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## **Sarcodina**

This phylum includes amoeba and various pathogenic species. These organisms are similar in appearance but have key biological differences at the cellular level. Sarcodines have cells that are either spherical or irregular in shape and form. The pellicles, or envelopes, of their cells are generally soft, transparent and flexible. Some sarcodines have external shells or skeletons and have cytoplasms comprised of ectoplasms and endoplasms, which may have multiple nuclei. These organisms obtain energy by consuming food particles and organic matter. Sarcodines generally eat by trapping food particles and substances with their pseudopods then carrying out digestion in special chambers called food vacuoles. Sarcodines may reproduce sexually or asexually. Sexual reproduction is accomplished through syngamy, which is the fusion of two gametes. Asexual reproduction, contrarily, spawns offspring through cell division. Sarcodines with multiple nuclei undergo cytoplasmic division, which involves the replication of cells and nuclei, in addition to the transfer of genes and traits that occurs during sexual reproduction. These organisms live in virtually every environment and live as individuals or in colonies.

### ***Entamoeba histolytica* – Amoebiasis**

*Entamoeba histolytica* is a protozoan parasite responsible for a disease called amoebiasis. It occurs usually in the large intestine and causes internal inflammation as its name suggests (histo = tissue, lytic =

destroying). 50 million people are infected worldwide, mostly in tropical countries in areas of poor sanitation. In industrialized countries most of the infected patients are immigrants, institutionalized people and those who have recently visited developing countries.

### **Morphology and life cycle**

Inside humans *Entamoeba histolytica* lives and multiplies as a trophozoite. Trophozoites are oblong and about 15–20 µm in length. In order to infect other humans they encyst and exit the body. **The life cycle of *Entamoeba histolytica* does not require any intermediate host.** Mature cysts (spherical, 12–15 µm in diameter) are passed in the feces of an infected human. Another human can get infected by ingesting them in fecally contaminated water, food or hands. **If the cysts survive the acidic stomach, they transform back into trophozoites in the small intestine. Trophozoites migrate to the large intestine where they live and multiply by binary fission.** Both cysts and trophozoites are sometimes present in the feces. Cysts are usually found in firm stool, whereas trophozoites are found in loose stool. **Only cysts can survive longer periods (up to many weeks outside the host) and infect other humans.** If trophozoites are ingested, they are killed by the gastric acid of the stomach. **Occasionally trophozoites might be transmitted during sexual intercourse.**

### **Pathogenicity and clinical signs**

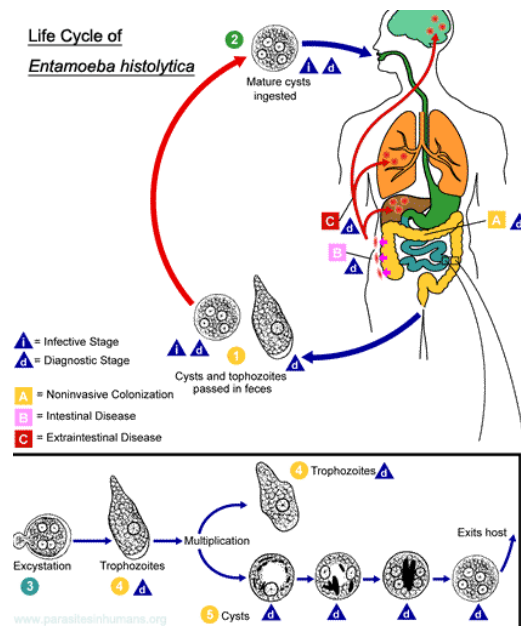
**Most *Entamoeba histolytica* infections are asymptomatic and trophozoites** remain in the intestinal lumen feeding on surrounding nutrients. About 10–20 % of the infections develop into amoebiasis which causes 70 000 deaths each year. **Minor infections** (luminal amoebiasis) can cause **symptoms** that include:

- gas (flatulence)
- intermittent constipation
- loose stools
- stomach ache
- stomach cramping.

Severe infections inflame the mucosa of the large intestine causing amoebic dysentery. The parasites can also penetrate the intestinal wall and travel to organs such as the liver via bloodstream causing extraintestinal amoebiasis. **Symptoms** of these more **severe infections** include:

- anemia
- appendicitis (inflammation of the appendix)
- bloody diarrhea
- fatigue
- fever
- gas (flatulence)
- **genital and skin lesions**
- intermittent constipation
- liver abscesses (can lead to death, if not treated)
- malnutrition
- painful defecation (passage of the stool)
- peritonitis (inflammation of the peritoneum which is the thin membrane that lines the abdominal wall)
- pleuropulmonary abscesses
- stomach ache
- stomach cramping
- toxic megacolon (dilated colon)

- weight loss.



## Zooflagellates

Zooflagellates without chloroplasts derive energy by the absorption of nutrients or the ingestion of food particles. Many species occur as free-living aquatic organisms whereas others live in insects and some vertebrates as symbiotes, commensals or parasites (several species cause major human diseases such as sleeping sickness, Chagas disease, kala azar and diarrhoea).

### Flagellates divided into:

1-Intestinal and urogenital flagellates

- Giardia intestinalis*
- Trichomonas foetus*

2-Hemoflagellates (blood and tissue flagellates)

Two genera within hemoflagellates infect human which are:

- Genus *Leishmania*
- Genus *Trypanosoma*

### *Giardia lamblia* (giardiasis)

*Giardia intestinalis* (also known as *Giardia lamblia* or *Giardia duodenalis*) is a protozoan flagellate causing giardiasis in the small intestine. It attaches to the mucosa and absorbs nutrients that it gets from the intestinal wall. In addition to humans, *Giardia intestinalis* infects birds, cows, sheep, deer, dogs and cats. Giardiasis is found worldwide mostly in warm climates.

### **Morphology and life cycle**

*Giardia lamblia* trophozoites are pear-shaped and 10–20 µm long. Other characteristics include: flagella, median bodies, sucking disks and two big nuclei. *Giardia intestinalis* cysts are oval to ellipsoid and 8–19 µm long. Immature cysts have two nuclei, whereas mature cysts have four.

*Giardia lamblia* lives as active trophozoites in the small intestine. Some trophozoites encyst into cysts which are released in a bowel movement. The feces might contaminate soil, water, food or surfaces such as bathroom sinks. **The cyst has a protective shell and it can survive in the environment for many weeks (in cold water many months).** You become infected after accidentally swallowing the microscopic cysts. Each cyst releases two trophozoites in the small intestine. **They remain in the lumen where they can feed freely or attached to the mucosa by a ventral sucking disk.** After eating enough, they go through another transformation and multiply by binary fission. The trophozoites encyst as they move towards the colon. Cysts are found more often in firm stool whereas both trophozoites and cysts are present in loose stool. Because the cysts become infective almost instantly after being passed out, the disease can be transmitted during anal-oral-sexual intercourse.

## **Pathogenicity and clinical signs**

Common giardiasis **symptoms** include:

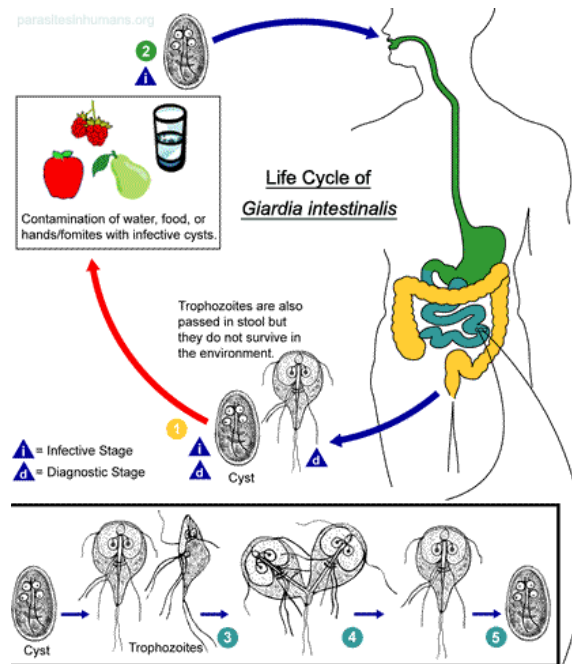
- bloating
- bad breath and farts
- dehydration
- **diarrhea or greasy floating stools**
- fatigue
- loss of appetite
- nausea
- stomach ache
- weakness
- weight loss.

**Diarrhea can be fatal, if you do not drink enough water with salt and glucose.** Another not so recognizable effect is the lack of **B12-vitamin**. **This is due to the impaired absorption (malabsorption)** in the damaged intestinal wall. 50 % of giardiasis cases are asymptomatic. Symptoms begin usually within two weeks after becoming infected. In healthy individuals the sickness normally persists up to three weeks, but sometimes longer.

## **Intracellular metabolism and biochemistry**

*Giardia* relies on glucose as its major energy source and breaks glucose down into ethanol, acetate and carbon dioxide. However, it can also use arginine as an energy source. *Giardia* possesses unique biochemical pathways that suggest it diverged from other eukaryotes at an early stage in evolution. B vitamins and bile salts, as well as glucose, are necessary

for *Giardia* to survive, and a low-carbohydrate diet was shown in mice to reduce the number of *Giardia* organisms present.



## Diagnosis

It can be diagnosed by stool samples, but it is important to note that certain other species are impossible to distinguish by microscopy alone. Trophozoites may be seen in a fresh fecal smear and cysts in an ordinary stool sample. ELISA or RIA can also be used

## Treatment

Usually nitroimidazole derivatives are used because they are highly effective against the trophozoite form of the amoeba and *Giardia*. Since they have little effect on cysts, usually this treatment is followed by an agent (such as paromomycin or diloxanide furoate) that acts on the organism in the lumen.

## ***Trichomonas foetus***

Trichomoniasis is a venereal disease of cattle characterized primarily by early fetal death and infertility, resulting in extended calving intervals. Distribution is probably worldwide.

### **Main properties**

The causative protozoan, *Trichomonas foetus*, is pyriform and ordinarily  $10\text{--}15 \times 5\text{--}10 \mu\text{m}$ , but there is considerable pleomorphism. It may become spherical when cultured in artificial media. At its anterior end, there are three flagella approximately the same length as the body of the parasite. An undulating membrane extends the length of the body and is bordered by a marginal filament that continues beyond the membrane as a posterior flagellum. Although *T foetus* can survive the process used for freezing semen, it is killed by drying or high temperatures.

### **Life cycle**

*T foetus* is found in the genital tracts of cattle. When cows are bred naturally by an infected bull, 30%–90% become infected, suggesting that strain differences exist.

### **Pathogenicity and Clinical Findings**

The most common sign is infertility caused by embryonic death. This results in repeat breeding, and attending stock persons often note cows in heat when they should be pregnant. This, along with poor pregnancy test results (eg, too many “nonpregnant normal” and late-bred cows) is usually the presenting complaint. In addition to a reduced number of cows estimated to calve during the regular calving season, an increased



number of cows with a “nonpregnant abnormal” reproductive tract diagnosis is seen. **These include cows with pyometra, endometritis, or a mummified fetus.**

**Fetal death and abortions can also occur but are not as common as losses earlier in gestation.** *T. foetus* has been found in vaginal cultures taken as late as 8 mo of gestation and, apparently, live calves can be born to infected dams. Pyometra occasionally develops after breeding. Variation in breed susceptibility to trichomoniasis may also exist. **Bulls of all ages can remain infected indefinitely, but this is less likely in younger males.** By contrast, most cows are free of infection within 3 mo after breeding. However, immunity is not longlasting and reinfection does occur. **Transmission can also occur when the semen from infected bulls is used for artificial insemination.**

## **Diagnosis**

*Trichomonas foetus* can be detected by two methods:

1. culture
2. PCR testing - A fecal sample is sent to a diagnostic laboratory for analysis. PCR testing searches the specimen for genetic evidence of the *T. foetus* organism. This test is the most reliable available at this time. The PCR test takes just a few days to complete, so it is the fastest way to get results.

## **Treatment**

Treatment of the infection is difficult due to drug resistance. Traditional antiprotozoal drugs such as fenbendazole and metronidazole do not alleviate the symptoms. Some antimicrobial drugs have been shown to improve symptoms but do not eradicate the parasite.

## Questions related to the lecture

- 1- amoebiasis caused by .....
- 2- infective stage of *E. histolytica* is .....
- 3- site of *E. histolytica* in .....
- 4- numerate the symptoms with severe infection ?
- 5- ..... Is the most important clinical signs with amoebiasis
- 6- extraintestinal amoebiasis includes.....
- 7- fatty diarrhea caused by ..... Parasite
- 8- Common giardiasis **symptoms** include?
- 9- with giardiasis the lack of B12-vitamin due to .....
- 10- what are the main materials that *Giardia* relies on to get energy ?
- 11- the infective stage of *T. foetus* is .....
- 12- The most common sign with trichomoniasis is embryonic death, mention the reason(s)?
- 13- mention the mode of transmission for *T. foetus*?

1- The **life cycle** of *Entamoeba histolytica* does not require any intermediate host.