples and their examination by suitable techniques.

2- Identification:

Requires adequate skill and expertise in recognizing the parasite in its various stages and its differentiation from morphologically similar artifacts.

Parasite Examination



- Stool examination
- Blood examination
- Urine examination
- Biopsy (skin, muscle)
- Sputum
- Sigmoidoscopy material
- Urogenital specimen
- Culture methods
- Animal inoculation
- Xenodiagnosis
- Immunological diagnosis

References

- Paniker, C. K. J. & Ghosh, S. 2021. *Paniker's textbook of medical parasitology*, New Delhi, Jaypee Brothers Medical Publishers.