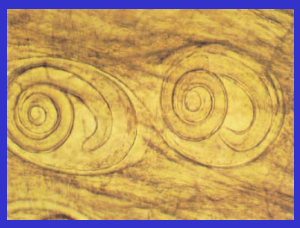
Biomedical Parasitology

Tissue nematodes



Prof. Peter O'DONOGHUE

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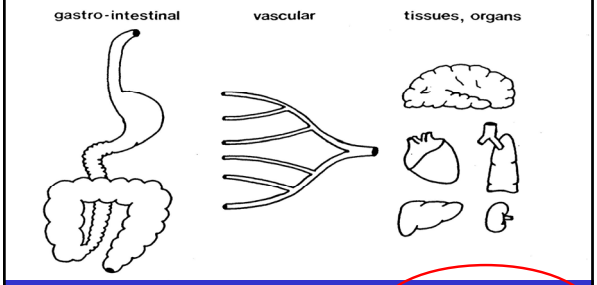
Nematode infections



simple cycle (egg infective)
diarrhoea/obstruction

complex cycle (larvae infective)
blood loss/anaemia

vector-borne
(microfilariae)
oedema

intermediate hosts
(larval stages)
lesions/malfunction

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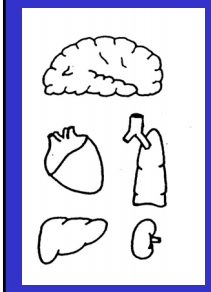
TISSUE NEMATODES



Trichinella spiralis
Toxocara canis
Toxocara cati
Capillaria hepatica
Dirofilaria immitis
Angiostrongylus cantonensis
Gnathostoma spinigerum
Dracunculus medinensis

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TISSUE NEMATODES

Problems caused by migrating or encysted larvae

Trichinella	muscle cysts	worldwide	pig
Toxocara	visceral larval migrans	worldwide	dog/cat
Capillaria	visceral larval migrans	variable	rodent
Angiostrongylus	eosinophilic meningitis	Asia	snails/slugs
Gnathostoma	creeping eription	Asia	copepod
Dracunculus	subcutaneous blisters	India	copepod

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Angiostrongylus (lungworm)

Order: Strongylida

- adults in pulmonary artery
- eggs hatch in lungs
- larvae undergo tracheal migration and passed in faeces
- differ from all other strongyles in using intermediate host (terrestrial molluscs)
- larvae and mollusc ingested by mammal

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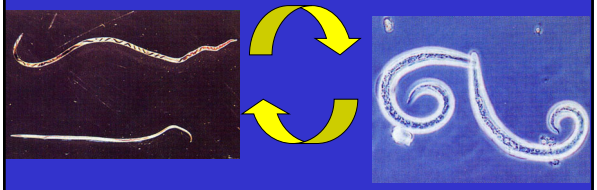
Angiostrongylus (lungworm)



adult worm 17-25 mm
in pulmonary artery

larvae 200 µm
in molluscan host

pathogenic species in rodents (*A. cantonensis*) dogs (*A. vasorum*)
humans accidental hosts

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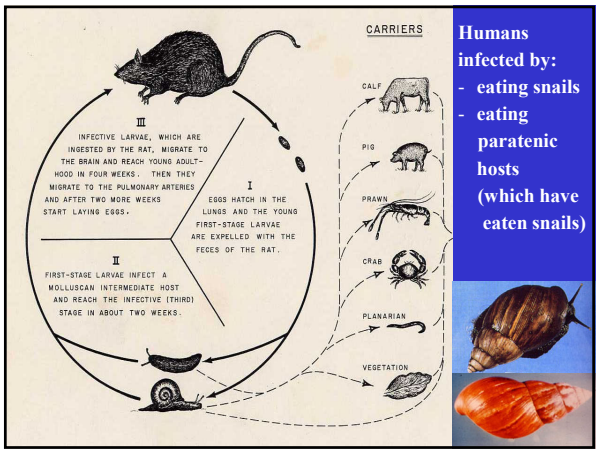

Humans infected by:
- eating snails
- eating paratenic hosts (which have eaten snails)

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Pathogenesis

- larvae ingested with mollusc migrate to brain and mature over 4 weeks
- heavy infections cause thrombotic infarction
- headache, convulsions
- eosinophilia (incl. spinal fluid)
- eye involvement (visual impairment, retinal haemorrhage)
- mebendazole

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Pathogenesis

- Adult worms develop in pulmonary artery
- Pulmonary symptoms usually absent in humans
- BUT infected animals have marked weight loss, tachycardia, arrhythmia, respiratory signs (dyspnoea, coughing), pale mucous membranes

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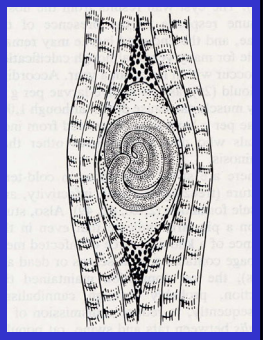
Trichinella spiralis

Order: Enoplida (Trichocephalida)

- adults in small intestine of almost any mammal
- females produce live larvae
- larvae penetrate gut and invade skeletal muscles



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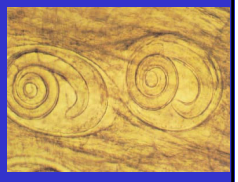
Trichinella (muscle worm)



adult worm 1-4 mm
under small intestinal epithelium

larvae 100 µm
in muscle cells

important parasite in many parts of the world (except Aust.)

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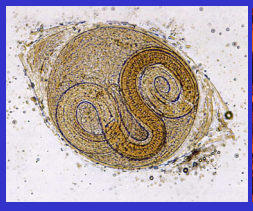
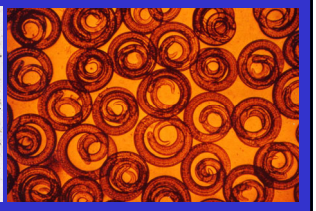
Encysted larvae

- larvae invade muscle cells and coil tightly
- host cell transforms into nurse cell
- larva (still L1) eventually eaten by predator/scavenger
- emerge and form adults in small intestine
- any animal can act as definitive and intermediate host





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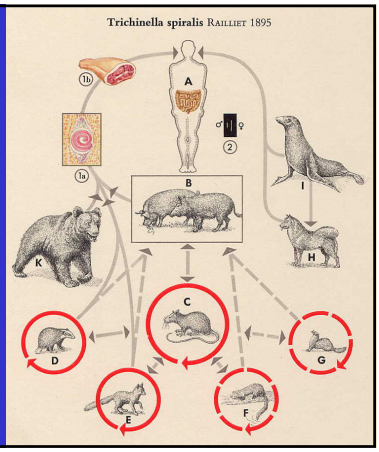
Predator-prey transmission

ascension through food chain

ingestion of raw or undercooked meat especially pork (domestic, wild, bush, warthog)

domestic and sylvatic cycles

infections accumulate



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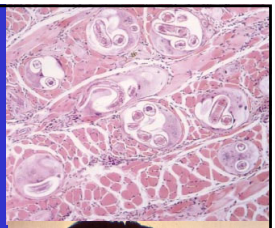
Pathogenesis

intestinal phase
- mucosal irritation

muscle invasion phase
- inflammation, fever
- facial oedema (periorbital)
- muscle damage
- myocarditis/tachycardia
- neurological complications mimic meningitis

convalescent phase
- calcification of cysts
- congestive heart failure

chemotherapy (mebendazole)



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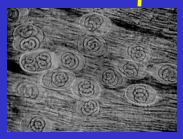
ZOONOSIS

- important zoonotic infection in many parts of the world
- meat from feral animals (pigs, horses) exported from Australia to Europe must be inspected for this parasite
- no infections have been detected so far! - BUT



1989 Tasmania

Trichinella pseudospiralis

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2 — THE AUSTRALIAN Tuesday July 27 1993 — 2

Rare disease discovered

NEW Zealand scientists have discovered the first ever case of a rare animal disease transferring into humans and are tracing the infection to Tasmanian wildlife.

The internationally significant discovery of the trichinella pseudospiralis parasite in the muscle tissue of a Wellington woman solved an unexplained seven-year illness.

The parasite is related to, but is far less virulent than, trichinella spiralis, which causes the potentially fatal disease trichinosis.

A wallaby stew is thought to be to blame in this case, although there was a slim chance the disease had been transferred after the woman handled faecal matter in the course of research on Tasmanian devils, a biologist at Wellington's Victoria University, Dr John Andrews, said.

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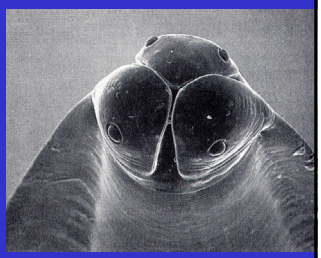
Toxocara (roundworms)

Order: Ascaridida

- infections common in companion animals
- distinctive lips
- migrating larvae cause disease in humans
  - visceral larval migrans
  - ocular larval migrans



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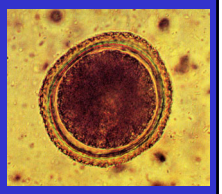
Toxocara (round worm)



adult worm 10 cm
in small intestines

egg 80 x 70 µm
infective stage

pathogenic species in carnivores

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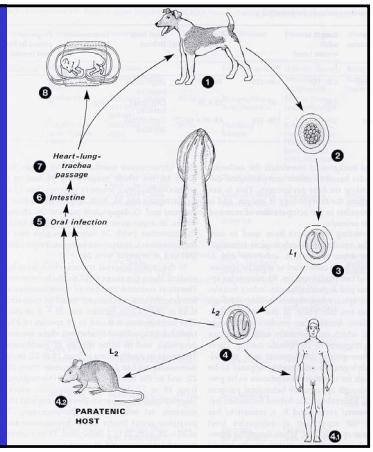
Faecal-oral transmission

eggs develop L2 larvae

hatch in gut after ingestion

larvae undergo tracheal migration in young animals

in older animals and humans, larvae migrate through organs and muscles (can lay dormant for years)



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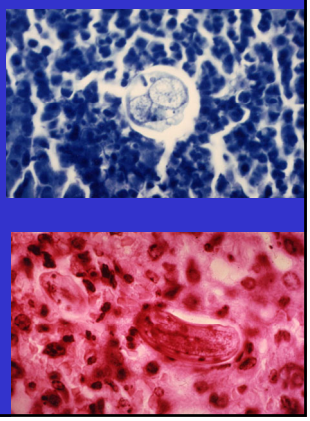
Pathogenesis

visceral larval migrans

- common in children (1-4 yr)
- larvae (0.5 mm) encapsulate in liver and lungs in dense fibrous tissue
- others continue to migrate causing inflammation and granuloma formation
- marked eosinophilia
- hepatomegaly
- hyperglobulinaemia
- pulmonary infiltrates
- chemotherapy (DEC = diethylcarbamazine)



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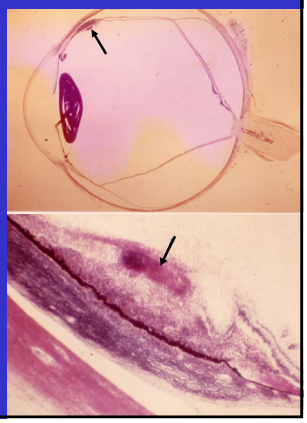
Pathogenesis

ocular larval migrans

- larvae invade eye
- cause granulomatous reaction in retina
- mimic retinoblastoma
- diagnosis aided by serology
- possible treatment by destroying larvae by photocoagulation



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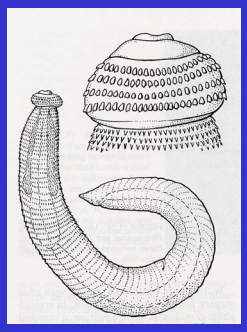
Gnathostoma

Order: Spirurida

- normally found in dogs and cats (SE Asia)
- swollen head bulb covered with stout spines
- larvae develop in copepods
- migrating larvae in humans



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Gnathostoma

worms 10-50 mm in stomach tumours

eggs released in water
larvae taken up by copepods

adults in carnivores, larvae accidentally in humans

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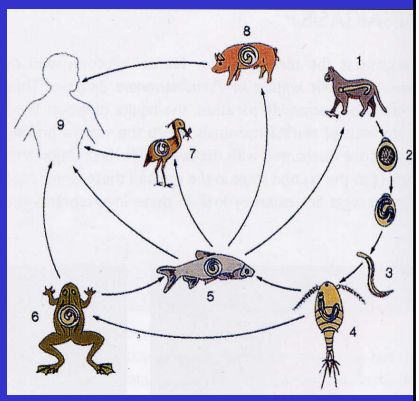
Transmission via water & carnivory

larvae ingested

- with copepod
- with paratenic host (fish, bird, frog, snake)



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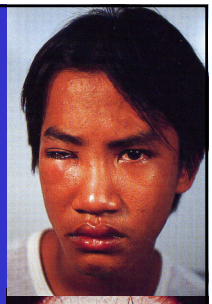
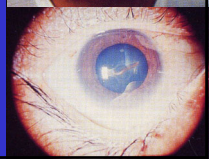
Pathogenesis

visceral larval migrans

- larvae migrate through body in deep cutaneous or subcutaneous tunnels
- swellings with inflammation, pain
- eosinophilia
- CNS involvement (paralysis, seizures, coma)
- surgical removal





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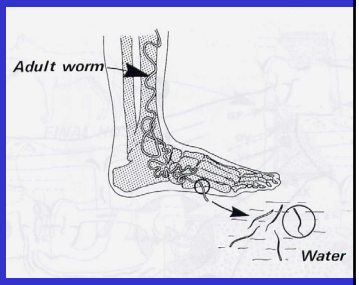
Dracunculus medinensis (guinea worm)

Order: Camallanida

- elongate adults in subcutaneous tissue
- release larvae through ulcerated blister
- larvae develop in copepods



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Dracunculus (guinea worm)

female worms 1m in subcutaneous tissue

larvae released in water taken up by copepods

the fiery serpent of biblical times?

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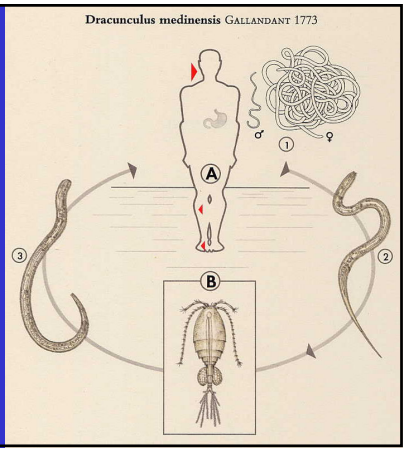
Transmission via water

cycle approx 1 year

larvae ingested with copepod



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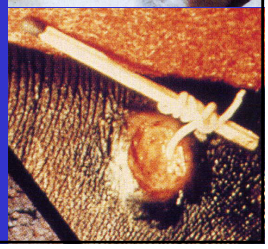
Pathogenesis

- gravid females cause:
  - erythema
  - papule
  - blister
- eventually ulcerates discharging larvae
- inflammation, urticaria
- slow removal
- supportive anti-inflammatories



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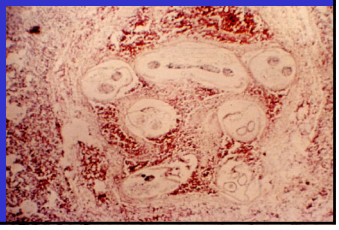
SUMMARY

Tissue nematodes

- infections acquired through food/water
- larval stages pose problems
  - larval migrans
  - encystment
- tissue trauma
- granulomas
- potent allergens
- surgery
- chemotherapy (mebendazole)



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