GIT Module
Diarrhea Associated Pathogens
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Medical definition of diarrhea:

- Passage of ≥3 loose or watery stools per day (taking the shape of the container)
- Often also defined as stool weight >200–250 g/day in adults.

Causes

- Infection (viral, bacterial, parasites)
- Food poisoning
- Intolerance (e.g., lactose)
- Medications (antibiotics)
- Stress / GI disorders

See a doctor if

- 2–3 days
- Dehydration signs
- Blood/mucus in stool
- High fever
- Severe pain
- Child or elderly

Management

- Hydration
- Light diet
- Avoid fatty, spicy, dairy, caffeine, alcohol
- Rest

Bacterial infections of GIT

Classification of Pathogens Associated Diarrhea

Toxin mediated

S. aureus

C. botulinum

C. perfringens

B. cereus

Watery (secretory) diarrhea

V. cholera

ETEC

EPEC

Cell invasion

Shigella

Salmonella enteritidis

EHEC

EIEC

Antibiotic associated diarrhea

C. difficile

Cell invasion and bacteremia

C. Jejuni

Salmonella typhi

Gastritis and ulcers

H. pylori

Toxin mediated

S. aureus

- **Source: Human skin and nasal passages**
- Food is **handled by people** (spreading bacteria from hands, nose, cuts)
- **Preformed toxin in food**
- **Fast onset: 1–6 hours**
- **Toxin acts on vagal afferent nerves in gut→ stimulates vomiting center in brain (medulla)**
- **No fever**
- Foods: **salads, cream pastries**
- Toxin is **heat-stable** (reheating doesn't help)
- **Treatment: fluids only (no antibiotics)**

Toxin mediated

C. perfringens

- **Toxin made in gut (after eating),** Spores survive cooking → germinate in intestine

- **Sourse: Soil + intestines of animals (especially poultry, beef, and pork)**
- **Watery diarrhea (main symptom):** Toxin binds intestinal epithelial cells → **disrupts cell membranes** → fluid leaks into gut)

- **Onset: 8–16 hours** (slower)
- Vomiting minimal or absent
- **No fever**
- Spores **survive cooking** → grow if food kept warm long time
- **Treatment: fluids only (no antibiotics)**

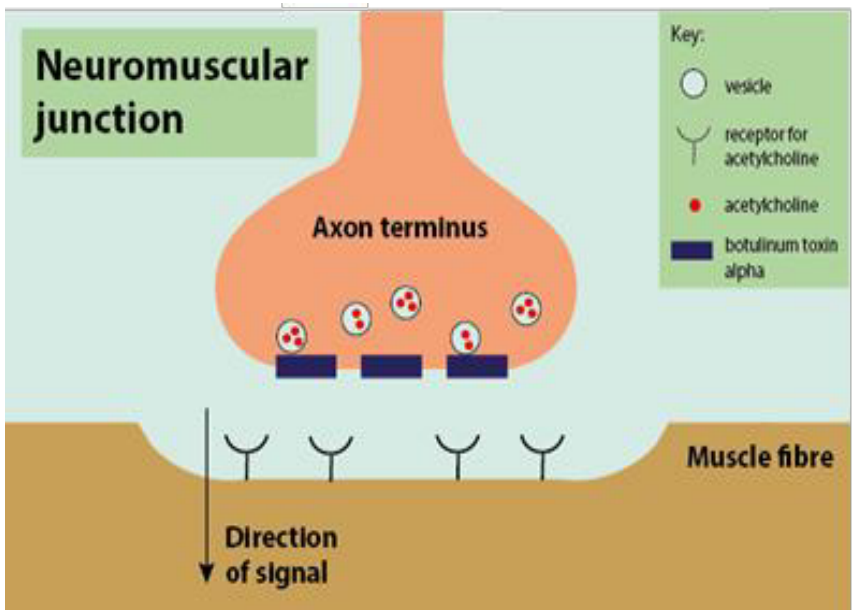
Toxin mediated

C. botulinium

Foodborne: 12–36 hours (can be up to ~3 days) (preformed toxins)

Infant botulism: days–weeks (spore germination)

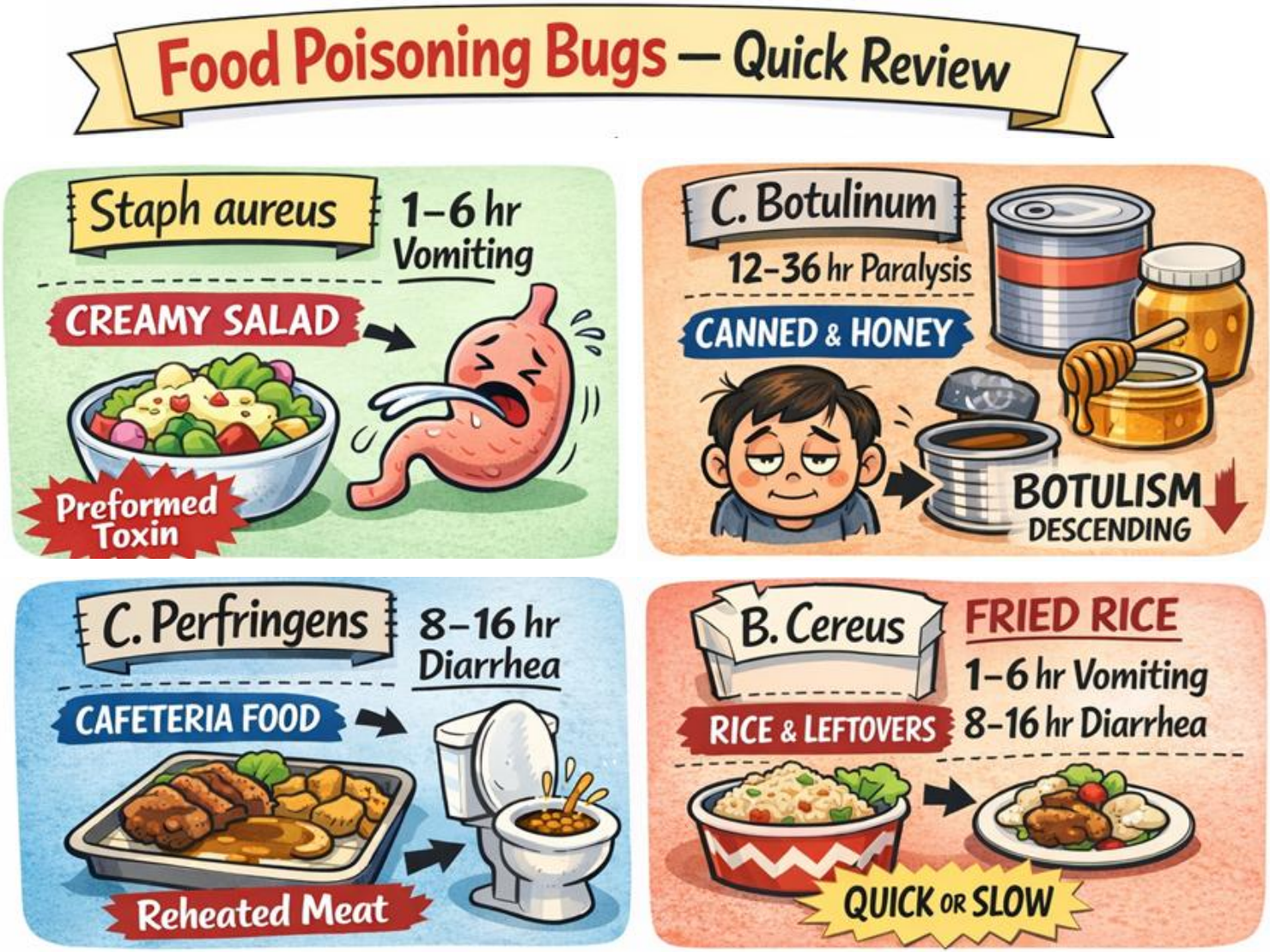
Wound botulism: 4–14 days



Mode of action

Toxin mediated pathogens

Bug	Onset	Main Symptom	Key Clue	Source/Food
Staphylococcus aureus	1–6 hr	Vomiting	Preformed toxin	Salads, cream (human handling)
Clostridium perfringens	8–16 hr	Diarrhea	Toxin made in gut	Meat, gravy (animal source)
Bacillus cereus	6–24 hr	Diarrhea	Spores → gut toxin	Rice, pasta, vegetables
Botulinium	12–36 hr	Paralysis	Toxin preformed	Canned food


Food Poisoning Bugs — Quick Review
Staph aureus
1–6 hr Vomiting
CREAMY SALAD
Preformed Toxin
C. Botulinum
12–36 hr Paralysis
CANNED & HONEY
BOTULISM
DESCENDING
C. Perfringens
8–16 hr Diarrhea
CAFETERIA FOOD
Reheated Meat
B. Cereus
FRIED RICE
1–6 hr Vomiting
8–16 hr Diarrhea
RICE & LEFTOVERS
QUICK OR SLOW

USMLE- mini cases

Case 1

A 22-year-old eats potato salad at a picnic.
3 hours later → severe vomiting, no fever.
Diagnosis: Staphylococcus aureus

Case 2

A family eats meat and gravy left out overnight.
10 hours later → watery diarrhea, mild cramps, no vomiting.
Diagnosis: Clostridium perfringens

Case 3

A student eats reheated fried rice.
4 hours later → vomiting, no fever.
Diagnosis: Bacillus cereus (emetic type)

FAST Tricks

vomiting → Staph or Bacillus (rice?)
Diarrhea after meat → C. perfringens
After antibiotics → C. diff

Short Case

A 4-month-old infant is brought to the ER with **poor feeding, weak cry, and decreased movement**. The mother reports the baby has been **constipated for 3 days**. On exam, the infant has **floppy tone ("floppy baby")**, **ptosis**, and **poor suck reflex**. There is no fever.

Question

Most likely mechanism of disease?

A. Toxin blocks 60S ribosome
B. Toxin blocks acetylcholine release
C. Toxin increases cAMP in intestinal cells
D. Autoimmune destruction of postsynaptic ACh receptors
E. Demyelination of peripheral nerves

Case

A 22-year-old student develops **sudden nausea and severe vomiting** about **3 hours** after eating cream-filled pastries at a party. Several others have similar symptoms. No fever. Diarrhea is mild.

Question

Most likely cause?

A. Clostridium perfringens
B. Staphylococcus aureus
C. Salmonella
D. Clostridium botulinum
E. Bacillus cereus

Answer: B. Staph aureus

Key Clues

- **Rapid onset (1–6 hrs)**
- **Preformed toxin**
- Prominent **vomiting**
- Dairy/pastries

Case

A 19-year-old eats **reheated fried rice**. Within **4 hours**, she develops **intense vomiting** without fever.

Answer: *Bacillus cereus* (emetic type)

Why:

- Reheated rice (classic!)
- Rapid onset
- Vomiting
  → Preformed toxin

Case

Several people at a **wedding buffet** develop **watery diarrhea 12 hours later** after eating **meat dishes**. Minimal vomiting.

Answer: ***Clostridium perfringens***

Why:

- 8–16 hrs
- Meat, large batch food
- Diarrhea > vomiting
  → Toxin produced in gut

Mnemonic (How to remember)

Master Mnemonic: "Some Bad Clams Cook Beef"

S → ***S****taphylococcus aureus*

B → ***B****acillus cereus*

C → ***C****lostridium botulinum*

C → ***C****lostridium perfringens*

"Some Bad" → FAST vomiting (preformed toxins)

S*taphylococcus aureus*

B*acillus cereus* (emetic)

1–6 hours=Vomiting dominant

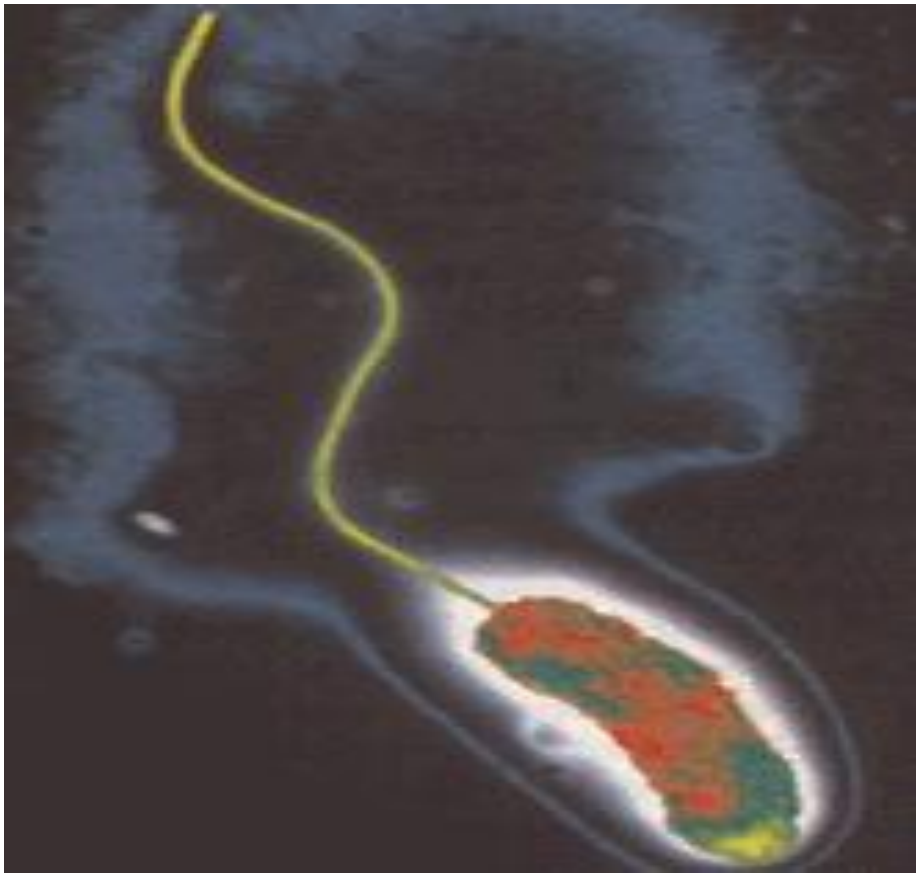
"Clams Cook Beef" → SLOW toxins (after ingestion)

C*lostridium botulinum* → **Neurotoxin (descending paralysis)**

C*lostridium perfringens* → **Watery diarrhea**

Longer incubation

Vibrio Cholera

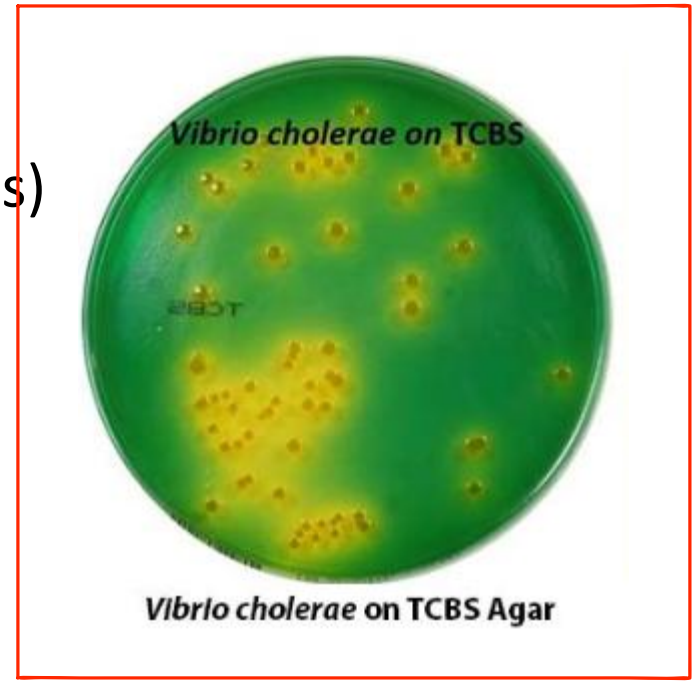


Watery (secretory) diarrhea

Vibrio Cholera

Lab / Diagnosis

- Stool: **no RBCs/WBCs**
- Culture on **TCBS agar** (yellow colonies)
- Clinical diagnosis in outbreaks



Vibrio cholerae on TCBS Agar

Treatment:

- **Immediate rehydration (oral or IV Ringer lactate)**
- **Doxycycline / azithromycin → ↓ duration**
- **Zinc in children**

Enteropathogenic vs. Enterotoxigenic E. coli

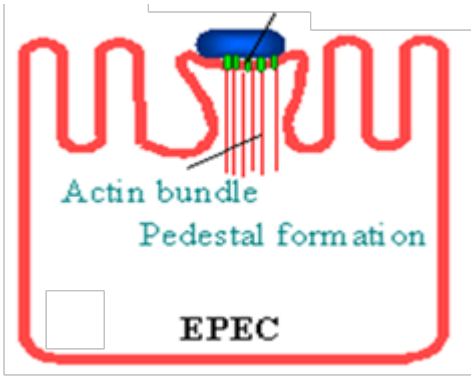
EPEC vs. ETEC

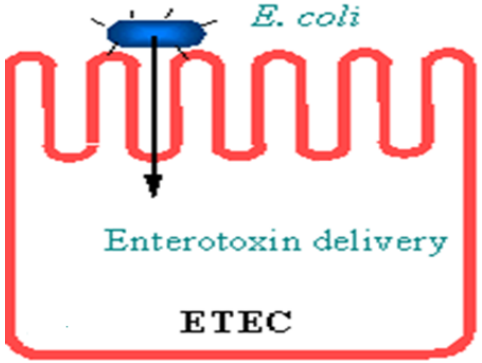
Feature	EPEC	ETEC
Mechanism	Attaching & effacing → destroys microvilli	Toxins (LT, ST) → ↑ cAMP / cGMP
Effect	↓ absorption	↑ secretion
Diarrhea	Watery (no toxin)	Watery (secretory)
Fever	Usually mild/absent	Absent
Population	Infants	Travelers ("traveler's diarrhea")
Invasion	No	No

pathogenic=

pediatrics

Attachment and eliminating villi





Entero ***T*** *oxigenic*

= **T**ravelers

Cholera vs. EPEC vs. ETEC

Feature	Cholera	ETEC	EPEC
Stool	Rice-water	Watery	Watery
Population	Endemic areas	Travelers	Infants
Mechanism	↑cAMP (CFTR)	↑cAMP & ↑cGMP	↓ absorption
Severity	Severe dehydration	Mild	Chronic

Case

A 24-year-old medical student returns from a trip to rural India with **profuse watery diarrhea**, abdominal cramps, and no fever. Symptoms started 2 days after eating street food. No blood or mucus is present.

Question

Most likely organism?

A. Escherichia coli (ETEC)
B. Shigella
C. Salmonella
D. Vibrio cholerae
E. Entamoeba histolytica

Answer: A. ETEC

Parasitic Infections of GIT (B. coli, G. lamblia)

Parasites

Protozoa

Helminths

Single celled organisms

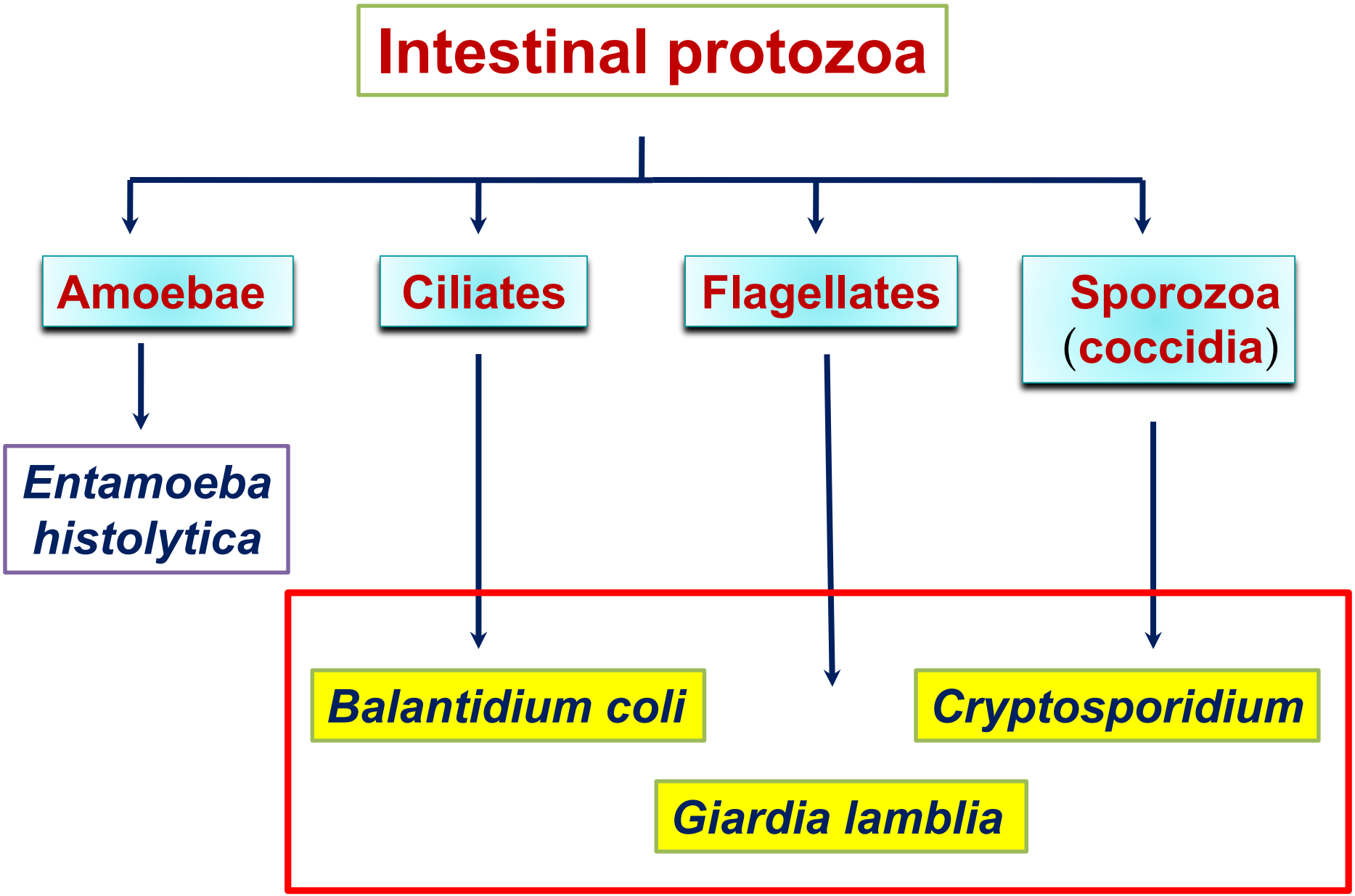
Classification based on motility

Pseudopodia → Amoebae

Flagellates → Flagella

Ciliates → Cilia

Sporozoa (**coccidia**) → Non-motile
Obligatory intracellular


Intestinal protozoa
Amoebae
Ciliates
Flagellates
Sporozoa (coccidia)
Entamoeba histolytica
Balantidium coli
Giardia lamblia
Cryptosporidium

Laboratory diagnosis

a) Direct

- Foul **bloody + mucoid diarrhea**
- **Stool exam (key)**
  - Trophozoites → loose stool
  - Cysts → formed stool
  - **Cilia (diagnostic!)**
- **Sigmoidoscopy** → ulcers ± trophozoites
- **Barium enema** → ulcers / stricture

Hint: **Pig + Cilia = Balantidium coli"**

+

b) Indirect

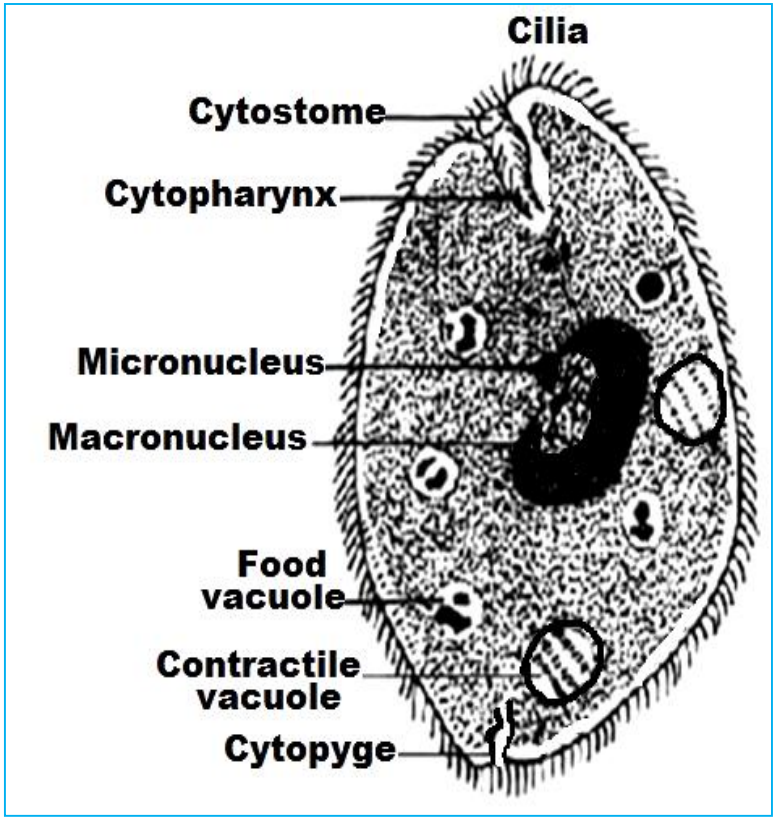
-Serological tests: CFT, IHAT, IFAT, ELISA and GDPT (gel-diffusion precipitin test).

Treatment

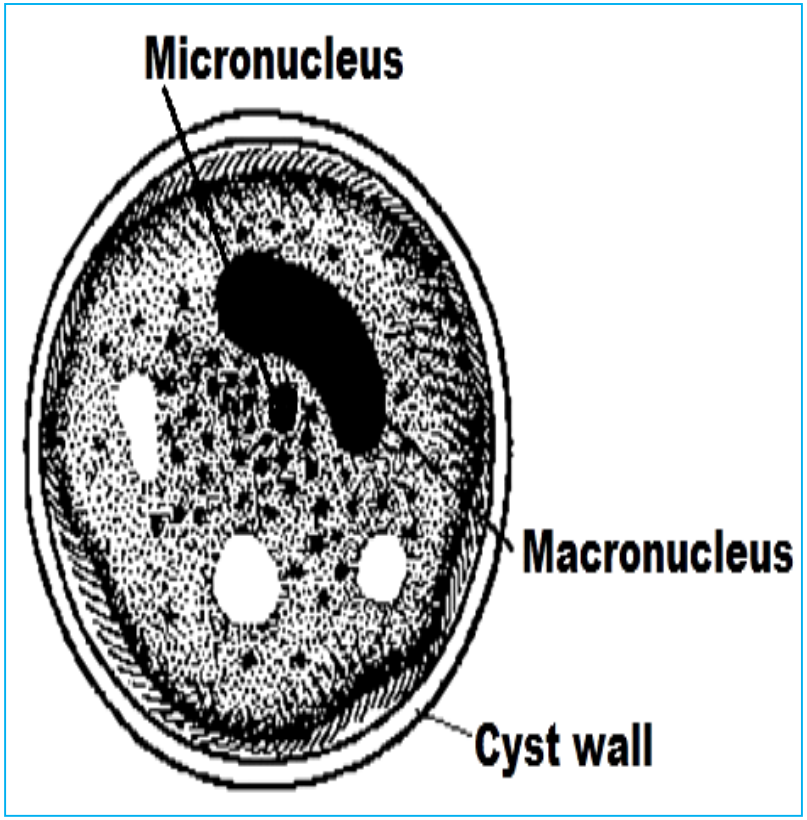
- **Tetracycline** (drug of choice)
- Alternatives:
  - Metronidazole

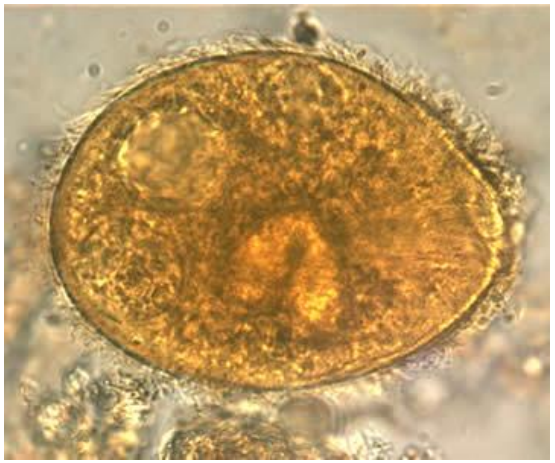
Morphological characters

1- Trophozoite stage

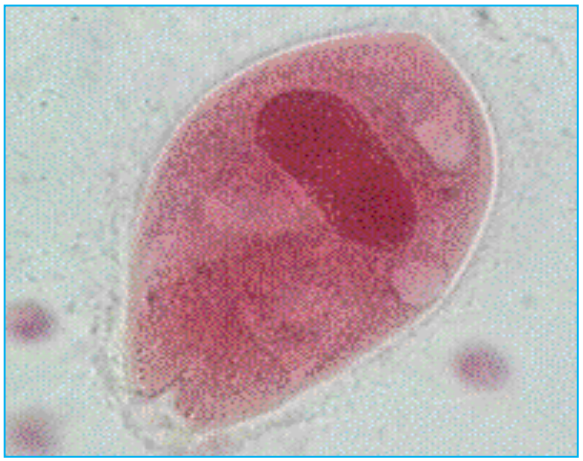


2- Cyst (I.S)



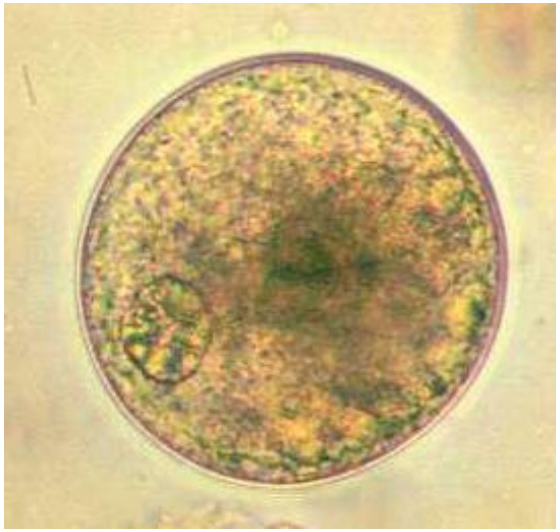


B. coli **trophozoite**



B. coli **trophozoite**

B. coli **trophozoite**



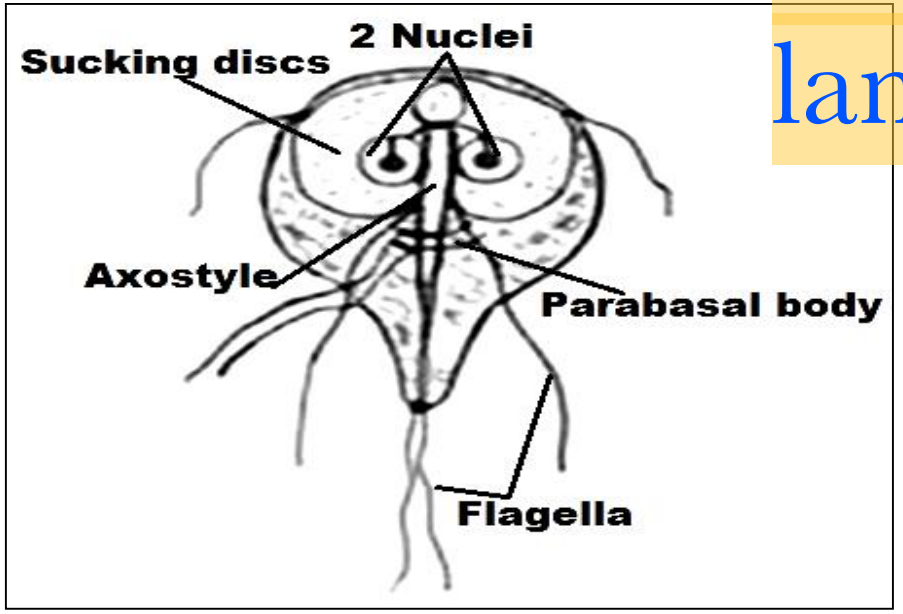
B. Coli **cyst**

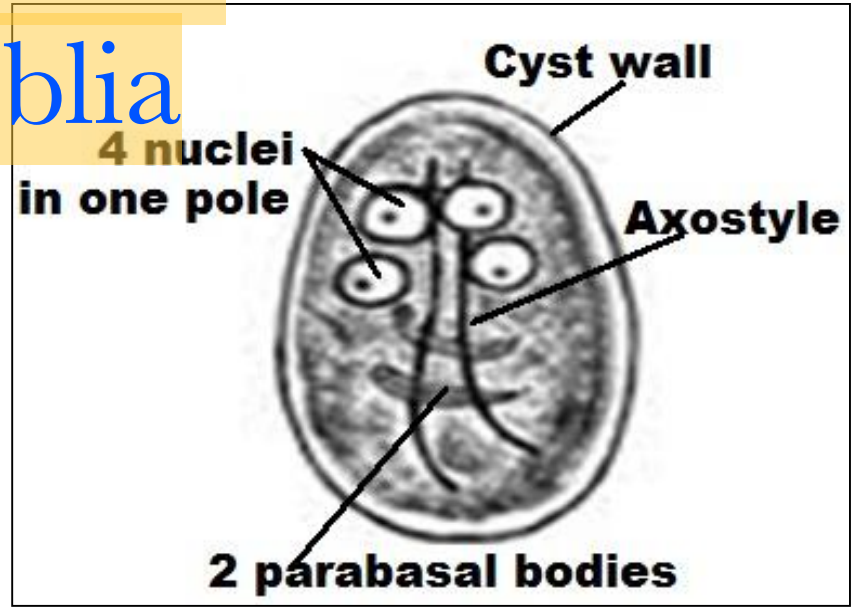
Morphological characters

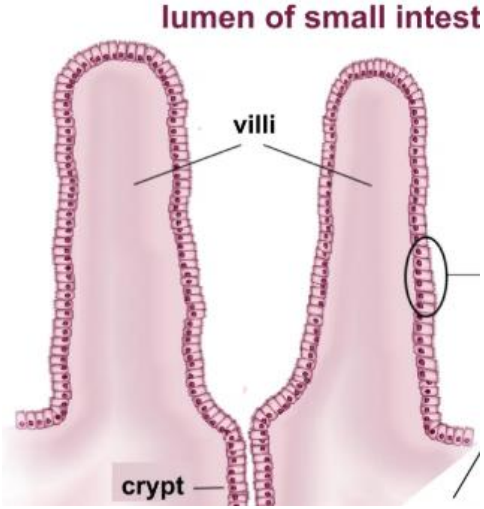
1-Trophozoite stage

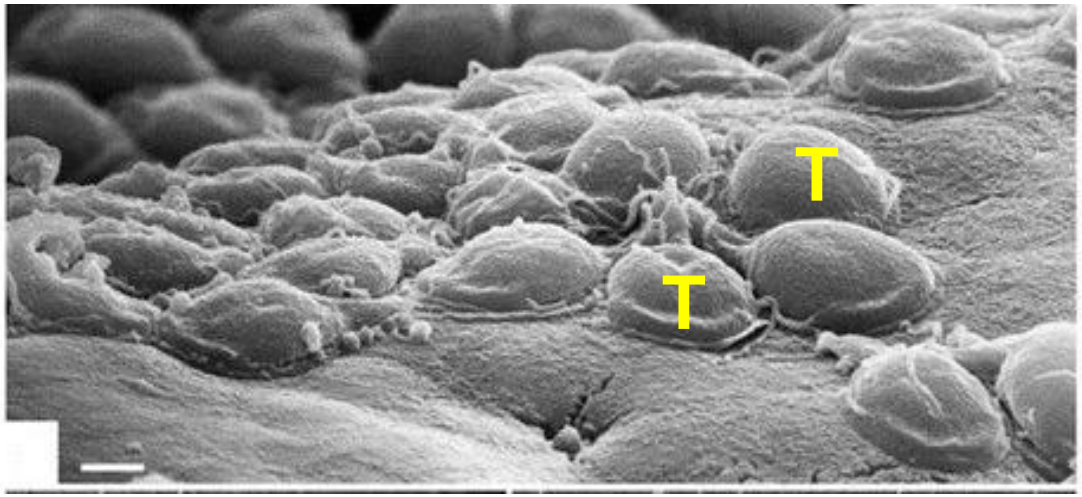
Giardia lamblia

2- Cyst (I.S)



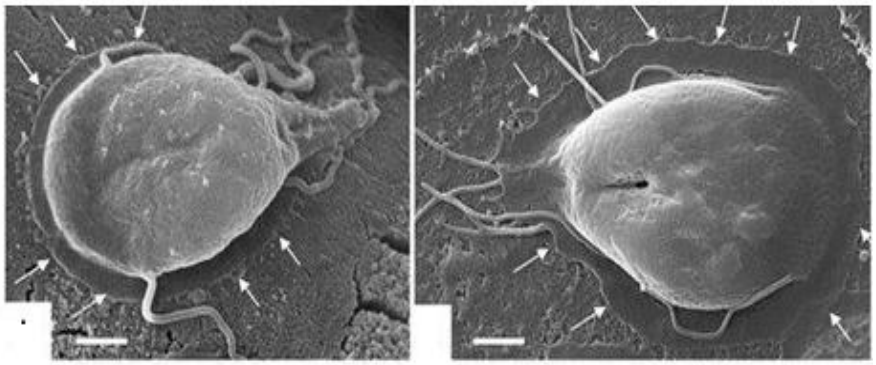






Trophozoites (T) attaching to the intestinal surface of an experimentally infected mouse.

“carpet-like layer”



Higher magnification view of a trophozoite attaching to the mouse and to human intestinal surface cells

Treatment

1- Metronidazole (Flagyl).

2-Nitazoxanide

USMLE Case: *Giardia lamblia*

A 28-year-old man returns from a camping trip and presents with **2 weeks of foul-smelling, bulky, greasy diarrhea**. He also reports **abdominal bloating, flatulence, and weight loss**. No blood or fever. Several others who drank from the same stream have similar symptoms.

On exam: mild dehydration. Stool exam shows **pear-shaped trophozoites with flagella**.

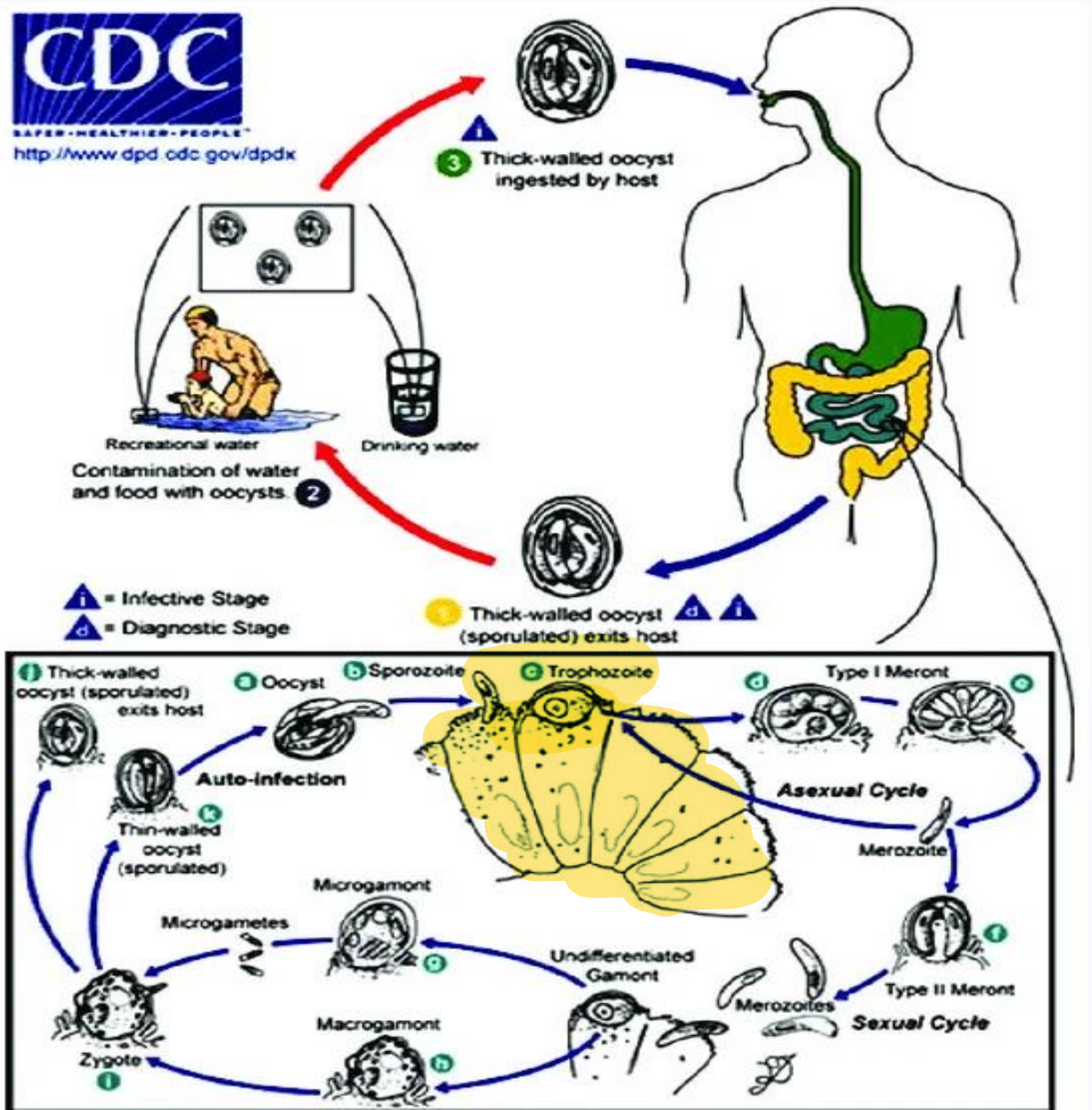
Most likely organism?

Giardia lamblia

Why this is Giardia (exam reasoning)

- **Camping / untreated stream water**
- **Greasy (steatorrhea)** → fat malabsorption
- **No blood, no fever** → non-invasive
- **Bloating + flatulence** → carbohydrate malabsorption
- **Outbreak in group** → waterborne spread

Cryptosporidium



Cryptosporidium vs. Giardia

Feature	Cryptosporidium	Giardia
Stool	Watery	Greasy (fatty)
Blood	No	No
Exposure	Pools/daycare	Streams/camping
Mechanism	Secretory	Malabsorption
Stain	Acid-fast	None