Intestinal protozoa

- Giardia lamblia (Flagellate)
- Entamoeba histolytica (Ameba)
- Cryptosporidium hominis (Sporozoa)
- Cyclospora cayetanensis (Sporozoa)

**GIARDIA LAMBLIA**

_Giardia lamblia_ (Giardia duodenalis or Giardia intestinalis) is the causative agent of giardiasis and is the only common pathogenic protozoan found in the duodenum and jejunum of humans.

Giardia exists in two forms: the _trophozoite_ and the _cyst forms._

- The _trophozoite_ of G. lamblia is a heart-shaped organism, has four pairs of flagella, and is approximately 15 μm in length.
- A large concave sucking disk on the ventral surface helps the organism to adhere to intestinal villi.
- As the parasites pass into the colon, they typically encyst, and the _cysts_ are passed in the stool. They are ellipsoid, thick-walled, highly resistant, and 8–
14 μm in length; they contain two nuclei as Immature forms and four as mature cysts.

Pathology and Pathogenesis

- Giardia lamblia is usually only weakly pathogenic for humans. Cysts may be found in large numbers in the stools of entirely asymptomatic persons.
- In some persons, however, large numbers of parasites attached to the bowel wall may cause irritation and low-grade inflammation of the duodenal or jejunal mucosa, with consequent acute or chronic diarrhea associated with crypt hypertrophy, villous atrophy or flattening, and epithelial cell damage.
- Stools may be
  - Watery
  - Semisolid
  - Greasy
  - Bulky
  - foul smelling at various times during the course of the infection.
Symptoms of malaise, weakness, weight loss, abdominal cramps, distention may continue for long periods.

**Stool Collecting**

Multiple stool samples over several days is recommended to increase the likelihood of microscopically detecting cysts in smears.

**Epidemiology**

- G. lamblia occurs worldwide. Humans are infected by ingestion of fecally contaminated water or food containing cysts or by direct fecal contamination, as may occur in day care centers, refugee camps, and institutions, or during oral–anal sex.
- Cysts can survive in water for up to 3 months.

**CRYPTOSPORIDIUM**

- Cryptosporidium species, typically C. hominis, can infect the intestine in immunocompromised persons (e.g., those with AIDS) and cause severe, diarrhea.
- They have long been known as parasites of rodents, fowl, monkeys, cattle, and other herbivores and have probably been an unrecognized cause of self-limited, mild gastroenteritis and diarrhea in humans.
- Oocysts measuring 4–5 μm are passed in feces in enormous numbers and are immediately infectious.

When oocysts in contaminated foods and water are ingested, sporozoites excyst and invade intestinal cells; the parasites multiply asexually within the apical portion of the intestinal cells, are released, and infect other intestinal cells to begin a new cycle. They also reproduce sexually, forming male microgamonts and female macrogamonts that fuse and develop into the oocysts.
Pathology and Pathogenesis

Cryptosporidium inhabits the brush border of mucosal epithelial cells of the gastrointestinal tract, especially the surface of villi of the lower small bowel.

The prominent clinical feature of cryptosporidiosis is watery diarrhea, which is mild and self-limited (1–2 weeks) in normal persons but may be severe and prolonged in immunocompromised or old individuals.

The small intestine is the most commonly infected site, but Cryptosporidium infections have also been found in other organs, including other digestive tract organs and the lungs.

Diagnosis depends on detection of oocysts in fresh stool samples.

Monoclonal antibody-based testing can detect low-level infections, and fluorescent microscopy with auramine staining is useful.

EIA tests are now available for detection of fecal antigen.

Epidemiology

The incubation period for cryptosporidiosis is from 1 to 12 days, and the disease is acquired from infected animal or human feces or from fecally contaminated food or water.

For those at high risk (immunocompromised and old persons), avoidance of animal feces and careful attention to sanitation are required.

STRONGYLOIDES STERCORALIS (human threadworm)

Adult females (about 2 mm long) of Strongyloides stercoralis inhabit the intestine. They lay eggs within the intestine; larvae hatch from the eggs and are passed into the feces. These larvae can either

1. develop into parasitic forms
2. develop into free-living male and female worms that mate and produce several generations of worms in the soil.
The larvae of the free-living forms, under certain environmental conditions such as temperature, can develop into parasitic forms.

Pathology and Pathogenesis

- Strongyloides can produce an internal **reinfection** or **autoreinfection** if newly hatched larvae never exit the host but, instead, undergo their molts within the intestine.
- These larvae penetrate the intestine, migrate throughout the circulatory system, enter the lungs and heart, and develop into parasitic females in the intestine.
- They are able to **sustain an infection for many years** and, in the event of immunosuppression, produce a hyperinfection in which a fulminating, fatal infection occurs.
- In disseminated infections, clinical signs and symptoms primarily involve the gastrointestinal tract (severe diarrhea, abdominal pain, gastrointestinal bleeding, nausea, vomiting), lungs (coughing, wheezing, hemoptysis), and skin (rash, and pruritus).
- Larvae migrating from the intestine carrying enteric bacteria can cause local infections or sepsis, resulting in death.

Sanitation involving proper disposal of human wastes. Infected persons and animals may be treated with appropriate anthelmintic.

Diagnosis is based on finding juveniles in freshly passed stools, by a direct smear in cases of heavy infection or following concentration or zinc flotation with centrifugation.
Symptoms-Pathogenicity

1. Dermatitis is produced by migration of the infective juveniles through the skin (cutaneous infection).
2. Mild to severe symptom of pneumonia during migration to air-sacs of lungs.
3. Inflammation of the intestinal mucosa.
4. Diarrhea accompanied by exhaustion.
5. In massive infections, death may result unless therapeutic measures are taken.
**Rhabditoid larvae**, is the feeding stage of the parasite, open mouth, club-shaped anterior portion, molt 4 time before becoming an adult.

**Filariform larvae**, non feeding stage, close mouth, infective to the man, swim in water, survive in water and soil for several years.

**Balantidium coli**, a giant intestinal ciliate of humans and pigs, is the only human parasite representative of this group (is considered rare). Causes the disease **balantidiasis**.
*Balantidium coli* has two developmental stages, a trophozoite stage and a cyst stage. In trophozoites, the two nuclei are visible. The macronucleus is long and sausage-shaped, and the spherical micronucleus is often hidden by the macronucleus.

Cysts are smaller than trophozoites and are round and have heavy cyst wall made of one or two layers. Living trophozoites and cysts are yellowish or greenish in color.

**Transmission**

*Balantidiasis* is a zoonotic disease and is acquired by humans via the feco-oral route from the normal host, the pig, where it is asymptomatic.

Contaminated water is the most common mechanism of transmission

**Role in disease**

*Balantidium coli* lives in the cecum and colon of humans, pigs, rats and other mammals. It is not readily transmissible from one species of host to another because it requires a period of time to adjust to the symbiotic flora of the new host. Once it has adapted to a host, the protozoan can become a serious pathogen, especially in humans.

Infection occurs when the cysts are ingested, usually through contaminated food or water. It can thrive in the gastrointestinal tract as
long as there is a balance between the protozoan and the host without causing dysenteric symptoms.

Infection most likely occurs in people with malnutrition due to the low stomach acidity or people with compromised immune systems.

Once the cyst is ingested, it passes through the host’s digestive system. Once the cyst reaches the small intestine, trophozoites are produced. The trophozoites then colonize the large intestine, where they live in the lumen and feed on the intestinal flora. Some trophozoites invade the wall of the colon using proteolytic enzymes and multiply, and some of them return to the lumen.

In the lumen trophozoites may disintegrate or undergo encystation.

Encystation is usually occurs in the distal large intestine, but may also occur outside of the host in feces.

Now in its mature cyst form, cysts are released into the environment where they can go on to infect a new host.

In acute disease, explosive diarrhea may occur as often as every 20 minutes. Perforation of the colon may also occur in acute infections which can lead to life-threatening situations.

**Epidemiology**

Balantidiasis in humans is common in the Philippines, but it can be found anywhere in the world, especially among those that are in close contact with swine. The disease is considered to be rare and occurs in less than 1% of the human population. The disease poses a problem mostly in developing countries, where water sources may be contaminated with swine or human feces.
The cyst is the infectious stage and is acquired by the host through ingestion of contaminated food or water.

Some trophozoites invade the wall of the colon.

1. Cyst
2. Cyst
3. Trophozoite
4. Trophozoite
5. Cyst

Life Cycle of *Balantidium coli*