GIT Module
2024-2025
Parasitic Infections of the GIT (4)
(B. coli, G. lamblia & Cryptosporidium)

Dr. Mohammad Odaibat
Department of Microbiology and Pathology
Faculty of Medicine, Mu'tah University

Parasites

Protozoa

Helminths

Single celled organisms

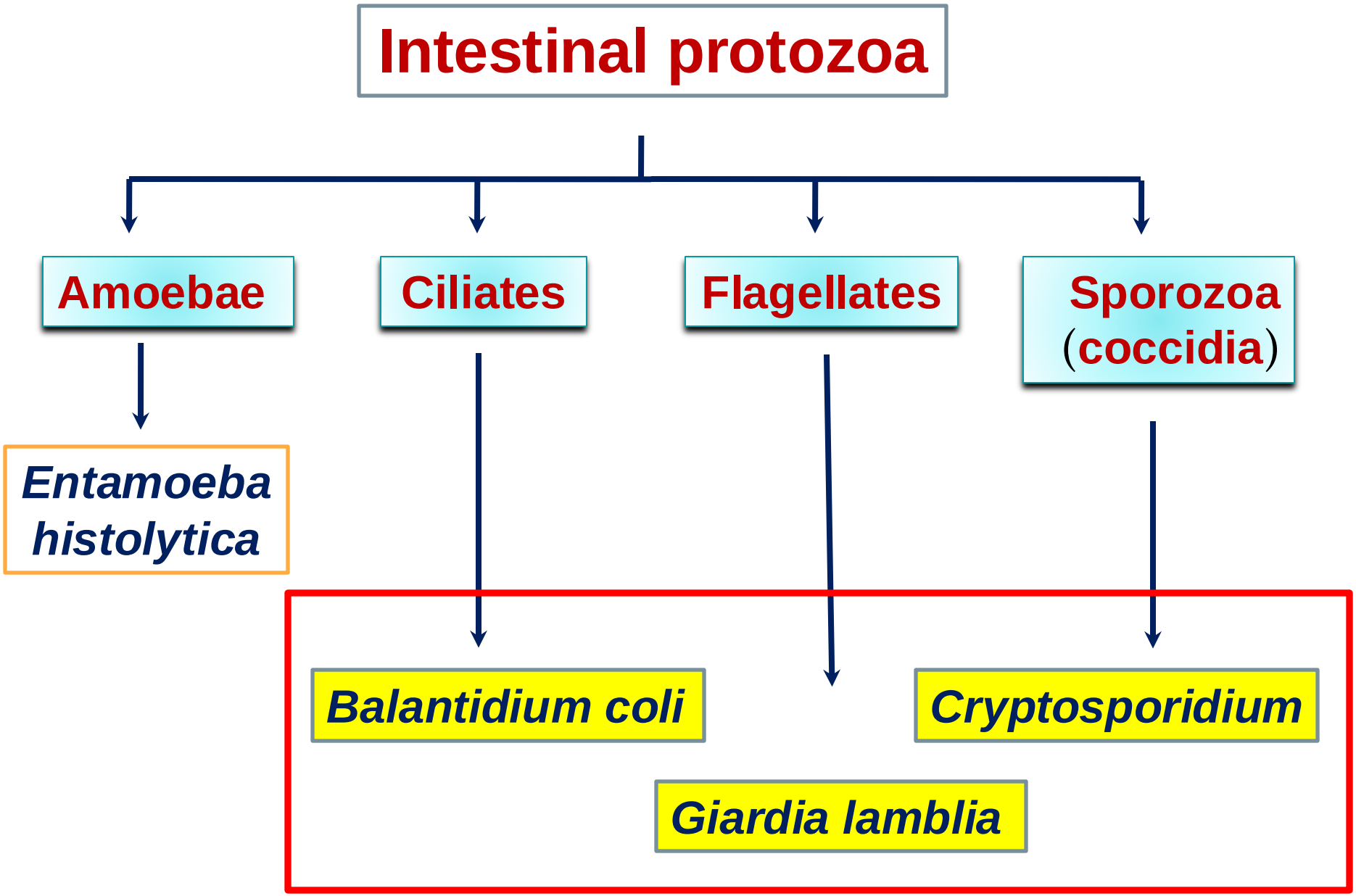
Classification based on motility

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

Ciliates

General characters

1- Move by cilia.

2- Multiply asexually by transverse binary fission and sexually by conjugation between two organisms.

3- Contain 2 compact nuclei: A large kidney shaped nucleus (macronucleus) and a small one (micronucleus).

4- Form cyst.

5- *Balantidium coli* is the only member of the ciliates known to be pathogenic to human.

Balantidium coli
The largest protozoa

❖**Geographical distribution:** Cosmopolitan especially in pig raising countries.

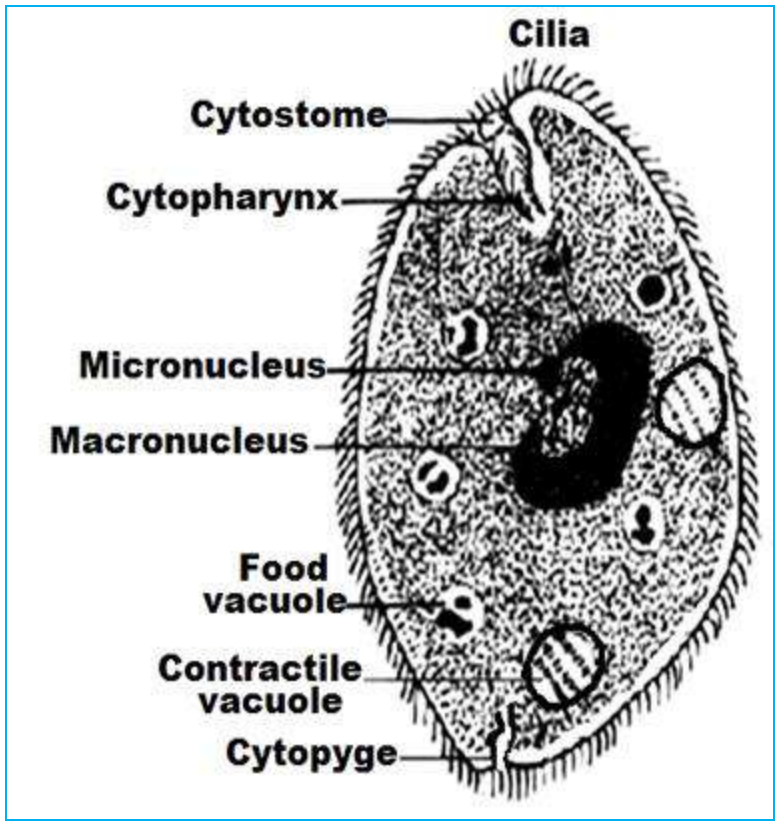
❖**Habitat:** Large intestine (caeum & rectosegmoid region).

❖**D.H:** Man.

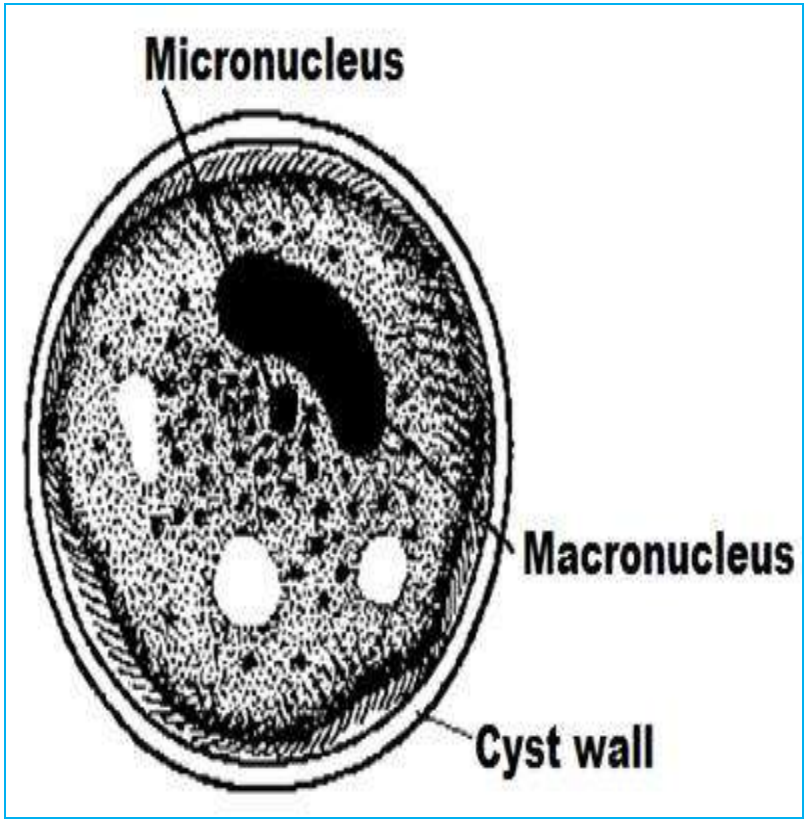
❖**R.H:** Pigs and rats.

Morphological characters

1- Trophozoite stage



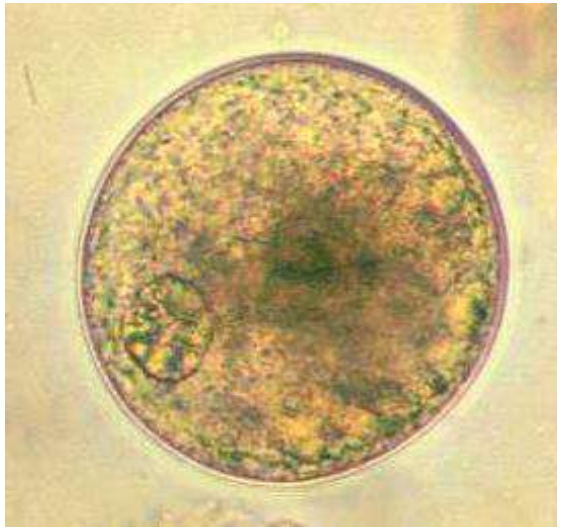
2- Cyst (I.S)



B. coli **trophozoite**

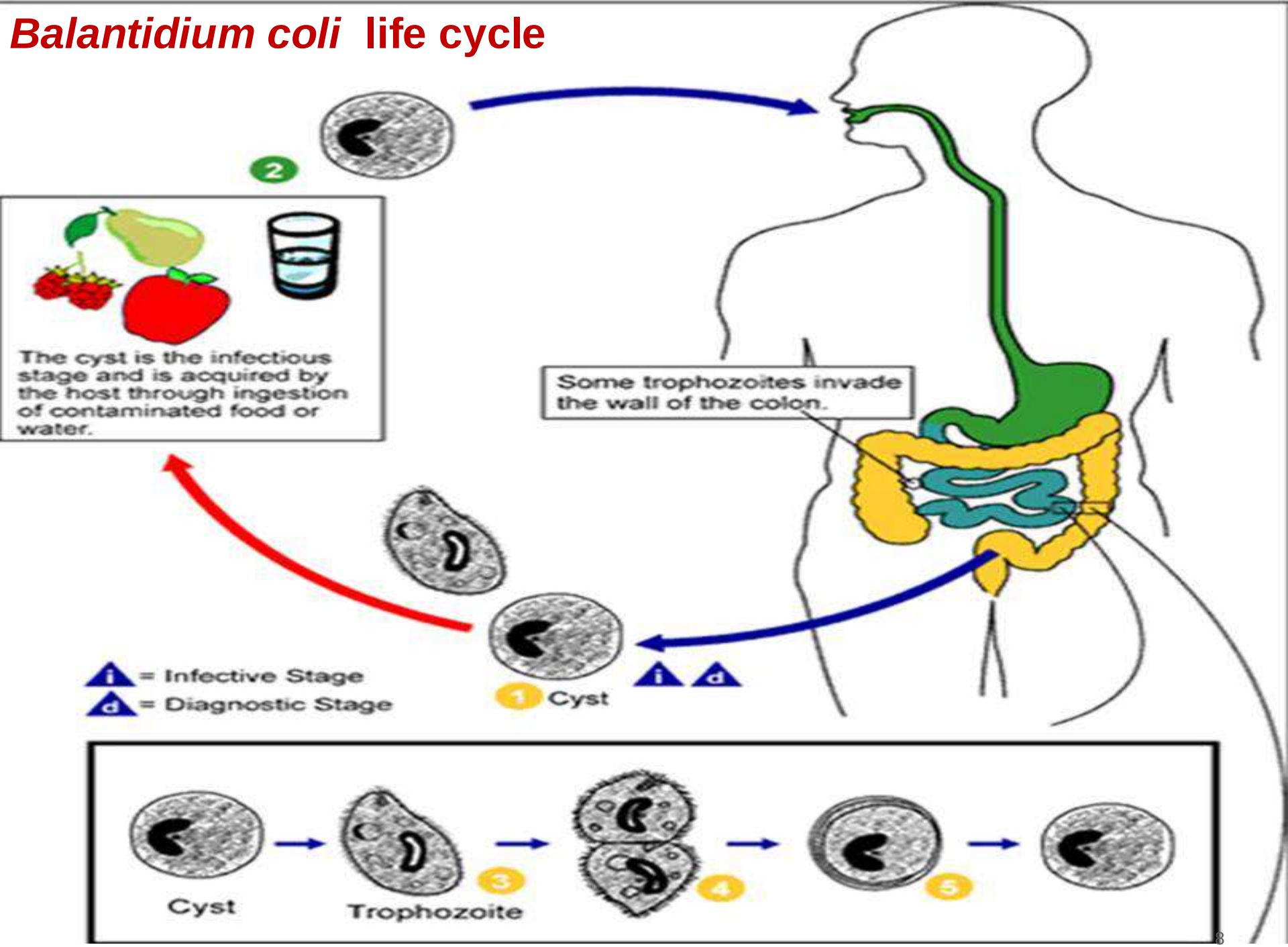
B. coli **trophozoite**

B. coli **trophozoite**



B. Coli **cyst**

Balantidium coli life cycle



Balantidium coli

Mode of transmission

1- **Ingestion of food or drink** contaminated with mature cyst directly or indirectly by flies.

2- Handling food by infected food handlers as **cookers and waiters.**

3- **Autoinfection** (hand to mouth infection).

Pathogenesis and symptomatology

Disease: Balantidiasis or balantidial dysentery

- In heavy infection, the mucosa and submucosa of the large intestine are invaded and destroyed by the multiplying organisms. This is helped by the boring action of the cilia and the proteolytic secretion ➲ the formation of small abscesses that leads to flask shaped ulcers with red undermined edges.
- Infection is severe in immunocompromised patients

Clinical pictures

1-Asymptomatic infection

Most common , trophozoites remain in the intestinal lumen feeding as a commensal without tissue invasion (Asymptomatic patient known as a healthy carrier and cyst carrier)

2-Symptomatic infection

Acute balantidial dysentery

Fever, abdominal pain, tenderness, tenesmus & frequent motions of loose stool containing mucus, blood and trophozoites.

Chronic infection

low grade fever, recurrent episodes of diarrhea alternates with constipation. Only cysts are found in stool

Complication

- Haemorrhage
- Appendicitis.
- Intestinal perforation & peritonitis.

Laboratory diagnosis

a) Direct

- **Macroscopic:** Offensive loose stool mixed with mucus and blood.
- **Microscopic:**

1-Stool examination: Reveals either trophozoites (in loose stool) or cysts (in formed stool) by direct smear, iodine stained.

2-Sigmoidoscopy: To see the ulcer or the trophozoites in aspirate or biopsy of the ulcer.

3-X-ray after barium enema: to see the ulcer, deformities or stricture.

b) Indirect

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

✍**N.B.** These serological tests are positive only in case of invasion to intestinal mucosa but negative in asymptomatic carriers.

Treatment

1- Tetracycline.

2- Metronidazole (Flagyl).

Flagellates

General characters

1- Move by one flagellum or multiple flagella.

2- Multiply by longitudinal binary fission.

3- Vesicular nucleus with central karyosome.

4- Some species have a cytostome (mouth).

Giardia lamblia

❖**Geographical distribution:** **Cosmopolitan especially tropical and subtropical regions.**

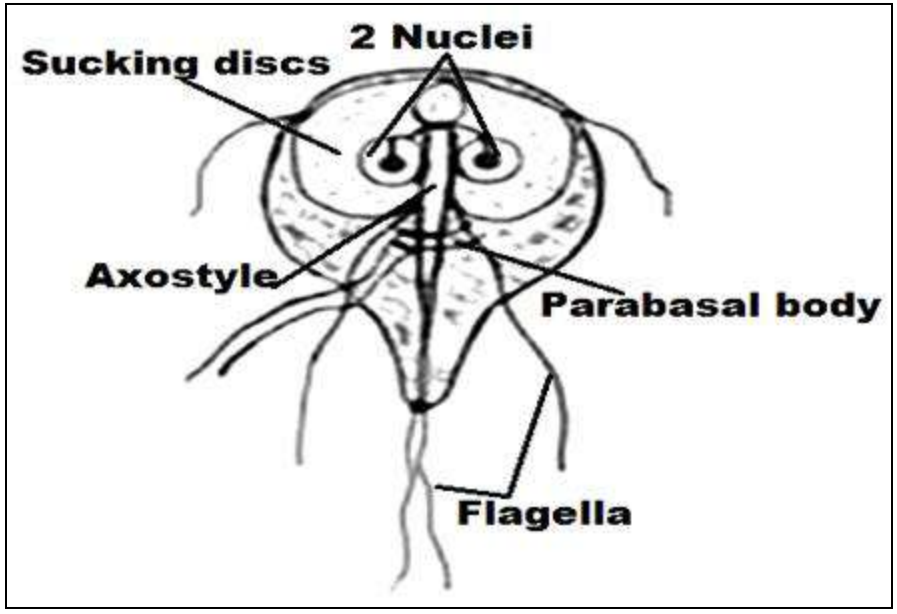
❖**Habitat:** **In the small intestine mainly the crypts of the duodenum and occasionally in the common bile duct and gall bladder.**

❖**D.H:** **Man.**

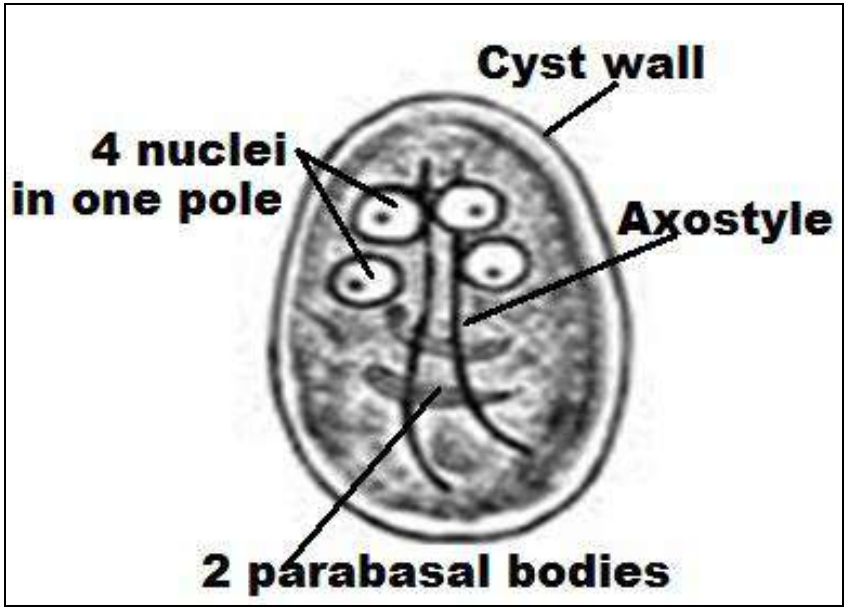
❖ ***G. lamblia*** **one of the opportunistic protozoa.**

Morphological characters

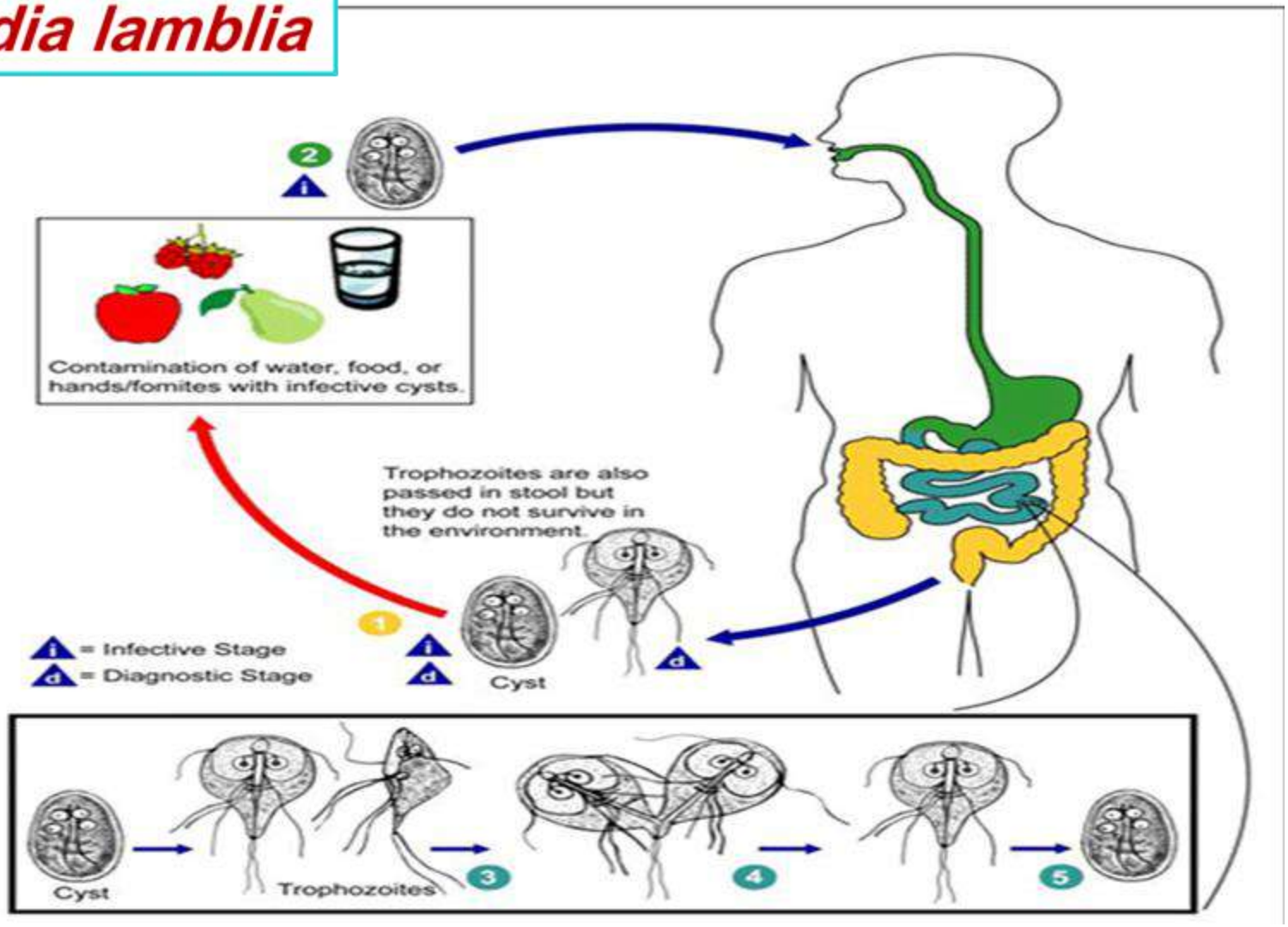
1-Trophozoite stage



2- Cyst (I.S)



Giardia lamblia



Mode of transmission:

The same as *Balantidium coli*

Pathogenesis and symptomatology

Disease: Giardiasis

Predisposing factors for the development of infection with *G. lamblia*

- **Hypogammaglobulinaemia.**
- **Low level of secretory IgA in the gut.**
- **Achlorhydria (decreased HCL).**
- **Malnutrition.**

The pathogenesis of *G. lamblia* infection depends on the following factors:

a) Mucosal factors

Direct attachment of the trophozoites to the duodenal mucosa leads to:

- Atrophy of duodenal microvilli and hyperplasia of the crypts ➲malabsorption syndrome for:

- Lactose ➲ lactose intolerance.
- Glucose and amino acids.
- Fat ➲ steatorrhea (light coloured fatty stool).
- Fat soluble vitamins (A,D,E,K) and vitamin B12.

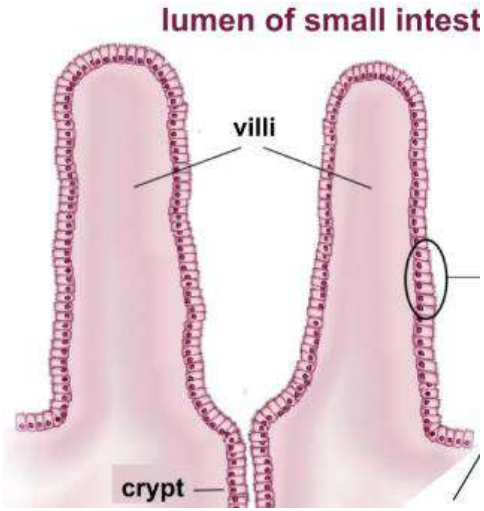
b) Luminal factors

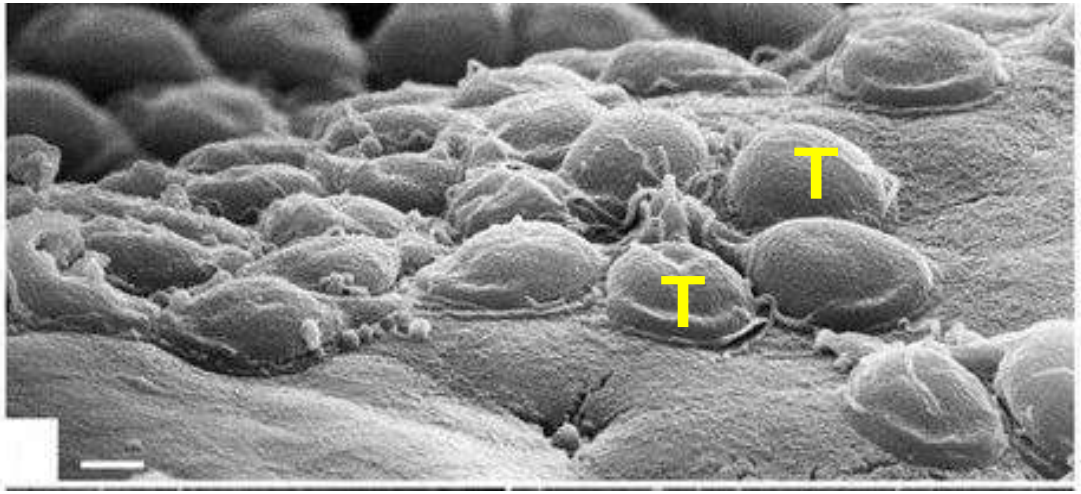
Infection with *Giardia lamblia* infection leads to:

1- Bacterial overgrowth ➲ mucosal damage and bile salts deconjugation ➲ impaired absorption of fat ➲ steatorrhoea

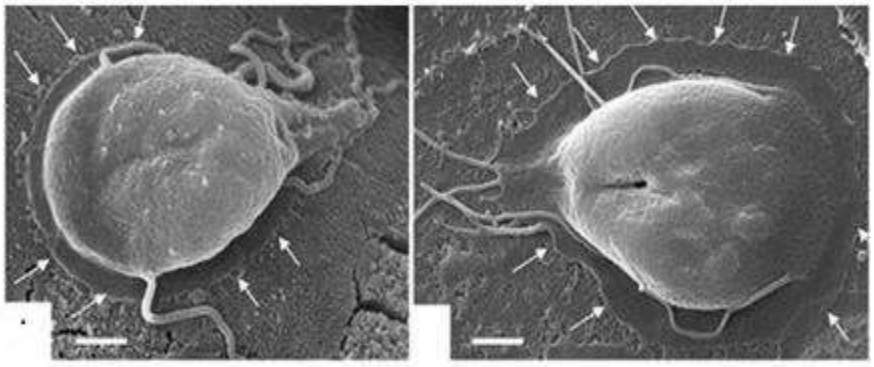
2- Decrease luminal bile salts: Due to the uptake of bile salts by *Giardia lamblia* trophozoite during its growth ➲ impaired absorption of fat and fat soluble vitamins and also vitamin B12.

3- Inhibition of digestive enzymes such as lipase and trypsin ➲ maldigestion





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



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

Treatment

1- Metronidazole (Flagyl).

2-Nitazoxanide

Clinical pictures

1-Asymptomatic infection

Most common. The trophozoites remain in the intestinal lumen feeding on surrounding nutrients and mucus without causing manifestations (Asymptomatic patient known as a healthy carrier).

2-Symptomatic infection

Acute giardiasis

- Common in children and travelers to endemic areas.
- Fever, abdominal colic, epigastric pain, anorexia, flatulence, vomiting, watery diarrhoea with excess mucus (no blood) but later steatorrhoea occurs ➲ dehydration and loss of weight. Trophozoites are found in the stool in this case.
- Invasion to gall bladder ➲ cholycystitis, jaundice and biliary colics.
- In immunocompetent patient, giardiasis is self limiting.
- In immunodeficient patient, IgA secretion in the gut is decreased ➲ severe infection with persistent diarrhea, steatorrhea, malabsorption syndrome and weight loss.

Chronic giardiasis

complications

2-Symptomatic infection

- **Acute giardiasis**
- **Chronic giardiasis**
  - **- Common in adults.**
  - **-The patient suffers from anorexia, epigastric pain, dyspepsia, nausea, vomiting & diarrhea alternating with constipation. Only cysts are found in stool.**
- **Complications**
  - **1- Retardation of growth & development in infant and young children.**
  - **2- Malnutrition and malabsorption syndrome.**
  - **3- Biliary tract disease.**

Laboratory diagnosis

Direct methods

Macroscopic

Stool is bulky, offensive, loose and greasy mixed with mucus and usually float on the water surface in toilet.

Microscopic

1) **Stool examination:** Reveals either trophozoites (in loose stool) or cysts (in formed stool) by: direct smear or concentration methods.
2) **Endoscopic biopsy** from duodenum for trophozoites & pathological changes in mucosa.

Indirect methods

-**Serological tests.**
-**Faecal antigen ELISA:** Immunologic test for detection of *G. lamblia* antigen in the stool. It is a sensitive & specific test.
-**PCR:** For detection of DNA of *G. lamblia*

Coccidia

General characters

1- Single-celled obligate intracellular parasites.

2- Multiply by alternation of sexual and asexual cycle either in the same host or two different hosts.

3- They are opportunistic parasites that common affected immunosuppressed persons.

Cryptosporidium

Geographical distribution: Cosmopolitan especially among immunosuppressed patients.

D.H & I.H: Man

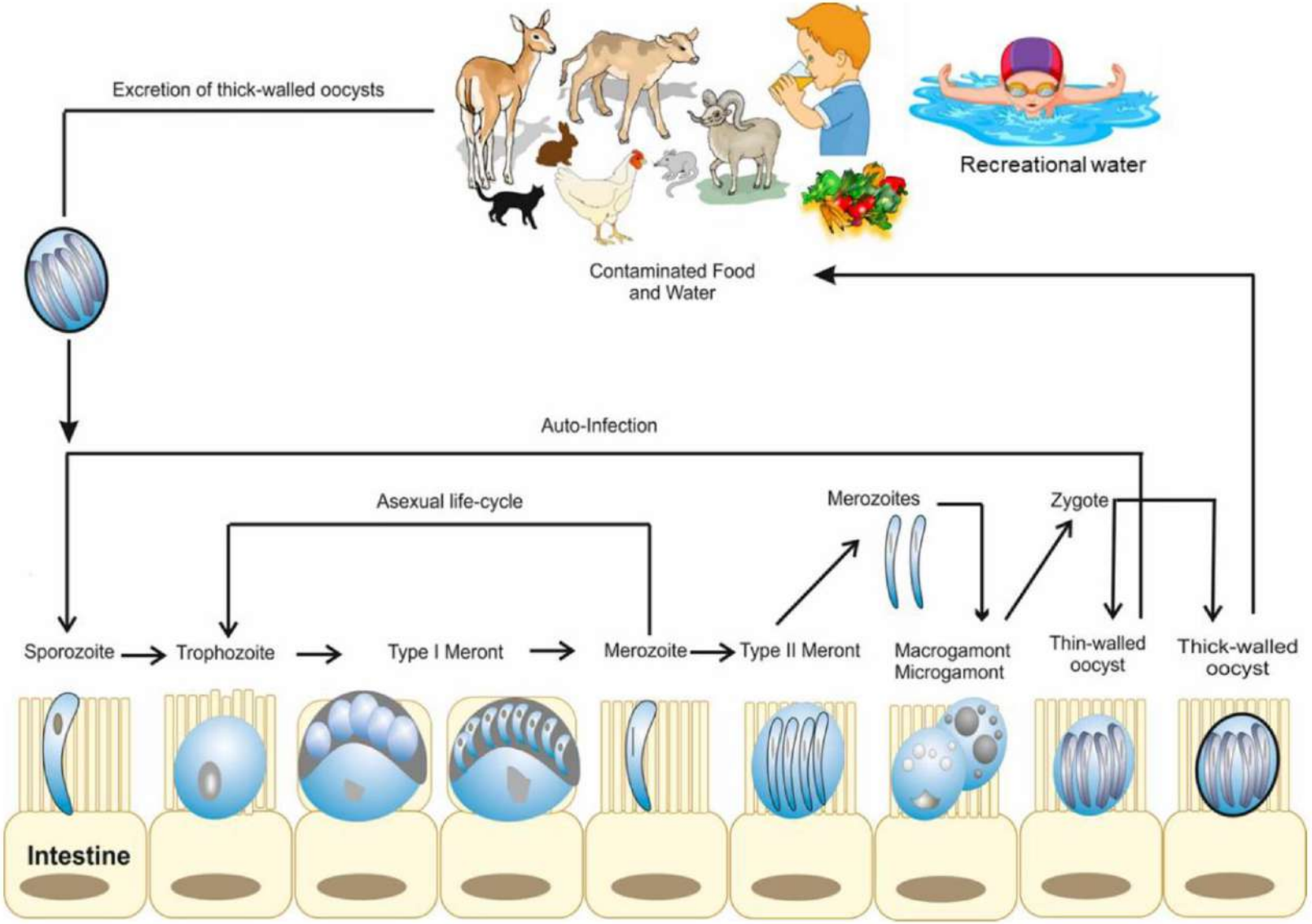
R.H: Domestic animals such as cattle, sheep, goats & dogs.

Habitat:

- Mainly in the brush border of the small & large intestine.
- In the epithelium of the respiratory and biliary tracts (in immunocompromised individuals).

***Cryptosporidium* species are:**

1- *C. parvum*. 2- *C. muris*. 3- *C. bovis*.


Excretion of thick-walled oocysts
Recreational water
Contaminated Food and Water
Auto-Infection
Asexual life-cycle
Merozoites
Zygote
Sporozoite
Trophozoite
Type I Meront
Merozoite
Type II Meront
Macrogamont Microgamont
Thin-walled oocyst
Thick-walled oocyst
Intestine

Mode of transmission

- **Contamination of food or drink with mature oocyst either directly by stool of patient or animal or indirectly by house fly.**
- **Handling food by infected food handlers as cookers and waiters.**
- **Autoinfection both external (hand to mouth infection) & internal.**
- **Inhalation of oocysts.**

Pathogenesis and symptomatology

Disease: Cryptosporidiosis

The parasite is located in the brush border of the epithelial cells of the small intestine (intracellular but extracytoplasmic) ➲ damage to the microvilli where it attaches.

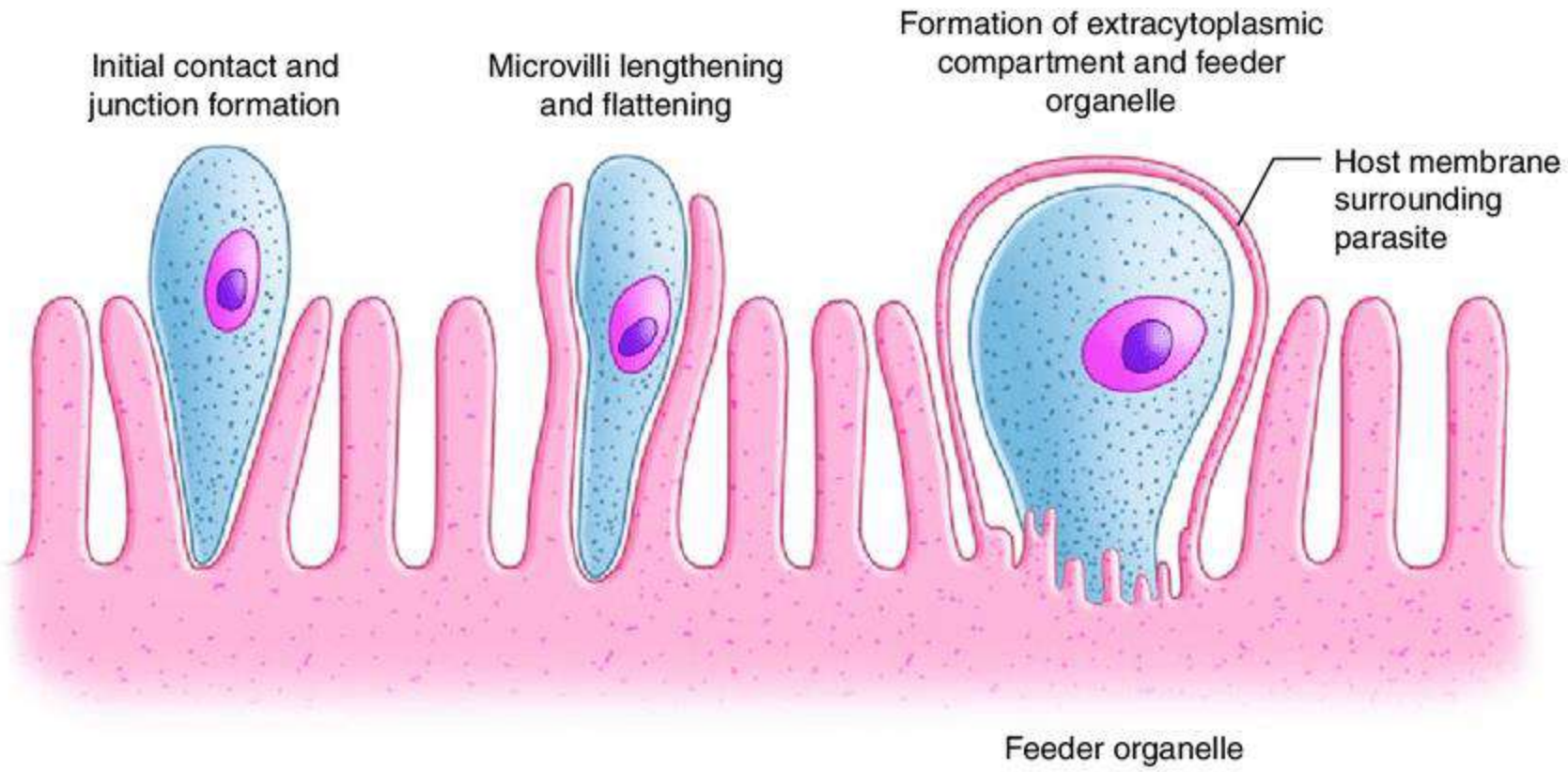
In immunocompenent patient

Acute self limited watery diarrhoea that can last for a few weeks with abdominal cramps, low fever, nausea, vomiting, malabsorption and dehydration.

In immunocompromised patient

The disease is more severe with cholera like diarrhea ➲ severe malabsorption and weight loss. The diarrhea is chronic and last for 2 months or more.

Intracellular but extracytoplasmic



Laboratory diagnosis

Direct

- **Stool examination** for detection of oocysts by:
  - Direct smear.
  - Concentration floatation methods.
  - Smear stained with modified Ziehl-Neelsen stain or acid fast stain.
- **Intestinal biopsy** stained with hematoxylin and eosin for detection of oocysts attached to the brush border.

Indirect

- **Serological tests:** For detection of antibodies.
- **Antigen detection in the stool by using:** DFAT, ELIZA, IFAT.
- **PCR.**
- **For biliary cryptosporidiosis:** Ultrasonography and endoscopy.

Treatment

For immunocompetent patient

- **Supported treatment:** Fluid + antidiarrhoeal treatment ➲ ends with spontaneous recovery.
- **Drugs:** Nitazoxanide and Spiramycin

For immunocompromised patient

- Spiramycin.
- In case of pulmonary cryptosporidiosis ➲ Azithromycin + Paromomycin.
- In case of biliary cryptosporidiosis ➲ Biliary drainage.

Summery

Balantidiasis or balantidial dysentery

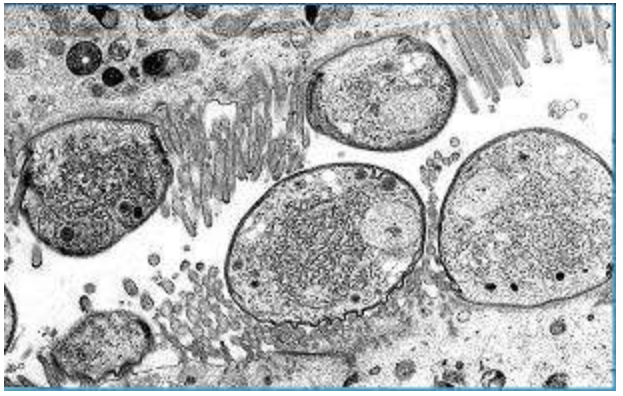
Fever, abdominal pain, tenderness, tenesmus

Giardiasis

Diarrhea, nausea, gas, bloating and abdominal cramps. Often there is microscopic blood in the stool, but obvious bleeding is rare. No **tenesmus**

Cryptosporidiosis

Abdominal cramping. Diarrhea, which is often watery, non-bloody, large-volume, and occurs many times a day.



Intestinal Schistosomiasis

- Abdominal pain.
- Frequent motion, dysentery with blood and mucus in stools

Hook worms

Iron deficiency anemia caused by blood loss at the site of intestinal attachment of adult worms may occur especially in heavy infections. Occult blood in the stool may also be seen in heavy infections

Web worm:

Blood or mucus in feces.

Intestinal nematodes

Small intestine

- With tissue stage:
  - *Ascaris lumbricoides*
  - *Ancylostoma duodenale*
  - *Necator americanus*
  - *Strongyloides stercoralis*
  - *Trichinella spiralis*

Large int.

- Without tissue stage:
  - *Enterobius vermiculars*
  - *Trichuris trichiura*

THANK YOU