Welcome to *Parasitic Diseases*
Fall 2009
Dickson Despommier, Ph.D.
Charles Knirsch, MPH, MD
Josh Stillman, MD

Parasite
Any organism that takes metabolic advantage of another organism
Viruses
Rickettsiae
bacteria
Fungi
Protozoa*
Helminths*
  Nematodes - round worms
  Cestodes - segmented flat worms
  Trematodes - non-segmented flat worms
Arthropods* = six and eight-legged critters
* Covered in *Parasitic Diseases*

Nematodes - round worms
1. All are eukaryotes - *Caenorhabitis elegans* is the best known example and is free-living in soil.
2. Most nematodes are non-parasitic.
3. Almost 4 billion people harbor at least one species of parasitic nematode. Many have more than one.

Geohelminths
*Enterobius vermicularis* (Pinworm)
*Trichuris trichiura* (Whipworm)
*Ascaris lumbricoides* (Giant intestinal worm)
*Toxocara canis* and *T. cati* (Visceral larva migrans)
Hookworms
  *Ancylostoma duodenale*
  *Necator americanus*
Strongyloides stercoralis

Highly Recommended textbook*
Available at bookstore.

* Lots of really gross pictures!!!
Use of human feces as fertilizer is commonplace

Wash all produce before eating

Why 1/2 of the world’s humans harbor parasites

Helminths: Nematoda

Enterobius vermicularis
(Pinworm)
Adult Female *Enterobius vermicularis*

- Head
- Tail
- Ovary with eggs

2 mm

Adults on perianum deposit eggs

Photo: Martin Weber, MD, Children's Hospital; Hannover Medical School; Hannover, Germany

**Eggs of *Enterobius vermicularis***

- Larva
- Unembryonated
- Embryonated

*Enterobius vermicularis* in appendix

- Alae

Clinical Disease:

None
Diagnosis:
Eggs found on microscopic examination of clear sticky tape.

Helminths:
Nematoda

Trichuris trichiura
( Whipworm)

Drug of Choice:
Mebendazole

Mode of Action:
De-polymerizes invertebrate tubulins, only.

Prevention and Control:
Prevention is impossible among school-aged children, especially those attending day care facilities and lower grades. We “out-grow” our pinworm infections once we reach puberty.
**Adult Trichuris muris in situ (SEM)**

**Pathogenesis:**

*Trichuris* adults secrete a pore-forming protein that may play a role in diarrhea. Adult worms do not feed directly on blood or other host tissues. Mechanism of anemia still unknown.

**Clinical Disease:**

1. Diarrhea
2. Anemia
3. Malnutrition (protein calorie deficiency?)

---

**Prolapsed rectum with many adult Trichuris trichiura**

**Crohn’s Disease and iatrogenic Trichuris infection**

Reddy A, Fried B. Department of Biology, Lafayette College, Easton, PA 18042, USA. Adireddymd@gmail.com

Infections with gastrointestinal (GI) nematodes are prevalent worldwide, despite the fact that anti-helminthic medications are regarded as safe, efficient, and widely available globally. In this review, we highlight the potential therapeutic benefits that may be realized through the clinical use of Trichuris suis and other helminths for Crohn’s disease (CD). Long-lived helminthic parasites are remarkable in their ability to down-regulate host immunity, protecting themselves from elimination, and also minimize severe pathological host changes. This review summarizes what is known about the underlying mechanisms that may account for the observed patterns in humans treated with helminths for CD. The Th2 arm of the immune system is emphasized as a component of primary importance in the association between the host immune system and GI nematode infections. Although GI nematode infections in humans cause significant morbidity and mortality, the existence and nature of protective mechanisms these helminths may confer remain largely unclear.
Diagnosis:
Microscopic examination of feces for eggs

Helminths:
Nematoda

Ascaris lumbricoides
(Giant intestinal worm)

Drug of choice:
Mebendazole

Mode of Action:
De-polymerizes invertebrate microtubules, only

Prevention and Control:
Sanitary disposal of feces

Adult Ascaris lumbricoides

Jar of Ascaris adult
Collected from one rural village in Bangladesh in a single day.
Pathogenesis:

1. "Verminous" pneumonia, lung tissue damage due to migratory larvae.

2. Bowel obstruction - too many adult worms.

3. Parasite secretes trypsin inhibitor, prevents host from digesting proteins; cause of malnutrition.

4. Aberrant migration of adult worms to:
   a. Ampulla of Vater
   b. Common duct
   c. Liver
   d. Pharynx
   e. Peritoneum
Clinical Disease:

1. Light infections are asymptomatic as long as the adult worms do not migrate.

2. Heavy infection leads to:
   a. protein calorie malnutrition - “failure to thrive” syndrome.
   b. bowel obstruction.
   c. aberrant migratory events.

Infant with heavy Ascaris infection

Child with heavy Ascaris lumbricoides infection

Bolus of Ascaris lumbricoides in small intestine

The result of successful treatment

Ascaris lumbricoides adult in appendix
Ascaris adults in liver (fatal case)

Bolus of *Ascaris lumbricoides* (fatal case)

**Drug of choice:**
Mebendazole

Mode of Action:
De-polymerizes invertebrate microtubules, only

**Medical Ecology**

**Prevention and Control:**
Sanitary disposal of feces
Helminths: Nematoda

Toxocara canis
Toxocara cati
Visceral and ocular larva migrans

Embryonated egg of Toxocara canis

Pathogenesis:
Tissue damage (systemic) due to migratory 3rd stage larva

Clinical Disease:
1. Fever
2. Loss of visual acuity
3. Blindness
4. Learning disabilities
Granuloma in retina due to *Toxocara canis*

**Drugs of choice:**
- Mebendazole
- Steroids
  - Prednisolone

**Larvae of *Toxocara canis* in mouse brain**

**Diagnosis:**
Serological tests (ELISA-based)

**Prevention and Control:**
- Sanitary disposal of dog and cat feces
- Cover sand boxes at night
- Regular treatment of pets