Estimated Prevalence

Hookworms	740,000,000
Ascaris lumbricoides	1,472,000,000
Trichuris trichiura	1,049,000,000
Wuchereria bancrofti	107,000,000
Schistosomes (all)	200,000,000

Source: American Society For Parasitologists 2003

Morbidity and Mortality

Science, Vol 302, Issue 5652, 1921-1922 , 12 December 2003
[DOI: 10.1126/science.1092488]

« Previous Article • Table of Contents • Next Article »

The Burden of Chronic Disease

C. G. Nicholas Mascie-Taylor[1,*] and Enamul Karim[2]

Table 1. Estimated global prevalences and associated morbidity and mortality due to soil-transmitted helminths and schistosomes.

Parasite	Prevalence of infection (cases, millions)	Mortality (deaths, thousands)	Morbidity (cases, millions)
Ascaris lumbricoides	1450	60	350
Trichuris trichiura	1050	10	220
Hookworms	1300	65	150
Schistosomes	200	20	20

Antonie Dubini* and the Saint Gotthard Tunnel Hookworm Epidemic of 1880

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

Length - 15 kilometers
Depth - 1,700 meters

"An effort….. to build a rail tunnel through the St. Gotthard massif was treacherous. That construction between 1872 and 1882 was plagued by bad rock and flooding. It killed 310 workers, incapacitated 877 others and bankrupted the contractor".

* Dubini, A. Ann. Univ. Med. Milano. 1843 106:5-13. First record of disease caused by hookworm

Helminths
Nematoda:

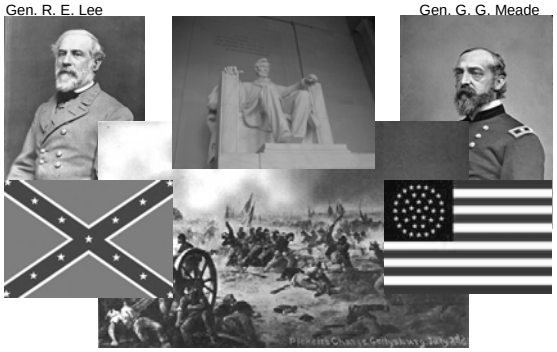
The Hookworms

Ancylostoma duodenale
Necator americanus

Civil War -1861-1865

Gen. R. E. Lee

Gen. G. G. Meade



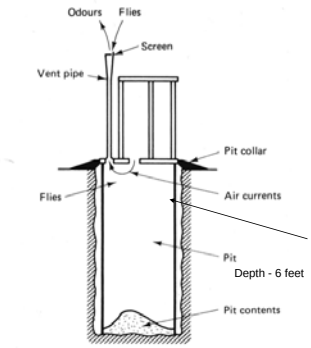
Pickett's Charge

Distribution Of hookworm up to 1927

Coelho, Philip R. P. and Robert A. McGuire, "Biology, Diseases, and Economics: An Epidemiological History of Slavery in the American South," Journal of Bioeconomics 1:2 (1999) 151-190.

One theory suggests that hookworm disease may have influenced the outcome of the civil war. Southern troops grew up with the infection and had little in the way of sturdy clothing or shoes. Hookworms were brought to America from Africa in the early 1800s via the slave trade. They have been here ever since.

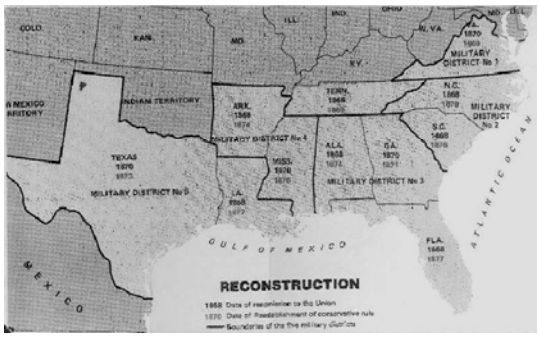
The Pit Privy



Distribution and installation began in the 1920's following The Rockefeller Sanitary Commission Report to Congre

Height to which hookworm larvae can crawl = 4 feet.

Economic recovery was slow following the Civil War, and J. D. Rockefeller wanted to know why!



Colorado Out House*

* The camper's best friend

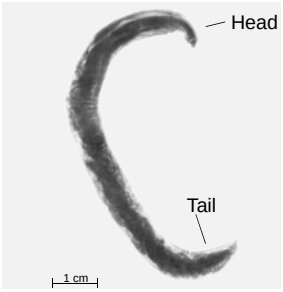
Circa 2006

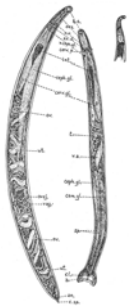
QuickTime™ and a TIFF (Uncompressed) decompressor are needed to see this picture.

John D. Rockefeller
Oil Baron *par excellent*

JDR established a sanitary commission (1909-1915) headed by Charles Wardell Stiles to look into the matter of "southern laziness".

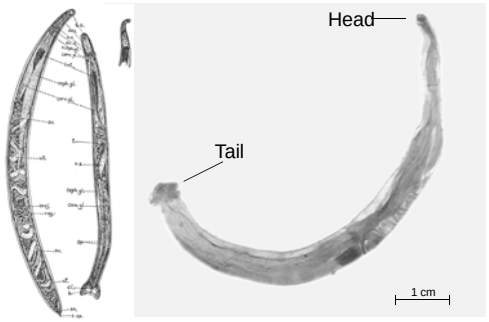
Adult female *Ancylostoma duodenale*



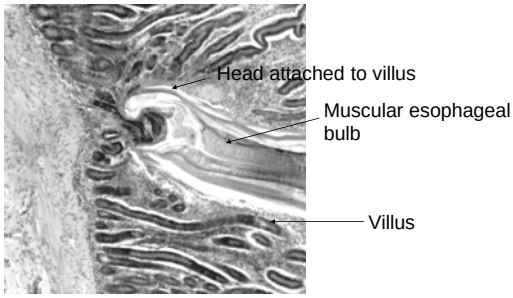


Looss' original elegant drawings

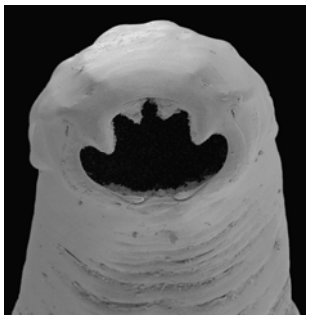
Adult male *Ancylostoma duodenale*



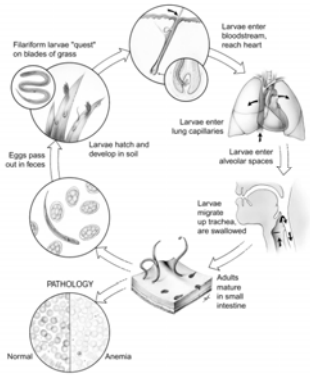
Histological section of adult hookworm attached to villus of small intestine



Adult *Ancylostoma duodenale*



Necator americanus

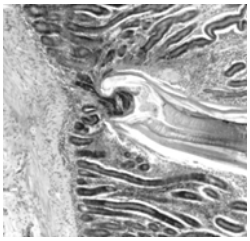


Adult *Necator americanus*

Hookworm larvae in dog skin

Pathogenesis:

Adult worms suck blood and feed on villus tissue.

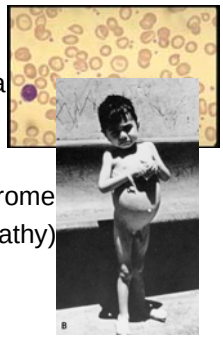


In order to do all this, the worm has evolved a set of powerful anti-coagulants*even more effective than those of the medical leech. The cDNAs for these HW peptides have bee cloned and may offer some interesting practical applications for medical use.

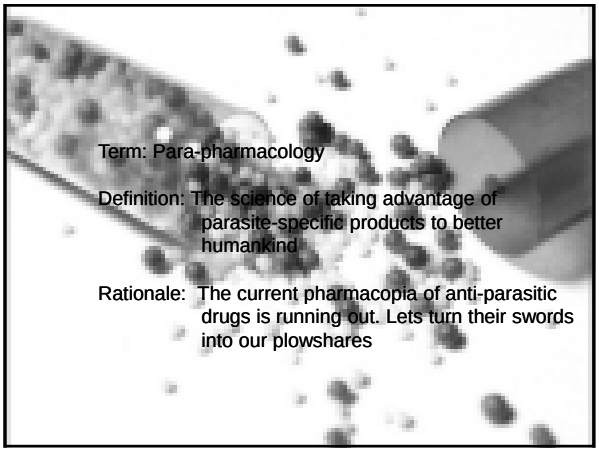
* Cappello, M. et al. 1995. PNAS USA. 92: 6152-56

Clinical Disease:

1. Iron-deficiency anemia



2. Failure-to-thrive syndrome (idiopathic endocrinopathy)



Term: Para-pharmacology

Definition: The science of taking advantage of parasite-specific products to better humankind

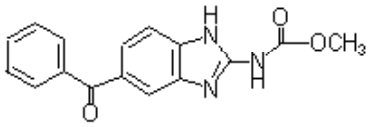
Rationale: The current pharmacopia of anti-parasitic drugs is running out. Lets turn their swords into our plowshares

Diagnosis:

Microscopic examination of feces for eggs

Hookworm adult as seen on endoscopy

Drug of choice:

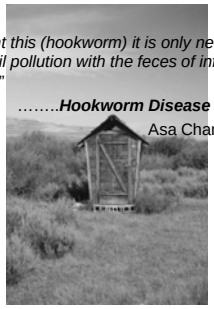


Mebendazole

Mode of Action:
De-polymerizes invertebrate microtubules, only

Prevention and Control

"*To prevent this (hookworm) it is only necessary to prevent soil pollution with the feces of infested individuals*"



……..***Hookworm Disease***

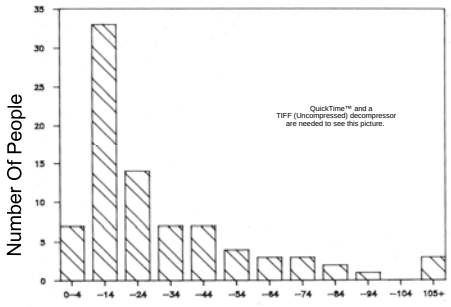
Asa Chandler, 1929

Greatest single invention of the 20th century!

Dogs and *Ancylostoma caninum*

Paro, Bhutan

Ancylostoma In India



Infectious larva of *Ancylostoma sp.*

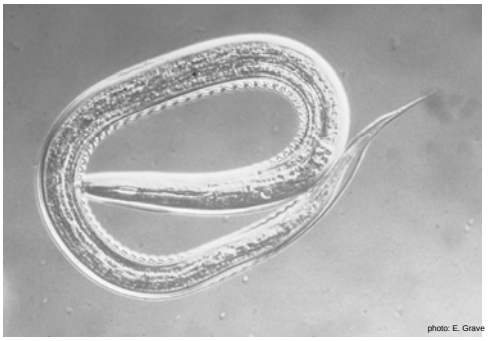
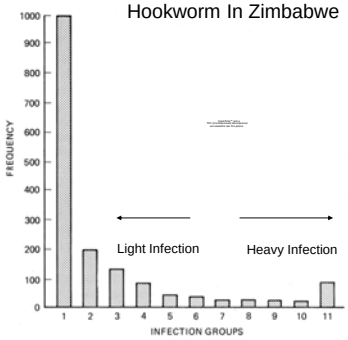


photo: E. Grave

Hookworm In Zimbabwe



"Creeping eruption" on the foot of a patient who stepped on an infective larva of *A. braziliense*

Photo: G. Zalar

Helminths
Nematoda:

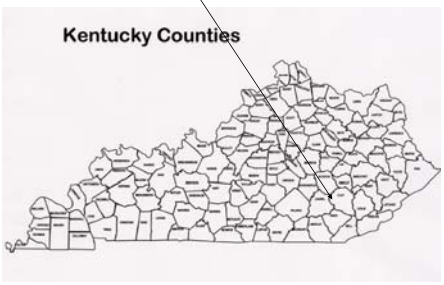
Strongyloides stercoralis

Am J Trop Med Hyg. 1982 Mar;31(2):313-9.

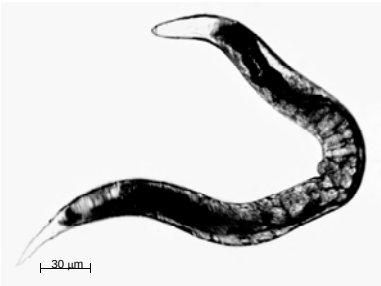
Epidemiologic features of Strongyloides stercoralis infection in an endemic area of the United States.

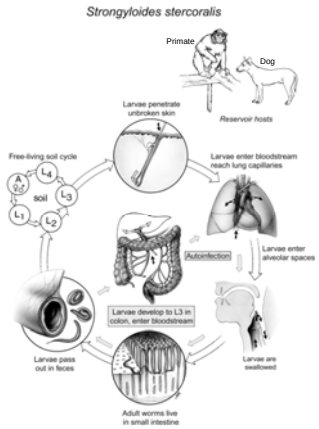
Walzer PD, Milder JE, Banwell JG, Kilgore G, Klein M, Parker R.

The epidemiologic features of Strongyloides stercoralis infection in Kentucky were studied by an analysis of clinical cases at the University of Kentucky Medical Center (UKMC); by an analysis of parasitologic records of the Kentucky Bureau for Health Services (KBHS); and by a prospective stool survey of school children in Clay County, located in southeastern Kentucky, an area of the state previously found to be highly endemic for intestinal parasites. S. stercoralis was the most common parasitic infection diagnosed at UKMC. The patients were predominantly white male adults who were over 50 years old, had an associated chronic or debilitating medical illness, were of low socioeconomic background, and resided in southeastern Kentucky. S. stercoralis was a common parasitic infection at KBHS ad the patients showed a similar geographic distribution. Of 561 Clay County children surveyed, 23.7% harbored one or more intestinal parasite pathogens and 3.0% had S. stercoralis. Thus, S. stercoralis remains highly endemic in Kentucky and may cause disease even in geriatric patients.

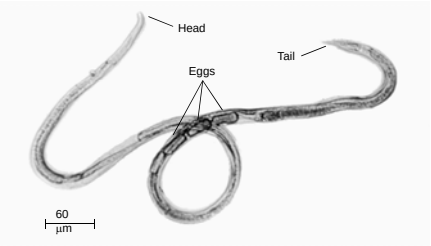


Free-living female *Strongyloides stercoralis*

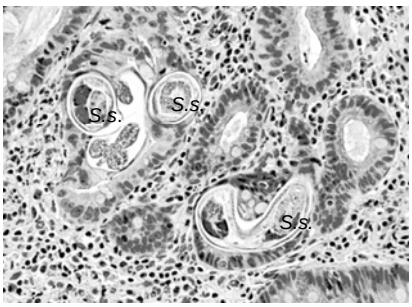




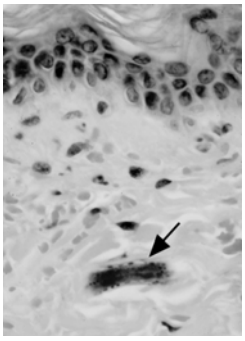
Parasitic female *Strongyloides stercoralis*



Strongyloides stercoralis in situ



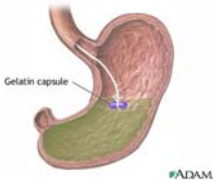
Larva of *Strongyloides stercoralis* in skin

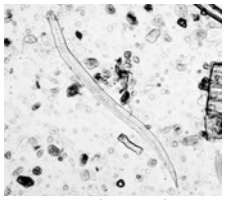


Diagnosis:

1. Microscopic examination of feces (x 6)

2. "String" test





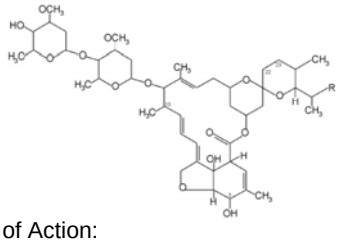
Second stage larva

Pathogenesis:

Worms invade epithelial cells, induce cell death

Drug of choice:

Ivermectin*



Mode of Action:
Blocks $Cl^{(-)}$ ion channels, inhibits γ-aminobutyric acid receptor complex.

* Alternate drug for all geohelminths

Clinical Disease:

1. Diarrhea

2. Malabsorption syndrome

3. Secondary bacteremia/septicemia as larvae migrate throughout body and defecate microbes that they ingested in large intestine.

4. Death due to overwhelming bacterial septicemia.

Prevention and Control:

Sanitary disposal of human feces*

Low Tech

High Tech

*Dog is a common reservoir host. Cannot control spread of dog feces which may contain infective larvae.