Protozoans and Helminthes
Protozoans
<table>
<thead>
<tr>
<th>Pathogenic Protozoans</th>
<th>Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entamoeba histolytica</td>
<td>Amebic dysentery</td>
</tr>
<tr>
<td>Cryptosporidium</td>
<td>Cryptosporidiosis</td>
</tr>
<tr>
<td>Leishmania</td>
<td>Visceral Leishmaniasis (kala-azar)</td>
</tr>
<tr>
<td>Giardia lamblia</td>
<td>&quot;beaver fever&quot;</td>
</tr>
<tr>
<td>Trichomonas vaginalis</td>
<td>Trichomoniasis</td>
</tr>
<tr>
<td>Plasmodia</td>
<td>Malaria[s]</td>
</tr>
<tr>
<td>Toxoplasma gondii</td>
<td>Toxoplasmosis</td>
</tr>
</tbody>
</table>
Protozoan: Cryptosporidium parvum

Description:

Transmission: Unidentified modes (?water; ?food; ?oocysts passed in feces MAY be transmission)

Primary Disease: Cryptosporidiosis

Affects: Bowel

Diagnosis: Fresh stool sample

Characteristics: Associated with AIDS; watery diarrhea (explosive and more than 20 L/day); abdominal cramps after 4-14 days incubation; generally lasts between 5-11 days, but may be prolonged for a month; in immunocompromised patients, generally causes death; generally seen in AIDS, CA or organ transplant patients; weight loss; lyte imbalances; Stools HIGHLY infectious! PROTECT yourself! Farm workers/DVM’s at high risk of infection

Treatment: NO effective treatment; self limiting (1-2 weeks); 7-8 day incubation
Protozoan: *Entamoeba histolytica*

**Description:**

<table>
<thead>
<tr>
<th>Cyst</th>
<th>Life cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Cyst Image" /></td>
<td><img src="image2.png" alt="Life Cycle Image" /></td>
</tr>
</tbody>
</table>

**Transmission:** Water/food; direct contact

**Primary Disease:** Amebic dysentery

**Affects:** Intestine, liver, lungs

**Diagnosis:** Stool examination; trophozoites in mucous strands

**Characteristics:** tenesmus; deep intestinal ulcers; abdominal tenderness which may be confused with a hot appy (LRO pain); diarrhea; weakness; prostration; N/V; pain; [no fever which differentiates it from bacillary dysentery]; complication: amebic hepatitis/abscesses; symptoms develop within 4 days after exposure all the way up to 1 year after exposure or NEVER. Pathological changes are ALWAYS due to trophozoites.

**Treatment:** abscesses may be treated with chloroquine and metronidazole; call CDC for treating asymptomatic carriers
Protozoan: Giardia lamblia

Description:

Transmission: Water/contact; secondary to fecal contamination as in day care facilities and jails

Primary Disease: Giardiasis; beaver fever

Affects: Bowel

Diagnosis: Stool examination; do times 3 to be considered negative

Characteristics: explosive diarrhea with bloody, foul smelling stools; fever; cramps; anorexia; N/V, weakness, weight loss; gas; greasy stools, belching; incubation about 1-3 weeks; disease persists for 2-3 months in many cases;

With chronic disease comes fat malabsorption syndromes: steatorrhea, Vitamins A, D, E, K mal absorption; B12 absorption decreases; folate absorption decreases; reduces activity of all carbohydrate enzymes in small bowel in 1/2 of all patients

Treatment: Quinacrine, furazolidone
**Worm:** Leishmania donovani

**General Family:** Trypanosomes (Blood/tissue flagellates)

**Life Cycle:**

**Location:** Tropics

**Disease:** Kala-azar

**General Description:** Lesions in reticuloendothelial system; hepatosplenomegaly, often fatal
Protozoan: Plasmodium ovale, malariae, vivax, falciparum

Description:

Transmission: Mosquito (Anopheles) bite

Primary Disease: Malaria

Affects: Liver, RBC

Diagnosis: Peripheral blood smears: thin and thick smears

Characteristics: Big problem world-wide; vivax, ovale, falciparum: new merozoites every 48°; malariae: every 72°; vivax and ovale: periodic relapses up to 5 years; also, difficult to tell apart from each other; malariae: lasting 40 years reported; falciparum: invades RBC of ALL ages (including) stem cells), make "knobs" on RBC which cause thrombosis and local ischemia; falciparum: more serious infection than ovale, malariae, vivax; COLD phase: initial chill for 15' to 1 hour; N/V, headache; HOT phase: fever spiking at or above 40°C, lasts 3-8 hours; WET phase: sweating, no fever, patient sleeps and awakens feeling well; normocytic anemia also develops in malaria

Treatment: Quinine, chloroquine, primaquine
Protozoan: Toxoplasma gondii

Description:

Transmission: Cat/feces; contaminated food; undercooked meat and milk products; 1-21 days after defecation, feces becomes infectious

Primary Disease: Toxoplasmosis; "cat-scratch fever"

Affects: Blood, eyes, tissue cells

Diagnosis: Peripheral blood smear

Characteristics: Congenital damage possible; 1st trimester: "stillbirth"; 2d-3d trimesters: blindness, learning difficulties; also associated with AIDS; craniocervical lymphadenopathy, malaise, no fever, muscle pain; In severe form: pneumonitis, hepatitis; In congenital form: lesions in the CNS; jaundice, anemia, general lymphadenopathy (resembles infectious mononucleosis: occasionally with fever at this depth of disease); more common in warmer climates than cold; may be confused with lymphoma

Treatment: Treatment is NOT required for most infections; sulfonamides give some relief
<table>
<thead>
<tr>
<th>T</th>
<th>Toxoplasmosis</th>
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<tbody>
<tr>
<td>O</td>
<td>Other agents</td>
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<tr>
<td></td>
<td>Syphilis</td>
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<tr>
<td></td>
<td>HIV's</td>
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<td></td>
<td>Plasmodia</td>
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<tr>
<td></td>
<td>Varicella Zoster Virus</td>
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<td>Listeria</td>
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<td>Influenzaviruses</td>
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<td></td>
<td>Epstein-Barr virus</td>
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<td>R</td>
<td>Rubella</td>
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<td>C</td>
<td>Cytomegalovirus</td>
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<tr>
<td>H</td>
<td>Herpes Simplex</td>
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</tbody>
</table>

Intrauterine or perinatally acquired infections

BIGGEES: hepatosplenomegaly; jaundice; petechiae; meningoencephalitis; chorioretinitis

LESS OFTEN: microcephaly; hydrocephaly; intracranial calculi; myocarditis; osteogenic lesions
Protozoan: Trichomonas vaginalis

Description:

Transmission: STD

Primary Disease: Trichomoniasis

Affects: Urogenital organs

Diagnosis: UA or swab examination

Characteristics: may result in sterility; fairly common in pregnant women or after vaginal surgery; persistent burning; redness; vulvar itching with frothy and/or malodorous discharge; infection USUALLY does not go to uterus; mucus membranes covered with frothy yellow-cream colored discharge; mix with KOH and a fishy odor occurs; about 10% of men have a thin white urethral discharge

Treatment: Metronidazole, Tinidazole: TREAT BOTH partners; NO EtOH with Flagyl
Helminthes
Worm: *Ancylostoma duodenale* or *Necator americanus* (Hookworms)

General Family: Nematode

**Ovum**  
**Larvae or Adult**

**Life Cycle:**

**Location:** Worldwide

**Disease:** Hookworm

**General Description:** Abdominal pain, found in small bowel, larvae transported via lungs, thru skin, contaminated soil, drinking contaminated water

**ASIDE: ALL NEMATODES:** have longitudinal muscles for penetrating movement; complete digestive systems, separate sexed adults (unlike cestodes); unsegmented
Worm: *Ascaris lumbricoides* (Giant round worm)

General Family: Nematode

<table>
<thead>
<tr>
<th>Ovum</th>
<th>Larvae or Adult</th>
</tr>
</thead>
</table>

**Life Cycle:**

- Egg ingested → small bowel
- Expectorated (swallowed)
- Trachea
- More maturation
- Lungs → blood
- Larvae hatch
- Excreted

**Location:** Worldwide

**Disease:** *Ascariasis*

**General Description:** Emaciation, pneumonia, in small bowel, larvae from lungs, eating eggs from fecally contaminated food/soil
Worm: Clonorchis sinensis (Chinese liver fluke)

General Family: Trematode (fluke)

<table>
<thead>
<tr>
<th>Ovum</th>
<th>Larvae or Adult</th>
</tr>
</thead>
</table>

Life Cycle:

Location: China, Japan, Korea, etc.

Disease: Clonorchiasis

General Description: poor fat digestion, snail, in host liver, raw, smoked or pickled fresh water fish, jaundice
Worm: Diphyllobothrium latum (fish tape worm)
General Family: Cestode (segmented tape worms)

Life Cycle:

Location: Coastal regions of the world
Disease: Tapeworm
General Description: pernicious anemia, small bowel, uncooked freshwater fish; loves $B_{12}$ (Finns)
Worm: Echinococcus granulosis (dog tapeworm)
General Family: Cestode

Life Cycle: See Taenia spp
Location: Sheep raising regions of the world
Disease: Hydatidosis
General Description: Liver damage, liver, lung, brain, abdomen, long bones, kidney; from K9 family
Worm: Enterobius vermicularis (pin worm; urban parasite)

General Family: Nematode

Life Cycle:

Location: Worldwide

Disease: Enterobiasis

General Description: anal itching; cecum, colon, self-contamination; anal-oral; viable eggs; perianal; scratching; males rarely, if ever, seen
Worm: Fasciola hepatica (sheep liver fluke)
General Family: Trematode

Life Cycle:

Location: Sheep raising regions of the world
Disease: Fascioliasis (liver rot)
General Description: liver damage, from aquatic vegetation
Worm: Hymenolepis nana (dwarf tapeworm of humans)
General Family: Cestode

Life Cycle:

Location: Worldwide
Disease: Tapeworm
General Description: diarrhea, small bowel, anal-oral; vague abdominal discomfort, loss of appetite leads to weight loss
Worm: Paragonimus westermani (lung fluke)
General Family: Trematode

Life Cycle:

Location: N. America and Far East
Disease: Paragonimiasis
General Description: Lung, brain, raw crab, cough, poor breathing, hemoptyisis
Worm: Schistosoma haematobium (blood fluke)
General Family: Trematode (Flat worm)

Life Cycle:

Location: International waters of Africa, mid-East, Egypt
Disease: Schistosomiasis
General Description: veins of bladder, large bowel, liver, penetrates skin, rash, fever, from snail, hematuria, dysuria, bladder/rectal CA, found in the last drops of urine at end of micturition
**Worm:** Schistosoma japonicum (blood fluke)

**General Family:** Trematode

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**Ovum**

**Larvae or Adult**

---

**Life Cycle:**

- Adults copulate in portal vessels
- Eggs laid in small bowel veins
- Infection
- Skin penetration
- Larvae in snail
- Eggs to feces
- Ulceration
- Blood vessels

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**Location:** Far East, Africa, S. America, Caribbean, Philippines

**Disease:** Schistosomiasis

**General Description:** rash, fever, from snail, veins of colon, rectum, liver, penetrates skin; CNS problems (seizures); see S. haematobium
Worm: Schistosoma mansoni (blood fluke)
General Family: Trematode

Life Cycle:

Location: S. America, Caribbean, Egypt, Japan, China, Philippines
Disease: Schistosomiasis
General Description: rash, fever, from snail, veins of bowel, liver, penetrates skin; see S. haematobium
Aside: Schistosome Dermatitis

• Caused by Schistosommatium douthitti
• Causes an allergic dermatitis
• The itch comes because the organisms crawl under our skin and die, causing the hypersensitivity reaction.
• From birds; can not mature in man
• Prominent in Europe and N. America
• aka swimmer’s itch
• Destroy the snail with Cu salts
• Happened the last time Washoe Lake was dry and Little Washoe was down (before 2005); at Davis Creek Pond Summer 2017
Snails Hosts of Schistosomes
Schistosome Reproduction
Worm: *Strongyloides stercoralis* (threadworm)

General Family: Nematode

**Life Cycle:**

- Feces contaminated soil (night soil) → bare feet
- Penetration by rhabditiform larvae
- Skin
- Arteries, veins
- Adult form
- Adult form releases larvae
- Larvae or Adult
- Ovum

**Location:** Worldwide

**Disease:** Strongyloidiasis

**General Description:** Anemia, abdominal pain, duodenum, jejunum, through skin and lungs
Worm: Taenia saginata (beef tapeworm; giant tape worm 3-10 m long)
General Family: Cestode

Life Cycle: Ova NOT infective to man; only worm or larvae

Location: Worldwide
Disease: Tapeworm
General Description: Small bowel, diarrhea, eating uncooked beef
Worm: Taenia solium (pork tapeworm)
General Family: Cestode

Life Cycle:

Location: Worldwide
Disease: #1: tapeworm; #2: Cysticercosis
General Description: #1: Small bowel, diarrhea, uncooked pig; #2: eye, SQ, CNS, eat eggs
Worm: *Trichinella spiralis*
General Family: Nematode

**Life Cycle:**

<table>
<thead>
<tr>
<th>Ovum</th>
</tr>
</thead>
</table>

**Location:** Worldwide
**Disease:** Trichinosis
**General Description:** Diarrhea, muscle pain, loss of eye motion, striated muscle, uncooked pork
Worm: Trichuris trichiura (whipworm)

General Family: Nematode

Life Cycle:

Location: Worldwide

Disease: Trichuriasis

General Description: Abdominal pain, cecum, colon, feces and contaminated soil ingestion
Worm: Wuchereria bancrofti
General Family: Nematode

Life Cycle: TWO hosts

Location: Tropical/subtropical regions of the world
Disease: Filariasis
General Description: edema, elephantiasis (due to blocked lymph drainage); lymph nodes, mosquito bite

Image source: http://www.dpd.cdc.gov/dpdx/HTML/Filariasis.htm
<table>
<thead>
<tr>
<th>Generic Name: Albendazole</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade Name: Valbozen (Albenza)</td>
</tr>
<tr>
<td>Indication/Usage: received FDA approval (1996 or 1997) for use to treat cysts of the liver, lung, peritoneum that are caused by the larvae of Echinococcus granulosis (hydatid disease) and neurocysticercosis caused by T. solium larvae. Albenza is an orphan drug and its approval AND manufacture are important therapeutic gains.</td>
</tr>
<tr>
<td>Warnings: Known Allergies</td>
</tr>
<tr>
<td>Pregnancy Category: C -- Contraindicated in first trimester (<a href="http://www.emedicine.com/med/topic2293.htm">http://www.emedicine.com/med/topic2293.htm</a>)</td>
</tr>
<tr>
<td>Administration: Dosage for hydatid disease is 400-mg bid with meals times 28 days, 14 days off, 28 days on, 14 days off and 28 days on</td>
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<tr>
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<tr>
<td>Neurocysticercosis can result in seizures and headaches when the disease gets into brain tissue. Oral or IV corticosteroids should be considered to prevent cerebral hypertensive episodes during the first week of anticysticercal therapy.</td>
</tr>
<tr>
<td>Dosage for neurocysticercosis is 400 mg bid with meals times 8-30 days.</td>
</tr>
<tr>
<td>In both hydatid disease and neurocysticercosis, if the patient weighs less than 60 kg, the dosage is 15 mg/kg/day with meals divided bid but no more than 800 mg/day.</td>
</tr>
<tr>
<td>Generic Name:</td>
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<tr>
<td>Trade Name:</td>
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<td>Indication/Usage:</td>
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<tr>
<td>Warnings:</td>
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<tr>
<td>Pregnancy Category:</td>
</tr>
<tr>
<td>Administration:</td>
</tr>
</tbody>
</table>
Generic Name: Mebendazole
Trade Name: Vermox
Indication/Use: pinworm, whipworm, giant round worm, hook worm

Warnings: Determine hypersensitivity
          Personal hygiene improves treatment due to decreased reinfection
          Do NOT use routinely in children < 2 YOA
          Do not use in first trimester

Pregnancy Category: C

Administration: p.o.: pinworm tab 1 for 1 day; whip/hook/giant round worm tab 1 q 12 h for 3 days; repeat in 2-3 weeks if necessary

- Adverse effects are negligible, except headaches during early therapy. These symptoms are from metabolites secreted from nematodes that are killed by the drug. Causes worm death by selectively and irreversibly blocking uptake of glucose and other nutrients in susceptible adult intestines where helminths dwell. (http://www.emedicine.com/med/topic2293.htm)
Generic Name: Niclosamide

Trade Name: Nicolicide

Indication/Use: Beef tape worm, pork tape worm, fish tape worm, dwarf tape worm

Warnings: Determine hypersensitivity
Refrain from routine use in children < 2 YOA
Chew thoroughly
Segments/ova of beef/fish tape worms after 7 days = tx failure

Pregnancy Category: B
Administration: p.o.

<table>
<thead>
<tr>
<th>Beef/Fish Tape Worms</th>
<th>Dwarf Tape Worms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults: tabs 4 one dose</td>
<td>Adult: tabs 4 qd for 7 days</td>
</tr>
<tr>
<td>Children over 75#: tabs 3 one dose</td>
<td>Children over 75#: tabs 3 one day;</td>
</tr>
<tr>
<td>Children between 25-75#: tabs 2 one</td>
<td>tabs 2 qd for 6 days</td>
</tr>
<tr>
<td>dose</td>
<td>Children between 25-75#: tabs 2 one</td>
</tr>
<tr>
<td></td>
<td>dose; tabs 1 qd for 6 days</td>
</tr>
</tbody>
</table>

- Beef/fish tapeworms: Treatment may be repeated in seven days if needed.

- Dwarf tapeworm: Treatment may be repeated in seven to fourteen days if needed.

Generic Name: Oxamnique

Trade Name: Vansil

Indication/Use: All stages of S. mansoni

Warnings: Epileptiform seizures have been known to occur with this
Dizziness/drowsiness has occurred

Pregnancy Category: C

Administration: p.o.; adult: 12-15 mg/kg one day

<table>
<thead>
<tr>
<th>Weight range (pounds)</th>
<th>Dose (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>66-88</td>
<td>500</td>
</tr>
<tr>
<td>90-132</td>
<td>750</td>
</tr>
<tr>
<td>134-176</td>
<td>1000</td>
</tr>
<tr>
<td>178-220</td>
<td>1250</td>
</tr>
</tbody>
</table>

Give after food to improve patient's toleration of drug
Generic Name: Piperazine citrate

Trade Name: Vermizine

Indication/Use: Giant round worm and pin worm

Warnings: Determine hypersensitivity -- if so, d/c
If GI and CNS sx occur, d/c
Recommend personal hygiene to patient

Pregnancy Category: ?

Administration: p.o.; Round worms: adults: 3.5 g qd before breakfast for 2 days; children: 75 mg/kg for two days (maximum dose = 3.5 g/d) -- Pin worms: Adults and Children: 65 mg/kg qd (maximum dose 2.5 g/d) for 7 days
Generic Name:  Praziquantel

Trade Name:  Biltricide

Indication/Use:  Schistosomiasis

Warnings:  
Determine hypersensitivity
Do NOT drive/operate machinery on day of treatment OR the day after treatment
Women do NOT nurse on day of treatment or for 72 hours afterwards
Refrain from use in children < 4 YOA
O.D.: give rapid acting laxative
Do not treat ocular schistosomiasis with this: causes irreparable eye damage 2° worm damage in tissues

Pregnancy Category:  B

Administration:  p.o.: 20 mg/kg tid X 1d; wash down unchewed tabs with liquid during meal; time between doses is to be 4-6 hours
Generic Name: Thiabendazole

Trade Name: Mintezol

Indication/Use: Strongyloidiasis (thread worm), trichinosis (MAY be used with hookworm, whipworm and giant round worm* when wish for a 2d agent (co-drug) or shot-gunning

Warnings: Determine hypersensitivity
Avoid activities that require mental alertness
Do not use prophylactically, but after diagnosis
Refrain from use in children less than 14 kg
N/v, diarrhea, tinnitus, hyperglycemia, hematuria, live Ascaris in mouth and nose have been reported

Pregnancy Category: C

Administration: maximum daily dose = 3 grams; after meals; p.o.; chew tablets before swallowing; dose based on patient's weight;

Strongyloidiasis Trichinosis Ascariasis/Trichuriasis
2 doses qd for 2 days 2 doses qd for 4 days 2 doses qd for 2 days

*MAY cause Ascaris to MIGRATE