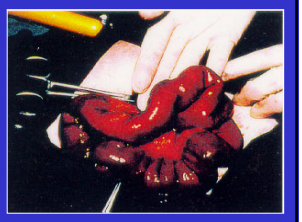
Biomedical Parasitology

PARASITIC WORMS

Prof. Peter O'DONOGHUE

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HELMINTHS
defining characteristics

- eukaryotes
- metazoa
- bilateral
- triploblastic
- protostome
- invertebrate

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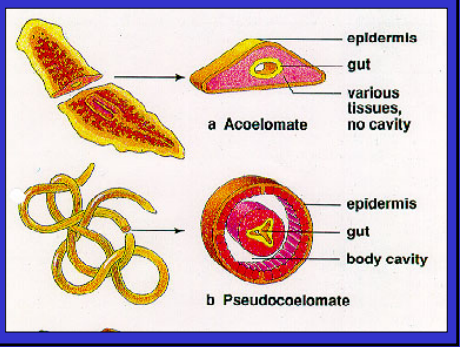
WORM ANATOMY (body cavity)

flatworms

roundworms



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Three main assemblages

nematodes	cestodes	trematodes
		
roundworms	tapeworms	flukes

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INTENSITY OF INFECTIONS

Helminth infections accumulate but do not amplify

Unlike viral, bacterial, protozoal or fungal infections, worms do not proliferate within their hosts

Within a given generation, they grow, moult, mature, copulate, reproduce and lay eggs, but do not replicate

The intensity of infection (and severity of disease) depends solely on intake (number of eggs or larvae)

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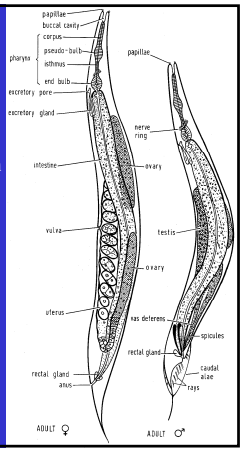
NEMATODES (roundworms)

Characteristics

- long thin tube, a hydrostatic skeleton
- morphological elaboration concentrated around openings
- straight gut with highly variable pharynx (oesophagus)
- sexes separate



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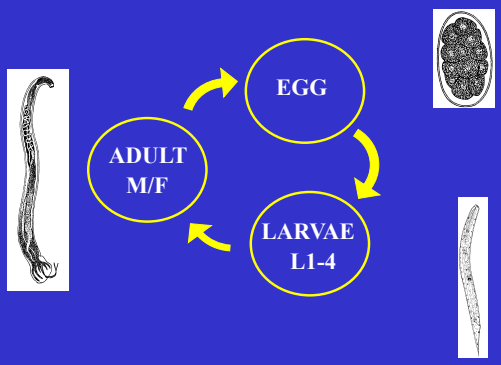
GENERALIZED LIFE CYCLE



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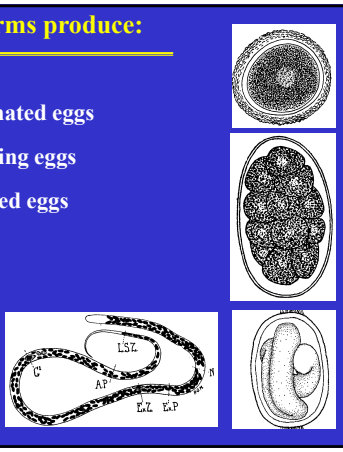
Female worms produce:

- unembryonated eggs
- embryonating eggs
- embryonated eggs
- larvae



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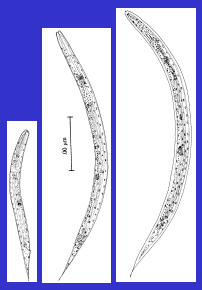
Worm development

- first stage larva (L1)
- second stage larva (L2)
- third stage larva (L3)
  (usually infective stage)
- fourth stage larva (L4)
- adults (male + female)



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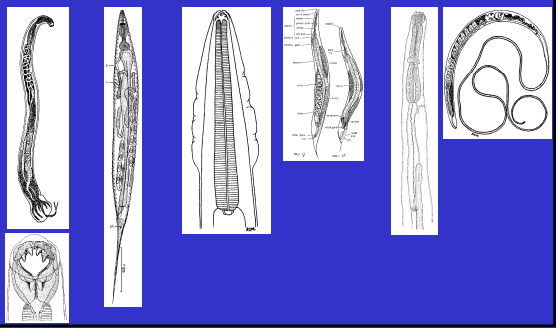
Nematodes - 6 Orders

Strongylida Oxyurida Ascaridida Rhabditida Spirurida Enoplida
Trichocephalida



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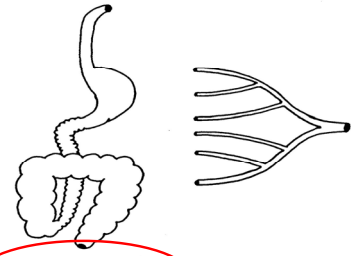
Nematode infections

gastro-intestinal | vascular | tissues, organs



gastro-intestinal	vascular	tissues, organs
simple cycle (egg infective) diarrhoea/obstruction	vector-borne (microfilariae) oedema	intermediate hosts (larval stages) lesions/malfunction
complex cycle (larvae infective) blood loss/anaemia		

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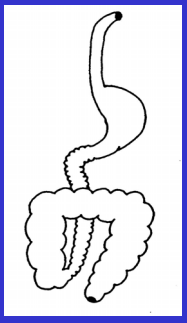
ENTERIC NEMATODES



- *Trichuris trichiura*
- *Enterobius vermicularis*
- *Trichostrongylus orientalis*
- *Capillaria phillippinensis*
- *Ascaris lumbricoides*

enteritis

- *Ancylostoma duodenale*
- *Necator americanus*
- *Strongyloides stercoralis*

anaemia

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ENTERIC NEMATODES

Simple life cycles
- eggs ingested
- larvae/adults in gut

e.g. *Trichuris* (whipworm)
Enterobius (pin worm)
Trichostrongylus (hair worm)
Capillaria (round worm)

More complex
- egg ingested
- larvae migrate through lungs
- adults in gut

e.g. *Ascaris* (round worm)

Most complex
- larvae penetrate skin
- larvae migrate through lungs
- adults in gut

e.g. *Ancylostoma/Necator* (hookworm)
Strongyloides (threadworm)

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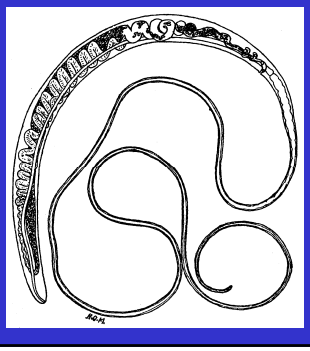
Trichuris (whipworm)

Order: Enoplida
(Trichocephalida)
Family: Trichuridae

Adults with
distinctive shape

Is the handle
of the whip:

the head?
or
the tail?



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Trichuris

adult worms 3-8 cm
(thin heads embedded
in colonic mucosa)

egg 50 x 20 µm
(polar plugs)

important species in humans, sheep, cattle, pig, dog

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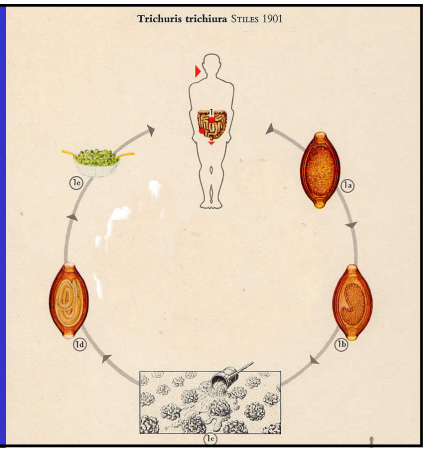
Faecal-oral
transmission

cycle
1 month - years

esp. prevalent
where night soil
used to fertilize
vegetable gardens

infections >200
worms can cause
symptoms



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Pathogenesis

- asymptomatic
- inflammation, allergy
- mechanical damage to mucosa
- haemorrhage, anaemia, bloody diarrhoea

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Pathogenesis

- tenesmus, straining
- rectal prolapse

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Enterobius (pin worm)

Order: Oxyurida

Small adults

Females lay eggs around anus at night-time

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Enterobius (pinworm)

adult worms 1 cm in caecum

eggs 25 x 50 µm attached peri-anally

numerous pinworm species in vertebrate and invertebrate hosts

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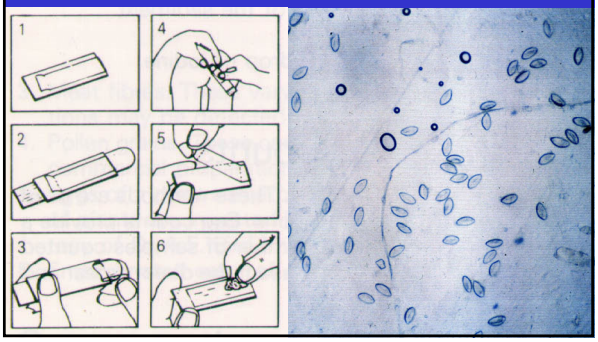
Peri-anal sticky tape test

detect egg laid overnight around anus



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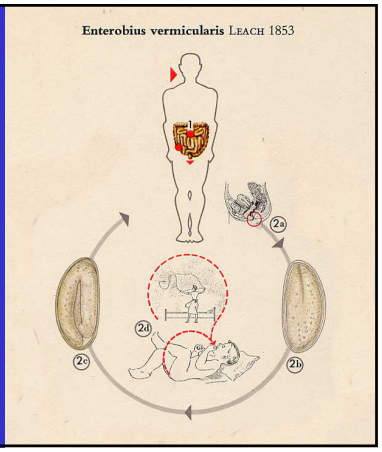
Faecal-oral transmission

cycle
2-13 weeks

esp. prevalent in children with poor hygienic standards

infections accumulate



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Pathogenesis

- asymptomatic
- perianal pruritis (itching)
- insomnia, restlessness
- irritability
- sometimes diarrhoea
- rarely, extra-intestinal granuloma

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Trichostrongylus (hair worm)

Order: Strongylida
Family: Trichostrongylidae

small adults 'hair-like'

males bursate

common in herbivores

worldwide

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Trichostrongylus (hair worm)

adult worms 4-7 mm
(embedded in
small intestinal mucosa)

egg 80 x 40 µm

many pathogenic species in herbivores, several in humans

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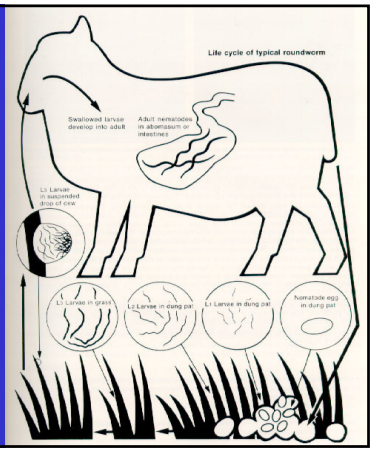
Transmission via contaminated vegetation

cycle
2 weeks - months

prevalent in rural areas in third world countries

infections accumulate



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Pathogenesis

Trichostrongylus spp. (similar in all mammals)

- worms disrupt integrity of small intestinal mucosa
- desquamation, villous atrophy, malabsorption
- diarrhoea (scours), emaciation
- haemorrhage, anaemia, bottle-jaw oedema

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Ascaris (roundworms)

Order: Ascaridida

Big "roundworms"

- infect small intestine
- three anterior lips
- generally eat food of their hosts
- heavy infections cause obstructions

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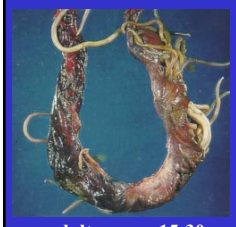
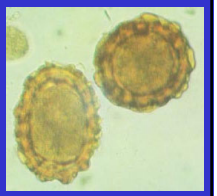
Ascaris (roundworm)





adult worms 15-30 cm
(in small intestinal lumen)

egg 60 x 40 µm
mammillated coat

important species in humans and pigs

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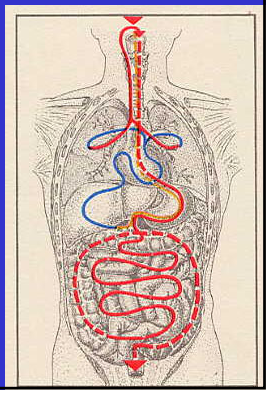
Tracheal migration (pulmonary cycle)

- ingested eggs hatch in intestines
- larvae migrate through gut to blood/lymph and carried to lungs
- perforate alveoli, molt, grow, migrate to epiglottis and swallowed
- larvae reach small intestines and mature to adults



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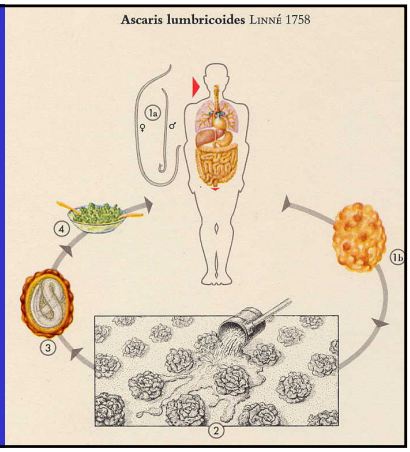
Faecal-oral transmission

cycle
2 months – 5 years

esp. prevalent in communities where nightsoil is used to fertilize vegetable gardens

heavy infections cause symptoms



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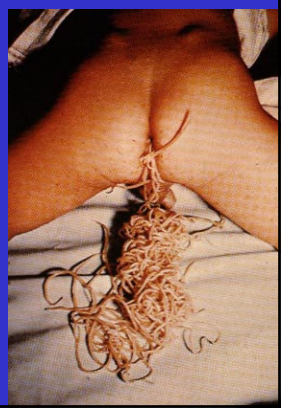
Pathogenesis

- allergic reactions (urticaria, eosinophilia)
- larval migration (pneumonitis)
- mechanical blockage (gut obstruction)
- malnutrition (impaired carbohydrate absorption)



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Pathogenesis

Single worms may migrate:

- **obstruct biliary or pancreatic ducts**
- **regurgitated under anaesthesia**

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Anisakis

Order: Ascaridida

***Anisakis/Phocanema/ Contracaecum* spp.**

- **larval nematodes acquired from marine fish**
- **form granulomas**

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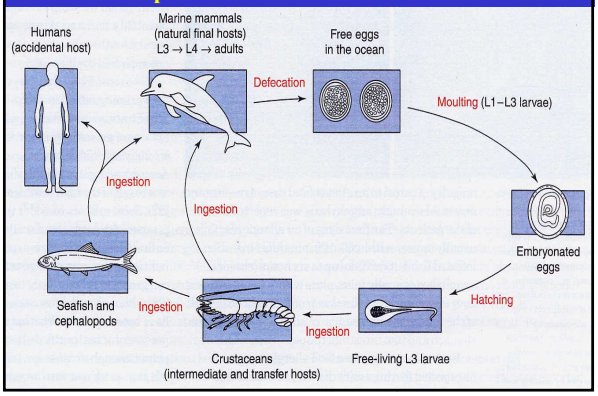
Infection acquired by ingestion of raw/pickled/salted/smoked marine fish



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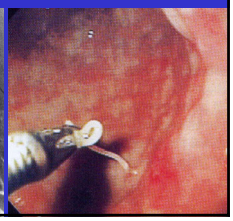
Pathogenesis

- **larvae penetrate gut wall (occasionally throat)**
- **become embedded in eosinophilic granulomas**
- **nausea, vomiting (mimic ulcer/carcinoma/etc)**
- **low grade eosinophilia, positive stool occult blood**
- **surgical removal required**



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TREATMENT - nematocides

Anthelmintic	mebendazole	albendazole	pyrantel
Trichuris (whipworm)	++	+	-
Enterobius (pinworm)	++		++
Ascaris (roundworm)	++	++	++

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