BIO 475 - Parasitology Spring 2009

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http://www4.nau.edu/isopod

Lecture 8

11. Trypanosomes such as *Leishmania* have an amastigote stage that undergoes rapid replication within certain cells of its vertebrate host. These cells are:

a. red blood cells
b. dermal cells
c. liver parenchyma cells
d. monocytes
e. macrophages

16. The trypanosome stage that is transferred to the insect vector is called a:

a. stumpy trypomastigote
b. epimastigote
c. slender trypomastigote
d. promastigote
e. metacyclic trypomastigote

Phylum Stramenopiles

Order Opalinida

(Family Opalinidae)

1. *Opalina*

a. A bit of redundancy in systematics!

b. A cloacal and rectal parasite of amphibians.

Opalina ranarium

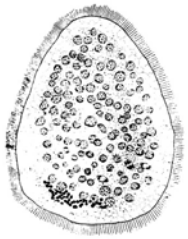


FIG. 4-9. *Opalina ranarum* × 230. This figure shows many nuclei, some of which are in the process of division. Most of the endospherules have been omitted. (From Metcalf. Courtesy of the U.S. National Museum Bulletin.)

Order Opalinida

c. Morphology - like that of ciliates

1. Large, with oblique rows of cilia

2. Multinucleate

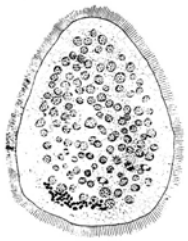


FIG. 4-9. *Opalina ranarum* × 230. This figure shows many nuclei, some of which are in the process of division. Most of the endospherules have been omitted. (From Metcalf. Courtesy of the U.S. National Museum Bulletin.)

However:

1. Nuclei are all the same, unlike true ciliates who have *macro and micronucleus*.

2. Sexual reproduction differs from that of ciliates.

a. No swapping of micronuclei - syngamy instead.

3. Asexual reproduction is also different.

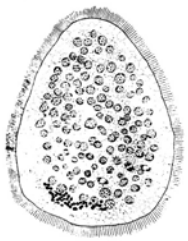


FIG. 4-9. *Opalina ranarum* × 230. This figure shows many nuclei, some of which are in the process of division. Most of the endospherules have been omitted. (From Metcalf. Courtesy of the U.S. National Museum Bulletin.)

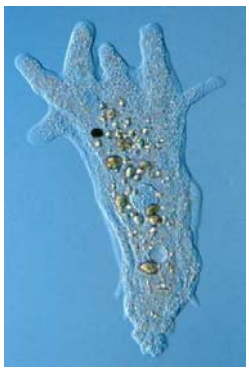
Reproduction and Transmission

1. Asexual reproduction in most seasons in frogs.
2. In spring:
   a. Hormonal changes in breeding hosts induce formation of *precysts*.
   b. *Cysts* shed in feces are eaten by tadpoles.
   c. Fusion in gut, resumption of asexual reproduction
3. Pathology unclear.

Phylum Amoebozoa

Systematics:

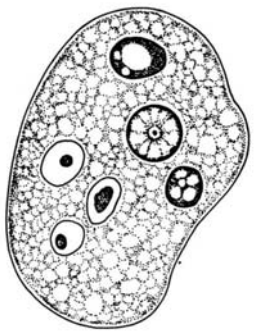
1. Seemed to be closely related to flagellates due to appearance of cytostomal and flagellated stages.
2. Supported by some molecular evidence.
3. However, there could be many examples of convergence.



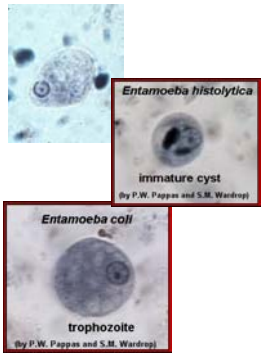
Phylum Amoebozoa

Class Lobosea;
Order Amoebida

1. Family Endamoebidae
   a. *Entamoeba*
      1. Genus with many species



Entamoeba species



Recognizable by:

a. Nuclear endosome of various sizes.

b. Helical bodies (hard to see except with phase microscopy).

c. Chromatoidal bodies

1. bar-shaped structures that appear in cysts.

Entamoeba histolytica

1.Common intestinal parasite: the "Handmaiden of War."

2.A.k.a, "Montezuma's Revenge."

Entamoeba histolytica

3. Transmitted mainly in contaminated water.

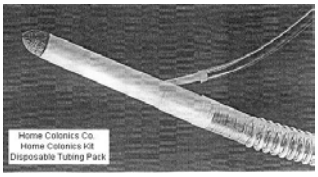
a. Also poor sanitation.

b. Flies and roaches.

Entamoeba histolytica

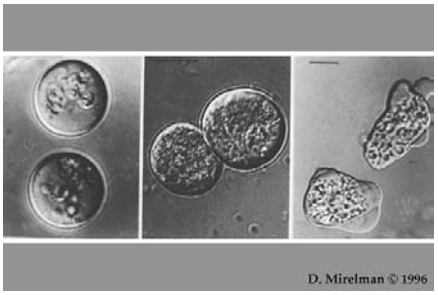
c. Sexual practices involving oral-anal contact.

d. “Health" practices: high colonic irrigation.



Entamoeba histolytica

4. Appear to be several strains that vary in pathogenicity (see book).

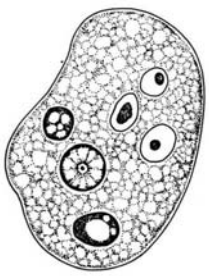


Life Cycle

1. Trophs passed in feces; capable of wandering around freely.

a. Recognized by conspicuous nucleus with central endosome and "wheel like" chromatin.

b. Often with vacuoles - in pathogenic forms often contain RBCs.

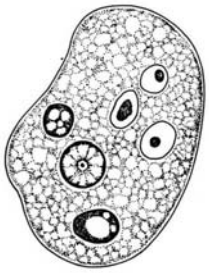


Life Cycle

2. Trophs contain no chromatoidal bars

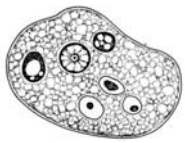
a. Undergo binary fission to asexually reproduce

4. If passed in stools, can't encyst, therefore won't become transmissible as parasites.



Precyst-Cyst-Metacyst Stages

1. Cysts form in intestine, troph rounds up and forms large glycogen vacuole



2. Rapidly forms resistant wall.

3. Chromadoidal bodies become obvious.

Precyst-Cyst-Metacyst Stages

4. Cyst itself may be quite small; due to reduction of cytoplasm.

5. Nucleus divides to form 2-4 nuclei.

a. Cysts with 4 nuclei – called *Metacysts*.

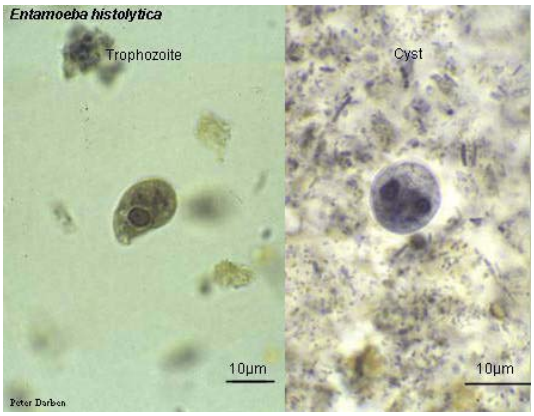
b. These are resistant and infective to new hosts.

Precyst-Cyst-Metacyst Stages

5. When ingested, all four nuclei divide.

a. Become 8 trophs.

b. These initial trophs are called, ***metacystic trophozoites***.



Pathology of *E. histolytica*

1. Often asymptomatic - pathology induced by changes in water or diet.

2. When pathogenic, usually with profuse diarrhea.

a. Then called "amoebic dysentery;" or "AD."

Pathology of *E. histolytica*

3. Without treatment, intestinal lesions may form due to histolytic abilities of amoebas.

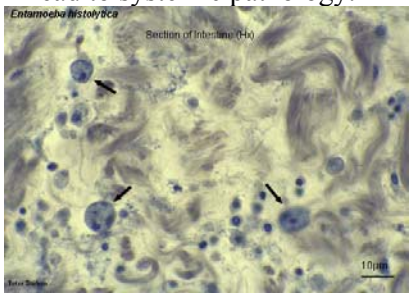
a. Can cause perforated colon.

b. Bowel obstructions due to *amoebomas*.

Flask-shaped Intestinal Lesion

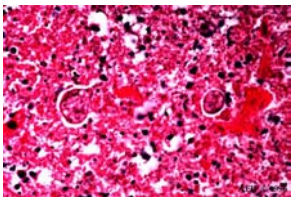
Pathology of *E. histolytica*

c. Entry of amoebas into bloodstream can lead to systemic pathology.



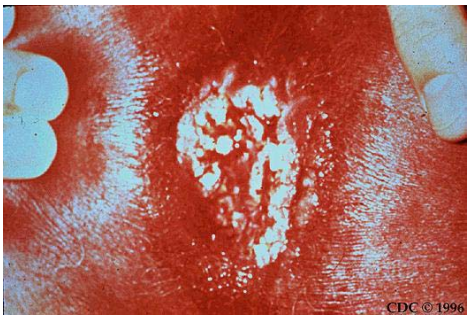
Systemic Conditions

1. Hepatic amebiasis
2. Pulmonary amebiasis
3. Amebic encephalitis - other forms of this not caused by *E.h.* described later.
4. Genitalic amebiasis - can be sexually transmitted.



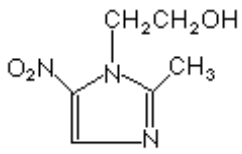
Systemic Conditions

1. Cutaneous lesions are usually visible



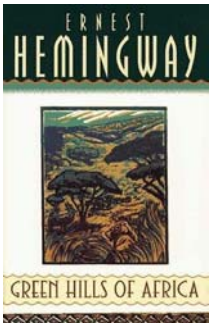
Treatment

a. Flagyl (metronidazole) and other similar drugs.



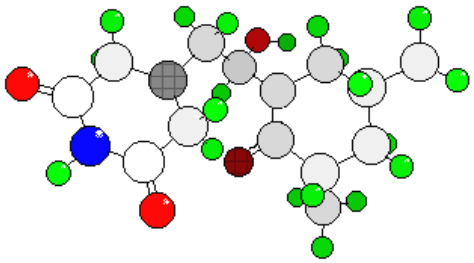
$C_6H_9N_3O_3$

Ernest Hemingway in Africa.



Ernest Hemingway: AD in Africa.

Emetine.



Other Amoebae

1. *Entamoeba coli*

a. Similar in appearance but with:

1. accentric endosome, thicker nuclear membrane.

Entamoeba coli

2. Cysts with

a. splinter shaped chromatoidal bodies

b. 8-16 nuclei

c. similar transmssion and life cycle but not usually pathogenic.

Entamoeba gingivalis

1. A mouth parasite of humans.

a. Up to 50% infection.

b. No cyst, so infection is direct;

Mainly via oral contact.

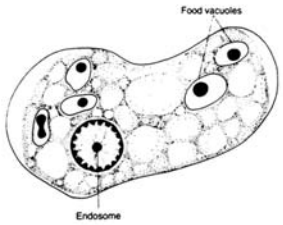


FIGURE 7.9
Entamoeba gingivalis trophozoite. The size usually is 10 to 20 µm.
Drawing by Ian Grant.

Entamoeba gingivalis

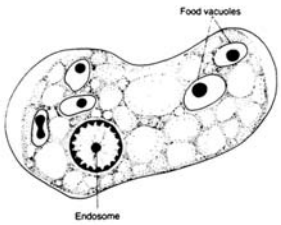


FIGURE 7.9
Entamoeba gingivalis trophozoite. The size usually is 10 to 20 µm.
Drawing by Ian Grant.

2. Characteristics:
   a. Central endosome.
   b. Thick nuclear wall.
   c. Lots of vacuoles filled with food.

Other Entamoeba Species

a. *E. blattae* - in cockroaches.
b. *E. phyllusae* - in tunicates.
c. *E. ranarum* - in amphibians.
d. *E. invadens* - in reptiles - useful for studies of genus.

Endolimax nana

1. The "internal slug."
2. Usually nonpathogenic intestinal parasite of humans.
3. Recognized by large accentric endosome, large vacuoles.
4. Similar cysts with 4 nuclei

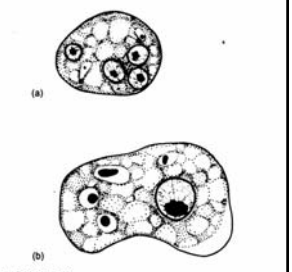
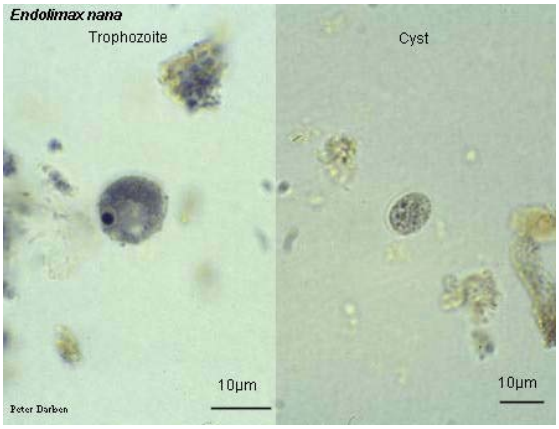


FIGURE 7.10
Endolimax nana. (a) cyst; (b) trophozoite. Note the large karyosome and absence of chromatin granules on the nuclear membrane.
Drawing by Ian Grant.



Idoamoeba butchlii

1. Intestinal parasite of swine.
2. Recognized by:
   a. Large endosome surrounded by lightly staining vesicles.

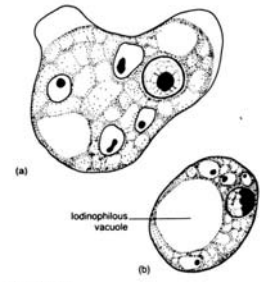


FIGURE 7.11
Iodamoeba buetschlii. (a) Trophozoite; (b) cysts. Note the persistence of glycogen mass in cyst, and the large eccentric karyosome.
Drawing by Ian Grant.

Idoamoeba butchlii

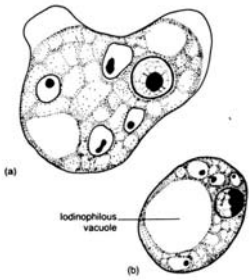
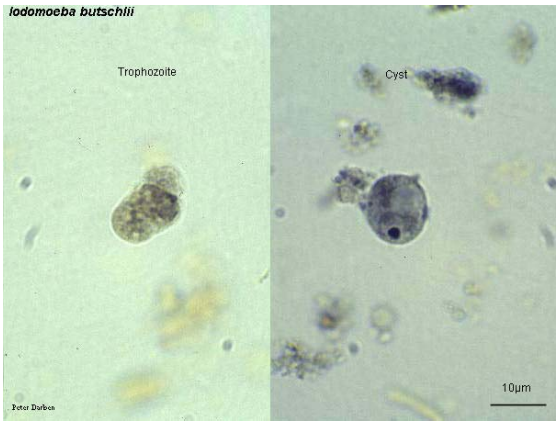


FIGURE 7.11
Iodamoeba buetschlii. (a) Trophozoite; (b) cysts. Note the persistence of glycogen mass in cyst, and the large eccentric karyosome.
Drawing by Ian Grant.

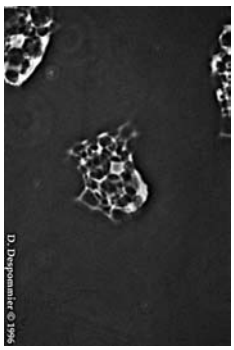
b. Cyst with large "iodinophilic" vesicle.

3. Can also infect humans; usually due to agricultural pollution.



Order Schizopyrenida

1. Mainly soil amoebae; live on bacteria.
2. Some confusion over systematics
3. Evidently a very old protozoan group.

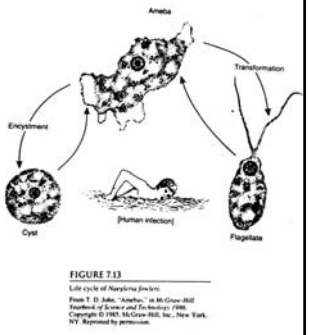


Family Vahlkamphidae

a. *Naegleria fowleri* - PAM

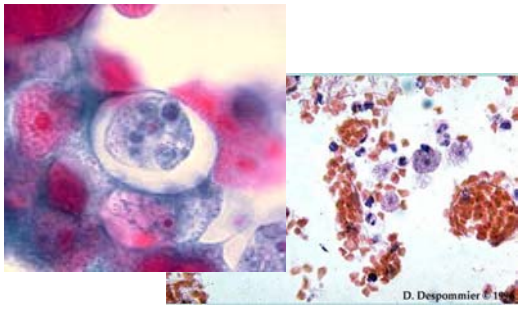
b. Often found in neglected swimming pools.

c. Also in thermal springs.



Family Vahlkamphidae

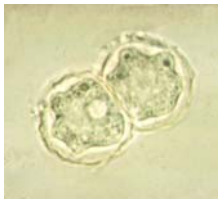
d. can be contracted by "mud diving."



Family Hartmannellidae

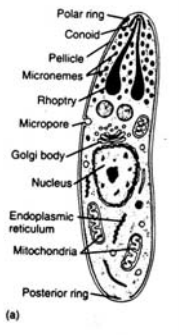
a. *Acanthamoeba*

1. Causes a similar condition but usually in immunocompromized individuals.

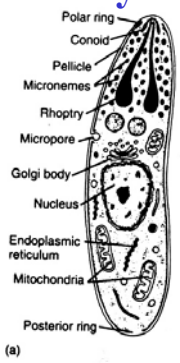


Phylum Apicomplexa

1. Name comes from complicated anterior end.
2. *Rhoptries* have their own DNA; therefore are symbiotic; possible ancestral parasites themselves.
3. Associated with entry into host cells.



Phylum Apicomplexa



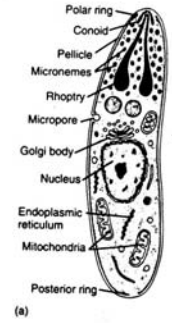
1. Also, *polar rings*; at apex of cell.

2. *Micronemes* - continuous with rhoptries

3. *Conoid* - just within polar rings

4. *Subpellicular microtubules* - run length of body along long axes.

Apicomplexan Life Cycles



1. Variable in character, in hosts parasitized.

2. In general:

a. Three reproductive phases.

Three Reproductive Phases

1. *Sporogony* - production of sporozoites

2. *Schizogony* - merogony -

a. production of merozoites

b. multiple fission

c. usually from a multinucleate cell - a plasmodium

3. *Gamogony* - production of gamontes

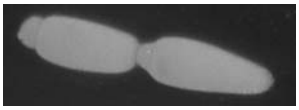
a. male and female

Systematics: 2 Major Classes

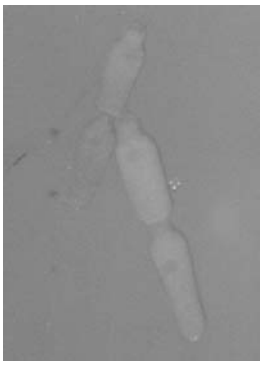
1. Class Gregarina

a. Large, mature gamonts.

b. Usually isogamous (vs. anisogamous).



Systematics: 2 Major Classes



b. Bodies may consist of two segments:

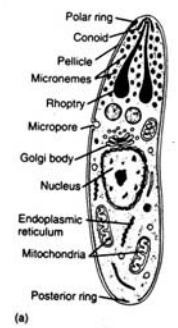
1. *Protomerites*, often with attachment structure.

a. epimerite.

2. Deuteromerites, contains nucleus.

3. Usually found in digestive cavity of inverts; usually homoxenous.

Systematics: 2 Major Classes



2. Class Coccidia

a. small mature gamonts; usually anisogamy

b. epimerites absent

c. usually intracellular

d. also digestive mostly, and homoxenous or heteroxenous.