

BIO 475 - Parasitology Spring 2009

Stephen M. Shuster
Northern Arizona University

<http://www4.nau.edu/isopod>

Lecture 9

Class Gregarina

1. Two major groups

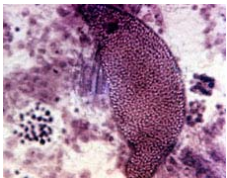
a. **Archaeogregarines**

1. Have all of the above life history stages

b. **Eugregarines** (Order Eugregarinida)

2. Do not have merogony.

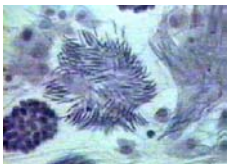
Class Gregarina



a. **Accephaline gregarines** - aseptate
(Suborder Aseptatina)

1. a single unit in the troph

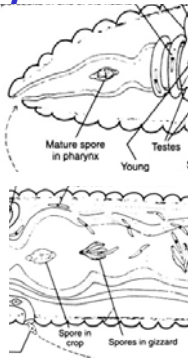
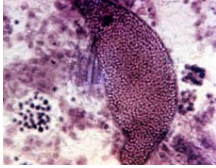
2. Example:
Monocystis



Monocystis sp.

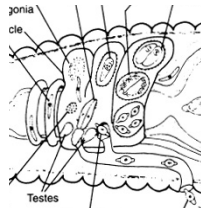
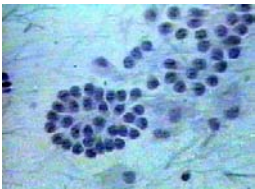
Life Cycle

- a. *Spores* eaten by earthworm.
- b. *Sporozoites* leave gut move by coelom or blood to seminal vesicles.

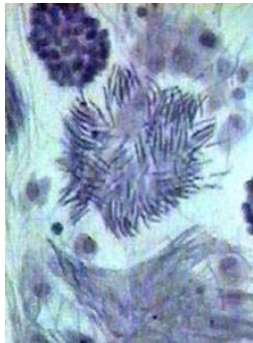


Monocystis sp.

- c. Sporozoites become associated with mother spermatogonia.



Monocystis sp.



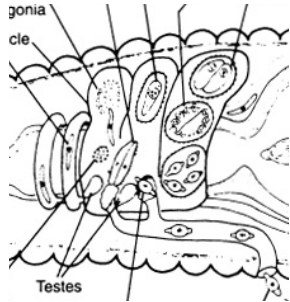
1. Sporozoites feed on sperm (they are now *trophozoites*) and destroy them.
2. Trophs become associated with lumen of seminal vesicles and there become mature – *gamonts*.

Monocystis sp.

d. Gamonts fuse –
syzygy.

1. Smaller anterior
individual is a
primita.

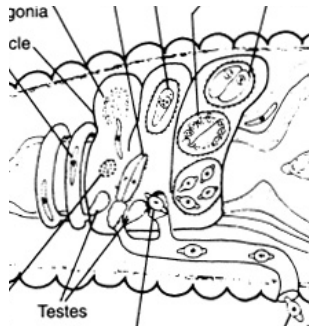
2. Larger posterior
individual is the
satellite.



Monocystis sp.

e. Together they
form a
gametocyst.

1. Multiple
nuclear division
occur within
each gamont.



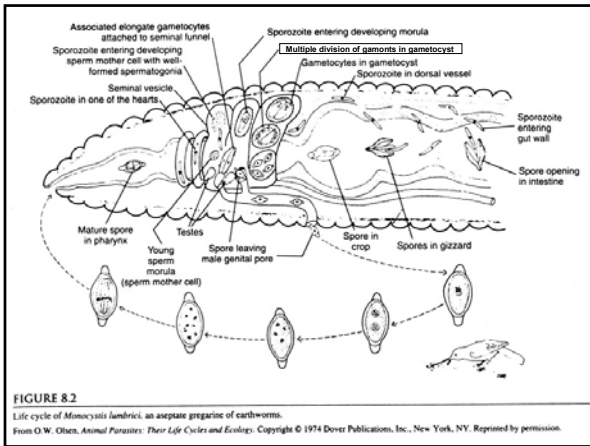
Monocystis sp.

2. The resulting gametes differ in size.

a. This is *anisogamy*.

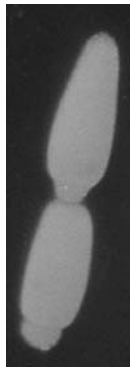
3. Pairs of gametes from each gamont fuse
to form a zygote that turns into a spore.

f. Spores are shed from male genital pore.



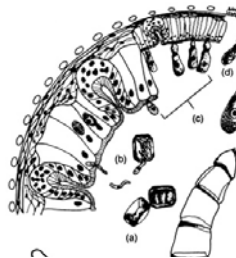
Class Gregarina

- b. Cephaline gregarines - septate
(Suborder Septatina)
- 1. Bodies are divided into two units
- 2. Example: *Gregarina*



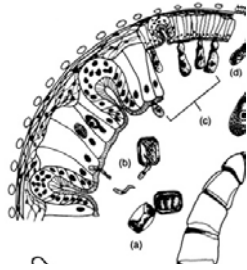
Gregarina sp.

- a. Spores are eaten by mealworms.
- b. Sporozoites leave spores (*exsporulation*) and invade intestinal cells.



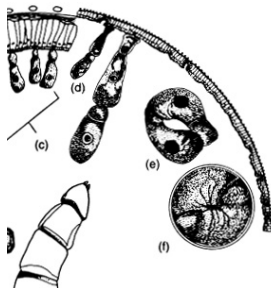
Gregarina sp.

- c. A *trophont* grows within the cell, eventually works its way to outside of cell.
- d. Trophonts eventually detach, and become *gamonts*, which fuse with other gamonts



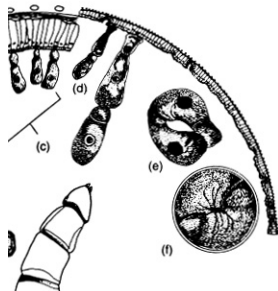
Gregarina sp.

- e. *Gamonts* undergo *syzygy* (*primita* and *satellite* are distinct by now).
- f. A *gametocyst* forms and gametogenesis, fertilization and sporulation (oocyst formation) occur within.



Gregarina sp.

- g. Gametocysts are shed in feces.
- h. Spores leave by *dehiscence*.



Class Coccidia

3. Taxonomic divisions:

a. Order Adeleida - Family

Haemogregarinidae: Haemogregarines

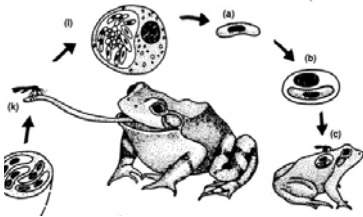
1. example: *Hepatozoon*

a. also described as *Haemogregarina*

Hepatozoon sp.

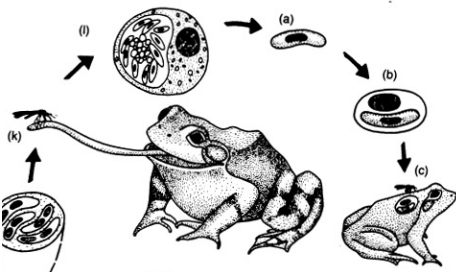
1. Frog eats mosquito, sporozoites invade liver to multiply (merogony)

2. Merozoites enter blood cells.



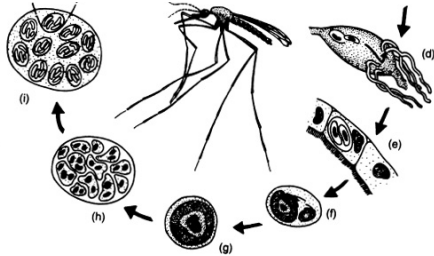
Hepatozoon sp.

3. Gamonts in blood cells, ingested by mosquito.



Hepatozoon sp.

4. Gamonts leave cells in insect gut, invade cells in Malpighian tubules.

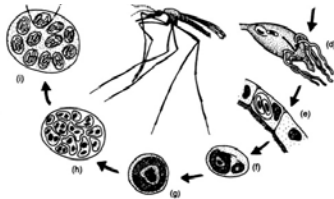


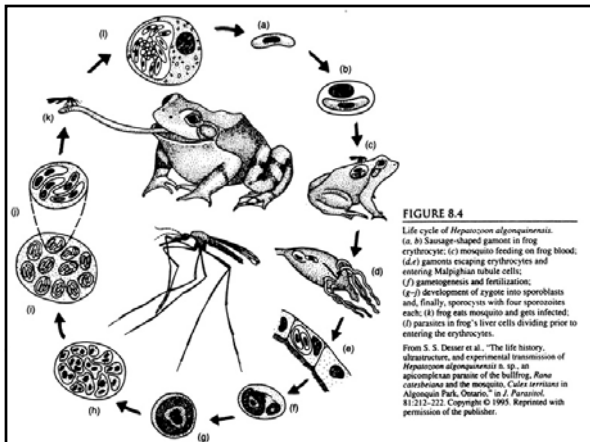
Hepatozoon sp.

5. Micro and macrogamonts fuse in cell.

6. Form gametes, these fuse to form sporoblasts.

7. Each spore with 4 sporozoites.





Order Eimerida

Family Eimeriidae

1. *Eimeria* species

a. A common disease of birds, also cattle, rodents and occasionally humans.

1. Associated with intestinal epithelium.

Eimeria tenella

c. oocyst structures

1. generally recognizable by 4 sporocysts within oocyst

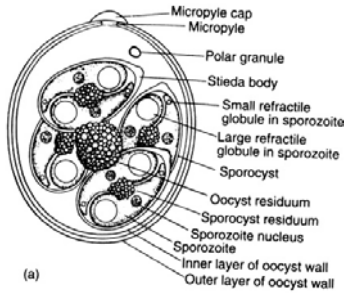
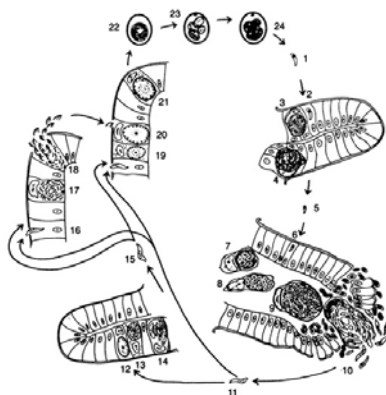
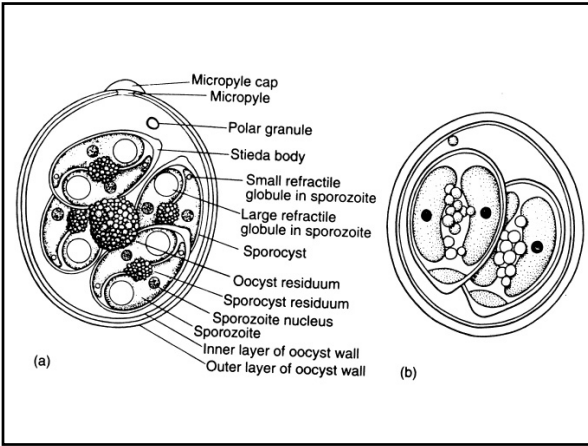


FIGURE 8.6

Life cycle of the chicken coccidian *Eimeria tenella*. A sporozoite (1) enters an intestinal epithelial cell (2), rounds up, grows, and becomes a first-generation schizont (3). This produces a large number of first-generation merozoites (4), which break out of the host cell (5), enter new intestinal epithelial cells (6), round up, grow, and become second-generation schizonts (7, 8). These produce a large number of second-generation merozoites (9, 10), which break out of the host cell (11). Some enter new host intestinal epithelial cells and round up to become third-generation schizonts (12, 13), which produce third-generation merozoites (14). The third-generation merozoites (15) and the great majority of second-generation merozoites (16) enter new host intestinal epithelial cells. Some become microgametocytes (16, 17), which produce a large number of microgametes (18). Others turn into macrogametes (19, 20). The macrogametes are fertilized by the microgametes and become zygotes (21), which lay down a heavy wall around themselves and turn into young oocysts. These break out of the host cell and pass out in the feces (22). The oocyst then sporulates. The sporont throws off a polar body and forms four sporoblasts (23), each of which forms a sporocyst containing two sporozoites (24). When the sporulated oocyst (24) is ingested by a chicken, the sporozoites are released (1).

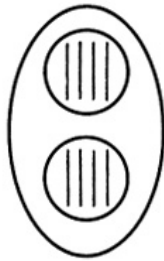


From N. D. Levine, *Protozoan parasites of domestic animals and of man*, 2d edition. Copyright © 1961 by Burgess Publishing Co., Minneapolis. Reprinted by permission.



Class Coccidia, Continued

1. *Isospora* - usually in birds, but occasionally in humans.

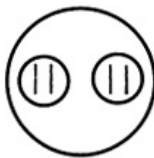


Isospora

Class Coccidia, Continued

2. *Cyclospora*

- a. not known in humans before 1990s
- b. causes diarrhea, cramping,
- c. usually from contaminated raw fruit; raspberries
- d. problem in people w/ AIDS



Cyclospora

Class Coccidia, Continued

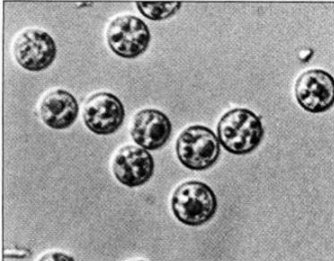


Cryptosporidium

3. *Cryptosporidium*
- a. another isosporan type intestinal parasite
 - b. work on it led to the discovery of *Cyclospora*
 - c. like cyclo, is self limiting except when in immunocompromised patients.

Cryptosporidium sp.

- a. Intestinal, severe diarrhea (1-17 liters/day)
- b. Usually opportunistic in AIDS patients



Treatment



Cryptosporidium

- d. Both respond to Trimethoprim-sulfamethoxazole



Cyclospora

Class Coccidia, Continued

4. Note differences in cysts

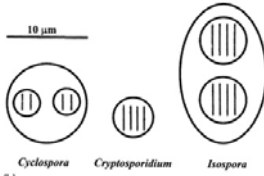


Figure 8.10
 (a) Unsporulated *Cyclospora* oocysts from a human fecal specimen ($\times 400$). (b) Diagrammatic comparison of oocysts from *Cyclospora cayentensis*, *Cryptosporidium parvum*, and *Isospora belli*. Outer circle or ellipse is the oocyst wall, and inner circles, if present, are the sporocyst walls. Line is 10 μm .
 (a) Courtesy of Yasu Ohga. (b) From R. Sasse, "Cyclospora: An Overview," *Clin Inf. Dis.* 23:429-437. © 1996. Reprinted with permission.



Pneumocystis sp.

1. Causes severe lung infections in AIDS patients

Figure 8.22
 Transmission electron micrograph of a *Pneumocystis carinii* cyst. Note the intracystic bodies.
 From K. Yoneda et al., "Pneumocystis carinii: Freeze-fracture study of stages of the organism," in *Egs. Parasitol.* 53:66-76. Copyright © 1982.

Family Sarcocystidae

a. Tend to have heteroxenous life cycles

1. vertebrate intermediate hosts; carnivorous definitives.

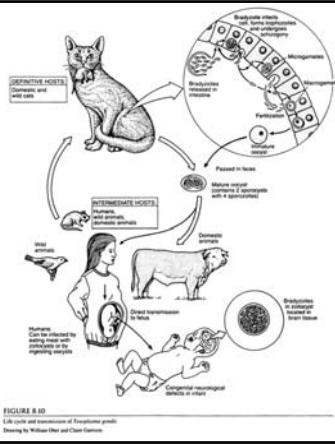
2. Examples:

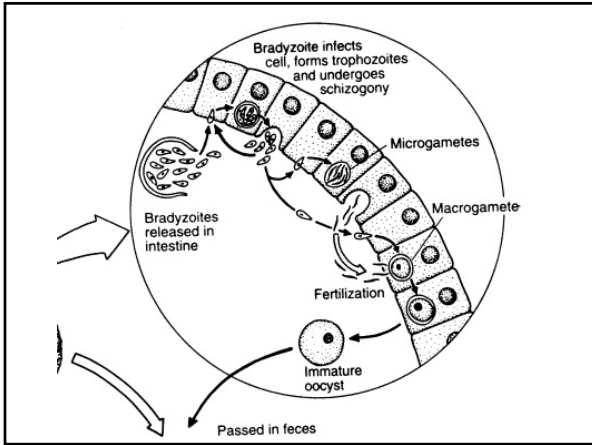
a. *Toxoplasma gondii*

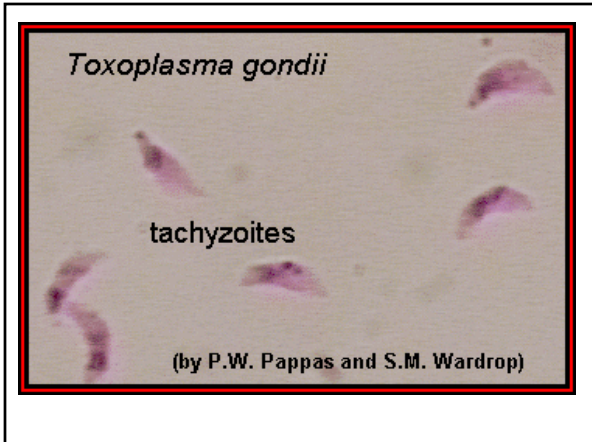
b. *Sarcocystis*

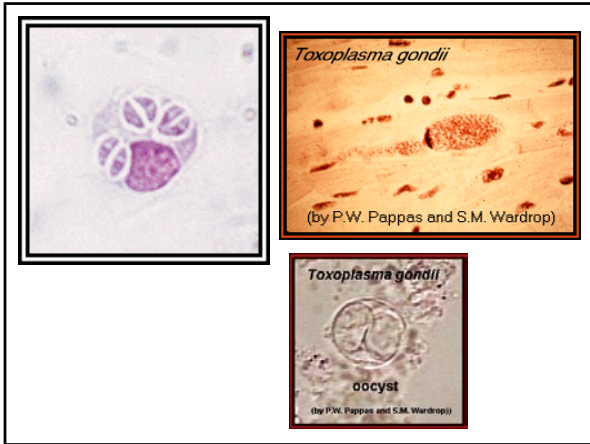
Toxoplasma gondii

- a. Usually parasitic in cats, causes problems in humans
- b. Note: 2 sporocysts in oocyst; 4 sporozoites each.



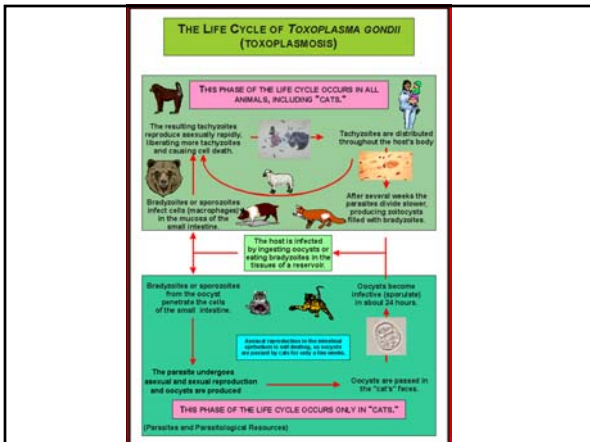






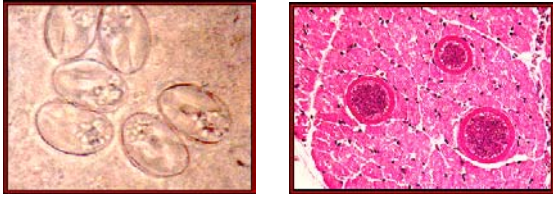
Toxoplasma gondii

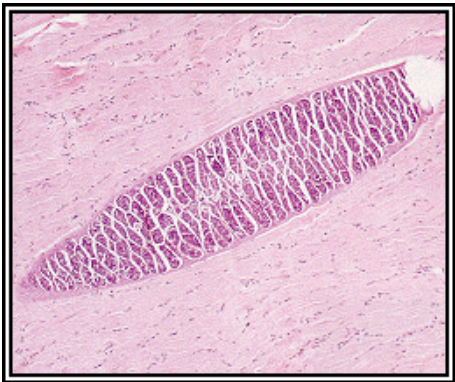
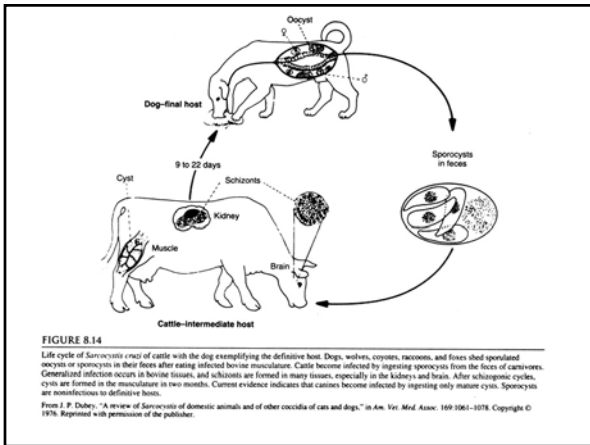
1. Infections usually due to presence of cats
 - a. Also ingestion of raw meat.
2. Infected individuals usually have immunity.
 - a. Becomes a problem when people become immunocompromised.



Sarcocystis sp.

- 1. Mostly in dogs, occasionally humans
 - a. Again, infection usually due to raw meat
 - b. Not a problem unless individual becomes immunocompromised.

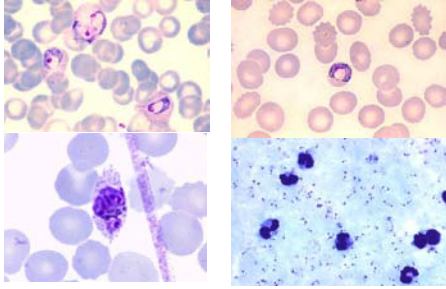




Sarcocyst in human muscle

Family Plasmodidae

All *Plasmodium* species belong to Family Plasmodidae



Family Plasmodidae

1. They are characterized by:
 - a. habitation of vertebrate blood and cells
 - b. vectored by insects.
 - c. schizogony (merogony) occurs in vertebrate host.
 - d. sporogony occurs in insects.
 - e. zygotes are motile, sporozoites are naked.

Malaria

1. Is a widespread disease; 1-5 million people infected.
 - a. Much is known, but disease persists.
 1. Cure/prevention requires economic resources.
2. Not possible in many countries where malaria is a problem.

