Protozoa: Exercise 12

35. Describe trophozoite and cyst stages

What stage of a protozoa’s life is it metabolically active, feeding, capable of motion and found in fresh, warm stool samples?

Trophozoites stage

• This stage causes patients to have symptoms.
• Best view while stool still warm

What stage of a protozoa’s life is it inactive (dormant)?

Cyst stage

• Will have a regular shape (oval or circle) than in the troph stage

36. With the aid of your drawings on p.12-17 and 12-18, identify:

*Entamoeba histolytica* trophozoites and cyst

<table>
<thead>
<tr>
<th>Class <strong>Sarcodina</strong></th>
<th>Mode of Locomotion: Pseudopods (False feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Name/ Common Name</td>
<td><strong>Disease</strong></td>
</tr>
</tbody>
</table>
| **Entamoeba histolytica** | Amoebic dysentery (infection of intestines) | Cysts or trophs in stool | Cysts in food & water or feces | Bloody diarrhea, dehydration | Metronidazole (Flagyl) | | • 10% world affected  
• 50% population in some countries |
Look for:

- Nucleus will contain a dark stained dot called a Karyosome.
- Cigar shaped Chromatin Body
- Troph stage will have Pseudopods, an extruding cytoplasmic extension
### Class *Mastigophora*  
**Mode of Locomotion:** Flagella

<table>
<thead>
<tr>
<th>Scientific Name/ Common Name</th>
<th>Disease</th>
<th>Size/Shape</th>
<th>Laboratory Diagnostic</th>
<th>Source of Infection/ Intermediate Host/Vector</th>
<th>Sign/Symptoms</th>
<th>Treatments</th>
<th>Stats</th>
</tr>
</thead>
</table>
| *Trichomonas vaginalis*     | Female: Trichomoniasis  
Male: Prostate & epididymis infections | Tear shaped in troph stage | Trophs in vaginal & prostate secretions, sediment in urine | Sexually transmitted. Trophs in vaginal & prostate secretions | Male: Asymptomatic  
Female: Vaginal discharge, burning, itching, chafing, increased urination | Metronidazole (Flagyl) for both sex partners | 10-25% women in US infected |
| *Giardia lamblia*          | Giardiasis/ backpacker's parasite | Pear shaped flagellate. “Eyes on a face” | Cysts or trophs in stool | Cysts in food & water or feces. Drinking water in the wilderness without purification | Abdominal discomfort, severe diarrhea, malabsorption, milk intolerance, weight loss | Boiling water (5-10 min)  
Quinacrine hydrochloride | |
| *Trypanosoma*              | African or American sleeping sickness, Chagas’ disease | Blood smear | Tsetse fly (T.b.g & T.b.r.) or reduviid (triatomid) bug (T.c.) | Fever, headaches, nausea, vomiting, coma, death | Produce 1000 antigenic coats  
No cyst stage | |

**Trichomonas vaginalis trophozoites**

- No cyst stage
- Look for:
  - Tear shaped
  - 3 to 5 flagella on anterior end
  - Nucleus with Karyosome
  - Purple stain

![Image of Trichomonas vaginalis trophozoites](image)
*Giardia lamblia* trophozoites and cysts

**Troph**
- Pear shaped
- Ovoid, concave sucking disc of ventral surface
- Two nuclei, both with large central Karyosome
- “Eyes on face” appearance
- 4 to 5 flagella maybe present

**Cyst**
- Oval shape
- 2 to 4 nuclei

**Look for:**
- Troph: Pear shaped
- Cyst: Oval shape

**Key Features:**
- **Troph:**
  - Troph: Pear shaped
  - Ovoid, concave sucking disc of ventral surface
  - Two nuclei, both with large central Karyosome
  - “Eyes on face” appearance
  - 4 to 5 flagella maybe present

- **Cyst:**
  - Oval shape
  - 2 to 4 nuclei
Trypanosoma species trophozoites

No cysts stage
Look for: Flagella
   Found between blood cells in blood smears
   (Don’t need to distinguish by species)
### Class Ciliata

**Mode of locomotion: Cilia**

<table>
<thead>
<tr>
<th>Scientific Name/ Common Name</th>
<th>Disease</th>
<th>Size/Shape</th>
<th>Laboratory Diagnostic</th>
<th>Source of Infection/ Intermediate Host/Vector</th>
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<th>Treatments</th>
<th>Stats</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Balantidium coli</strong></td>
<td>Recurrent diarrhea alternating with constipation</td>
<td>Large, 200 micron</td>
<td>Cysts in stools</td>
<td>Ingested Feces of infected person</td>
<td>Diarrhea, constipation</td>
<td></td>
<td>Epidemic in US mental hospitals</td>
</tr>
</tbody>
</table>

**Balantidium coli** trophozoites and cysts

Look for:
- **Troph:** Large size
- Cilia
- Oval shape
- Prominent long & kidney shaped macronucleus
  (Micronucleus present but not usually visible)

- **Cysts:** Spherical shape
- No cilia
- Cysts wall
Class **Sporozoa / Apicomplexa**  
Mode of locomotion: None, use spores for reproduction

<table>
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<tr>
<th>Scientific Name/ Common Name</th>
<th>Disease</th>
<th>Size/Shape</th>
<th>Laboratory Diagnostic</th>
<th>Source of Infection/ Intermediate Host/Vector</th>
<th>Sign/Symptoms</th>
<th>Treatments</th>
<th>Stats</th>
</tr>
</thead>
</table>
| **Plasmodium**               | Malaria | Blood smear|                       | Blood smear, headache, muscle pain, sweating |               | • Mefloquine hydrochloride (Larium)  
                              | P. falciparum |           | Anopheles mosquito | Kill mosquitos  
                              | P. vivax | | | Repellants & netting  
                              | P. malariae | | | | | | |  
| **Toxoplasma gondii**        | Toxoplasmosis, Hydrocephaly- "Water on the brain" (congenital defect) | Crescent shaped, 6 microns long to 3 in width | Biopsied tissue or body fluids/serology, mouse inoculation | Cat feces (litter box), raw meat or transplacental (mother to infant) | Human Fetus: Congenital defects, retinchoroiditis, mental retardation (from water on the brain), convulsions, blindness, death | • Pyrimethamine (Daraprim)  
                              | | | | | | | | | • Spiramycin (for pregnant women in Europe)  
| **Cryptosporidium parvum**   | Traveler’s diarrhea | Oocysts in stool with acid-fast stain, fluorescent stain or immunoassays | Water or feces, fecal-oral route | Profuse/watery diarrhea, abdominal cramping, n/v, fever, headache | | • Microfiltration  
                              | | | | | | | | | • Oral & parenteral rehydration therapy  
                              | | | | | | | | | • Very resistant to disinfectants  
                              | | | | | | | | | • Opportunistic infection of AIDS patients  

Plasmodium species trophozoites

- Red blood cell
- Ring form of Plasmodium falciparum

No cysts stage
Look for:
  - Ring found inside blood cells
  - (Don’t need to distinguish by species)
Toxoplasma gondii trophozoites

- No cysts stage
- Look for:
  - Bow or boomerang shaped
  - Nuclei

Cryptosporidium oocyst

- Oocyst stage
- Look for:
  - Bright red spheres in acid-fast stain
Platyhelminthes: Exercise 13

37. With the aid of your drawings on p. 13-13 and 13-14, identify:

<table>
<thead>
<tr>
<th>Scientific Name/ Common Name</th>
<th>Disease</th>
<th>Size/Shape</th>
<th>Diagnostic Stage</th>
<th>Infective Stage in Humans</th>
<th>Sign/Symptoms</th>
<th>Treatments</th>
<th>Stats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clonorchis sinensis / Chinese liver fluke</td>
<td>Chinese liver fluke infestation</td>
<td>Adult: leaf shaped Ova: urn shaped 25-35 m</td>
<td>Ova in feces</td>
<td>Metacercaria in raw freshwater fish</td>
<td>Biliary obstruction, jaundice, diarrhea, liver pain, anemia, abdominal distress</td>
<td>Praziquantel</td>
<td>- Found in SE Asia - Monoecious = organism is male &amp; female</td>
</tr>
<tr>
<td>Schistosoma mansoni / Blood fluke</td>
<td>Schistosomiasis/bilharziasis</td>
<td>Leaf shaped</td>
<td>Ova in feces</td>
<td>Free-swimming cercaria in fresh water penetrate skin</td>
<td>Destruction of liver, lungs and/or urinary tract</td>
<td>Praziquantel &amp; Oximiniquine</td>
<td>- Dioecious = organism is male or female - 200 mil (world) - Burrows through skin</td>
</tr>
</tbody>
</table>
a. *Clonorchis sinensis* ova

Look for: Operculum (two shoulder or horn like projections)
          at one end
          Oval shaped

b. *Schistosoma mansoni* ova

Look for: Oval shaped
          Spine projection

Route of transmission

Free-swimming form (cercaria) which may penetrate intact human skin and infection ensues
## Class Cestoda: Tapeworms

<table>
<thead>
<tr>
<th>Scientific Name/ Common Name</th>
<th>Disease</th>
<th>Size/Shape</th>
<th>Diagnostic Stage</th>
<th>Infective Stage in Humans</th>
<th>Sign/Symptoms</th>
<th>Treatments</th>
<th>Stats</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Taenia saginata</em> / Beef tapeworm</td>
<td>Taeniasis, beef tapeworm infestation</td>
<td>25 meters</td>
<td>Ova/proglottids in feces</td>
<td>Cysticercus</td>
<td>Brain cysts</td>
<td>Niclosamide</td>
<td>In US through rare steak</td>
</tr>
<tr>
<td><em>Taenia solium</em> / Pork tapeworm</td>
<td>Taeniasis, pork tapeworm infestation, cysticercosis</td>
<td>Scolex has crown of hooks</td>
<td>Ova/proglottids in feces</td>
<td>Cysticercus or ova</td>
<td>Brain cysts, mimics brain tumor</td>
<td>Niclosamide</td>
<td>In Mexico, Central Amer, &amp; American Hispanic communities</td>
</tr>
<tr>
<td><em>Echinococcus granulosus</em> / None</td>
<td>Hydatid disease</td>
<td>A few millimeters long</td>
<td>Ultrasound imaging, magnetic resonance, serology</td>
<td>Ova</td>
<td>Depends on cyst location. Impairment of vital function. Death</td>
<td>Mebendazole, surgical removal of cyst</td>
<td></td>
</tr>
</tbody>
</table>

**c. Taenia species proglottid (beef or pork tapeworm)**

- Look for: 10 to 20 branches (tree like) in its uterus
- Scolex at head (not shown)
- Body divided into proglottid (segments) (one proglottid shown here)
d. *Taenia* species ova (**beef or pork tapeworm**)

Look for:
- Spherically shaped
- Covered in *striated shell*
- Six hook embryo inside
  (Taenia and Echinococcus ova are identical)

Route of transmission:
- Raw or undercooked beef meat

Disease:
- Beef or pork tapeworm infestation
- Cysticercosis (from pork)
e. *Echinococcus granulosus* hydatid sand (also called hydatid cyst)

Look for:
- Scolex with hooks visible
- Appears oval shaped
  (Taenia and Echinococcus ova are identical)

Route of transmission:
- Carnivorous animals like dog’s feces

38. Define:

What is another name for egg?

Ova

What is the term for a tapeworm’s head with 4 suckers and hooks by its mouth?

Scolex
What is the term for a tapeworm’s segmented body?

Proglottid

What is a fluid filled sac with buds that form and grow into brood capsules where many immature scolices develop?

Hydatid sand (or hydatid cyst)

What is the term for an organism that is either male or female (separate animals)?

Dioecious

What is the term for an organism that is both male and female (both sexes occur in the same animal)?

Monoecious
Nematoda (Aschelminthes): Exercise 14

39. With the aid of your drawings on p. 14-9, identify:

<table>
<thead>
<tr>
<th>Scientific Name/ Common Name</th>
<th>Size/Shape</th>
<th>Diagnostic Stage</th>
<th>Source of Infection</th>
<th>Sign/Symptoms</th>
<th>Treatments</th>
<th>Stats</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ascaris lumbricoides / (none)</strong></td>
<td>Female: Pencil thick/20-35 cm long Male: Smaller/ hook shaped tail</td>
<td>Ova in feces</td>
<td>Ingesting ova in soil, contaminated food or water</td>
<td>Hepatitis, abdominal pain, intestinal blockage, vomiting, diarrhea, fever Lungs: Severe pneumonitis, coughing spasms, allergic symptoms, asthmatic breathing</td>
<td>Antiminth (pyrantel pamoate) &amp; Antepar (piperazine citrate)</td>
<td>1 billion infected (world) 1 million in US Female produces 26 million eggs/200,000 per day</td>
</tr>
<tr>
<td><strong>Nector americanus / Hookworm</strong></td>
<td>1.5 cm, blunt ends/ single thin transparent hyaline shell</td>
<td>Ova in feces</td>
<td>Larvae in soil burrows through bare feet</td>
<td>Anemia, lethargy, mental &amp; physical retardation</td>
<td>Vermox (mebendazole) or Antiminth (pyrantel pamoate)</td>
<td>500 million infected Consumes 0.15 mil per day/ 500 worms = 1 pt per day</td>
</tr>
<tr>
<td><strong>Enterobius vermicularis / Pinworm</strong></td>
<td>Male: 2-5 mm Female: 13 mm Long thin pointy body</td>
<td>Ova from perianal region by Graham’s scotch tape method</td>
<td>Ingested ova in soil, contaminated food or water</td>
<td>Local itching, restlessness Hand to Mouth transmission, chronic itch at anus (pruritus ani)</td>
<td>Vermox Antiminth Povan (pyrvinium pamoate) causes red stool</td>
<td>209 million (world) 18 million (US &amp; Can) No maturation stage outside host</td>
</tr>
<tr>
<td><strong>Trichurus trichiura / whipworm</strong></td>
<td>Long &amp; thin, thick posterior body</td>
<td>Ova in feces</td>
<td>Ingested ova in soil, contaminated food or water</td>
<td>Asymptomatic Chronic: Bloody diarrhea, abd. pain, headache, N/V, anemia, prolapse rectum</td>
<td>Vermox</td>
<td>3000-7000 eggs produced daily</td>
</tr>
<tr>
<td><strong>Trichinella spiralis / (none)</strong></td>
<td>Spiral formation in striated muscle</td>
<td>Muscle biopsy or serologic tests</td>
<td>Ingested larvae in raw or undercooked pork or bear meat</td>
<td>Depends on # of worms, size/age of host</td>
<td>Corticosteroids</td>
<td>1 pork chop = 10,000 larvae</td>
</tr>
</tbody>
</table>
a. *Enterobius vermicularis*

**Common Name:** Pinworm

**Look for:** Oval shape
- One side flattened
- Well-developed embryo possible

**Route of transmission:**
- Ingested from hands or other fomites (rag or mop head)

**Diseases:** Pinworm infection

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b. *Ascaris lumbricoides* (fertilized)

**Look for:** Thick, transparent, hyaline shell covered with a thick outer layer

**Route of transmission:**
- Ova may get into food or water from the soil

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c. *Necatur americanus* ova

**Common Name:** Hookworm

**Look for:** Bluntly rounded ends
- Single thin transparent hyaline shell
- Embryo development at cell division stages

**Route of transmission:**
- Contracted when mature larvae penetrate the intact skin of a bare foot

**Diseases:** Severe anemia
d. *Trichuris trichiura* ova

Look for: Translucent polar plug at each end

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e. *Trichinella spiralis* larvae

Look for: Spiral form
Circular in cross section

Route of transmission:
Ingestion of larvae in raw or undercooked pork, bear, or meat from any other carnivorous animal

Diseases: Trichinosis