

# Medical Parasitology

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## Lec. 3 Protozoa

### II The flagellates

The flagellates are protozoa distinguished by having one to several thread-like extensions of the ectoplasm in their trophozoite stage, each of which contains an axial structure called axoneme arising from a basal body, associated with a kinetoplast or similar structure. The flagellum, basal body, and kinetoplast constitute the neuromotor apparatus of which the former two are the motor component and the latter the energizing portion. The flagellate protozoa that are parasites of man are conveniently discussed as (A) flagellates of the digestive tract and genital organs, and (B) flagellates of the blood and tissues. The first group of flagellates inhabiting the mouth, intestine, and genital tract are typically lumen parasites. Although no member of the group is a tissue invader, *Giardia lamblia* in the duodenum and *Trichomonas vaginalis* in the vagina may produce symptoms.

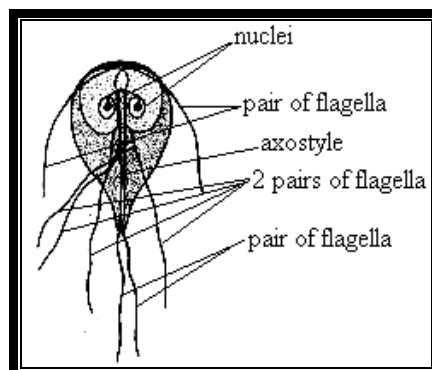
- Kingdom : Animalia
- Phylum : Protozoa
- Sub-phylum: Mastigophora
- Class : Zoomastigophorea

#### A. The flagellates of digestive tract and genital organs:

##### 1 *Giardia lamblia*

This parasite has a cosmopolitan distribution and it is common in both warm and temperate climates, causes a disease called Giardiasis. The parasite appears in two stages, trophozoite and cyst. The trophozoite lives on the epithelial brush border of the upper two thirds of the small intestine, stick itself on the epithelial cells. It lives in the duodenum and sometimes entering the bile duct. It infects the children more than the older people.

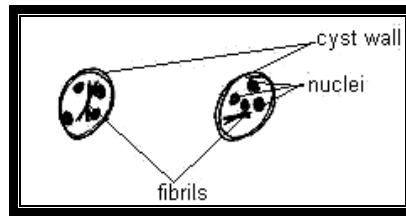
When the trophozoite is seen from the ventral aspect (view) it appears rounded anteriorly and tapering to a point posteriorly. When viewed from the lateral (profile), it has seen relatively thin and in the anterior half it is concave ventrally forming an [adhesive sucking disc]. It bears four pairs of flagella extends along the midline.



*Giardia lamblia* (trophozoite).

The trophozoite measures 9.5-21 $\mu$  in length by 5-15 $\mu$  in width and only 2-4 $\mu$  in thick. It has two ovoid nuclei each with a central karyosome and there is two axostyle between the two nuclei extends to the posterior end.

The cyst is ovoid in shape with thick wall, it measures 8-12 $\mu$  in length and 7-10 $\mu$  breadth and has 4 nuclei founds in one pole of the cysts or distributed as two nuclei in each pole. The cyst has also retracted flagella which appears as stiffly curved fibrils situated in parallel pairs.



*Giardia lamblia* (cyst).

## Life cycle

Human infection occurs by the ingestion of cysts in contaminated water, food, or by the fecal-oral route (hands or fomites). Decystation (or excystation) occurs in the small intestine (in the duodenum) releasing the trophozoites where each cyst produces two trophozoites. The trophozoites multiply by longitudinal binary fission, colonize the upper small intestine where they may swim freely or attach to the sub-mucosal epithelium via the ventral suction disc. The free trophozoites encyst as they move downstream and mitosis takes place during the encystment.

Cysts are resistant forms and are responsible for the transmission of Giardiasis. Encystation occurs as the parasites transit toward the colon. The cysts are hardy and can survive several months in cold water. Cysts are passed in the stool; both cysts and trophozoites can be found in the feces, the cyst is the stage found most commonly in nondiarrheal feces. Man is the primary host although beavers, pigs and monkeys are also infected and serve as reservoirs. Because the cysts are infectious when passed in the stool or shortly afterwards, person-to-person transmission is possible. While animals are infected with Giardia, their importance as a reservoir is unclear.

## Pathology

The presence of the parasite on the surface of the epithelial cells (on the brush border) causes mechanical complication leads to malabsorption of nutrients and digested food because it forms a pavement like sheet covering and damaging the mucosa, that leads to vitamins deficiency especially those which are soluble in fats. The parasite also causes heavy mucus secretion. It is feeding on this mucus, the amino acids, some vitamins and the other substances which are passing through the intestine.

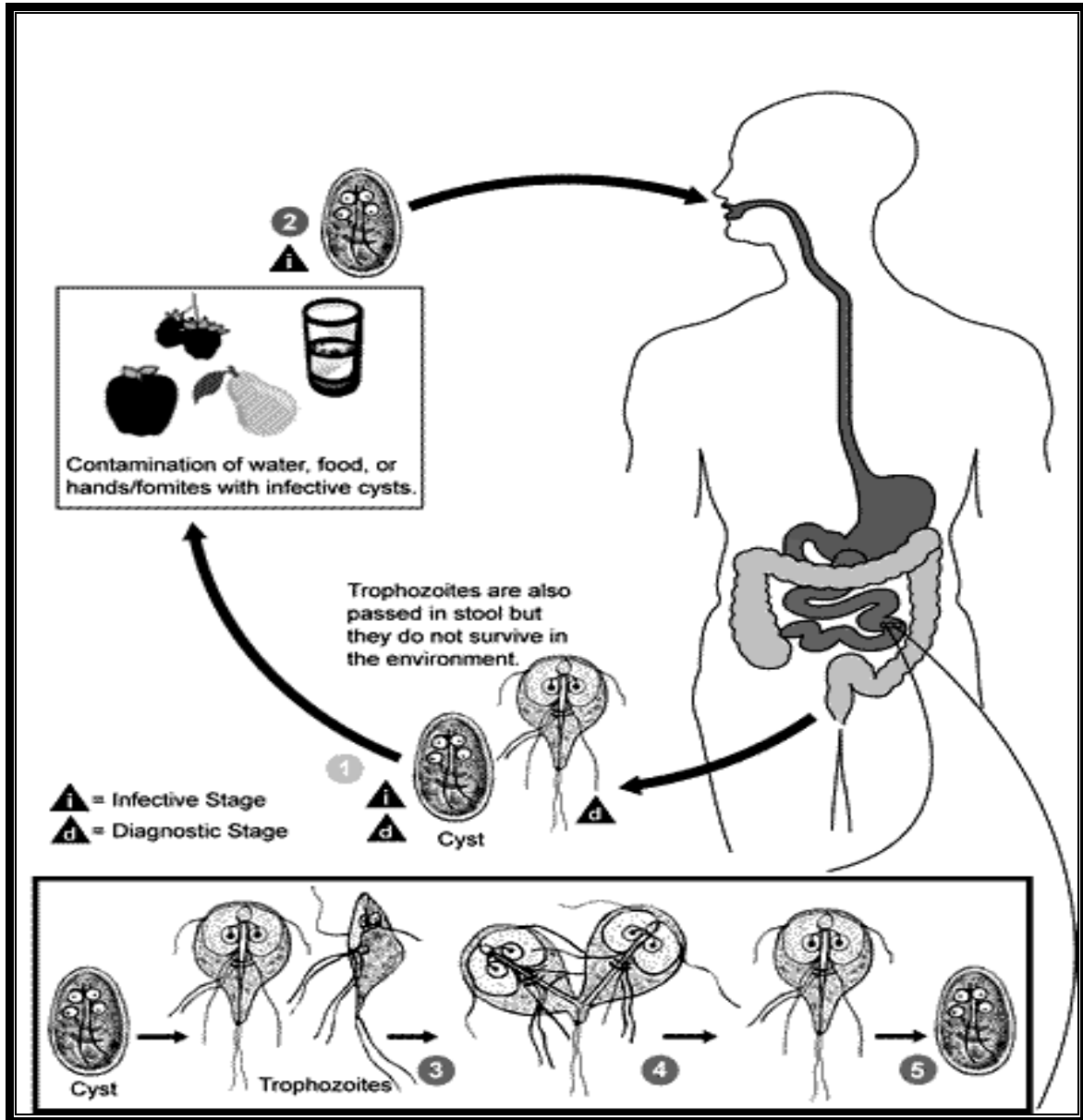
## Symptomatology

1. Early symptoms include Epigastric pain, abdominal cramps and discomfort expressed as flatulence, abdominal distension, nausea and foul-smelling bulky, explosive, and often watery diarrhea. The stool contains excessive lipids but very rarely any blood or necrotic tissue.

2. The more chronic stage is associated with vitamin B12 malabsorption, disaccharides deficiency and lactose intolerance, fat soluble vitamin deficiency.

3. The large quantity of mucus, and the presence of fats with the stool leads to continuous diarrhea with a large quantity of mucus, (the aggregation of fats result from the malabsorption of it), and sometimes constipation or steatorrhea.

4. Weight loss.



“Diagram for the life cycle of *Giardia lamblia*”

## Diagnosis

It is based on the detection of the typical cyst, and less frequently, the trophozoite in the stool. Trophozoites must be distinguished from the non-pathogenic flagellate *Trichomonas hominis*, which is an asymmetrical flagellate with an undulating membrane.

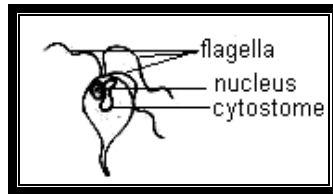
## Treatment

Giardiasis may be disappearing spontaneously but usually is eradicated following therapy with Quinacrine (Atabrine) or Metronidazole.

## 2 *Chilomastix mesnili*

It is cosmopolitan protozoan of the human intestinal tract (especially the large intestine). It has trophozoite and cyst stages and the infection usually acquired from the cysts in contaminated food or drink.

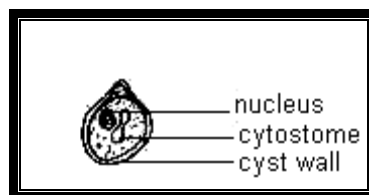
The trophozoite is pear-like and has a non-symmetric shape; the actively moving trophozoite is rounded anteriorly and spirally twisted posteriorly to a tapering end. It measures up to  $20\mu$  ( $6-20\mu$ ) in length when it is in progressive forward movement, but only ( $3-10\mu$ ) when it is relatively quiescent. In the anterior rounded portion, there is a distinct longitudinal cleft called the cytostome.



*Chilomastix mesnili* (trophozoite).

The cytostome arising from the anterior pole three thin flagella, two of them extends to the left back direction of the body while the third one lies within the cytostome, and two stiffer curved fibrils, one on each side of the cytostome “It is believed that the third flagellum consist an undulating membrane, pushing the food particles to the depth of the cytostome”. The nucleus is situated at the extreme anterior end.

The parasite moves forward with a jerky movement in a spiral path. Multiplication is by longitudinal binary fission.



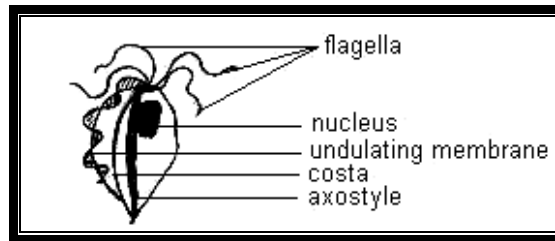
*Chilomastix mesnili* (cyst).

The cyst is lemon-shaped, measures  $7-9\mu$ ; it has a relatively thick hyaline wall, nucleus, and cytostome. In unformed stools the majority of this organism is motile trophozoite; in formed stool, only cysts are seen.

There is no evidence that this organism is pathogenic, but it could be say that this parasite benefits and multiplied in the intestinal infections, but it does not cause the disease.

## 3 *Trichomonas vaginalis*

The parasite has a cosmopolitan distribution, causes Trichomoniasis or Trichomonas vaginitis. This species is found only in a trophozoite stage. It measures  $15-20\mu$ , reaching maximum measurements of  $27\mu$  in length and  $18\mu$  in breadth. The parasite has a large nucleus, and four anterior flagella of equal length, a fifth one lies on the margin of a relatively short undulating membrane which does not extend beyond the posterior margin of the membrane (the flagellum). There is also a delicate axostyle protruding for a considerable distance beyond the posterior tip of the organism. Multiplication by longitudinal binary fission.



*Trichomonas vaginalis* (trophozoite).

Its habitat is the human vagina (in females) and the genital tract (in males) and probably localized in the prostate gland and the urethra. Mostly non-pathogenic for male, but sometimes causes urethritis.

Transmission of the infection is principally through sexual intercourse, or by the infected mucus in the W.Cs. or underwear.

## Symptomatology

1. The infection in women is frequently symptomatic. The symptoms vary from mild to severe. Vaginitis with a purulent discharge is the prominent symptom, and can be accompanied by vulvar and cervical lesions, abdominal pain, dysuria and dyspareunia. Also leads to heavy, acidic, mucoid secretion, excessive discharge together with genital sprays may produce urticaria and acute vulvitis. The incubation period is 5 to 28 days.

2. In men, the infection is frequently asymptomatic; occasionally, urethritis, epididymitis, and prostatitis can occur.

It is believed that this parasite and may be the bacteria also decrease the acidity of the vagina from (4-4.5) to (5.5).

## Diagnosis

Microscopic examination of wet mounts may establish the diagnosis by detecting the actively motile organisms. For the diagnosis of male infections, Giemsa-stained smears of urethral and prostatic discharges and urine are the suitable samples, whereas vaginal and urethral discharges in the females are the useful samples. In difficult cases, cultivation of a swab sample in Diamond's medium can be used, but the results are not available before 3 to 7 days. Trophozoites must be distinguished from the non-pathogenic flagellate *Trichomonas hominis*.

## Treatment

1. Metronidazole orally (250mg, 3times daily for 7 days).
2. Vaginal inserts of 500mg Metronidazole daily concurrently with the oral regimen provide increased efficacy in resistant infection. [Inserts= suppositories].

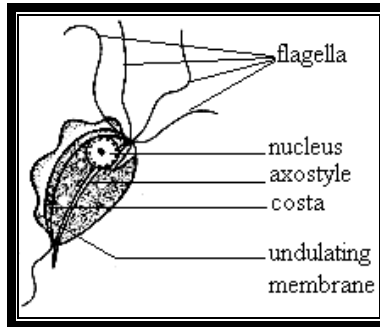
There are two other species related to genus *Trichomonas*:

### 4 *Trichomonas tenax*

It is non- pathogenic, but its presence associated with gum diseases.

## 5 *Trichomonas hominis*

It is parasitizing in the lumen of the cecum, the infection with this parasite is mostly accompanied with diarrhea; it can infect the dogs, cats, mice and other rodents, so, these animals act as reservoir hosts to human infection.



*Trichomonas hominis* (trophozoite).