BIO 475 - Parasitology Spring 2009

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http://www4.nau.edu/isopod

Lecture 7

C. mesnili Life Cycle

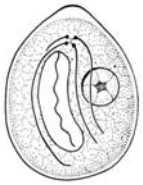
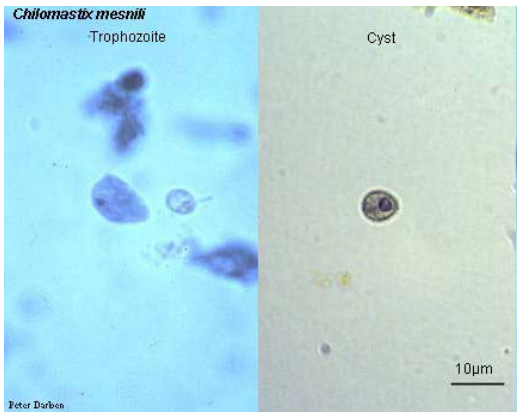


FIGURE 6.2
Cyst of *Chilomastix mesnili* from a human stool, showing the characteristic lemon or pear shape. Also visible are the large, irregul karyosome and the cytostomal fibrils.
Drawing by William Ober.

1. Transmitted by cysts in stools, thus indicate contaminated water.
2. Cysts hatch in intestine, trophs live in lower gut.
   a. Distinctive with lemon shape, large nucleus, fibrils.



Order Diplomonadida

(Family Hexamitidae)

1. Family is recognized by bilateral nuclei.

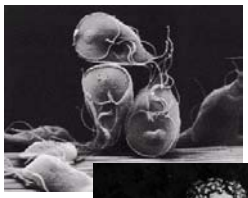
a. Most species are parasites/commensals of invertebrates.

b. However, one species is important in humans.

Giardia lamblia

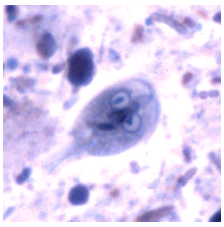
1. A common intestinal parasite of humans, often with drastic consequences.

a. Originally discovered by van Leeuwenhoek in his own stools.



Antony van Leeuwenhoek (1632-1723)

Giardia lamblia



2. Distinctive appearance of trophozoites:

a. Flattened ventral surface.

b. 2 nuclei, ventral groove, median bodies : "monkey face."

c. Flagellae: anterior, lateral, ventral, caudal.

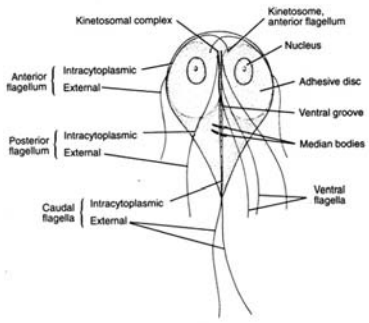


FIGURE 6.5
Diagram of *Giardia lamblia*.

Giardia lamblia

1. Trophs are rapid swimmers.

Giardia lamblia

2. Cysts (the usual means for diagnosis)
   a. 4 nuclei, flagellae, median groove, 4 median bodies.

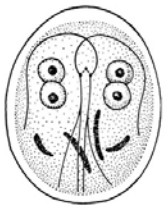


FIGURE 6.9
Cyst of *Giardia lamblia* in the human stool. It is 8 to 12 µm long. The karyosomes of all four cyst nuclei, as well as several intracytoplasmic axonemes, are visible.
Drawing by William Ober.

G. lamblia Life Cycle

1. Direct life cycle; trophs in intestine, form cysts.
2. Infection through contaminated water.

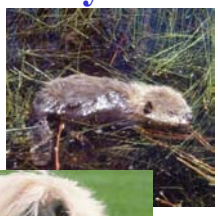
G. lamblia Life Cycle

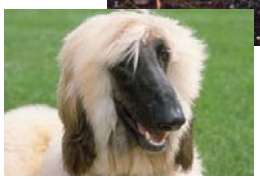
3. Reservoir hosts

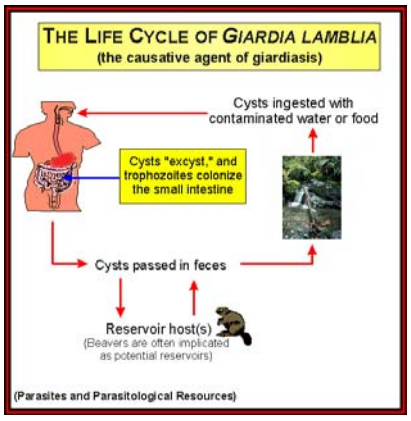
a. Beavers ("beaver fever")

b. Racoons

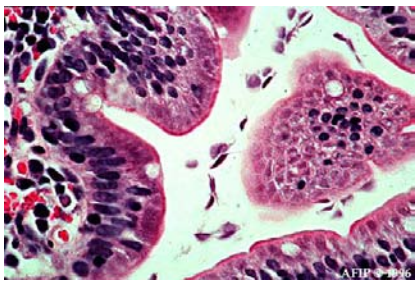
c. Dogs







G. lamblia Pathology

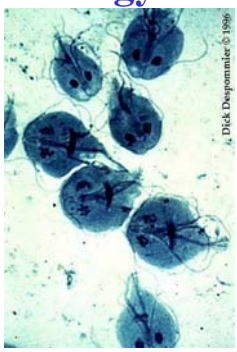


1. Rapid replication by binary fission.

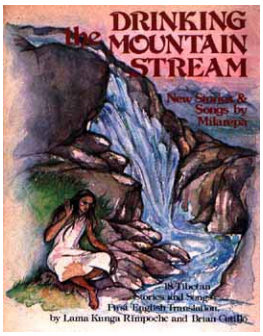
2. Sucking disks attach to mucosa, villi.

G. lamblia Pathology

3. Large numbers prevent fat absorbtion.
   a. Symptom is "fatty" stools.
   b. Can cause extreme diarrhea, emaciation.
   c. Occasional erosion of mucosa, but this is rare.



G. lamblia Prevention



1. Clean water, sanitation
2. Avoid "refreshment in mountain streams"
3. Cure usually with antiflagellate drugs - Flagyl and others; mostly ***metronidazole*** and relatives.

Hexamita meleagridis

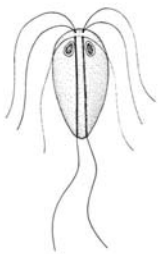


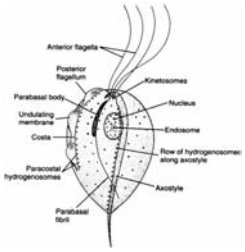
FIGURE 6.10
Diagram of a trophozoite of *Hexamita meleagridis*. It is 6 to 12 μm long.
Drawing by William Ober.

1. Parasite of young galliform birds
2. Similar to *Giardia* in life cycle, morphology with exceptions.

Hexamita meleagridis

a. Causes stunting, malnutrition, death in birds, especially when kept in high concentrations, as is true with most modern poultry farms.

Phylum Axostylata



a. Axostyle (central filament running through cell) made of microtubules.

b. Usually mucous or intestinal parasites or commensals.

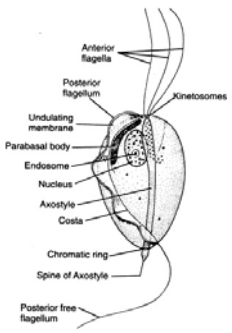
Order Trichomonadida

(Family Trichomonadidae)

a. Anterior flagellae, often several.

b. Undulating membrane.

c. Axostyle, often protrudes to posterior.



Trichomonas tenax

1. Occurs primarily in humans.

a. Mouth commensal.

b. Spread through kissing, use of other's toothbrushes.

c. Not usually pathological, common: 15% in NY.

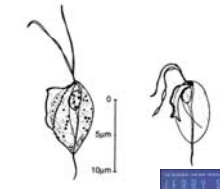


FIGURE 6.11

Typical trophozoites of *Trichomonas tenax*.

From B. M. Honigberg and J. J. Lee, "Structure and [illegible] tenax (O. F. Müller)," in *Am. J. Hyg.* 69:177–201. C[illegible]

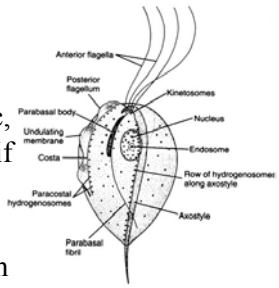
Trichomonas vaginalis

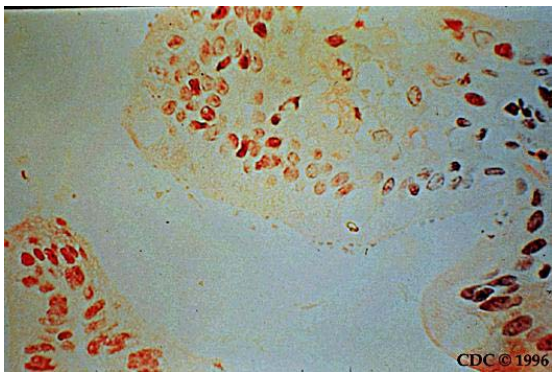
1. Also parasitic in humans.

a. A venereal disease.

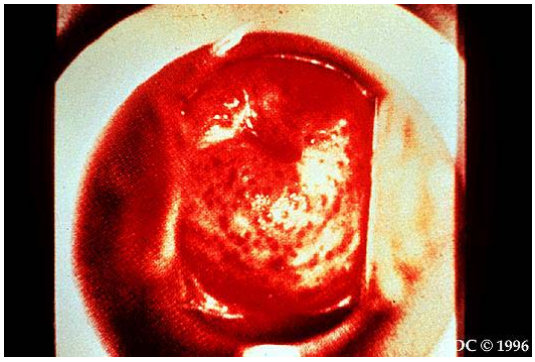
b. Often asymptomatic, but can cause sterility if untreated.

c. Causes greenish or whitish discharge from penis or vagina.





T. vaginalis trophs in discharge



Strawberry cervix caused by *T. vaginalis*

Trichomonas vaginalis

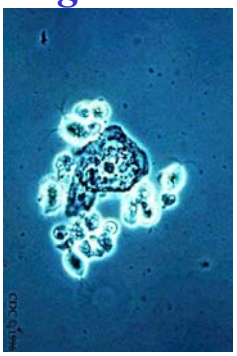
d. Usually spread via sexual intercourse, but also by dirty linen.

e. Cured by simultaneous treatment of sexual partners with anitflagellate drugs (***Metranidazole=Flagyl***)

Trichomonas vaginalis

f. Greater susceptibility as vaginal pH becomes more basic – thus variable infection rates over menstrual cycle.

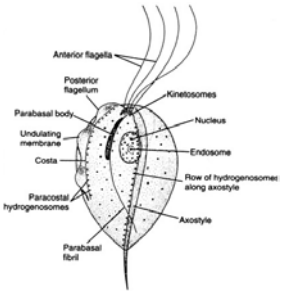
1. Trichs shift pH lower after infection.



Trichomonas vaginalis

g. Fronske Health Center reports very low frequency (none last year).

h. Coconino Health Department reports "a few cases per month."

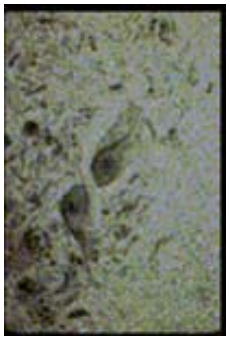


Pentatrichomonas hominis

3.Intestinal parasite of humans.

a. Used to be *Trichomonas hominis*.

b. Gut parasite, usually not severe, also in cats, dogs, etc.



Pentatrichomonas hominis

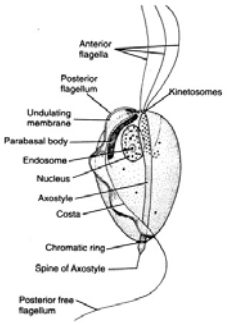
c. Spread via contaminated water, associated with other gut parasites acquired this way.

Often responsible for diarrhea in cats; but can be caused by other flagellates.

Tritrichomonas foetus

4. Usually found in cattle.

a. Used to be very common in european and US cattle.



Tritrichomonas foetus

b. Often spread by breeding practices; + bull can infect many cows.

c. Causes early abortion; can be cleared if cow sheds all membranes at birth.

Tritrichomonas foetus

1. If not, can cause permanent sterility.

2. Bull can be treated, but is expensive, time consuming and *risky*.

3. Involves rubbing antitrichimonal salve into penis repeatedly.

Hyperparasites

1. A situation in which a parasite is infected with its *own* parasite.

2. Possibly because energy transfer is possible, hyperparasites are often very successful.

matryoshka

Hyperparasites

3. Can permit transfer of hyperparasite to new host - the host of the parasitized parasite.

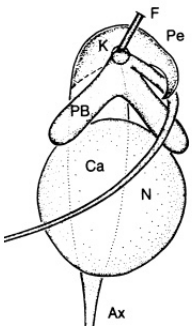
a. The parasitized parasite becomes a *vector*.

Hyperparasites

Two good examples in this order:

1. Family Monocercomonadidae

a. Named for presence of basal flagellar structures common to the group.



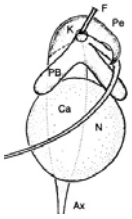
Histomonas meleagridis

1. Different from *Hexamita meleagridis*

2. Epidemiology

a. No cyst stage, troph is fragile.

b. Seems to be transmitted in the egg of a nematode.



Histomonas meleagridis

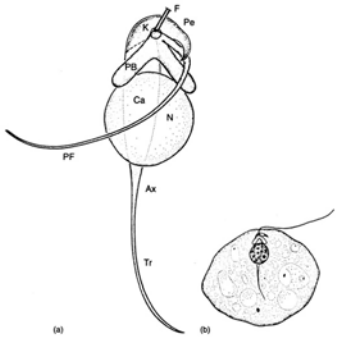


FIGURE 6.16

Histomonas meleagridis. (a) Composite, schematic diagram of the mastigont system and nucleus as seen from a dorsal and somewhat right view. (b) Composite diagram of an organism, with the mastigont system seen in the same view as in (a). The flagellum arises from the kinetosomal complex just anterior to the V-shaped parabasal body. The cytoplasm appears highly vacuolated and contains ingested bacteria and rice starch. **Ax,** axostyle; **Ca,** capitulum; **F,** flagellum; **K,** kinetosomal complex; **N,** nucleus; **Pe,** pelta; **PB,** parabasal body; **PF,** parabasal fibril; **Tr,** trunk of axostyle. (× 4270.)

Histomonas meleagridis

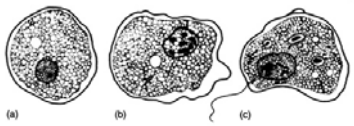
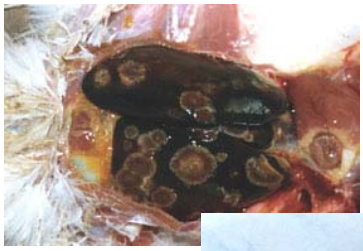


FIGURE 6.15

Examples of *Histomonas meleagridis.* (*a*) Tissue type of *H. meleagridis* in fresh preparation from liver lesion; viewed with phase contrast. (*b*) *H. meleagridis* in transitional stage in lumen of the cecum. Pseudopodia have been formed, and the distribution of chromatin suggests that binary fission is approaching. However, the flagellum has not yet appeared. (*c*) An organism in same cecal preparation as (*b*) but this one completely adapted as a lumen dweller.



Histomonas lesions on liver

Histomonas lesions on cecum

Heterakis gallinarium

1. *H.m.* troph invades gonads of this nematode via gut.
   a. Becomes inclosed in eggs.
   b. Eggs are shed in bird feces.

Heterakis gallinarium & *Histomonas meleagridis*

2. Nematode eggs hatch in soil,
   a. Flagellates replicate within nematodes, invade male tissues
   b. Are transmitted to female nematodes sexually.

Heterakis gallinarium & Histomonas meleagridis

3. Flagellates are also a venereal disease of nematodes.

a. Nematode eggs may also lay dormant in soil.

b. If eaten by bird - releases both nematode and troph.

4. If eaten by an earthworm:

a. Nematode larvae hatch, lie dormant in tissues.

b. Flagellates are still associated with nematodes.

Heterakis gallinarium & Histomonas meleagridis

Heterakis gallinarium

3. If earthworm is eaten by a bird (domestic or wild).

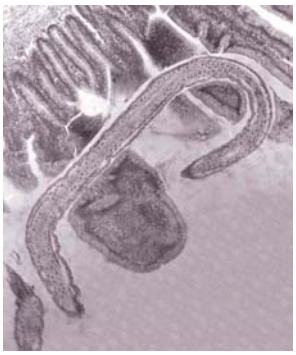
a. Both parasites infect bird.

Terminology

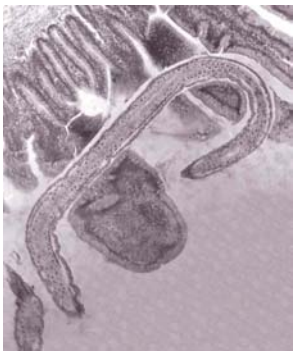
1. Nematode is a ***vector*** – it transmits flagellates to bird.

a. Nematode is also an ***intermediate host***.

b. Retains the flagellate in infective condition until it can be transmitted to a bird.



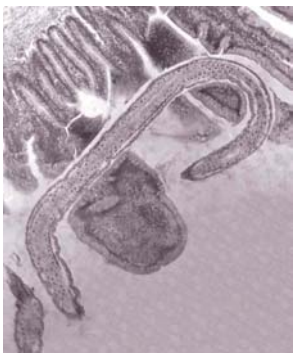
Terminology



2. Earthworm is also an ***intermediate host***.

a. It retains both nematodes and flagellates in infective condition.

Terminology



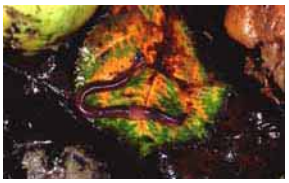
3. Nematode is a also the ***definitive host***.

This is where flagellates engage in sexual reproduction.

Terminology

4. Flagellate is a ***venereal disease***.

a. Earthworm is an ***intermediate host*** - and a ***paratenic host***



b. Because worms and flagellates can live in them indefinitely.

Terminology

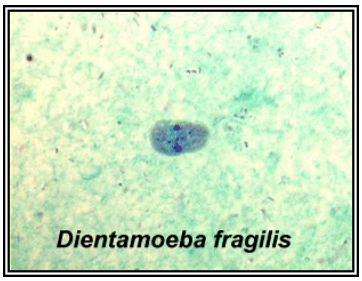
4. Chickens serve as ***reservoir hosts*** for turkeys.

a. Chickens retain infective stages that are also infective to turkeys.

Dientamoeba fragilis

1. Another flagellate that resembles an amoeba.

2. Seems to have similar relationship with nematodes.



Dientamoeba fragilis

a.In this case the nematode is *Enterobius vermicularis*, the human pinworm.

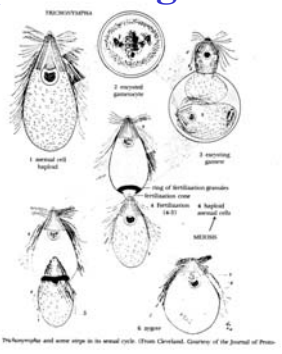
b. More on this later.

Order Hypermastigia

a. Makes sense, means "too many flagellae"!

b. Commensals of termites, other wood eaters.

c. Spread through the colony by anal and oral trophallaxis.



Order Hypermastigia

d. Common genus: *Trichonympha*