Pathogenic Flagellates

The flagellates are a group of protozoa distinguished by having one to several thread-like extensions from the ectoplasm in their trophozoite stage called flagella (single: flagellum). 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 kinetoplast the energizing portion. They are related to Sub-phylum Mastigophora, Class Zoomastigophorea. The flagellate protozoa that parasitize man primarily divided to:

A-The flagellates of the digestive tract and genital organs. (this group live the mouth, intestine and genital tract and are typically lumen parasites).

B- The blood and tissue flagellates. (this group live in the blood, lymph and tissues of vertebrate hosts).

Morphological Characteristics:

1. **Flagellum:** characteristic organelle of locomotion. It is an extension of ectoplasm and resembles a tail; moves with a whip-like motion.
2. **Axostyle:** a supporting mechanism; a rod-shaped structure; not all Genera exhibit these.
3. **Undulating membrane:** a protoplasmic membrane with a flagellar rim extending out like a fin along the outer edge of the body of some flagellates, moves in a wave-like motion.
4. **Costa:** a thin, firm rod-like structure running along the base of the undulating membrane in some flagellates.
5. **Cytosome**: a rudimentary mouth; also referred to as a gullet.

A- The flagellates of the digestive tract and genital organs

Giardia lamblia (G.duodenalis, G.intestinalis)

Geographical distribution: This parasite has a cosmopolitan distribution and it is common in both warm and temperate climates, where sanitation is poor. causes a disease called Giardiasis. The infection in children is more frequent than in older people.

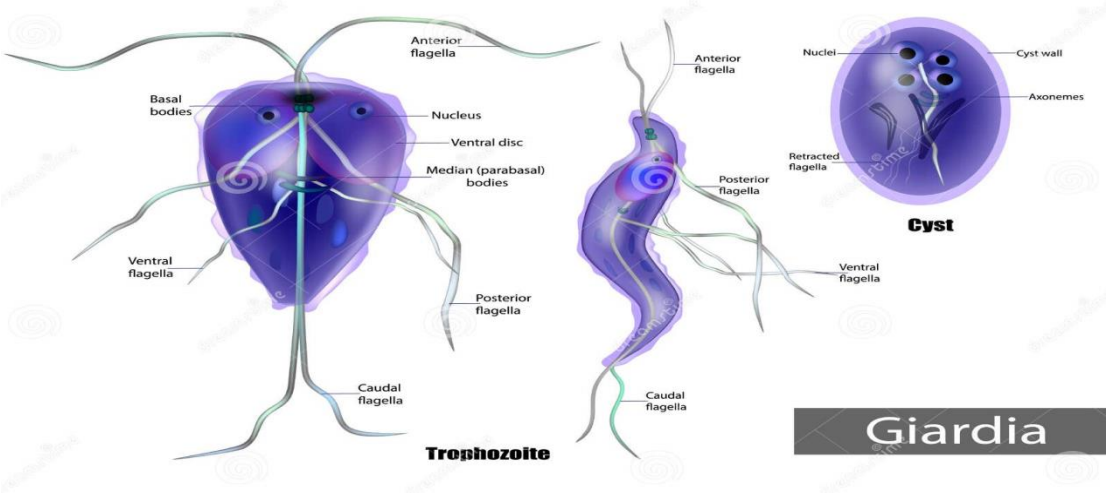
Habitat: It inhabits duodenum and the upper part of jejunum of man. pigs and monkeys are also infected and serve as reservoirs.

Morphology: It exists in two forms:

1. **Trophozoite:**
   -It measures 9.5-21µ in length by 5-15µ in width and only 2-4µ in thick.
   - pear (Tear) shaped with bilaterally symmetrical body.

- Nucleus: It has **two ovoid nuclei** each with a central karyosome and there is two axostyle (rod-like supporting organelles), between the two nuclei extends to the posterior end.
-It bears **four pairs of flagella** extends along the midline.
-When the trophozoite is seen from the ventral aspect it appears rounded anteriorly and t pointed posteriorly. When viewed from the lateral seen, their dorsal side is convex, the anterior part of the ventral side forms a concave adhesive disk.

2. **Cyst:**
-Slightly smaller than trophozoites 8 - 12 μm in length.
-They contain **2 - 4 nuclei**.
-The remains of the flagella and margins of the sucking disc may be seen inside the cytoplasm of the cyst.

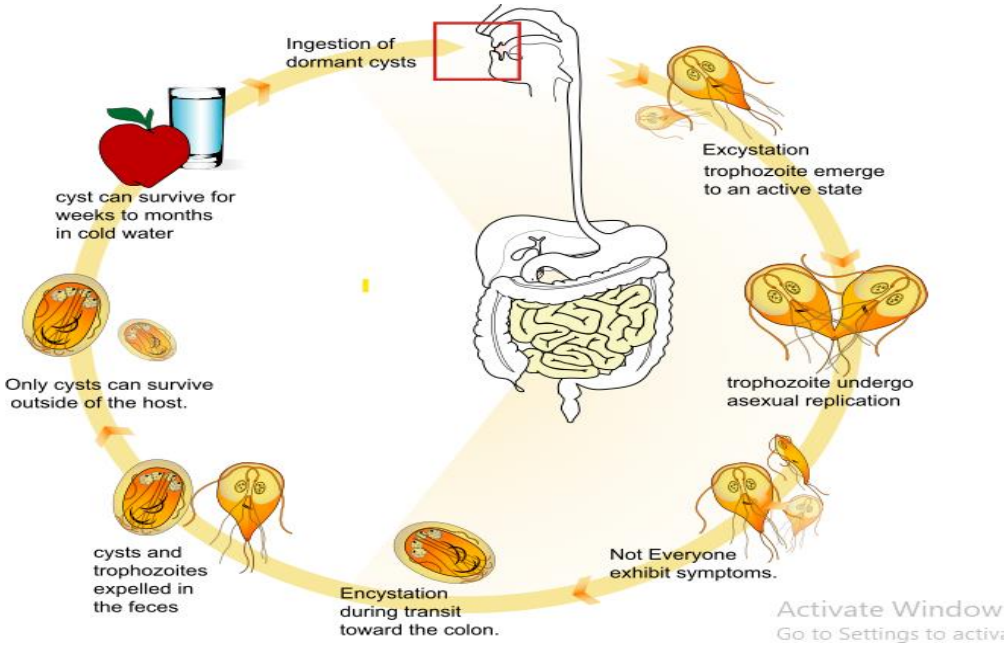


Life cycle:

It passes its life cycle in a single host, the man. No intermediate host is required. Mature cyst is the infective form of the parasite. Infection may occur through ingestion of as few as 10–25 cysts.

1- Excystation: Within 30 minutes of ingestion excystation occurs in the small intestine (specifically in the duodenum) releasing the trophozoites where each cyst produces two trophozoites. The trophozoites then multiply by longitudinal binary fission, colonize the upper small intestine, where they may swim freely in the lumen use its flagella or attach to the sub-mucosal epithelium via the ventral suction disc.

2- **Encystation:** 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. Cysts are passed in the stool; the cysts are hardy and can survive several months in cold water.



Reproduction: The trophozoites multiply by binary fission.
Transmission: infection occurs by the ingestion of cysts in contaminated water, food, or by the fecal-oral route (hands or fomites).
Pathogenicity: Ingestion of cysts results in one of three outcomes:
A) No infection (35 to 70%).
B) Asymptomatic infection with excretion of cysts (5 to 15%).
C) Symptomatic infection (15 to 60%).
Symptoms:
1- Early Symptoms may range from abdominal pain, nausea, often watery diarrhea
2- The stool contains Excess fat or lipid (steatorrhea), but very rarely may blood or necrotic tissue
3- The chronic stage is associated with vitamin B12 deficiency and lactose intolerance and significant weight loss. Symptoms usually begin 7 to 14 days after cyst ingestion. This disease is more common in children from 6 to 10 years.
Treatment: Metronidazole (Flagyl) will clear over 90% of. Recently nitrothiazole compound are used.

2. Trichomonas sp

1. These are common flagellates of the tropical areas.
2. They exist only in trophozoite stage. Cystic stage is absent.
3. They are pear-shaped body and measures 10-12 microns in length, a single ovoid nucleus is situated at the rounded anterior end and a cleft-like depression (mouth) lies at its side.
4. There are 3-5 free flagella, a thicker flagellum passes backwards along the side of the body forming the undulating membrane and coming out free at the posterior end.

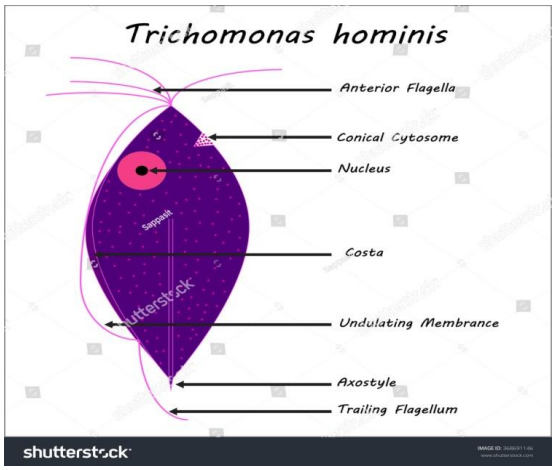
5. The undulating membrane is supported at the base by a rod like structure (costa).
6. The axostyle runs down the middle of the body and ends in the pointed end.

Genus Trichomonas is classified into 3 species:

1. *Trichomonas hominis:* (Intestinal flagella)

Habitat: It is parasitizing in the lumen of the cecum, and feeds on enteric bacteria. It can infect the dogs, cats, mice and other rodents, so, these animals act as reservoir hosts to human infection.

Morphology:



-It is pyriform, measuring 5–14 µm in length and 7–10 µm in width.
-It has an axostyle which runs from the nucleus down the centre of the body and extends from the end of the body and undulating membrane which extends the entire length of the body and projects from the body like a free flagellum.
- **Three to five** anterior free flagella and one posterior extending from the posterior end of the undulating membrane.
- Nucleus: **single** at the anterior end.

Reproduction: Binary fission
Transmission: Transmitted by oral- fecal mode.
Pathogenicity: It does not invade the intestinal mucosa. Though it has occasionally been found in the diarrhoeic stools, its pathogenicity is yet to be established.

2. *Trichomonas tenax:* (Oral flagella)

Habitat: It is a harmless commensal of the human mouth. living in the tartar around the teeth, in cavities of carious teeth.
Morphology: It is a pyriform flagellate. It measures 5–12 µm in length and 5–10 µm in width.
Reproduction: longitudinal binary fission
Transmission: It is transmitted by kissing, salivary droplets.
Pathogenicity: It is non- pathogenic, but its presence associated with gum diseases.
Treatment: no therapy is indicated. Better oral hygiene will rapidly eliminate the infection.

3. Trichomonas vaginalis: (Genital flagella)

T.tenax was first observed by Donne in 1836. It has worldwide distribution.

Habitat: are anaerobic protozoa, the normal habitat of the parasite is the vagina and urethra and in urinary bladder of women, and the urethra, seminal vesicles and prostate of man.

Morphology:

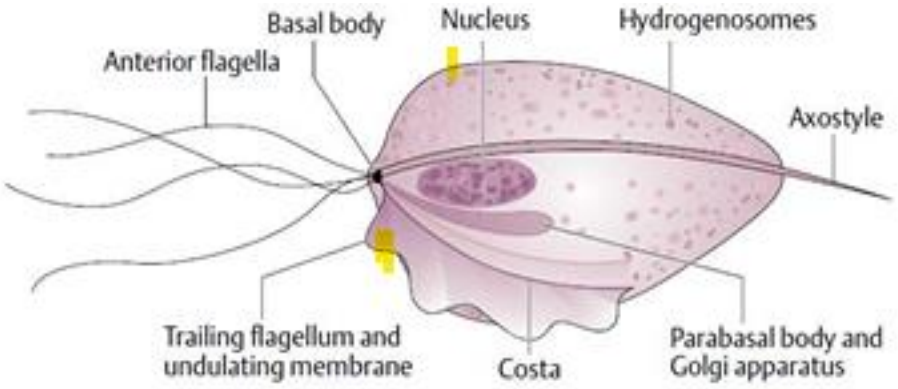
-It resembles *T.tenax* but it is larger than this. It measures 7–23 μm in length and 5–15 μm in width

-It is a pear shaped.

-Have **Five flagella** emerge from a basal body at the anterior pole, four freely extend forwards and one extends backwards, forming the outer edge of the undulating membrane, which reaches back only just beyond the middle of the cell.

- Axostyle made up of microtubules with its free tip from the posterior end of the cell.

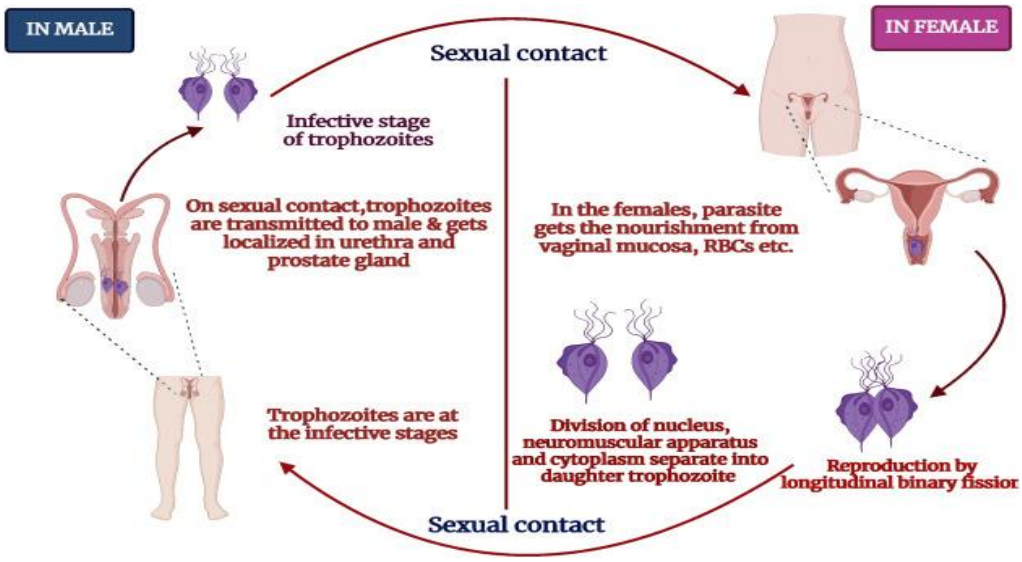
-The **oval cell nucleus** lies near the upper pole of the protozoon.



Morphology of *Trichomonas vaginalis* (schematic).

Life cycle

Human are only natural host for *T.vaginalis*. Transmitted directly from one person to another usually by sexaul inercourse, lives on the surface of the epithelium of the urogenital tract where is gets its energy via anaerobic pathways (Infects squamous epithelium but not columnar epithelium), cannot live without close association with vaginal, urethral or prostatic tissues. The incubation period is 4–28 days, but may survive in a host for 2+ years. Trichomonas vaginalis replicates by binary longitudinal fission, with mitotic division of the nucleus. The trophozoite form is the only stage seen as a flagellate. No cyst form has been found, and this parasite does not survive well in the external environment.



Reproduction: longitudinal binary fission.

Transmission: The trophozoite cannot survive outside and so infection has to be transmitted directly from person to person. Sexual transmission is the usual mode of infection.

Pathogenicity:

1. **Asymptomatic infection:** 25–50% of individuals are asymptomatic, harboring the trophozoites and can transmit the infection.
2. **Acute infection:** It produces **trichomoniasis** in women that is usually characterized by vaginitis with a thin purulent discharge accompanied by vulvar and cervical lesions, abdominal pain, or dysuria.
   In men, the infection can be asymptomatic or have characteristics of urethritis, epididymitis, and prostatitis.
3. **Chronic infection:** the disease is mild with pruritus and pain, vaginal discharge is scanty, mixed with mucus

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.