Class Coccidia, Continued

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

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

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

d. Both respond to Trimethoprim-sulfamethoxazole
Class Coccidia, Continued

4. Note differences in cysts

Pneumocystis sp.
1. Causes severe lung infections in AIDS patients

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 oocyte; 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.

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.
2. Not possible in many countries where malaria is a problem.

Figure 9.3

Longitudinal section of a mosquito intestine, with numerous merozoites (arrows) of *Plasmodium* sp.
Malaria-Life Cycle

a. Micro and macrogametocytes in mosquito stomach.

b. Ookinetes penetrate gut wall; forms oocyst.

c. Sporozoites develop in cyst in 7-10 days
   1. Infectivity increases 10,000 x
   2. Often causes pathology in mosquito; invades entire body.

Malaria-Life Cycle

d. Sporozoites enter blood in mosquito bite.
   1. Quickly invade fixed macrophages and liver parenchyma cells.
      a. Known as "exerythrocytic cycle" because is not yet associated with blood.
      2. There undergo schizogony and release merozoites.

Malaria-Life Cycle

3. Some merozoites may remain in parenchyma cells.
   a. This is the basis for recrudescence of malaria.
   b. Occurs in most forms, especially *P. malariae*.
   c. Doesn't occur in *P. falciparum*.

Malaria-Life Cycle

e. Merozoites enter RBCs form a ring stage
   1. Later develop into trophozoites with pigment dots (Schuffner's)
   2. Eventually divide (merogony) and become "segmenters" because nuclei appear to segment.
   3. Merozoites released again
Malaria-Life Cycle

f. Some merozoites develop into micro-others into macrogametocytes

1. Maturation occurs; forms characteristic types.

Malaria-Life Cycle

Gametocytes (macro and micro) are ingested by mosquitoes.

3. Once in mosquito stomach

a. Microgametocyte undergoes "exflagellation."

1. formation of long strings of gametes

Malaria-Life Cycle

2. Exflagellated forms are motile and penetrate macrogametocyte;

3. The life cycle continues

a. note - definitive host is where sex occurs.

Types of Malaria in Humans

*Plasmodium vivax*
Benign tertian malaria

1. Name comes from:

a. Active troph in erythrocytes

b. Cycles of pyroxisms; every 48 hours
**Plasmodium vivax**

2. Simple, non-deadly; responsible for 43% of human malaria.
3. Common in Asia
   a. Vectored by *Anopheles* mosquitoes
   b. Rarely above 65° N latitude
4. Africans often have natural immunity
   a. Duffy blood groups

5. Recognizable by large ring stage in erythrocytes
   a. Also Schuffner's dots
   1. Red parasitophorous vescicles