Intestinal Nematodes

A group that extends from minor to major pathogens

Trichuris trichiura

- The whip worm, named for its shape
  - Lives in large intestine down to rectum
  - adults are threaded through mucosa
  - adults live several years, thus producing large worm burdens
  - Simple, direct life cycle: eggs to soil to mouth hatching to adults in intestine threading into mucosa

Whipworms threaded through mucosa

Epidemiology of whip worm

- Two conditions for disease:
  - poor sanitation
  - appropriate conditions to promote embryonization
    - warm climate
    - moist conditions
    - dense shade
- Often co-infection with *Ascaris*
- Infected eggs directly from soil
  - night soil
  - geophagy
  - house flies
- 750 million cases

Night soil, human feces used as fertilizer

Pathology of *Trichuris*

- Pathology = worm burden
  - >100 worms needed
- Heavy infections can be fatal
  - Infections of 200-1000 worms not uncommon
- Pathology
  - dysentery
  - anemia
  - growth retardation
  - prolapse rectum
    - what's the cause?

Tenesmus & prolapsed rectum

Pathology continued

- Moderate to heavy infections
  - adversely affect cognitive function
  - worms feed on cells and blood
  - rectal tenesmus
    - leads to prolapse rectum
  - blood streaked stools
- diagnosis & treatment
  - characteristic eggs
  - drug of choice: **Mebendazole**

***T. trichiura* typical egg**

Embryonated egg of *Trichuris*

Enterobius vermicularis

- The pinworms, different spp infect a variety of animals and birds, *E. vermicularis* is strictly a human parasite.
- Ancient parasite, probably a human "companion" from the beginning.
  - In Utah human coprolites from 7800 B.C.
- Unlike most parasites, this one favors temperate to colder climates
- Economics do not play a role an "equal opportunity" parasite
  - although more common in orphanages, day care centers, mental hospitals, etc.

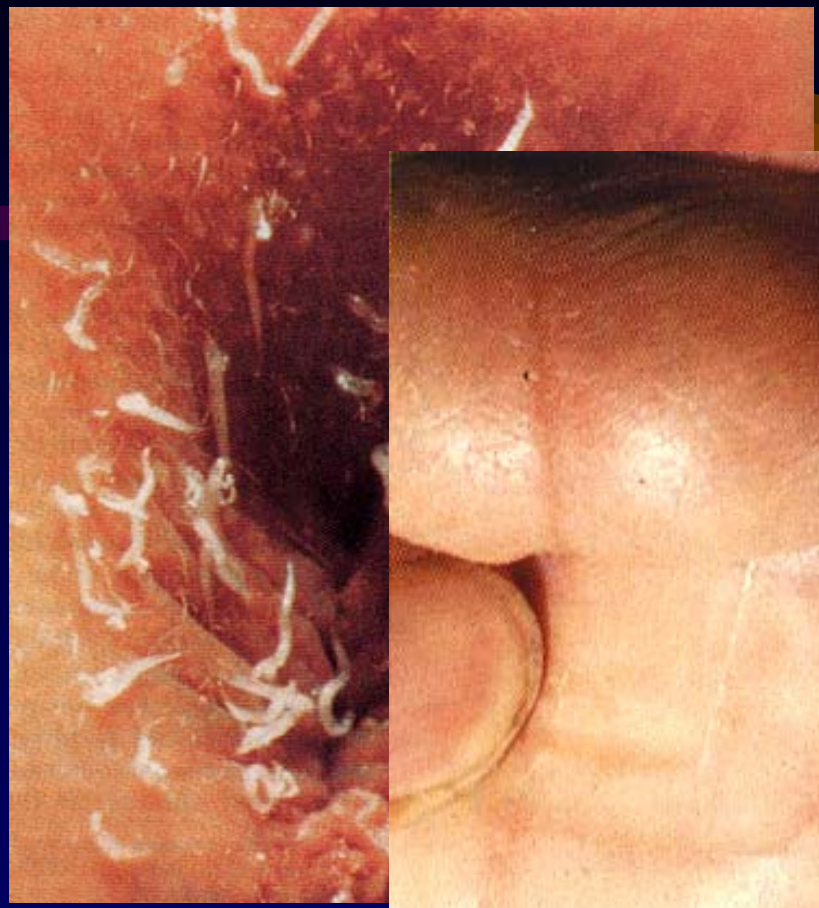
Epidemiology of pinworms

- >400 million cases
  - a irritation, like dandruff and acne
  - little being done to control this infection
  - pathology is low, but probably underrated
  - some cases may be serious

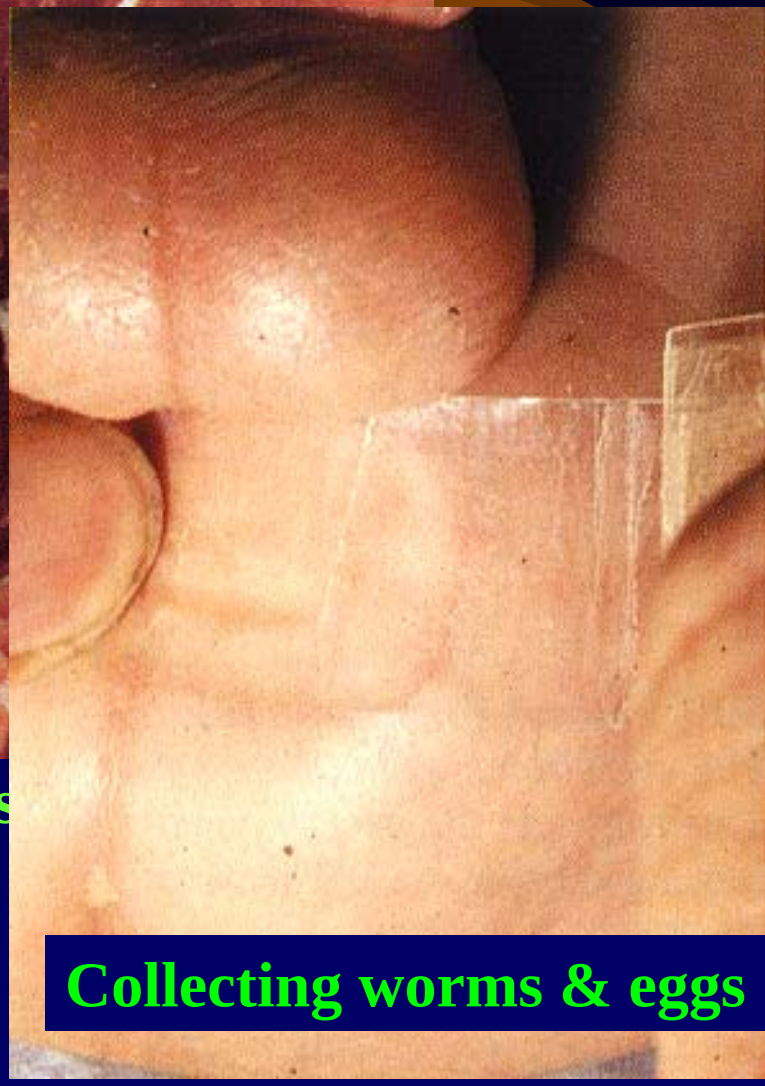
Enterobius vermicularis

Life cycle of *Enterobius*

- fecal/oral route
  - under fingernails
- Adults range from stomach to anus
  - ileocecal region
  - live on fecal debris & bacteria
  - Gravid females leave anus to lay eggs
    - in perianal folds
    - 4000-16000 eggs each
    - Eggs embryonate within 6 hours
    - itching/scratching eggs under fingernails/mouth



Pinworms



Collecting worms & eggs

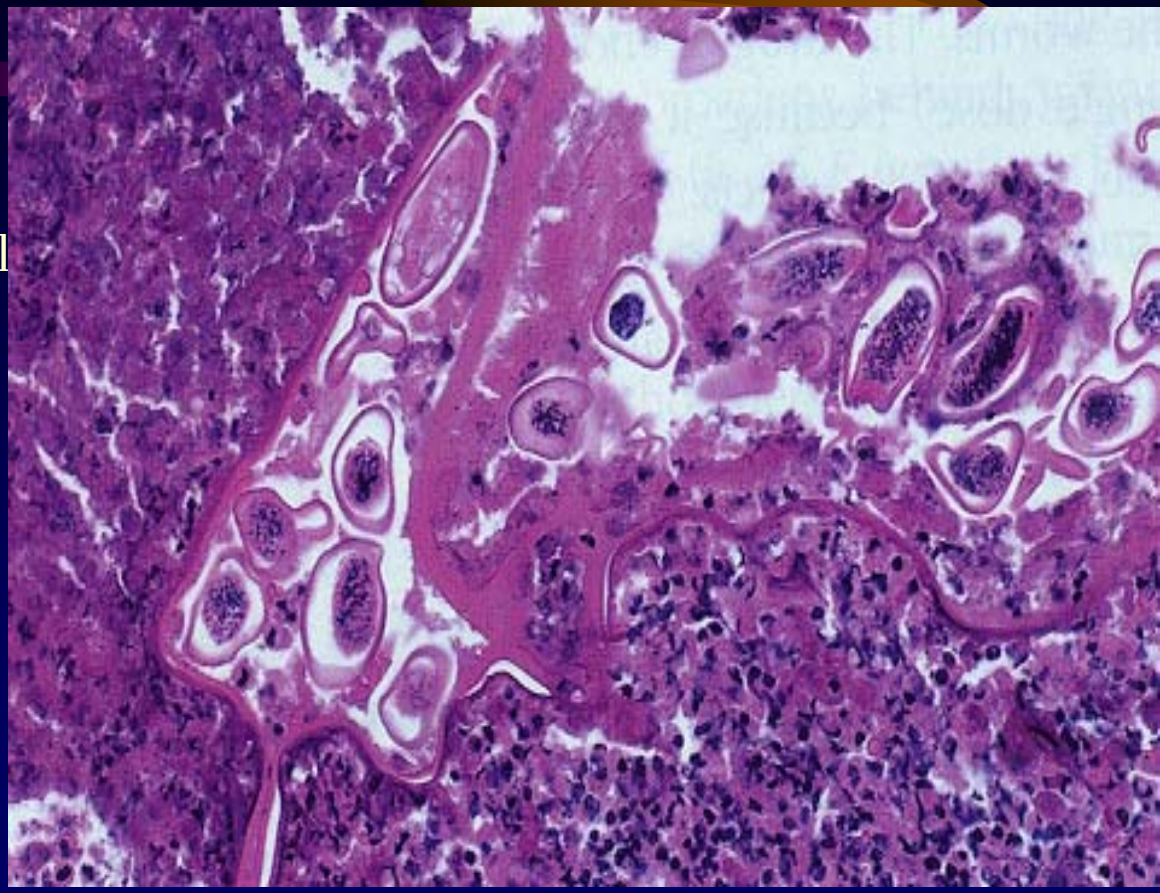
Life cycle & epidemiology

- retroinfection-juveniles
- clothing & bedding rapidly filled w/ eggs
- eggs everywhere
  - NY schools 100/sq.ft.
  - highly infectious
  - may become air borne and inhaled
  - impossible to prevent spread through family
  - dogs & cats not infected
  - school is best place to get infected!!

Embryonated *Enterobius* egg

Pathogenesis

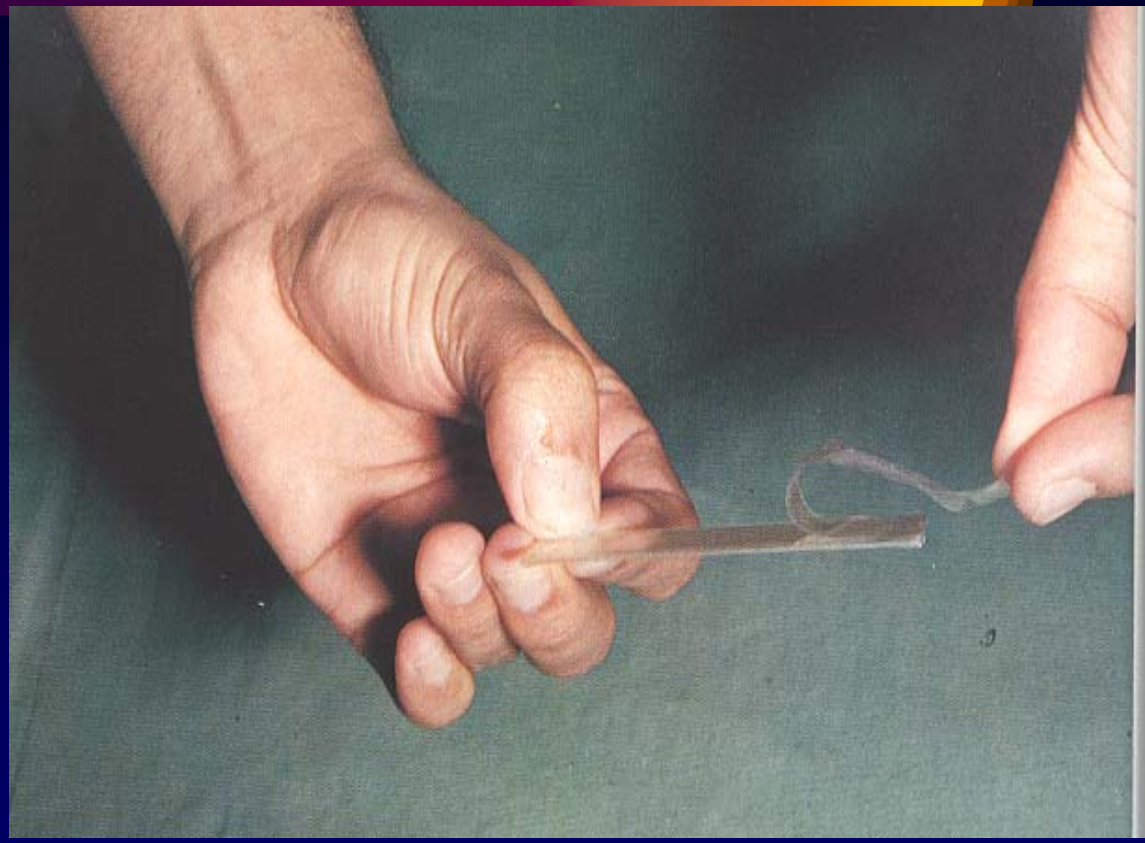
- Most asymptomatic
  - vague symptoms
  - damage to mucosa
    - inflammation, bacterial infections
    - may invade submucosal surface--serious!!
  - Perianal pruritus
    - Sleep disturbances
  - More pathogenic in females
    - vulva-vagina-uterus-peritoneum-bacterial-granulomas
  - major symptom: Pruritus ani, pruritus vulvi



Necrotizing granuloma in omentum due to eggs of *Enterobius*

Diagnosis and Treatment

- Role in transmission of *Dientamoeba fragilis*
- Scotch-tape test
- characteristic eggs
- fecal sample no good
- Treatment
  - Albendazole
  - Mebendazole
  - treat all family members--hope for the best



Scotch-tape test, before the bath

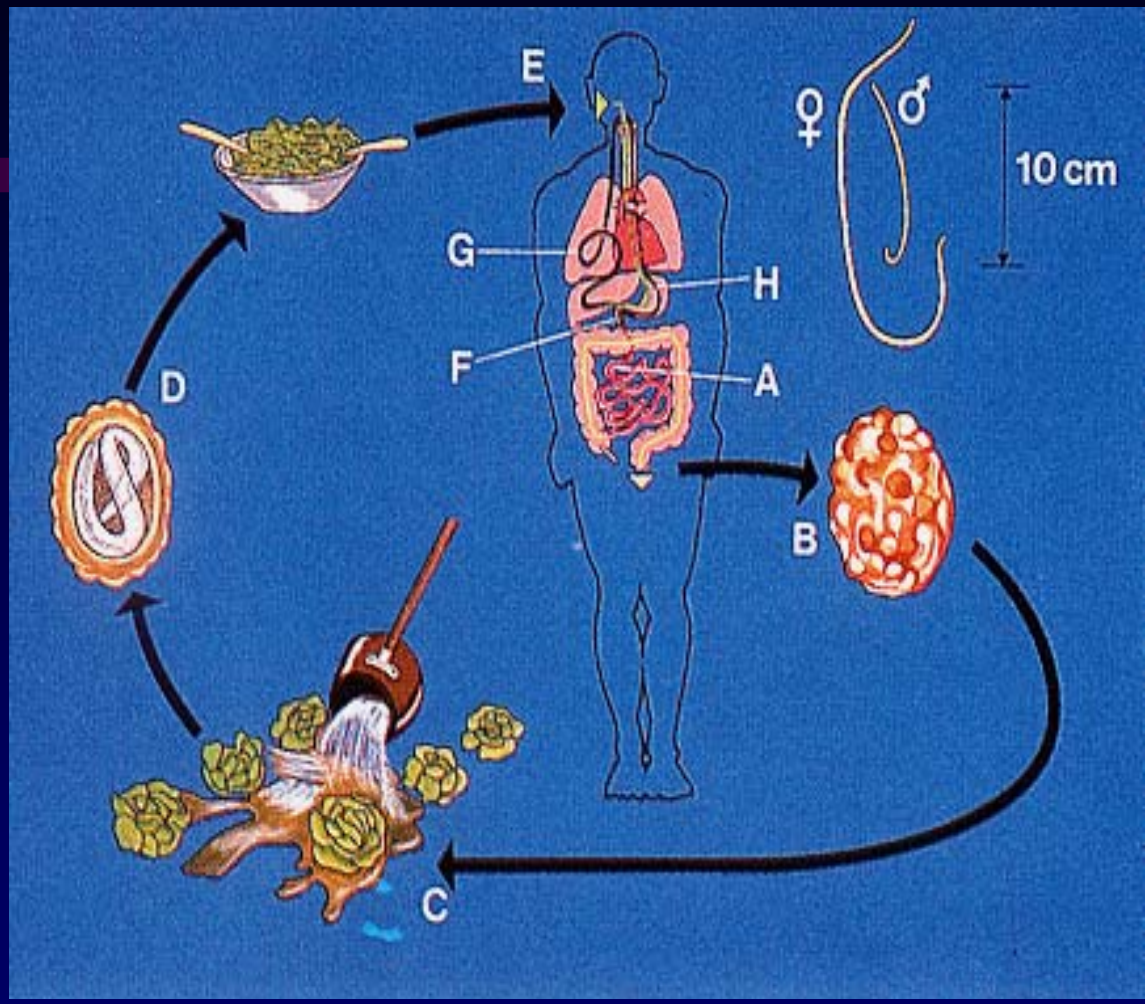
Ascaris lumbricoides

- Large (3-8”) round worm of humans.
  - Little difference between *A suum ?*, Humans probably got it at time of domestication of pig
- Most common helminthic infection, >1 billion infections
- From asymptomatic to serious disease

Ascarids removed from fatal case in Capetown South Africa

Life Cycle of *Ascaris*

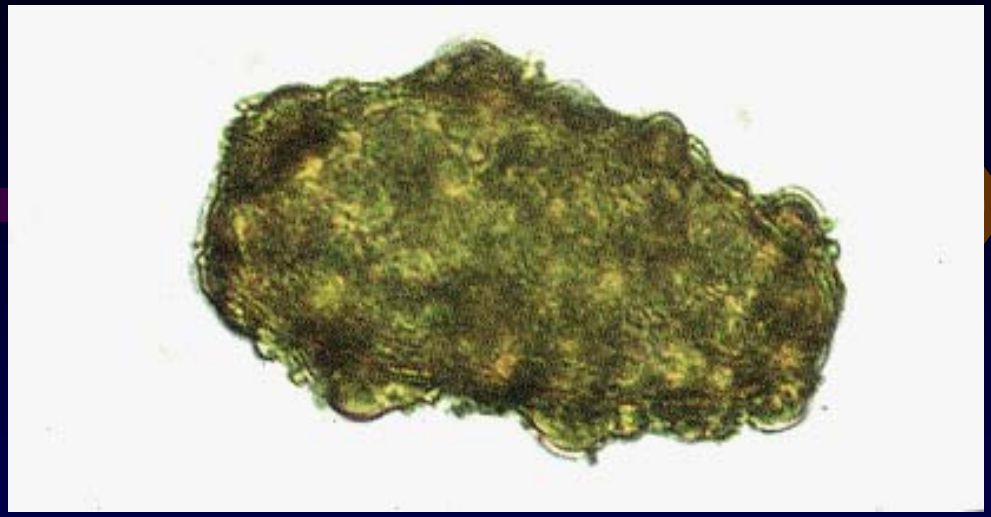
- Embryonization takes 9-13 days in soil
- hatch in duodenum
- juveniles penetrate to circulation to lungs
- molt in lungs--10 days
- migrate bronchial tree
- swallowed to gut
- mature to adults in 60 days



Life cycle of *Ascaris lumbricoides*

Epidemiology

- Eggs remain infectious for 10 years
- legendary chemical resistance in eggs
- SE USA, infection rate 20-60%
- nasal mucus of USSR children=3.2%
- even on German bank notes



Unbryonated ascarid egg

Embryonated ascarid egg

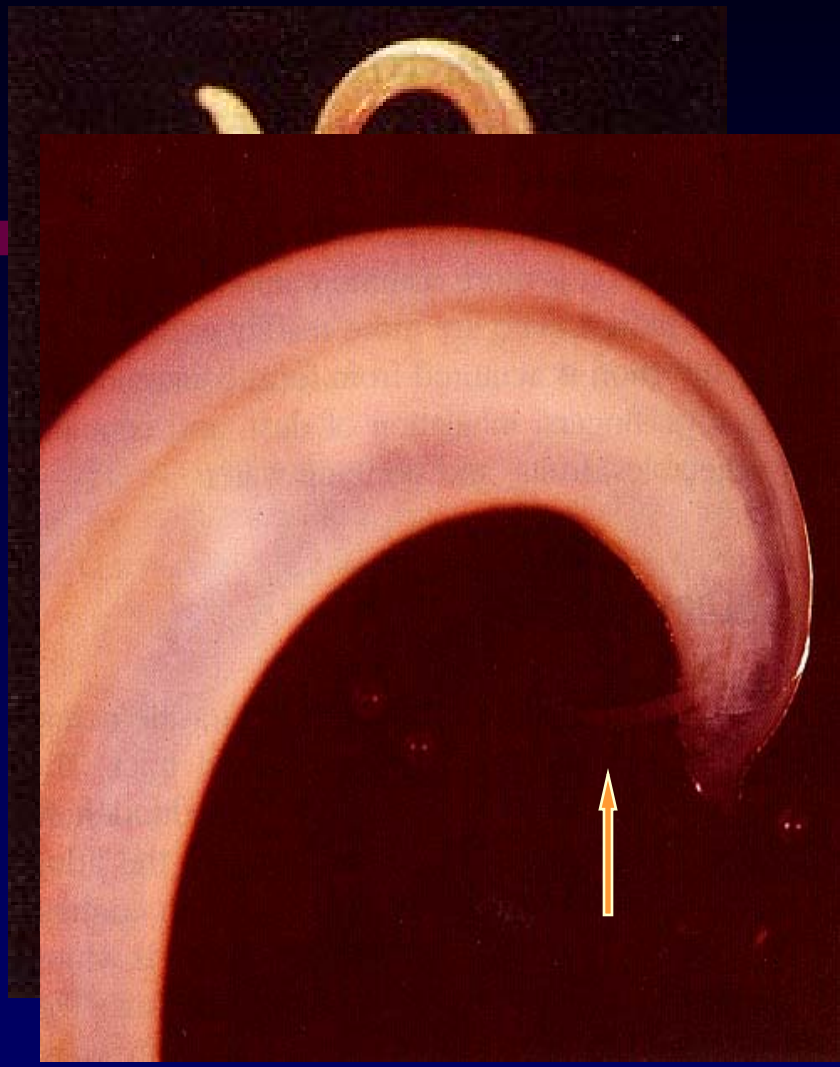
Pathogenesis

- Migrating larvae
  - potent allergens
  - ascaris pneumonia
    - larvae in sputum
  - bacterial infections
  - asthma
  - diseased lungs
- Adult infections
  - under nourishment
  - abdominal pain, eye pain, asthma, insomnia
- Intestinal blockage
  - often fatal

Intestinal obstruction in fatal case from 2 year old child

Pathogenesis continued

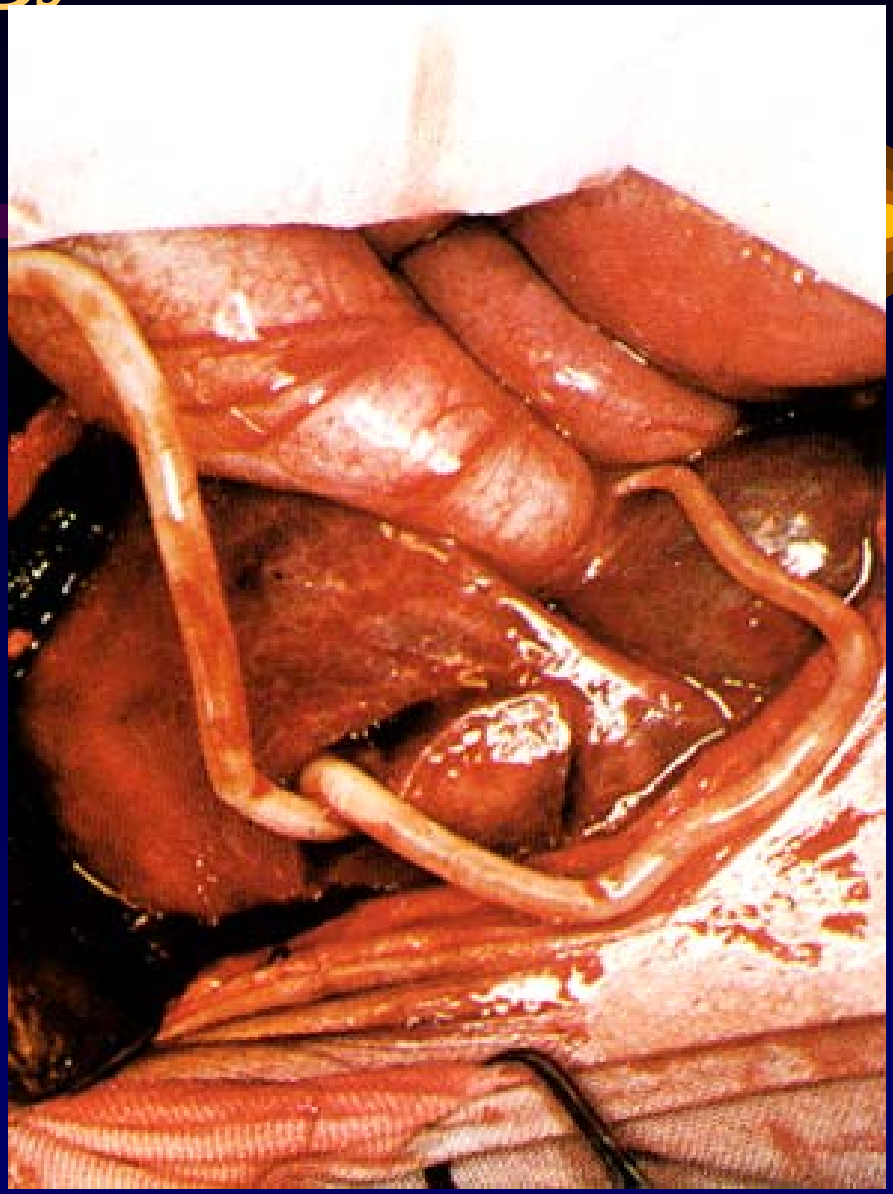
- Penetration to peritoneum
  - not common, but does occur
  - 35% all deaths due to abdominal emergencies in Capetown
- Wandering worms
  - some serious, some bizarre, all unpleasant
    - tropism of females to squirm thru coiled tail of male, so if no males--
      - Females begin to wander



Tail of male ascarid with spicule (reproductive organ)

Pathology continued

- Migrations into
  - pancreas, bile duct, liver, out anus -- (surprise)
    - obstructive jaundice
    - blockage of ducts
  - Into stomach where acid induces writhing and gag reflex
    - explosively expelled via mouth, nose, ears, wow!
    - extreme psychological trauma (to say the least)
    - nocturnal migrations to oesophagus to trachea-- suffocation



Migrating worms in liver

Diagnosis and Treatment

- Females contain 27 M eggs released at 200,000 per day
  - typical eggs in stool
- Adults seen on barium enema
- Juveniles in sputum?
- Treatment:
  - Mebendazole

Ascarids expelled following anthelminthic treatment