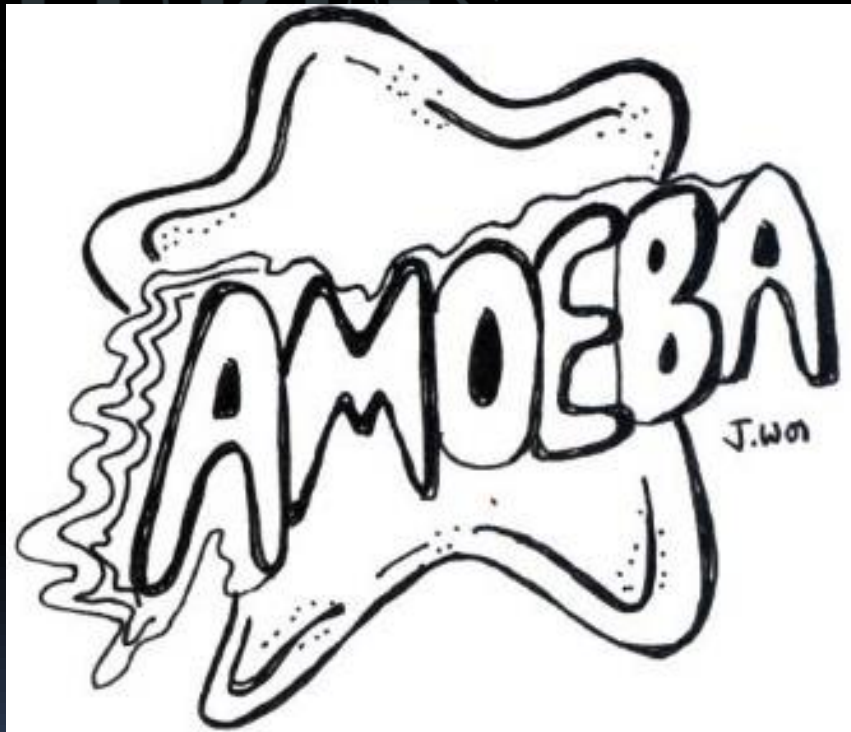


PARASITOLOGY

LECTURE-2




Dr Sadia Ikram



Learning objectives

At the end of lecture students should be able to recall

- Classification of protozoans.
 - Intestinal, urogenital, blood & tissue protozoa.
 - Life cycles , pathogenesis, clinical features of the diseases caused by these protozoans
 - They should be able to diagnose clinical cases of these protozoans .
- 

Clinical Classification of Protozoa

- **Intestinal**

- *Entamoeba histolytica* (Amoebiasis)
- *Giardia lamblia* (Giardiasis)
- *Balantidium coli* (Opportunistic infections)
- *Isospora*
- *Cryptosporidium*

- **Vaginal**

- *Trichomonas vaginalis* (Vaginal infections)

- **Blood**

- *Plasmodium* (Malaria)
- *Leishmania* (Kala Azar)
- *Trypanosoma* (Sleeping sickness)

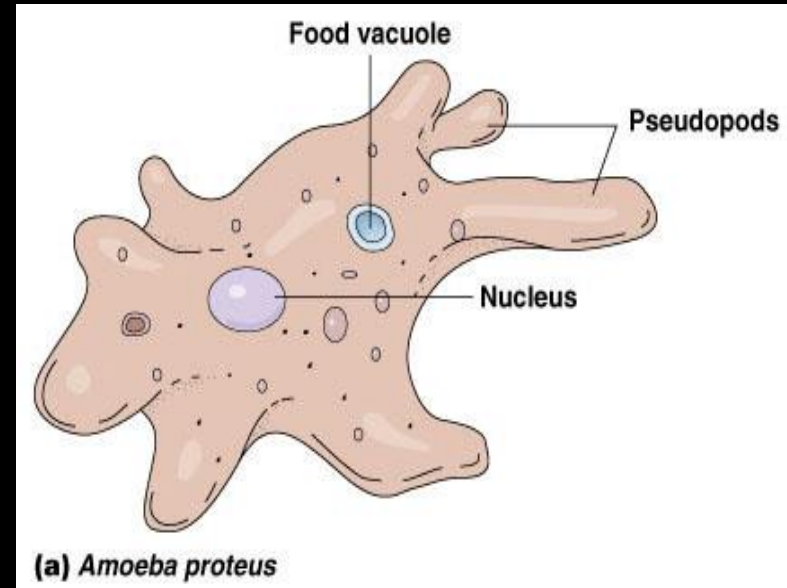
- **Tissue**

- *Toxoplasma gondii* (Toxoplasmosis)

Amoeba: *Entamoeba histolytica*

Causes : Amoebic dysentery & Amoebic liver abscess

- Infection found worldwide.
- Most frequent in tropical countries.
- Areas with poor sanitation.
- 1%-2% of people affected in United States.
- Prevalent among male homosexuals



Transmission & Pathogenesis:

Acquired by ingestion of cysts and transmitted by **fecal-oral** route in contaminated food & water.

Cysts ingested.



Cysts differentiate into trophozoites in ileum



Trophozoites invade colonic epithelium and secrete enzymes causing localized necrosis



Inflammation



After reaching muscularis layer, "**flask-shaped**" **ulcer** are formed destroying intestinal epithelium.



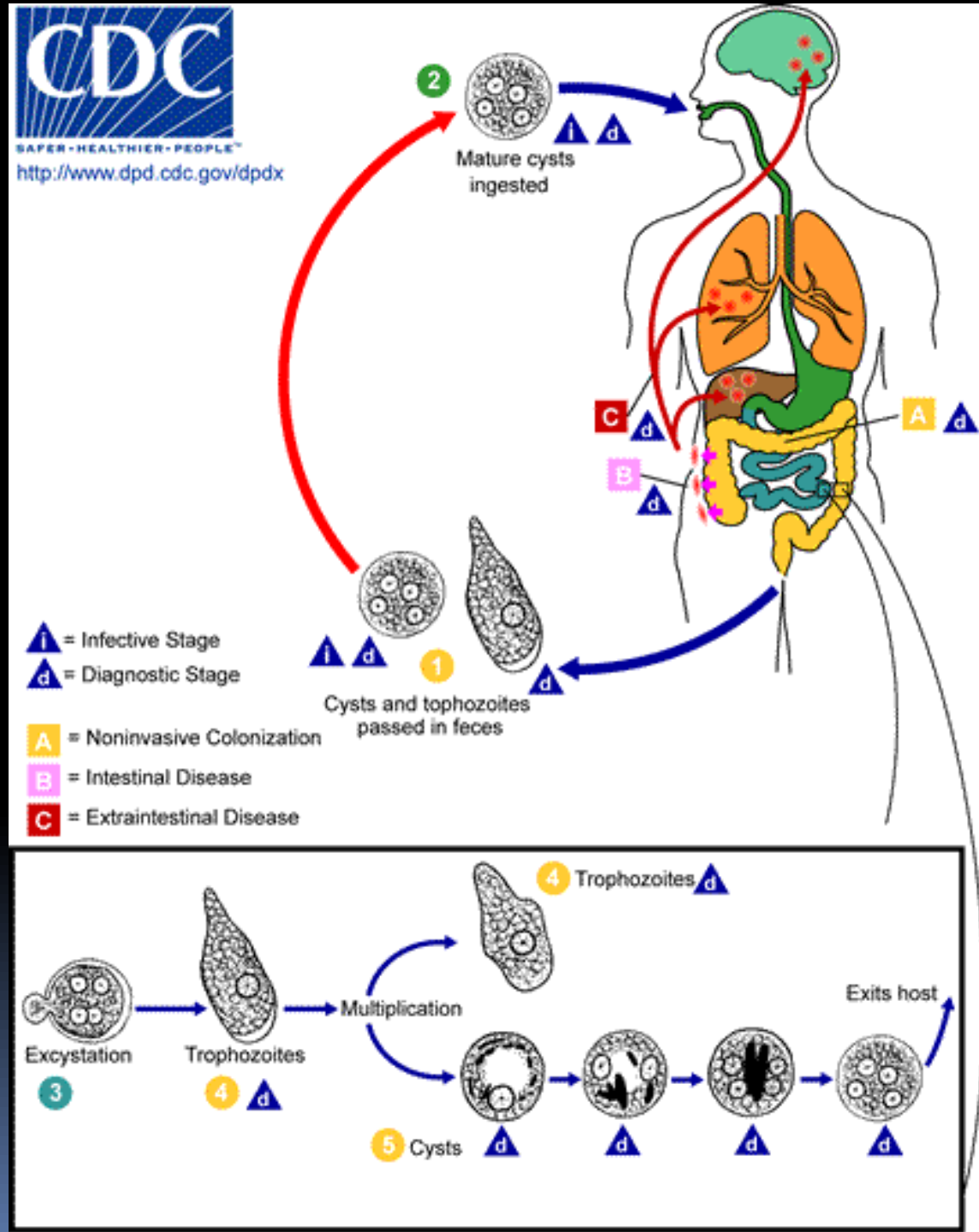
Progression to sub-mucosa leads to invasion of portal circulation by trophozoites.



Most frequent site of systemic disease is **liver** (abscesses containing trophozoites form).


Life cycle

- Direct Life cycle.
- Only humans host.
- Infective stage: ovum, cyst or larva passed out of body in feces.
- Infect healthy persons.



Clinical Findings

- Acute amebiasis presents as **Dysentery** (i.e. bloody, mucus-containing diarrhea)
- Lower abdominal discomfort, flatulence & tenesmus. (feeling of incomplete defecation)
- Chronic amebiasis: diarrhea, weight loss & fatigue.
- 90% of carriers. (feces having cysts transmitted to others).
- Some patients presents with granulomatous lesion (**ameboma**) in cecal or recto-sigmoid areas of colon.

- 
- **Amebic abscess of liver:** Right-upper-quadrant pain, weight loss, fever & tender, enlarged liver, can penetrate diaphragm & cause lung disease.
 - Aspiration of liver abscess yields brownish-yellow pus with consistency of **anchovy-paste.**

Laboratory Diagnosis

1. Stool examination: Unformed with blood & mucus (acid pH).

- **Intestinal & extra-intestinal lesions:** Trophozoites in diarrheal stools.

- Cyst in non-diarrheal stools.

- *Trophozoite of E. histolytica*

- Average size: 25X20µm

- Active amoeboid movement

- in fresh warm specimen.

- In dysenteric specimens: contain ingested red cells.

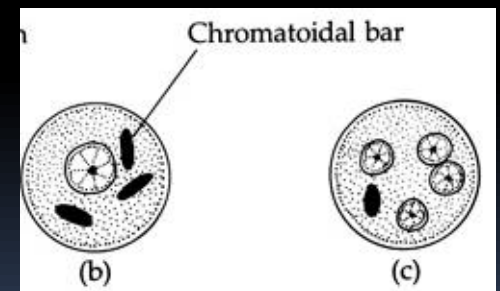
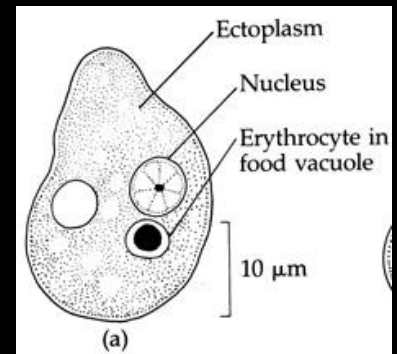
- Single nucleus having central karyosome.

- *Cysts of E. histolytica*

- Round, 10–15 µm .

- Contain, 1, 2 or 4 nuclei with a central karyosome.

- Chromatoid bodies (aggregations of ribosomes) in immature cysts.



Laboratory Diagnosis

- Wet mount in saline.
- Iodine-stained wet mount.

2. PCR-based assay.

3. Serologic testing: Indirect hem-agglutination test.

Treatment & Prevention

- Rx of intestinal amebiasis or hepatic abscesses: metronidazole (Flagyl) or tinidazole.
- Drainage of hepatic abscesses.
- Avoid fecal contamination of food & water.
- Observe good personal hygiene.
- Purification of municipal water supplies.

Differences Between Bacillary and Amoebic dysentery

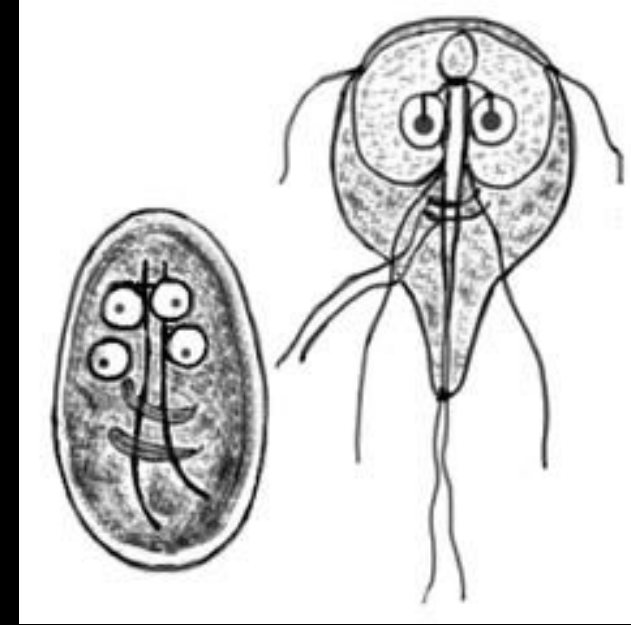
	Incubation period	Clinical	Epidemiology	Pathogenesis	Diagnosis
Bacillary Dysentery	24-72h	Bloody diarrhea	Developing countries	Shiga toxin	Stool examination & culture
Amoebic Dysentery	Gradual onset 1-3 weeks	Bloody diarrhea	Developing countries	Invasion of colonic mucosa & lysis of leukocytes	Trophozoites/ cysts in stool.

DIFFERENCES BETWEEN AMOEBIC AND BACILLARY DYSENTERY

Amoebic Dysentery	Bacillary Dysentery
Caused by <i>Entamoeba histolytica</i> .	Caused by <i>Shigella</i>
Transmitted by contaminated food & water.	Transmitted by contaminated food & water
<u>Gross examination of stool:</u> <ul style="list-style-type: none">•Offensive smell•Dark red color.•Fecal matter mixed with blood and stool.•Acidic reaction.	<u>Gross examination of stool:</u> <ul style="list-style-type: none">•Odour-less•Bright red color.•fecal matter not mixed with Blood & mucous.•Alkaline reaction.
<u>Microscopic examination:</u> <ul style="list-style-type: none">•Scanty pus cells.•Few macrophages.•Trophozoites of <i>Entamoeba histolytica</i> present.	<u>Microscopic examination:</u> <ul style="list-style-type: none">•Numerous pus cells.•Macrophages with ingested RBCs•No trophozoites present

Flagellates : *Giardia lamblia*

- Direct Life Cycle.
- Found worldwide.
- 5% in United States.
- Contaminated water supplies.
- Half of the infected asymptomatic carriers.
- Hikers drinking untreated stream water infected.
- Many species of mammals & humans reservoirs & pass cysts in stool.
- Common in children in day care centers, mental hospitals.




Transmission & Pathogenesis

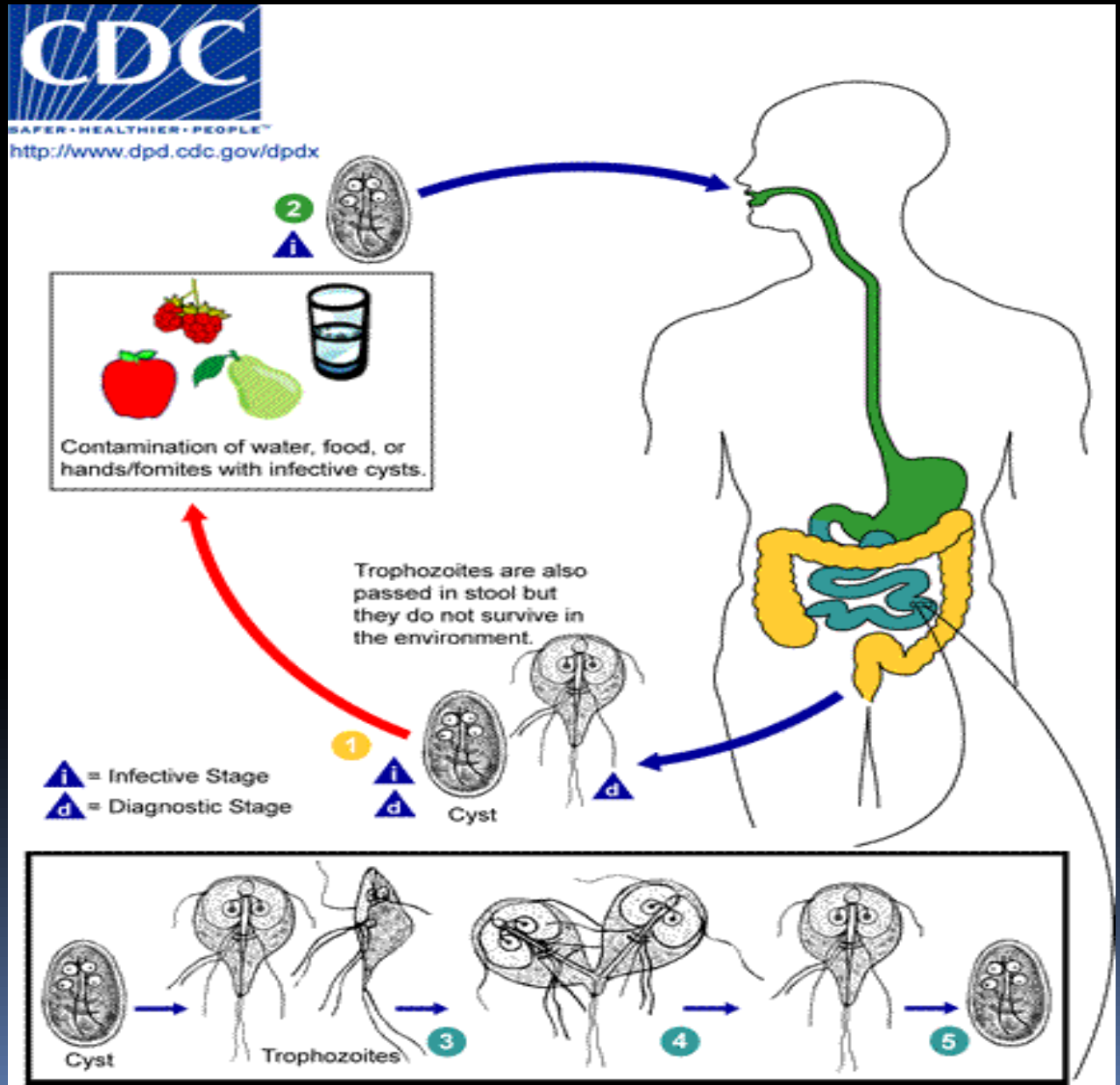
- **Faeco-oral route:** Ingestion of cyst in **faecally contaminated** food & water.
- Excystation in duodenum.
- Trophozoite attaches to gut wall.
- No invasion in mucosa & blood stream.
- Inflammation of duodenal mucosa.
- **Malabsorption** of protein and fat.



Clinical Findings

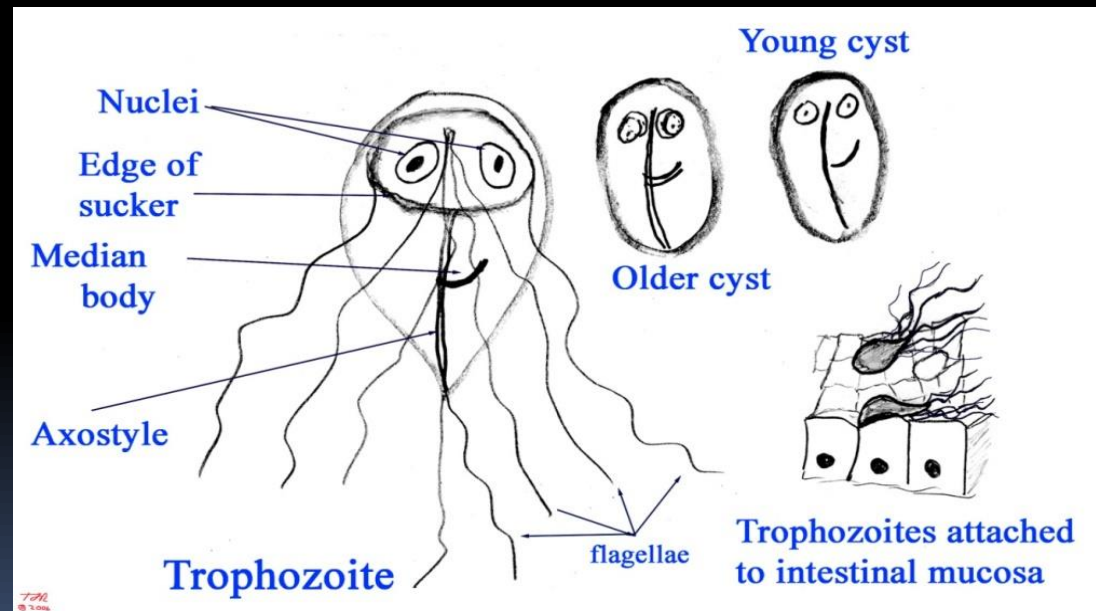
- Watery (non-bloody), foul-smelling diarrhea.
 - Nausea.
 - Anorexia.
 - Flatulence.
 - Abdominal cramps.
 - No fever.
- 

Direct Life cycle



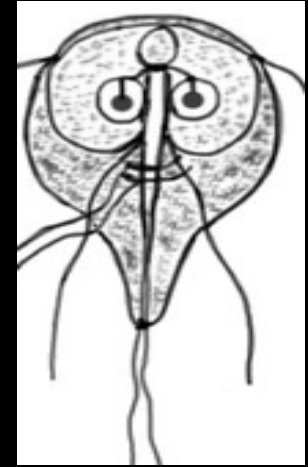
Laboratory Diagnosis

- **Stool Examination:** Unformed, pale colored, frothy, unpleasant smelling stools float on water (high fat content).
- Trophozoites or cysts or both in diarrheal stools.
- Cysts seen in formed stools of asymptomatic carriers.

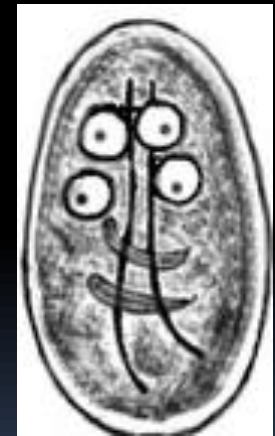


- **ELISA:** Detects *Giardia* cyst wall antigen in stool.

- **Trophozoite:** pear-shaped.
- Two nuclei.
- Four pairs of flagella.
- Suction disk for attachment to intestinal wall.




- **Cyst:**
- Thick-walled oval cyst.
- Four nuclei.
- Cyst forms two trophozoites during excystation in intestinal tract.





Treatment & Prevention

- Metronidazole (Flagyl).
 - Drinking boiled, filtered, or iodine-treated water in endemic areas and while hiking.
 - No prophylactic drug or vaccine.
- 

INTESTINAL PARASITES:

Sporozoa: CRYPTOSPORIDIUM

- ◉ *Cryptosporidium parvum* leads cryptosporidiosis, causing fulminant diarrhea.
- ◉ Diarrhea severe in **immuno-compromised** patients (AIDS).
- ◉ Cause diarrhea worldwide.
- ◉ Large outbreaks in United States due to inadequate purification of drinking water.
- ◉ Cysts highly resistant to chlorination.

TRANSMISSION & PATHOGENESIS

- ◉ **Fecal–oral** transmission.
- ◉ Oocysts from human or animal sources.
- ◉ Oocysts excyst in small intestine, where the trophozoites attach to gut wall.
- ◉ Invasion does not occur.
- ◉ Jejunum most heavily infested site.

IMPORTANT PROPERTIES

Oocysts release sporozoites, which form trophozoites



Formation of schizonts & merozoites



Microgametes and macrogametes formed



Unite to produce a zygote.

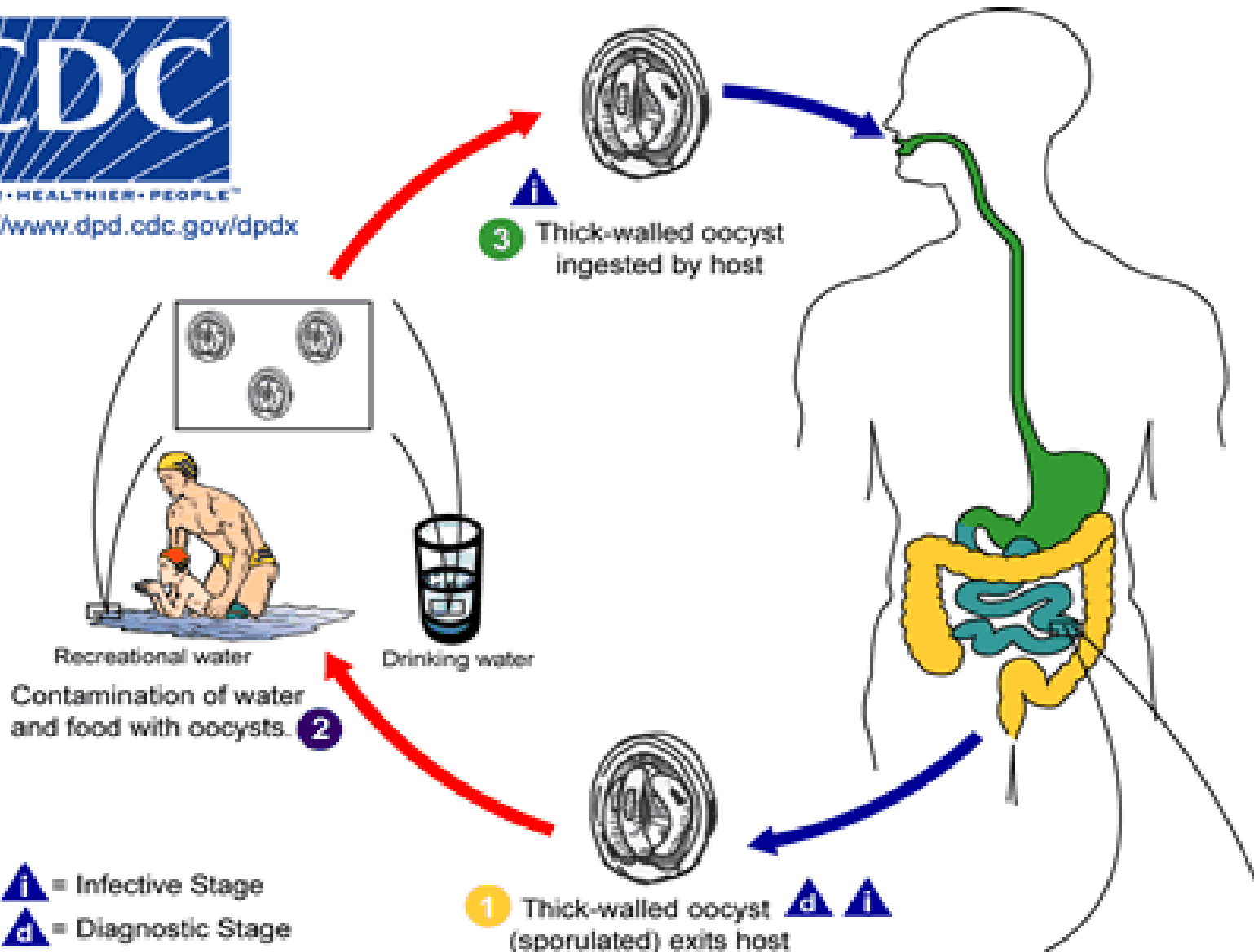


Differentiates into an oocyst.



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i = Infective Stage

d = Diagnostic Stage

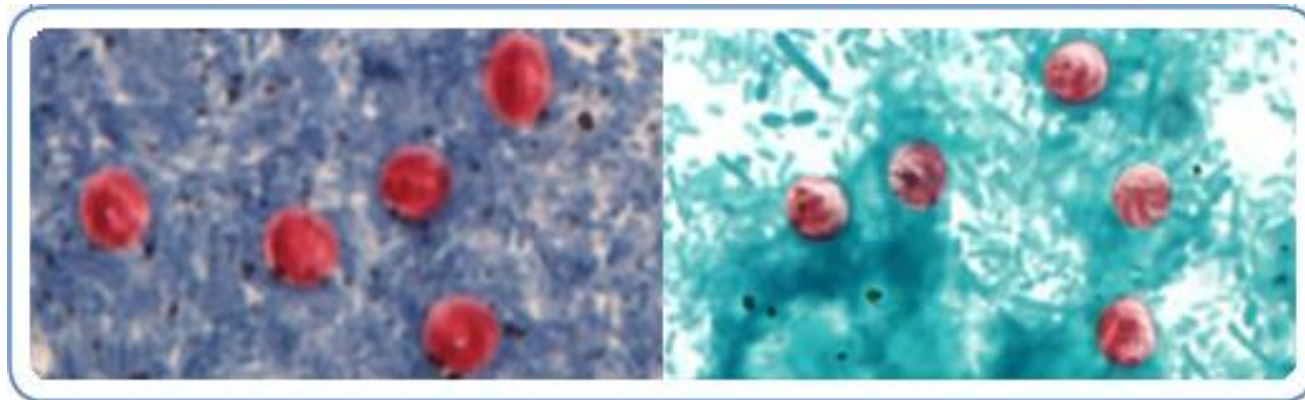
1 Thick-walled oocyst (sporulated) exits host

CLINICAL FEATURES

- ⦿ Disease in immuno-compromised patients.
- ⦿ Watery, non-bloody **diarrhea** causing large fluid loss.
- ⦿ Symptoms for long periods in immuno-compromised patients.
- ⦿ Self-limited in immuno-competent patients.

LABORATORY DIAGNOSIS

- ◉ Identifying oocysts in fecal smears by modified ZN staining technique.



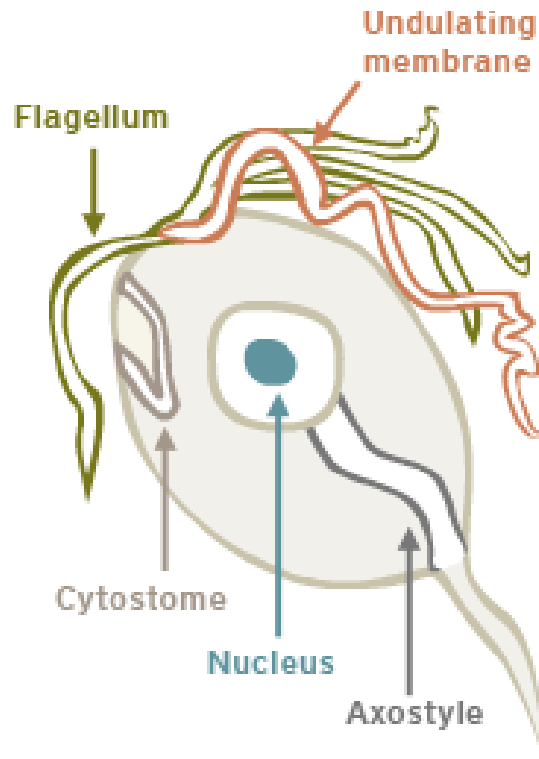
- ◉ No serologic tests.

TREATMENT & PREVENTION

- ⊙ No effective drug therapy for immunocompromised patients.
- ⊙ Paromomycin useful in reducing diarrhea.
- ⊙ Symptoms self-limited in immunocompetent patients.
- ⊙ No vaccine.
- ⊙ Purification of water supply, filtration to remove cysts resistant to chlorine.

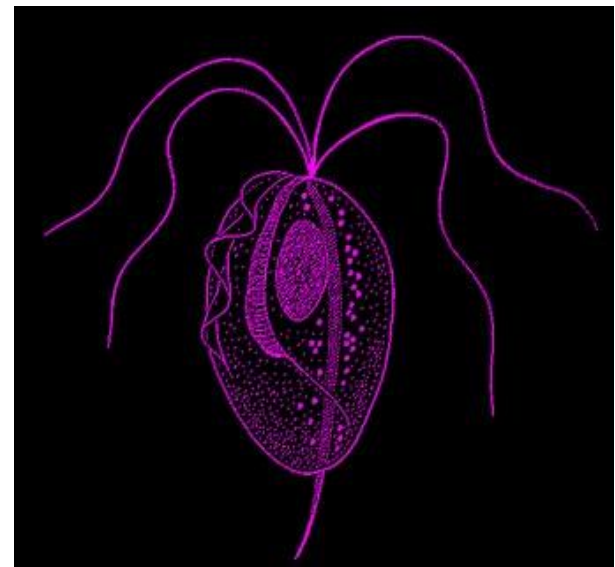
UROGENITAL PARASITES

Trichomonas vaginalis



FLAGELLATES: TRICHOMONAS VAGINALIS

- ⊙ Causes trichomoniasis.
- ⊙ *T. vaginalis*: Pear-shaped organism, central nucleus & four anterior flagella, undulating membrane that extends about two-thirds of its length.
- ⊙ Exists **only as a trophozoite**.
- ⊙ No cystic form.



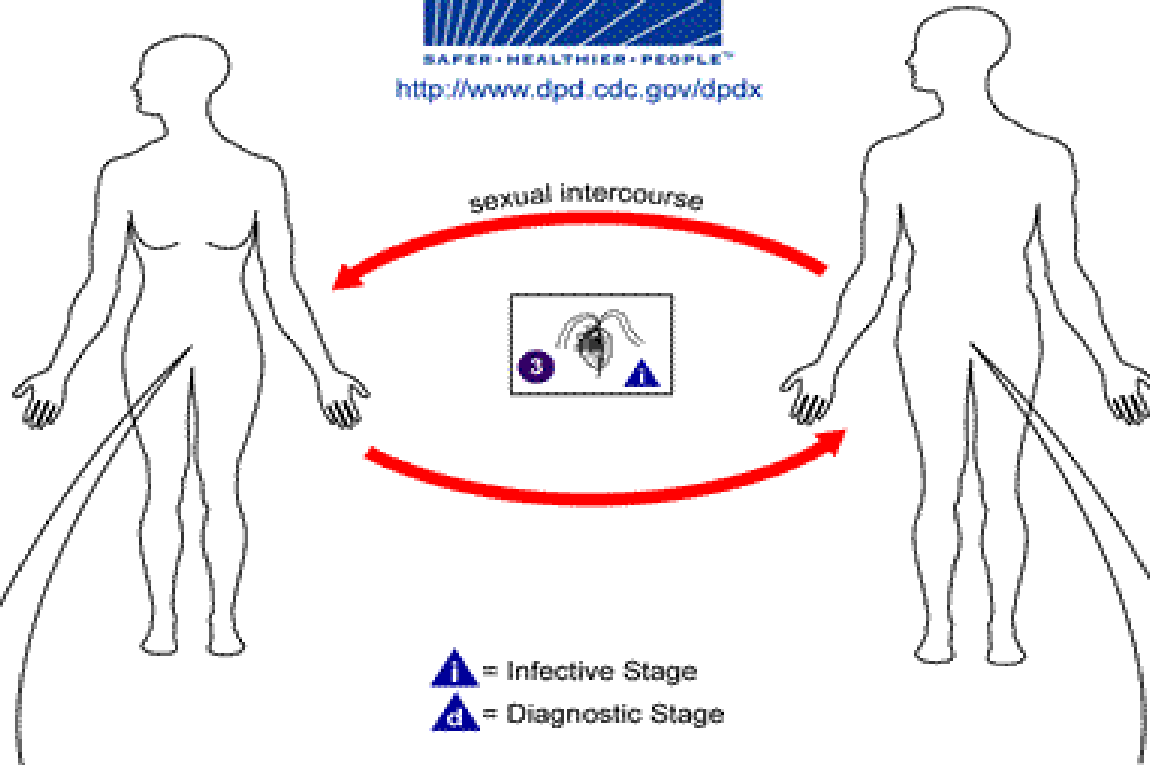
EPIDEMIOLOGY, TRANSMISSION & PATHOGENESIS

- One of most common infections worldwide.
- 25% to 50% of women in United States harbor organism.
- Frequency among sexually active women in thirties.
- Lowest in postmenopausal women.
- Transmitted by sexual contact.
- Primary location of organism vagina & prostate.

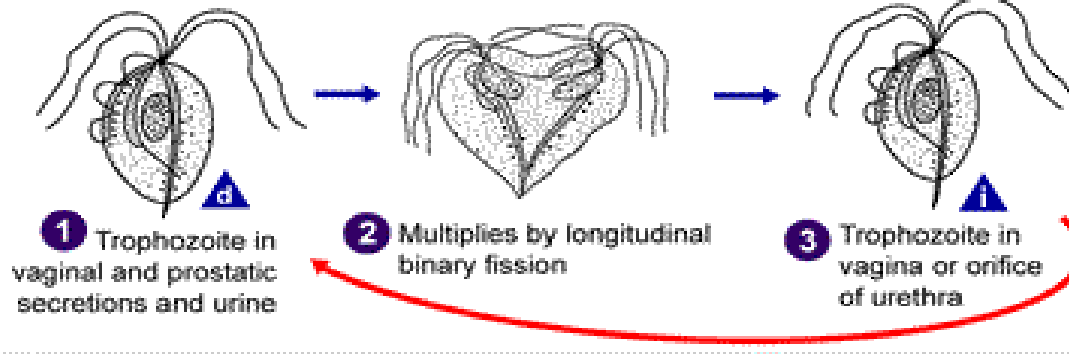


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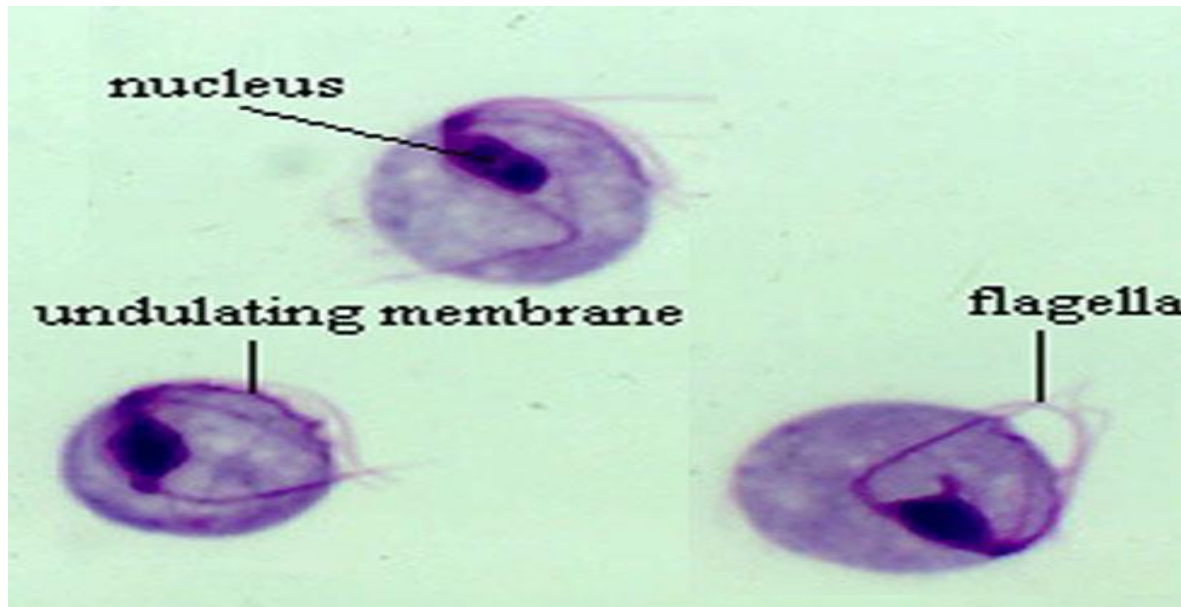


Trichomonas vaginalis



LABORATORY DIAGNOSIS

- **Microscopy:**
- Wet mount of vaginal/prostatic secretions: pear-shaped trophozoites with jerky motion.



- No serologic test.

TREATMENT & PREVENTION

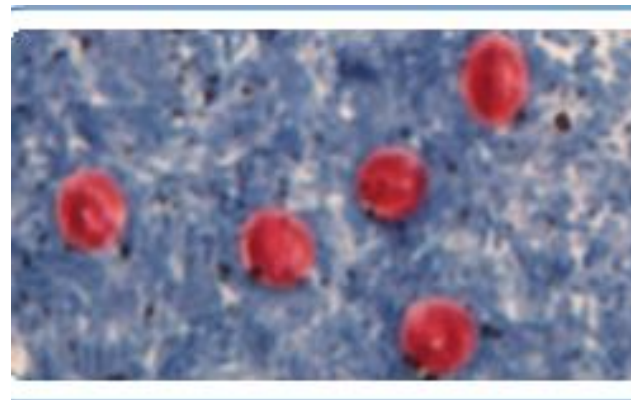
- ⊙ Metronidazole (Flagyl) for both partners to prevent re-infection.
- ⊙ Maintenance of low pH of vagina.
- ⊙ Barrier method limits transmission.
- ⊙ No prophylactic drug or vaccine.

DIFFERENCES BETWEEN BACTERIAL, FUNGAL AND PARASITIC VAGINITIS

	Normal	Bacterial vaginosis	Trichomonas vaginalis vaginitis	Candida albicans vulvovaginitis
Primary symptoms	none	Discharge, bad odor, itching	Discharge, bad odor, itching	Discharge, itching, burning of vulvar skin
Vaginal discharge	Slight, white, flocculent	Increased, thin, white, grey, adherent	Increased, yellow, green, frothy, adherent.	Increased, white, curd like cottage cheese
pH	< 4.5	> 4.5	> 4.5	< 4.5
Odor	none	Common, fishy	May be present, fishy	none
Microscopy	Epithelial cells, lactobacilli	Clue cells with adherent bacilli, no PMNs	Motile trichomonads, many PMNs	KOH preparation: Budding yeasts & pseudohyphae
Treatment	none	Metronidazole oral or topical	Metronidazole orally	Topical azole antifungal

MCQ # 1

- An AIDS patient presents to his primary care physician with a 2-week history of watery, non-bloody diarrhea. This stool revealed an organism which can be seen in the figure below. The most likely diagnosis is:
 - a. Cyclospora
 - b. Cryptosporidium
 - c. Enterocytozoon
 - d. Yeast
 - e. Acid-fast bacilli

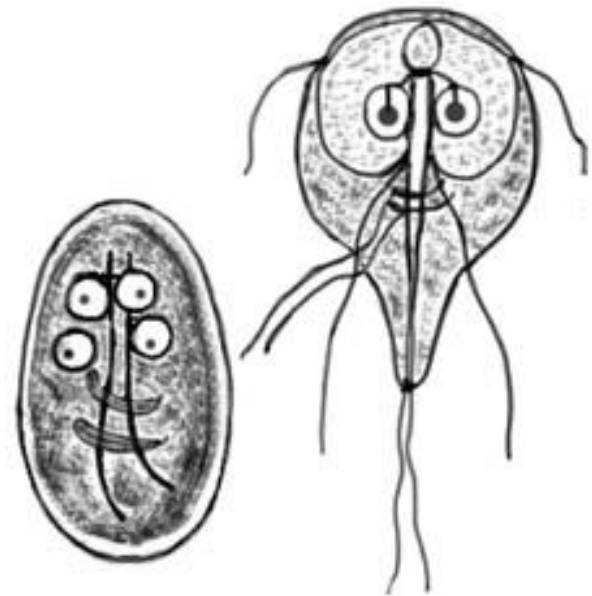


MCQ # 2

- A 30-year-old female stored her contact lenses in tap water. She noticed deterioration of vision and visited an ophthalmologist who diagnosed her with severe retinitis. Culture of the water as well as vitreous fluid would most likely reveal
 - a. Naegleria
 - b. Pneumocystis
 - c. Acanthamoeba
 - d. Babesia
 - e. Entamoeba coli

MCQ # 3

- The life cycle of this parasite consists of two stages: the cyst and the trophozoite, as shown in the figure below. The most likely identification of this organism is:
 - a. Entamoeba
 - b. Clonorchis
 - c. Giardia
 - d. Trichomonas
 - e. Pneumocystis



MCQ # 4

- Amebae that are parasitic in humans are found in the oral cavity and the intestinal tract. Which one of the following statements best describes these intestinal amebae?
- a. They are usually nonpathogenic
- b. They can cause peritonitis and liver abscesses
- c. They are usually transmitted as trophozoites
- d. They occur most abundantly in the duodenum
- e. Infection with *Entamoeba histolytica* is limited to the intestinal tract

MCQ # 5

- ⦿ A protozoan with characteristic jerky motility is most commonly observed in
 - ⦿ a. Vaginal secretions
 - ⦿ b. Duodenal contents
 - ⦿ c. Blood
 - ⦿ d. Biopsied muscle
 - ⦿ e. Sputum

SEQ # 1

- a) Name 3 protozoan causing intestinal infections.
- b) Give pathogenesis and lab diagnosis of *Entamoeba Histolytica*.

SEQ # 2

- A young male presents with severe cramping abdominal pain, fever and passage of scanty stool contain blood and mucus. A parasitic infection suspected.
- What will be the microscopic findings of his fresh stool?
- Briefly describe the life cycle of this parasite.

SEQ # 3

- Tabulate the differences between amoebic and bacillary dysentery.
- Tabulate the differences between bacterial, fungal and parasitic vaginitis