Helminths: An Introduction to Pathogenic Worms in Man

Introduction

Table 1 below summarizes *Helminths* and provides an overview of 18 different worms that create havoc with humans. This table is not by any means inclusive, but is representative of the major parasitic critters that are pathogenic to man.

Helminths		
Platyhelminthes		*Nemathelminthes*
Cestoda	*Trematoda*	*Nematoda*
Tapeworms	Flukes	Round worms
D. latum, Taenia spp., Echinococcus, H. nana	*S. japonicum, S. haematobium, S. mansoni, P. westermani, C. sinensis, F. hepatica*	*A. lumbricoides, E. vermicularis, N. americanus, A. duodenale, S. stercoralis, T. spiralis, T. trichiura*

Table 1. A summary of *Helminths*.

The classical method of identifying ova and parasites (O&P) is by examining fecal samples microscopically. Those samples may be examined by wet mounts of the fresh sample, wet mounts of the preserved specimen, wet mounts of concentrated specimen or by staining a fecal smear.

A wet mount is made by mixing a small amount of the fresh or preserved feces in normal saline. A drop of this suspension is applied to a microscope slide and a cover slip is positioned over the drop. Since this sample is to be examined under oil immersion, the cover slip must be sealed to the microscope slide. A mixture of paraffin and vaseline melted together and "painted" onto the edges of the cover slip serves this purpose.

Specimens may be concentrated, i.e., remove the garbage and collect the O&P, by one of two techniques. These techniques are summarized in **Table 2**.

Technique	Pros	Cons
Formalin-Ether	Efficient in recovering most *helminth* eggs; moderately effective in recovering schistosome eggs.	Lose *H. nana* eggs; decreases the concentration of *G. lamblia* cysts; EXPLOSIVE!
O&P settle to bottom after centrifugation		
Formalin-$ZnSO_4$ Flotation	Clears up specimen; decreases distortion of parasites	Unsatisfactory for schistosome ova
O&P float to top of supernatant after centrifugation		

Table 2. Summary of the two methods of obtaining O&P for microscopic exam.

Samples obtained by concentration methods are examined quickly under the microscope.

Table 3 summarizes one permanent staining technique for the microscopic visualization of O&P.

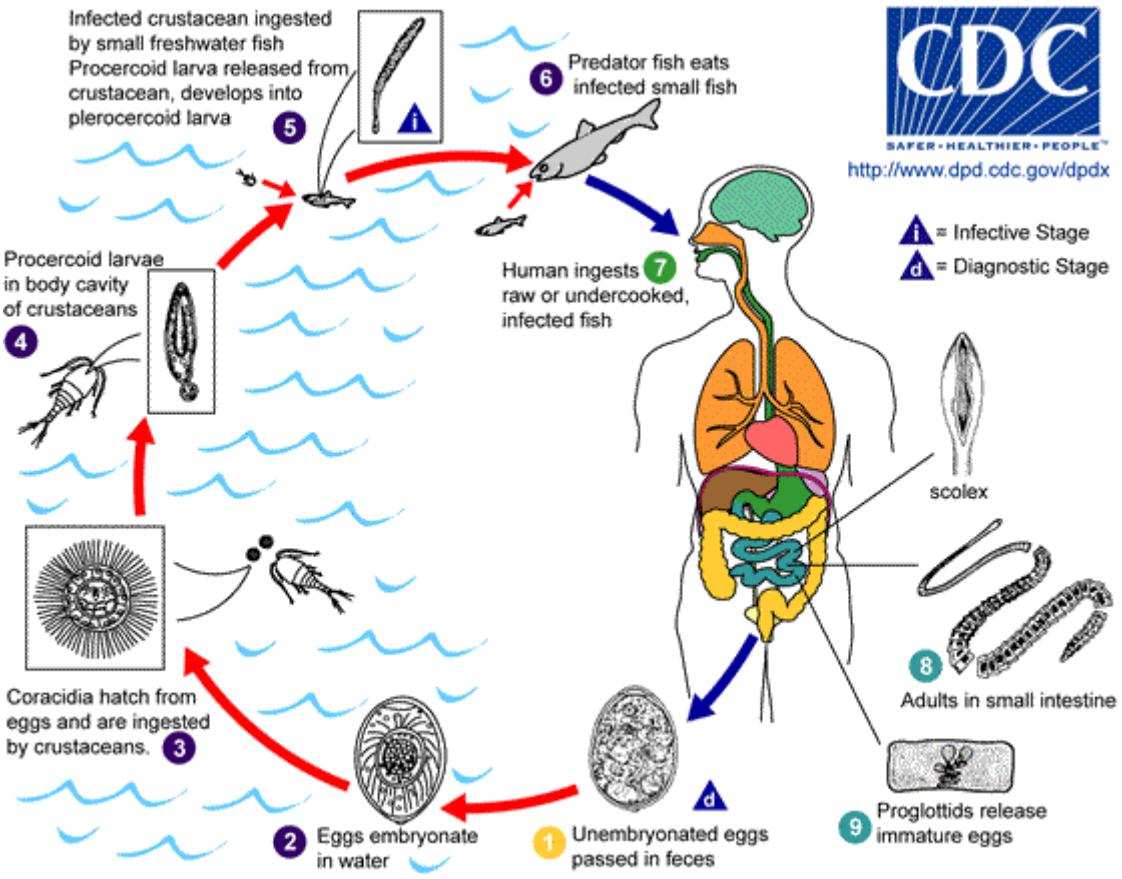
Technique	Comment
Wheatley Trichrome Stain	Destaining increases visualization of some O&P
Trichrome Stain REACTIONS	Cytosol of cysts and trophozoites are blue-green with a purplish tinge; the nucleus, RBC and bacteria are red to purple red; yeasts are green and the background of the slides is green

Table 3. Summary of the Wheatley Trichrome O&P Stain method.

In any event, the one variable which remains constant is that to visualize O&P, one must know their appearance. Following the NCID's format of life

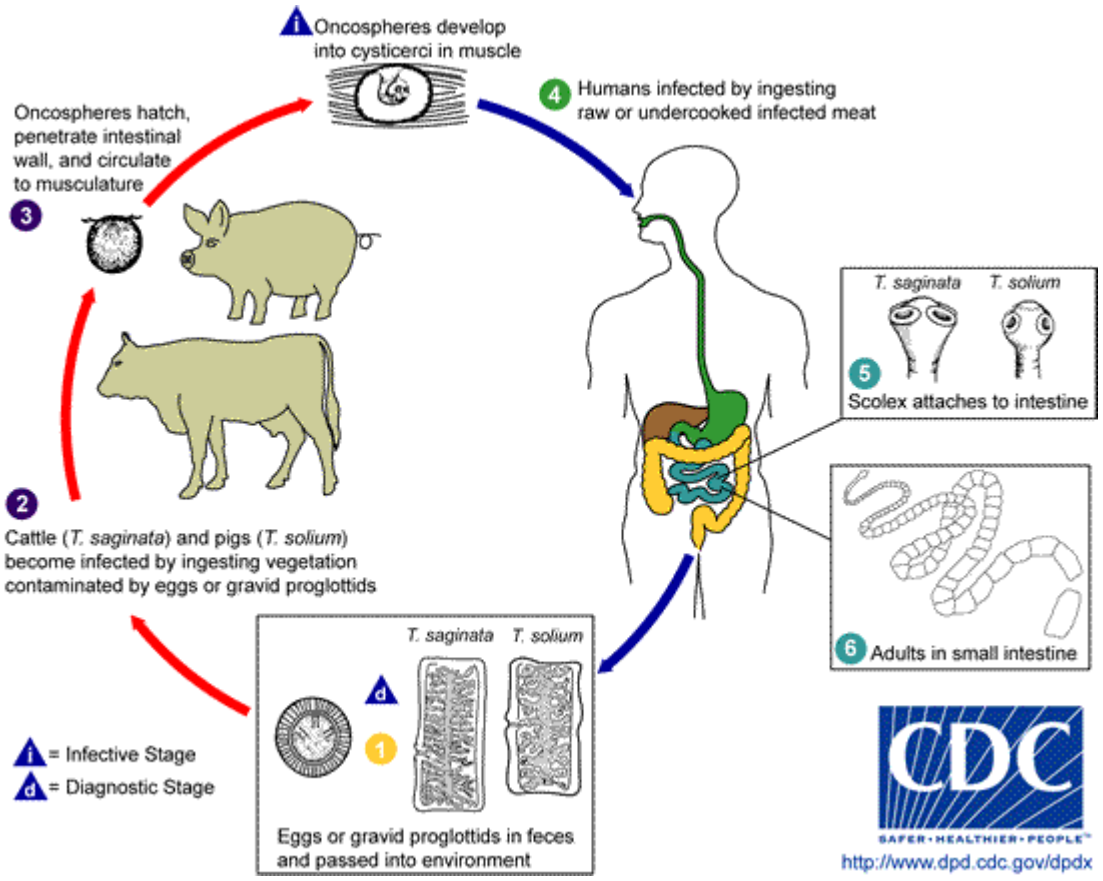
cycle with micrographs, once again, below are two representative cestodes (tape worms):

Diphyllobothrium. latum



http://www.dpd.cdc.gov/dpdx/HTML/ImageLibrary/Diphyllobothriasis_il.htm

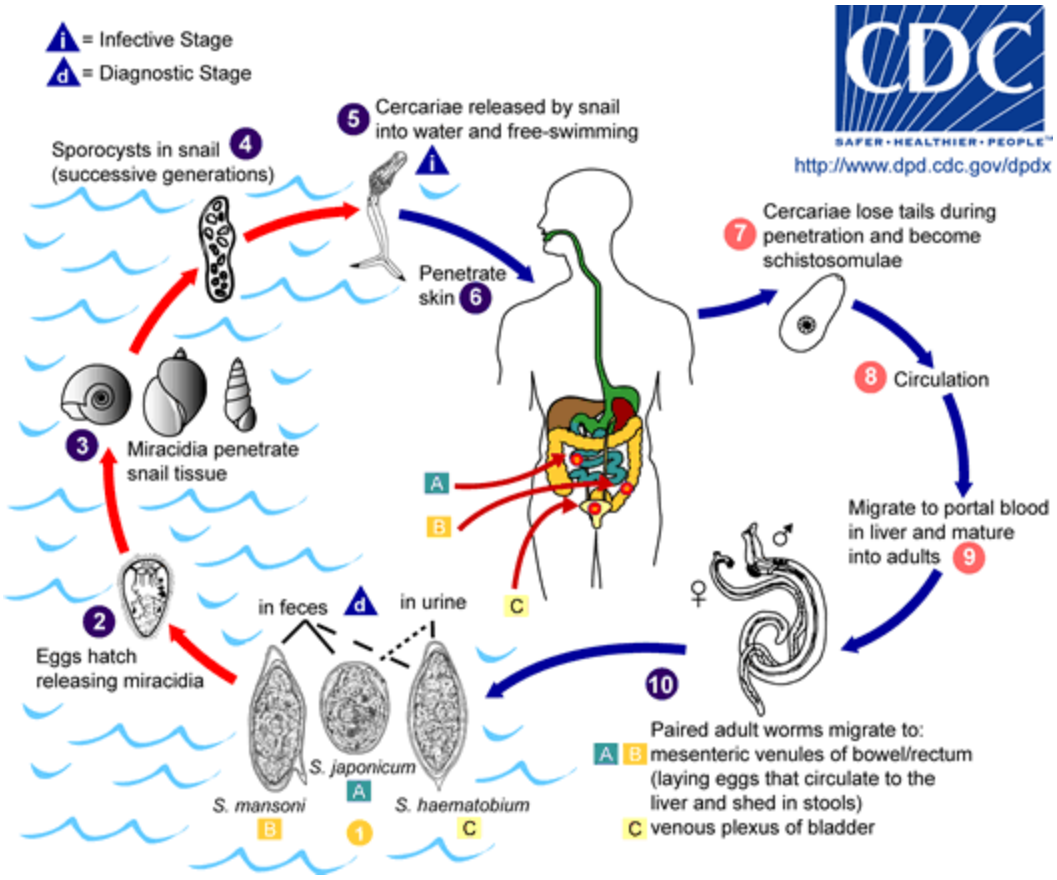
Taenia spp



http://www.dpd.cdc.gov/dpdx/HTML/ImageLibrary/Taeniasis_il.htm

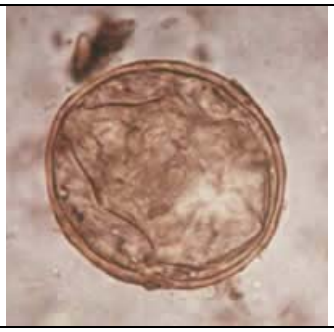
How they appear as adults is in your book – examples are also preserved in the lab.

The following are renderings of trematodes – the flukes. Life cycle format follows, directly:



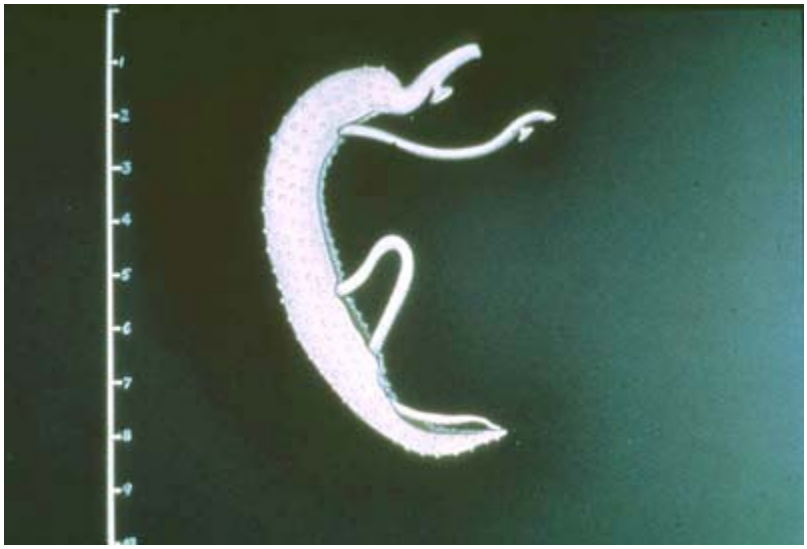
http://www.dpd.cdc.gov/dpdx/HTML/ImageLibrary/Schistosomiasis_il.htm

The ova of the schistosomes are illustrated (and cited) below:

		
S. mansoni (http://www.dpd.cdc.gov/dpdx/HTML/ImageLibrary/Schistosomiasis_il.htm)	S. haematobium (http://www.dpd.cdc.gov/dpdx/HTML/ImageLibrary/Schistosomiasis_il.htm)	S. japonicum (http://www.dpd.cdc.gov/dpdx/HTML/ImageLibrary/Schistosomiasis_il.htm)

The schistosomes are shaped differently: males short and stubby; females long and thin. This is because when they reproduce, the female slides inside

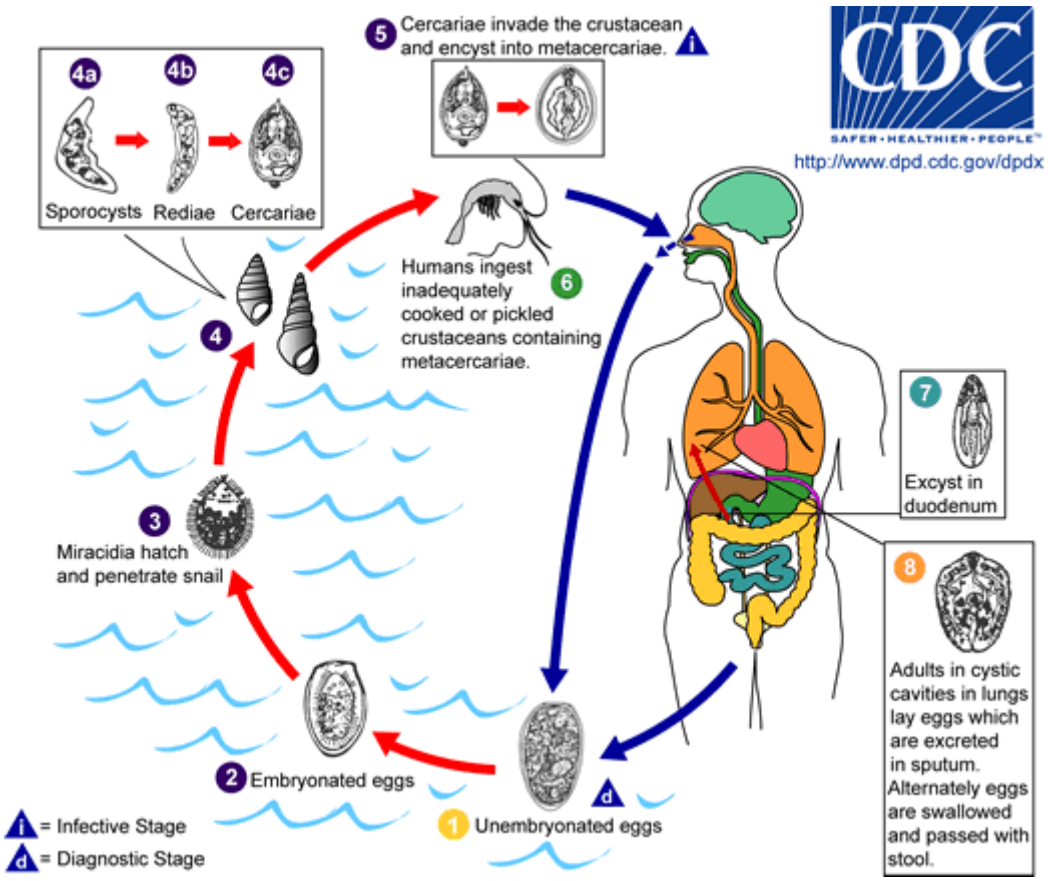
the male's coital groove. This groove serves as a receptacle for the female during copulation:



(http://www.med.sc.edu:85/parasitology/schis-2.jpg -- Dr. Abdul Ghaffar; University of South Carolina)

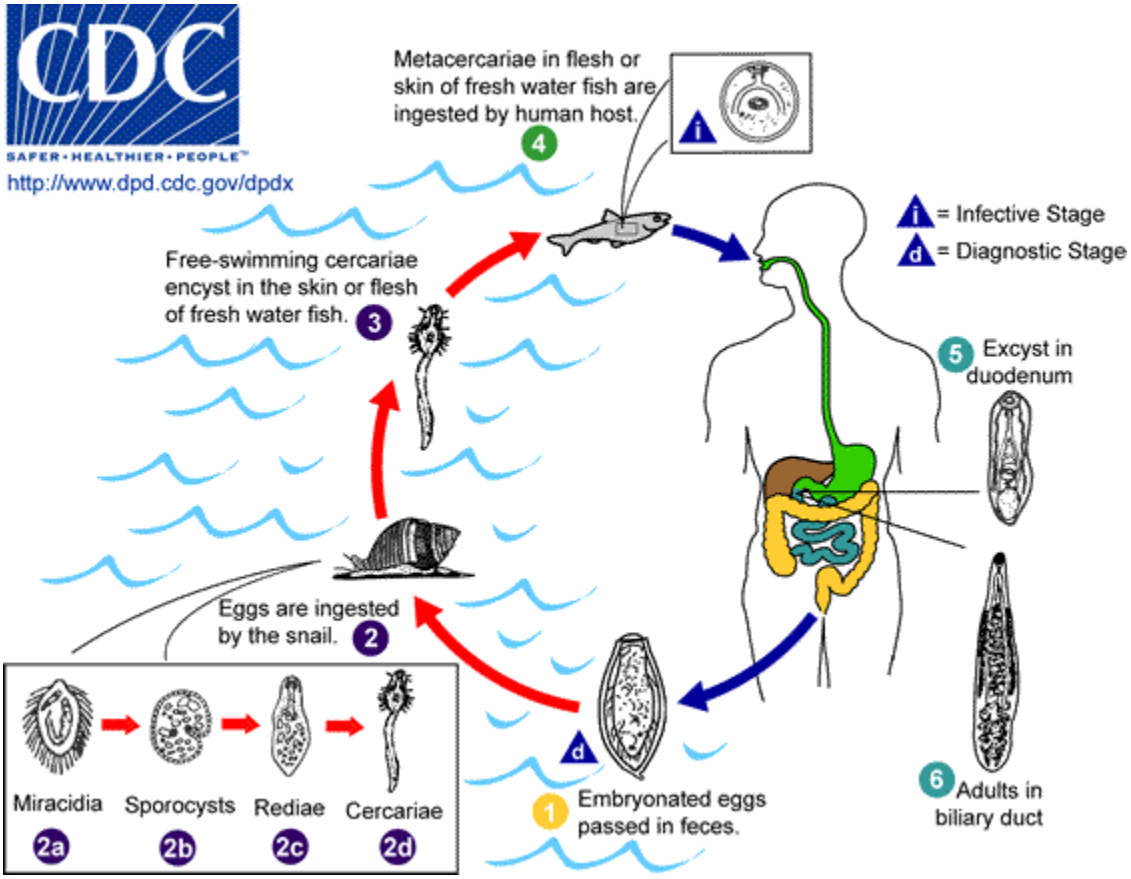
Sketches/renderings of the appearances of the ova of the last three *Trematodes* from **Table 1** are shown below:

Paragonimus westermani



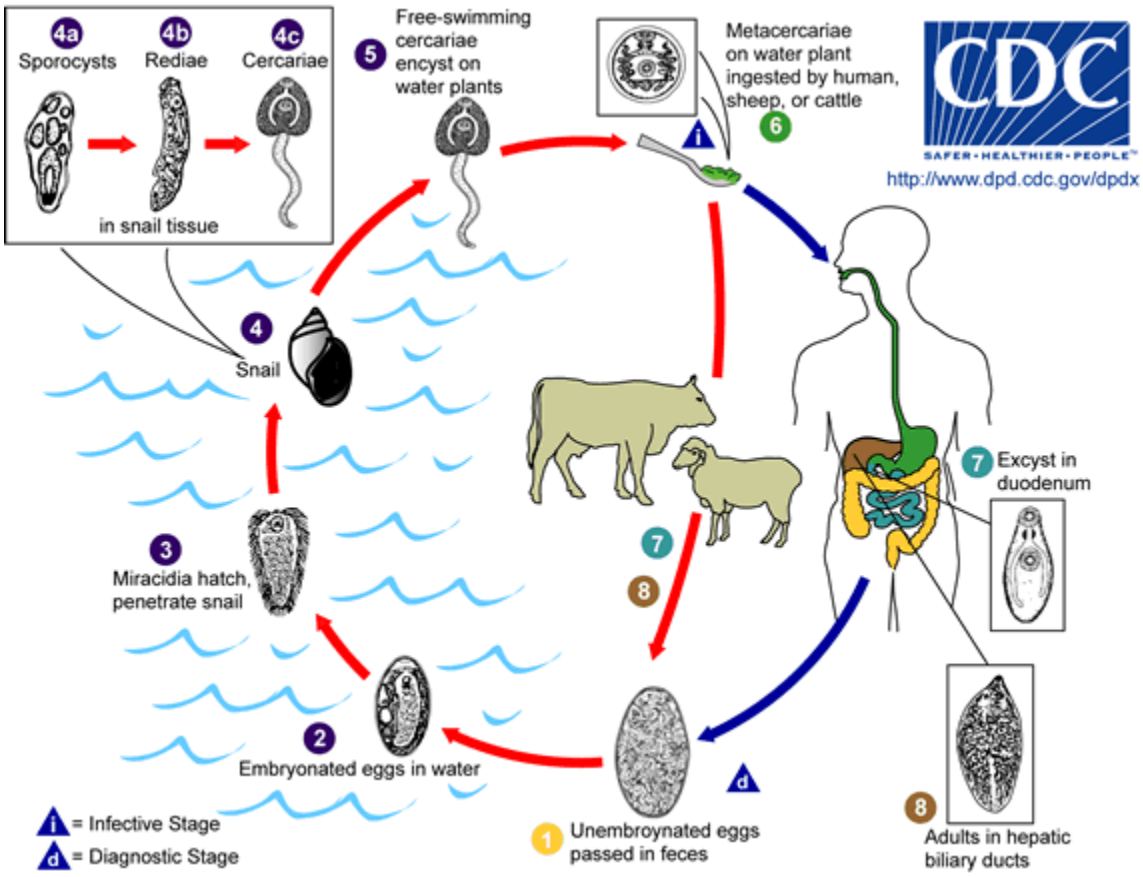
http://www.dpd.cdc.gov/dpdx/HTML/ImageLibrary/Paragonimiasis_il.htm

Clonorchis sinensis



http://www.dpd.cdc.gov/dpdx/HTML/ImageLibrary/Clonorchiasis_il.htm

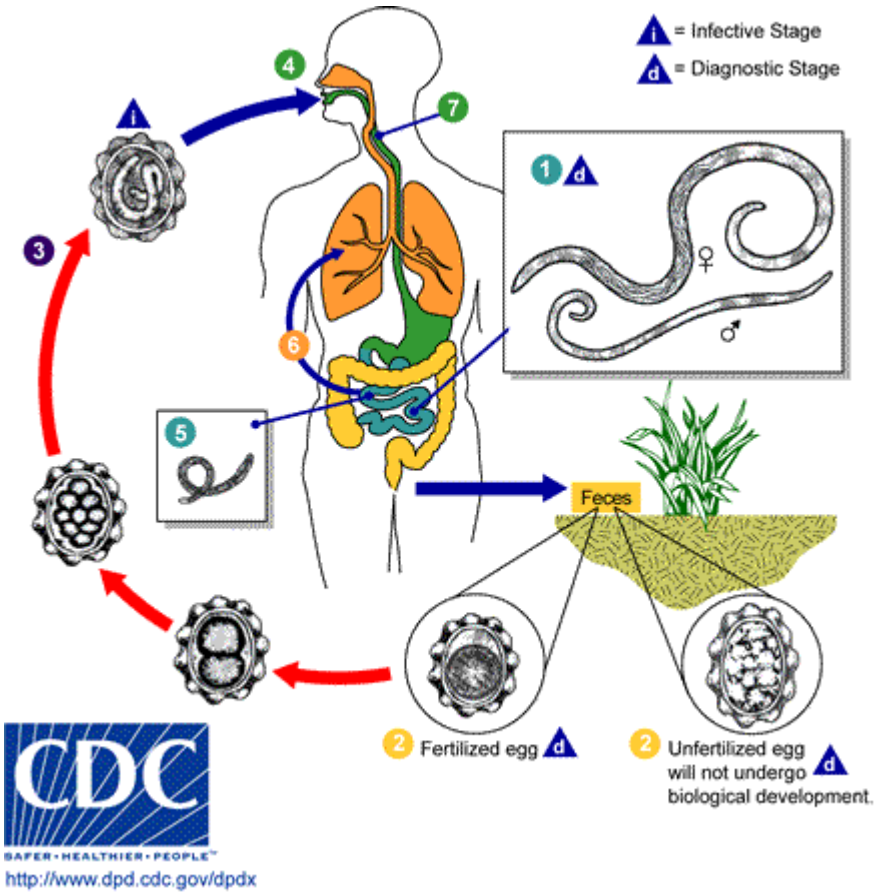
Fasciola hepatica



http://www.dpd.cdc.gov/dpdx/HTML/ImageLibrary/Fascioliasis_il.htm

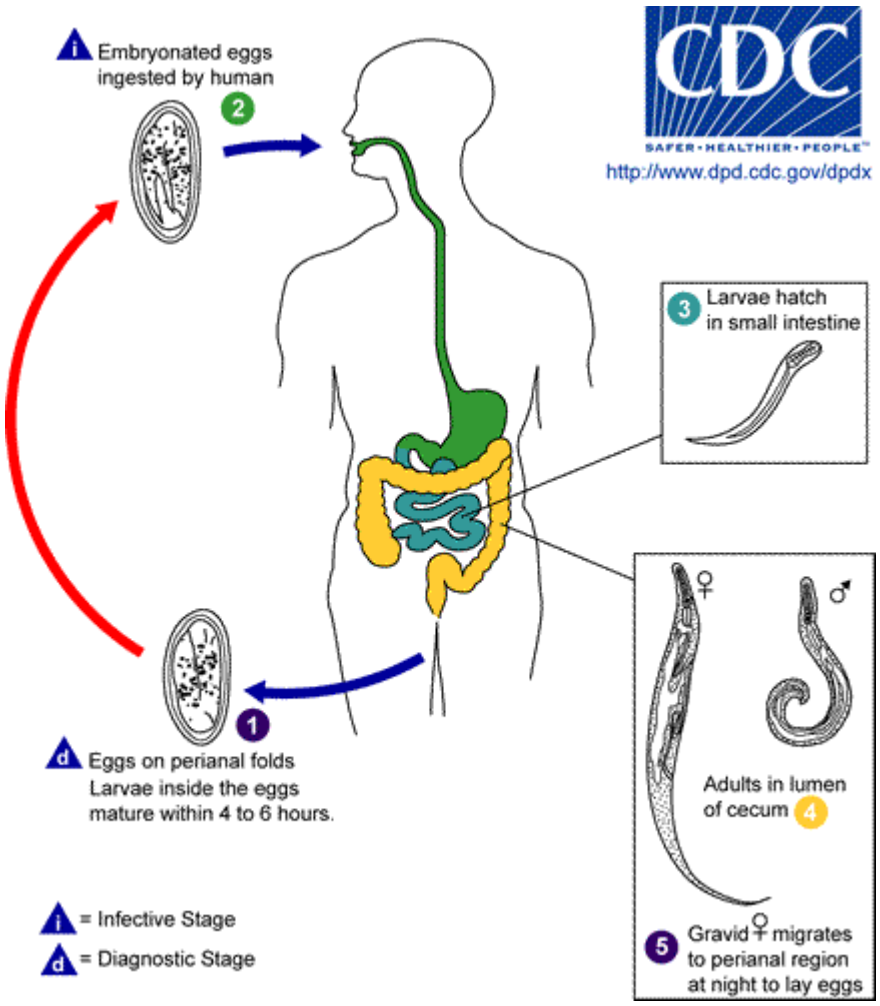
Next follows nematodes (round worms):

Ascaris lumbricoides



http://www.dpd.cdc.gov/dpdx/HTML/ImageLibrary/Ascariasis_il.htm

Enterobius vermicularis



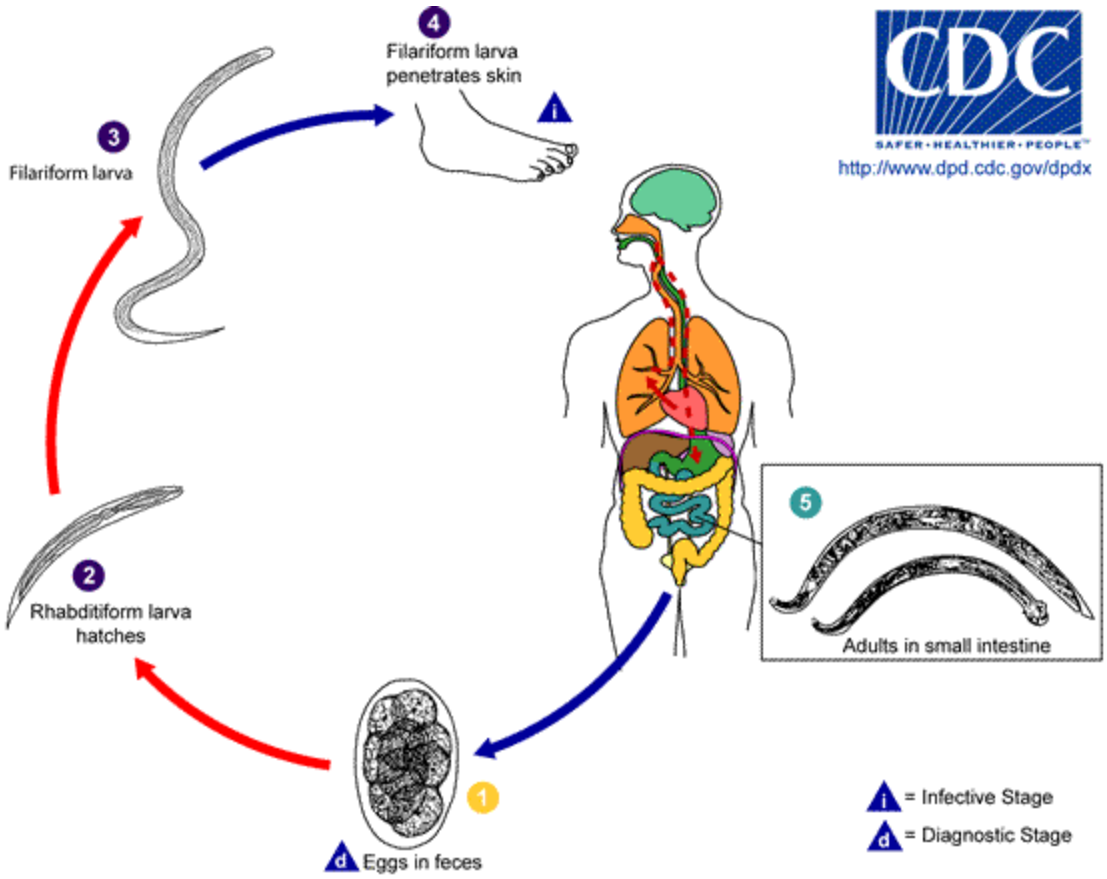
http://www.dpd.cdc.gov/dpdx/HTML/ImageLibrary/Enterobiasis_il.htm

The pin worm, *E. vermicularis*, is rather strange, as this parasite is difficult to visualize in a fecal preparation. The simplest manner in which to obtain a sample for microscopic examination is to perform a "Scotch Tap Prep". In essence, the "Scotch Tape Prep' works by removing O&P of *E. vermicularis* from the inner surfaces of the gluteal fold by clear Scotch tape. The two best times of the day to obtain good samples are about 2 hours after the patient has gone to bed and upon rising in the morning (before bath or bowel movement). It is also advisable to perform this sample collection on at least two consecutive days (in some cases three) at the same time of day.

CAUTION: Do NOT place the Scotch tape end of the tongue depressor IN or ON the anus -- this can irritate and/or damage the mucous membranes.

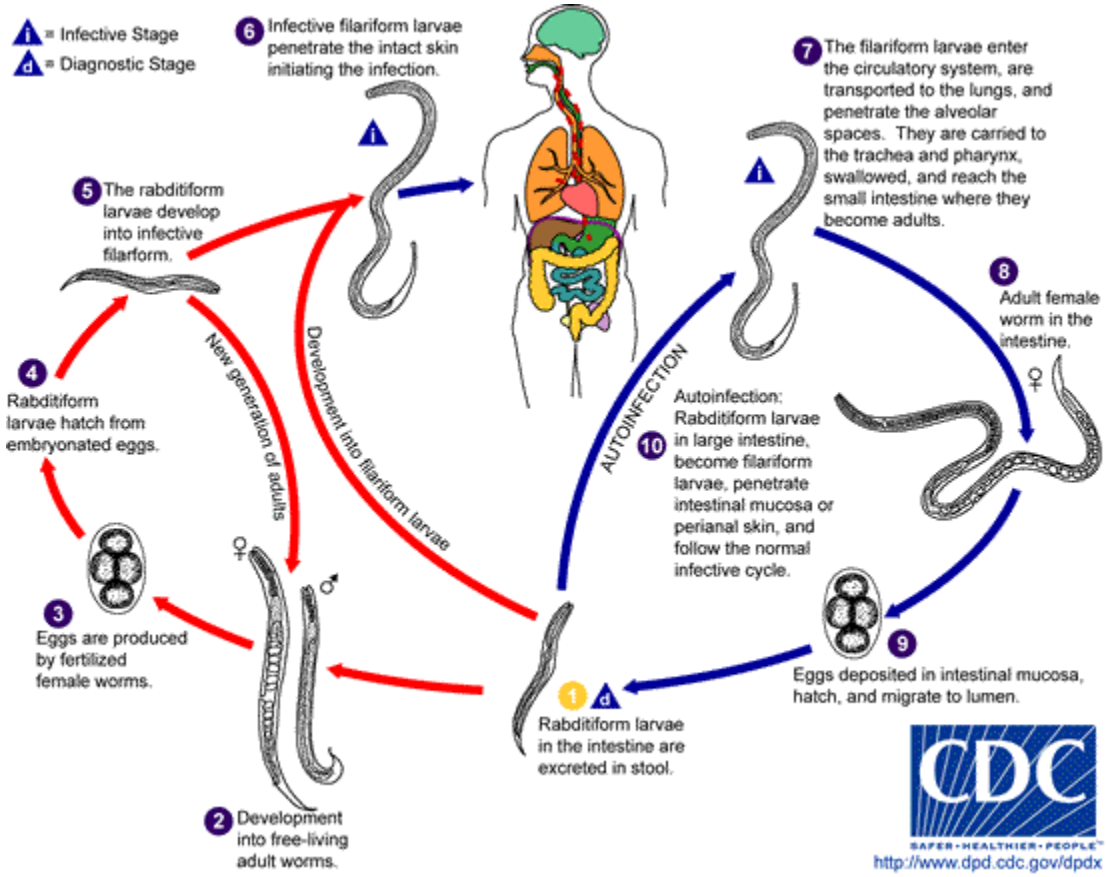
The sample is then returned to the lab where the slide is either immediately examined OR the tape is lifted (CAREFULLY: this is infectious) and one drop of toluene or 0.1N NaOH is placed on the slide, the tape reapplied, a cotton ball is run over the tape [and discarded] and the specimen is then examined. Toluene or NaOH helps to clear up the specimen so that ova, "egg shells" or parasites are more easily observed.

Necator americanus and/or Ancylostoma duodenale



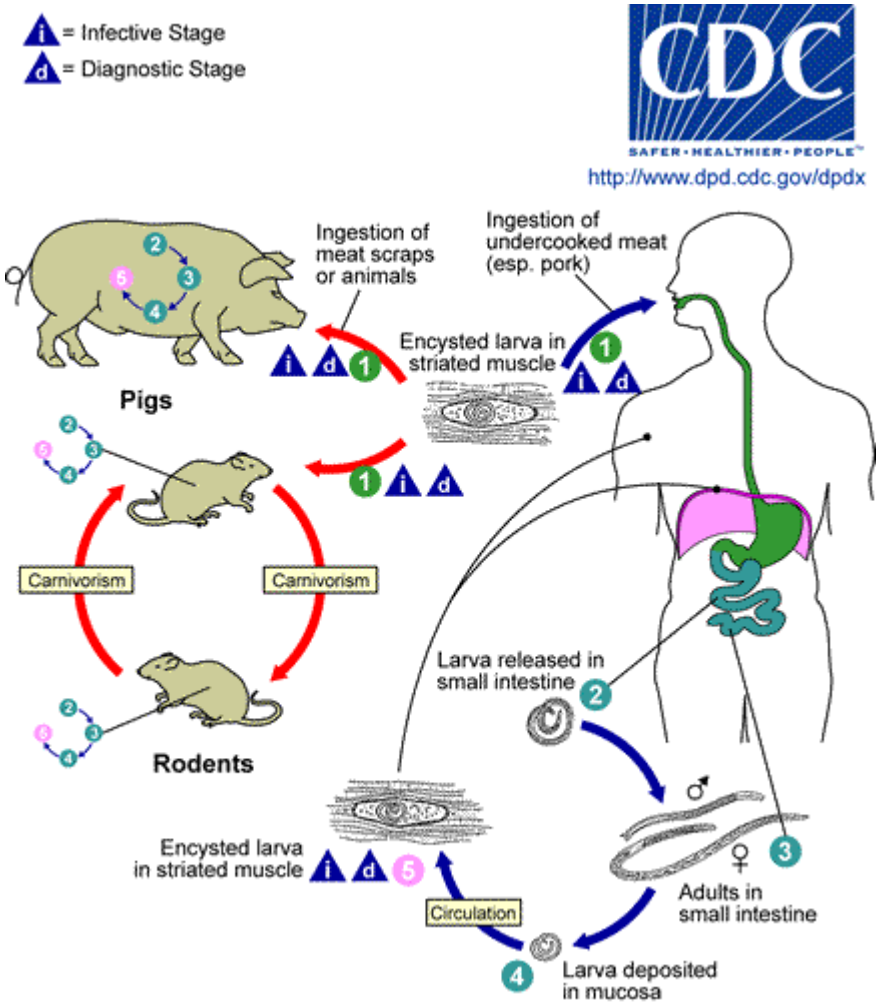
http://www.dpd.cdc.gov/dpdx/HTML/ImageLibrary/Hookworm_il.htm

Strongyloides stercoralis



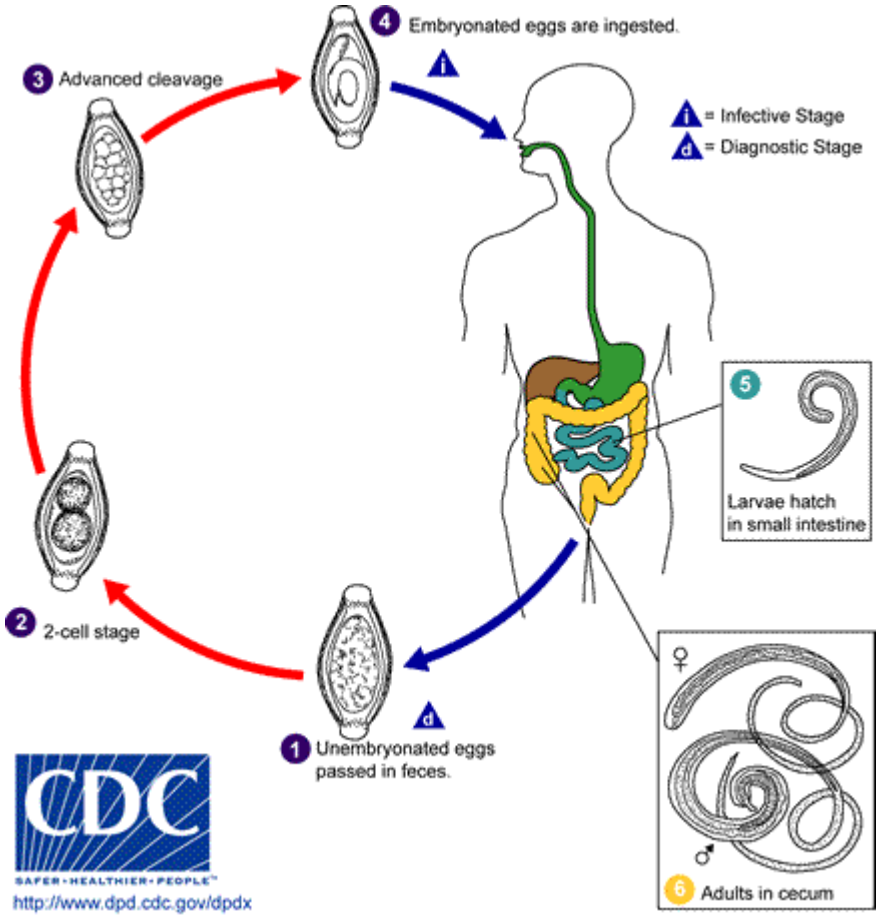
http://www.dpd.cdc.gov/dpdx/HTML/ImageLibrary/Strongyloidiasis_il.htm

Trichinella spiralis



http://www.dpd.cdc.gov/dpdx/HTML/ImageLibrary/Trichinellosis_il.htm

Trichuris trichiura



http://www.dpd.cdc.gov/dpdx/HTML/ImageLibrary/Trichuriasis_il.htm

Materials and Methods

Materials

Prepared slides of the following		
T. pisiformis	*Taenia ova*	*S. japonicum*
F. hepatica	*A. lumbricoides*	*T. trichiura*
T. spiralis	*E. vermicularis*	*C. sinensis*
D. latum		*N. americanus*
The following equipment/supplies		
Microscope	Immersion oil	Lens paper

Methods

With the exception of the slide of *S. japonicum*, observe each slide under oil immersion. Draw in the spaces below that which you see/saw. In the case of the slide of *S. japonicum*, experiment with the 10X and 20X objectives to observe its oral and ventral suckers. Draw in the spaces below that which you see/saw.

REFERENCES

1.Davidsohn, I. and Wells, B.B.: **Todd-Sanford Clinical Diagnosis by Laboratory Methods, Thirteenth Edition**. (W.B. Saunders Co.: Philadelphia) ©1965.

2.Henry, J.B., Ed.: **Todd, Sanford and Davidsohn's Clinical Diagnosis and Management by Laboratory Methods, Sixteenth Edition**. (W.B. Saunders Co.: Philadelphia) ©1979.

3.Jawetz, E., Ed.: **Medical Microbiology, Eighteenth Edition**. (Appleton and Lange: San Mateo) ©1989.

4.Noble, E.R. and Noble, G.A.: **Parasitology: The Biology of Animal Parasites, Third Edition**. (Lea and Febiger: Philadelphia) ©1973.