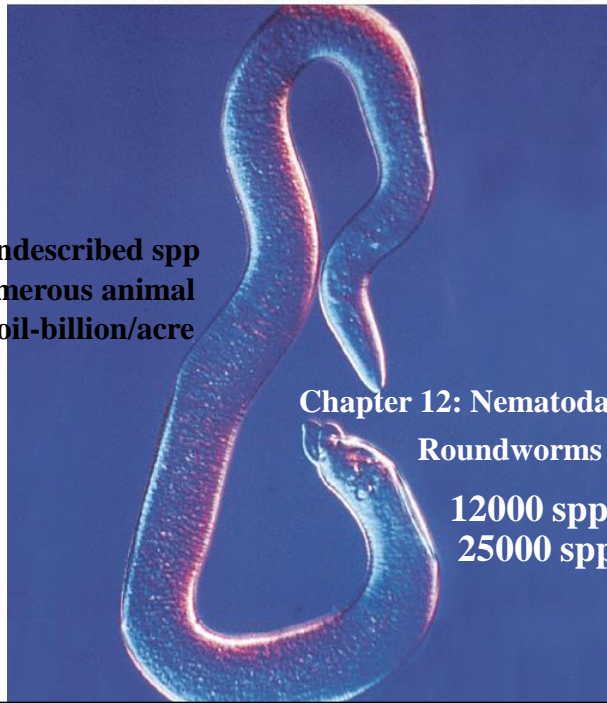


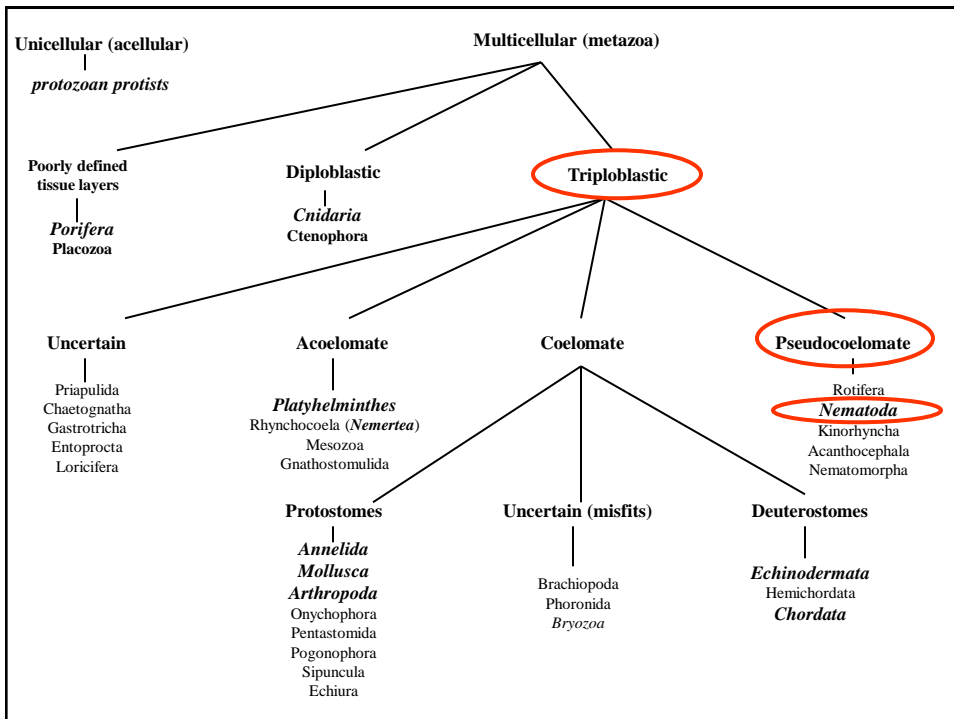
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**~500,000 undescribed spp**  
**most numerous animal**  
**e.g. topsoil-billion/acre**



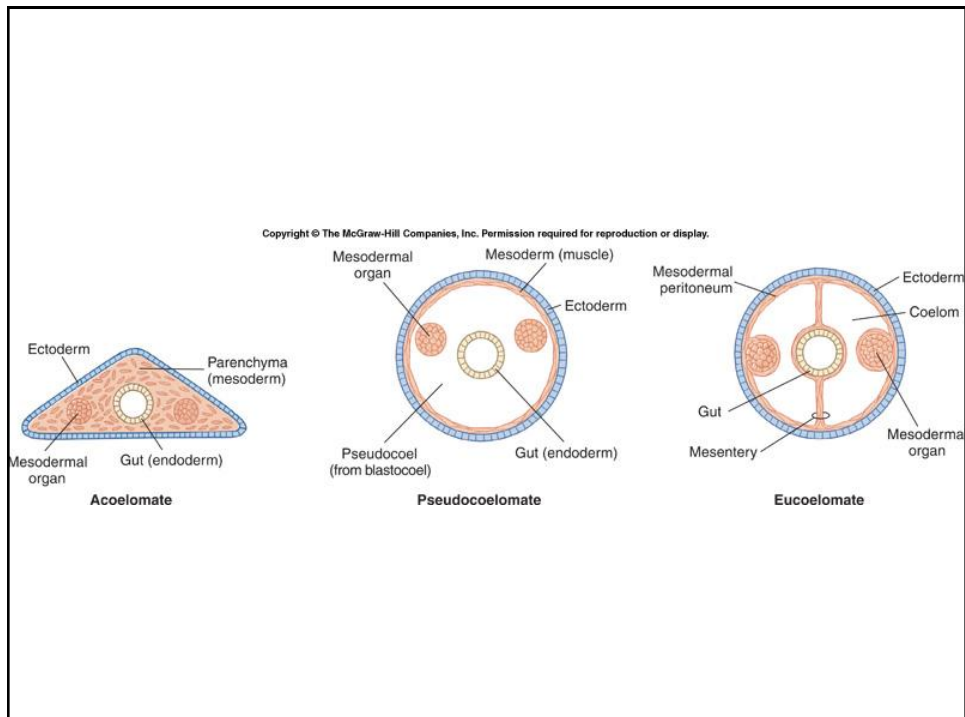
**Chapter 12: Nematoda**  
**Roundworms**

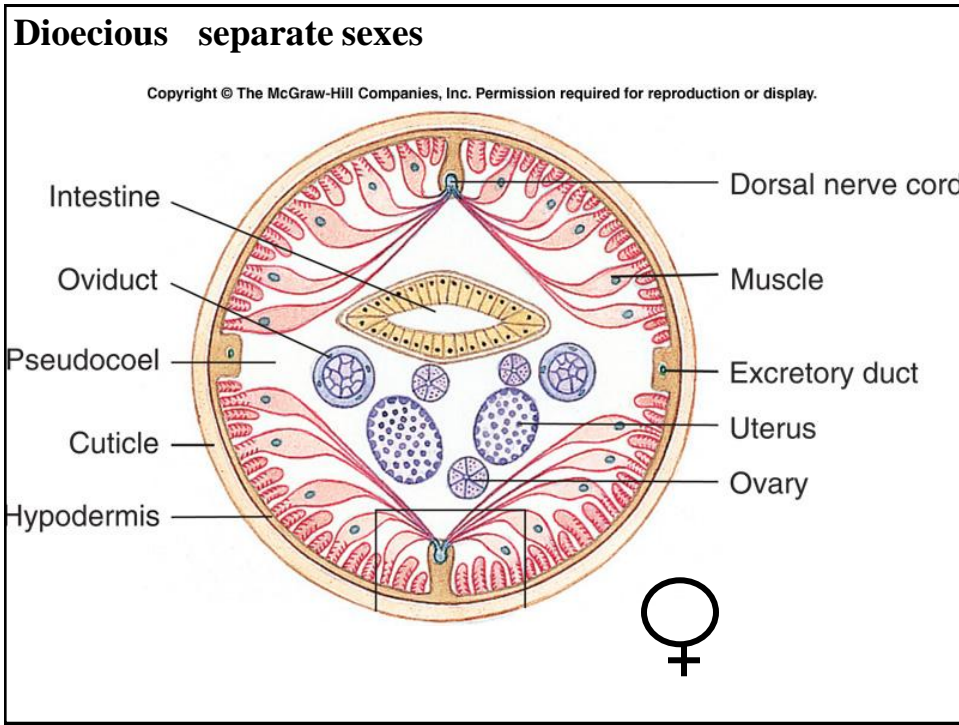
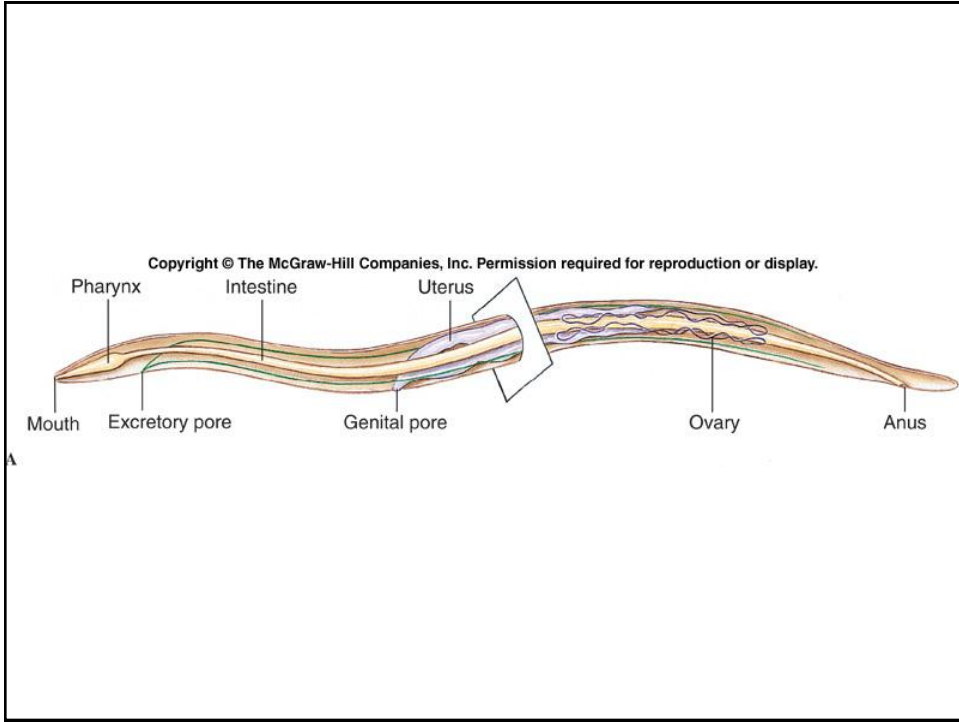
**12000 spp**  
**25000 spp**

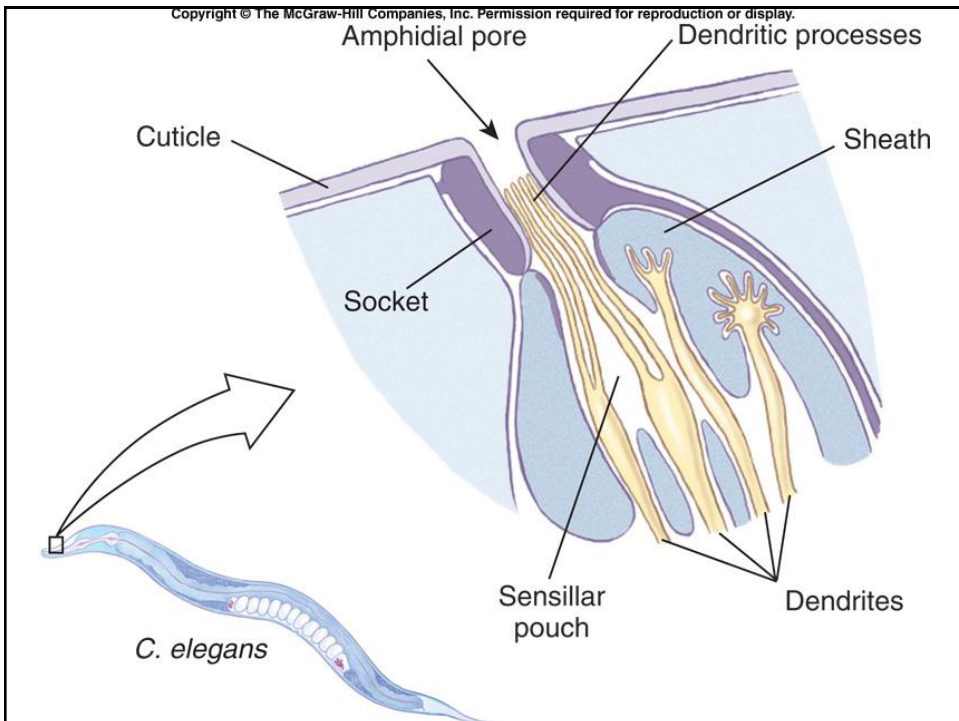
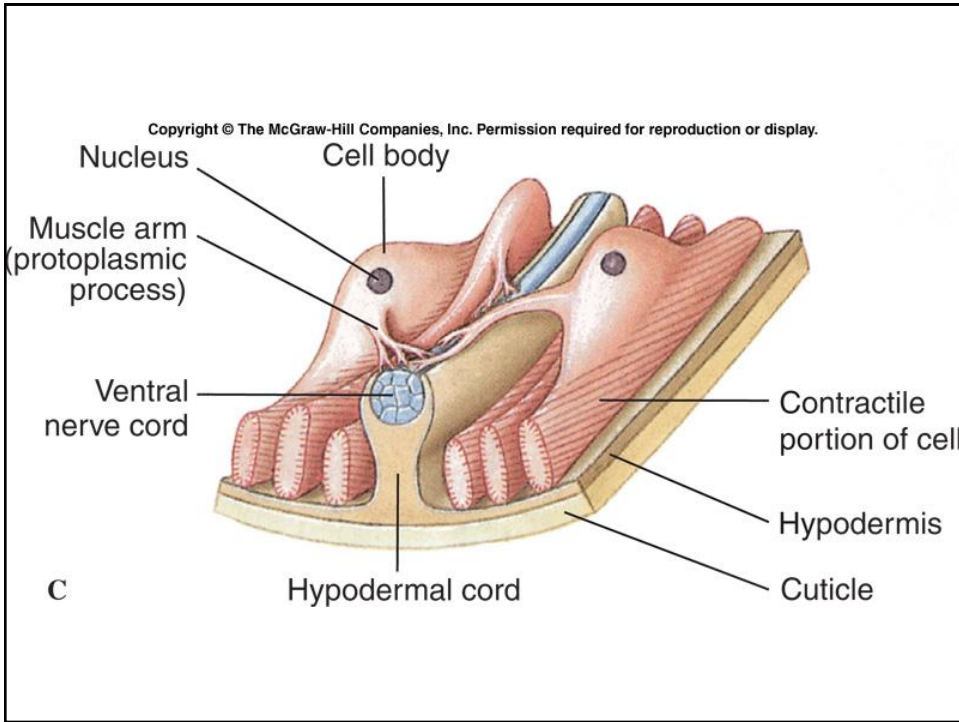


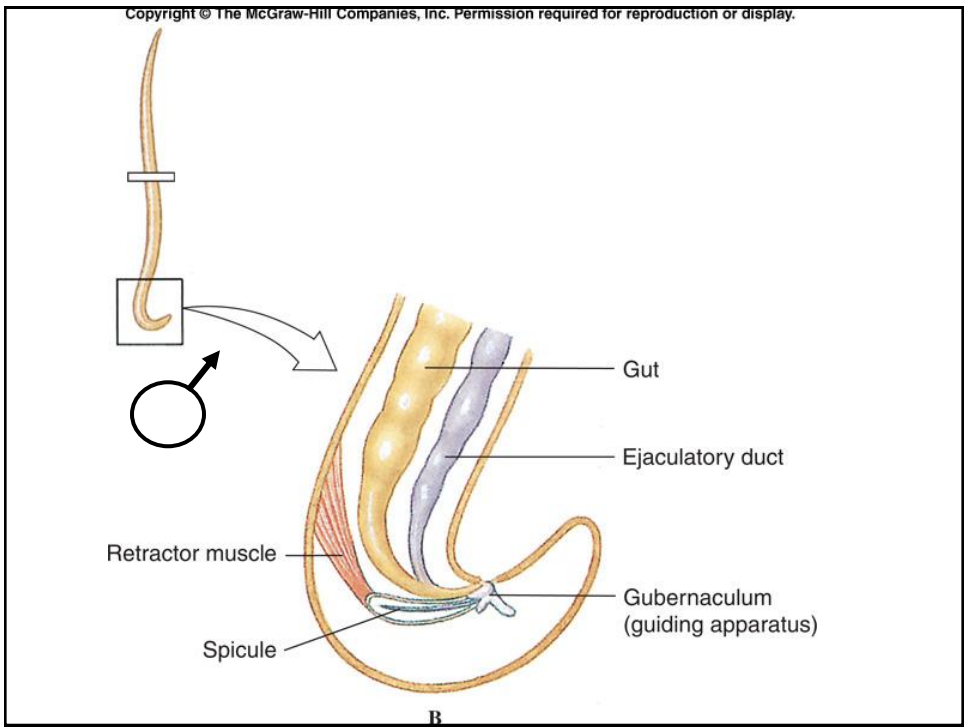
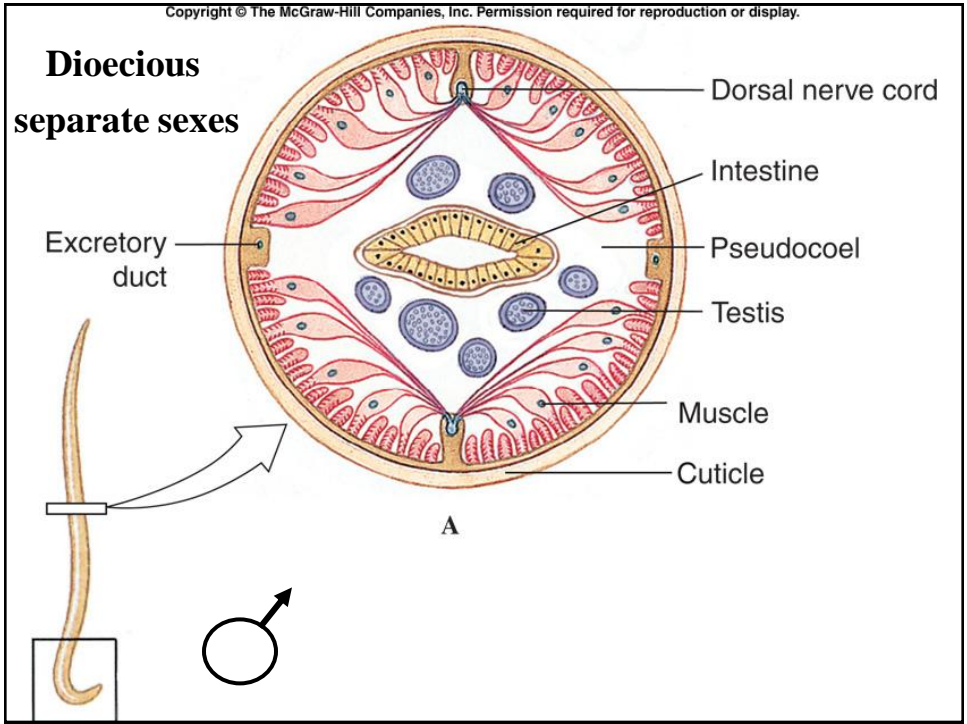
## Main Distinguishing Characteristics & Life Styles

- 1) cylindrical shape, generally small
- 2) nonliving cuticle → desiccation → restricted to moist environments
- 3) cuticle shed during four juvenile growth stages
- 4) lack motile cilia or flagella, except for one species
- 5) only longitudinally muscles lie beneath the cuticle; no circular muscles
- 6) lack protonephridia; one or more large glands or similar structures serve for excretion (renette cells?)
- 7) express *eutely* = a set number of cells
- 8) *pseudocoel (hydrostatic skeleton)* longitudinal muscles contract
- 9) live in virtually all habitats
- 10) free-living: feed on bacteria, yeasts, fungal hyphae & algae
- 11) predatory: rotifers, tardigrades, small annelids & other nematodes
- 12) parasites: in nearly all animal & plant spp; economically important
- 13) important food for mites, insects, larvae and fungi
- 14) most nematodes dioecious with males smaller than females









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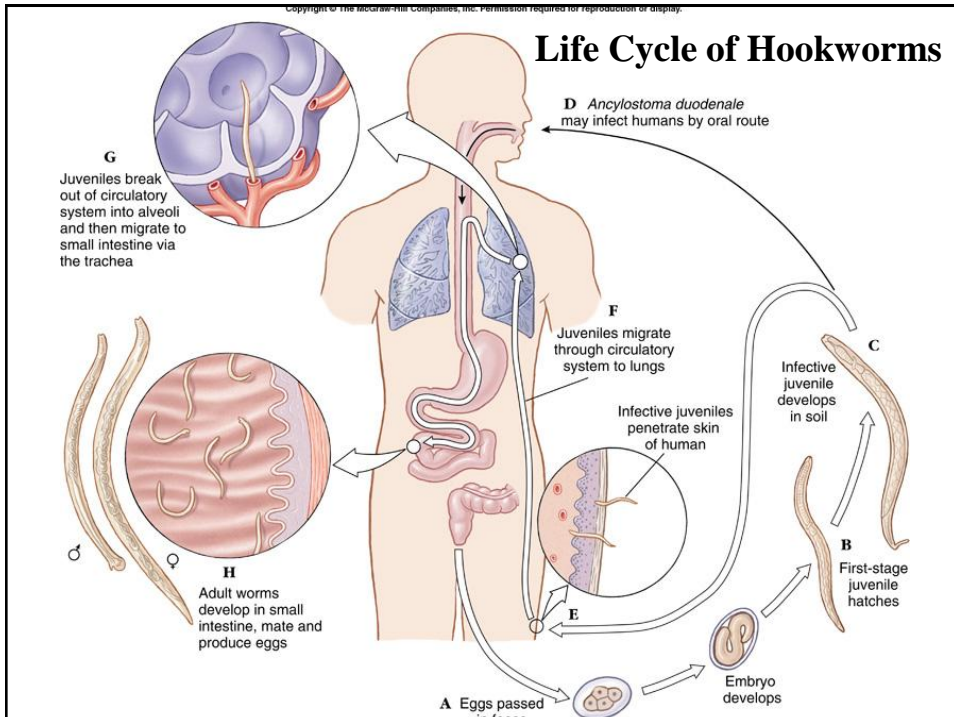
TABLE 15.1

Common Parasitic Nematodes of Humans in North America

Common and Scientific Names	Mode of Infection; Prevalence
Hookworm ( <i>Ancylostoma duodenale</i> and <i>Necator americanus</i> )	Contact in soil with juveniles that burrow into skin; common in southern states
Pinworm ( <i>Enterobius vermicularis</i> )	Inhalation of dust with ova and by contamination with fingers; most common worm parasite in United States
Intestinal roundworm ( <i>Ascaris lumbricoides</i> )	Ingestion of embryonated ova in contaminated food; common in rural areas of Appalachia and southeastern states
Trichina worm ( <i>Trichinella</i> spp.)	Ingestion of infected muscle; occasional in humans throughout North America
Whipworm ( <i>Trichuris trichiura</i> )	Ingestion of contaminated food or by unhygienic habits; usually common wherever <i>Ascaris</i> is found

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Life Cycle of Hookworms



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**mouth of  
hookworm**  
**cutting plates**



**A**

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**Muscular pharynx**  
**Esophageal glands**  
**Secrete anticoagulant**

**Plates**



**B**

## Nematode Parasites

### One Definitive Host

Ascaroid (intestine: feed on intestinal contents)

- 1) *Ascaris lumbricoides* (max 49 cm length) human intestine
- 2) *Toxocara canis* (dog) and *T. cati* (cat)

Hookworms (digestive tract: feed on blood) 380 million infected

- 1) *Necator americanus*

Pinworms (vertebrate/invertebrate gut)

- 1) *Enterobius vermicularis* affects children in the perianal region—children scratch anal area and lodge the eggs underneath fingernails which then can spread to other children or reinfect same host

Trichinelloids

Whipworms: *Trichinella spiralis* cysts in striated muscles of pig tissues→trichinosis

### Intermediate & Definitive Hosts

Filarioids (lymphatic glands and other tissues)

adults—filaria :near lymph glands

larvae—microfilariae: infective stage in blood when sucked up by intermediate hosts

intermediate hosts: blood-sucking insects (fleas, certain flies, mosquitoes)

- 1) *Wuchereria bancrofti* (elephantiasis) enlargement of legs, scrotum, breast as result of increase in connective tissues
- 2) *Dirofilaria immitis* (heartworm) heart/pulmonary arteries of dogs, wolves, foxes
- 3) *Loa loa* (African eye worm)

Dracunculoids

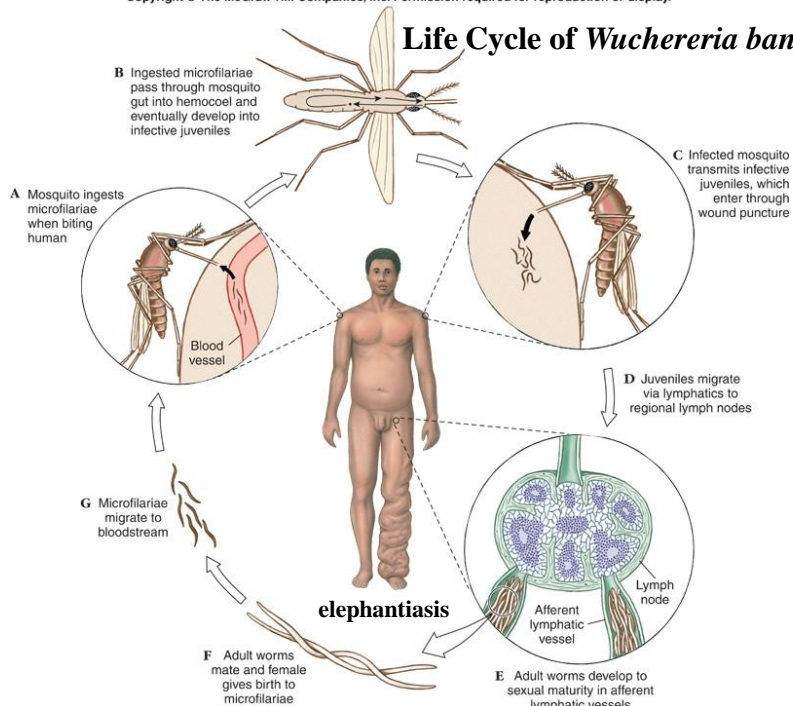
- 1) *Dracunculus medinensis* (guinea worm) wind up on match stick→caduceus (symbol of medical profession)  
larvae ingested by copepod crustaceans (*Cyclops*)

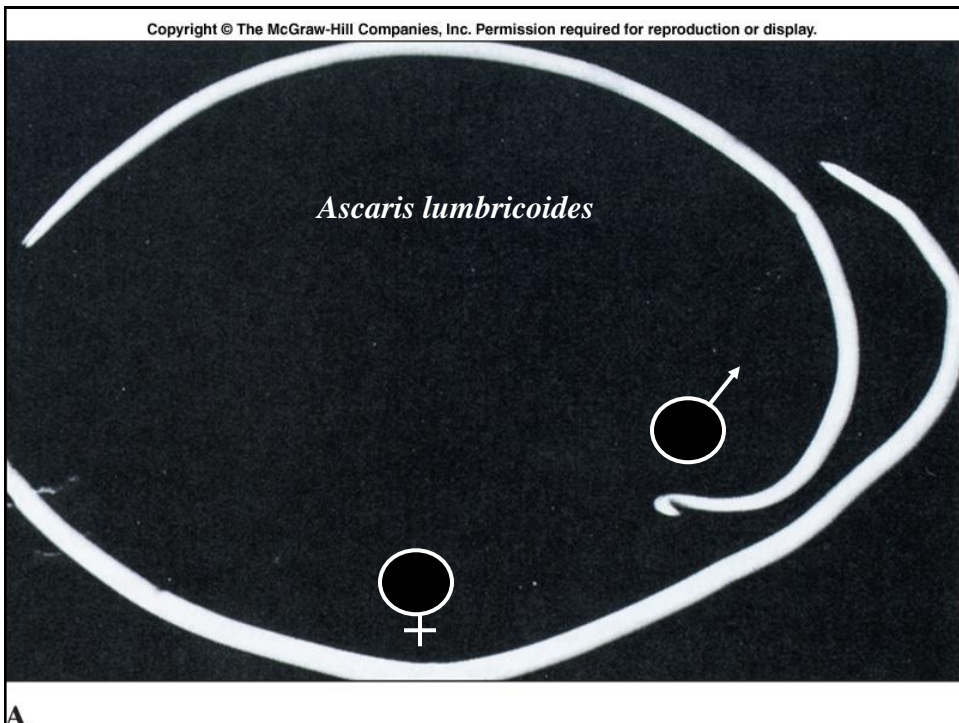
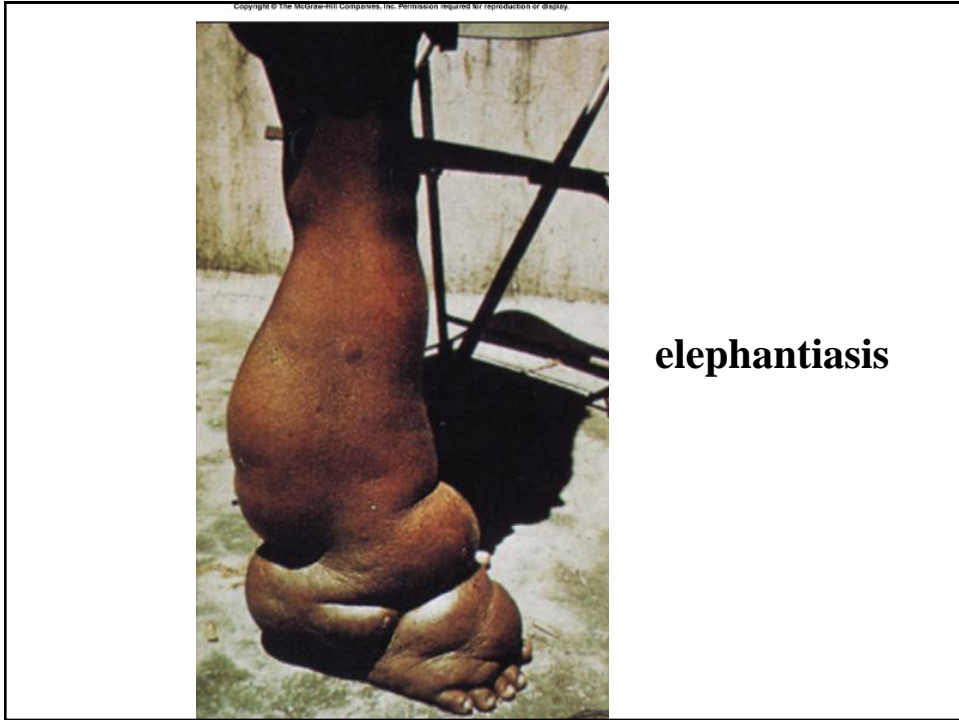


caduceus

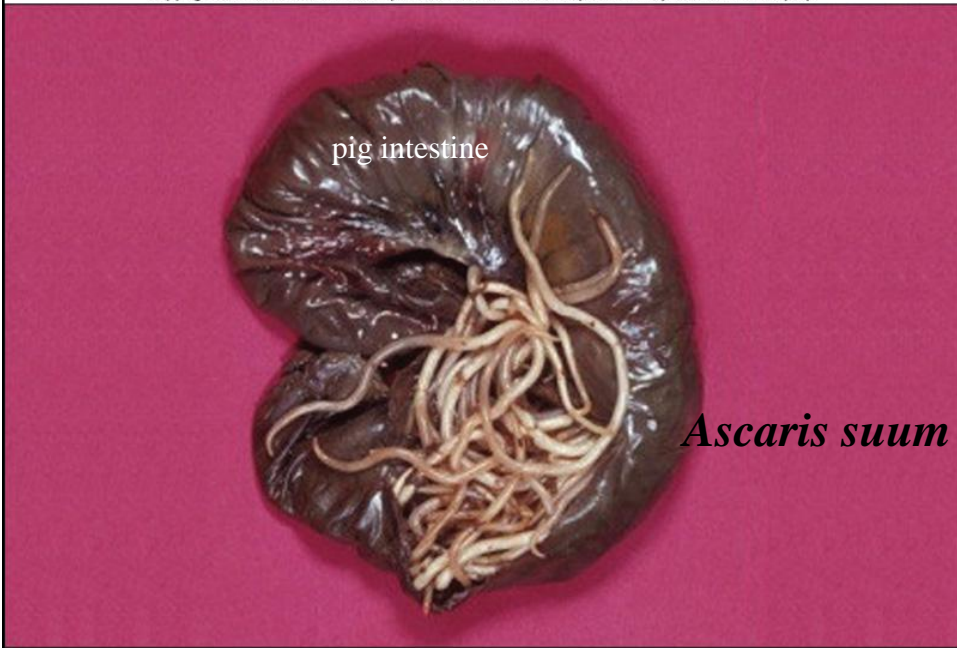
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## Life Cycle of *Wuchereria bancrofti*





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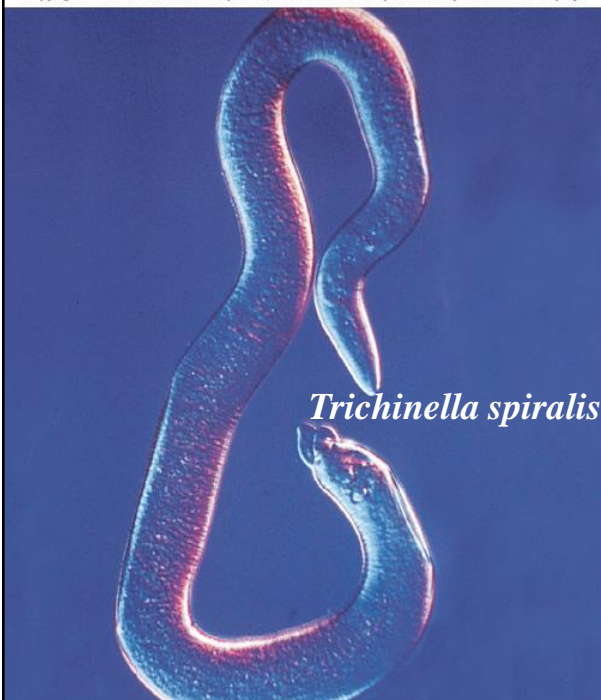


pig intestine

*Ascaris suum*

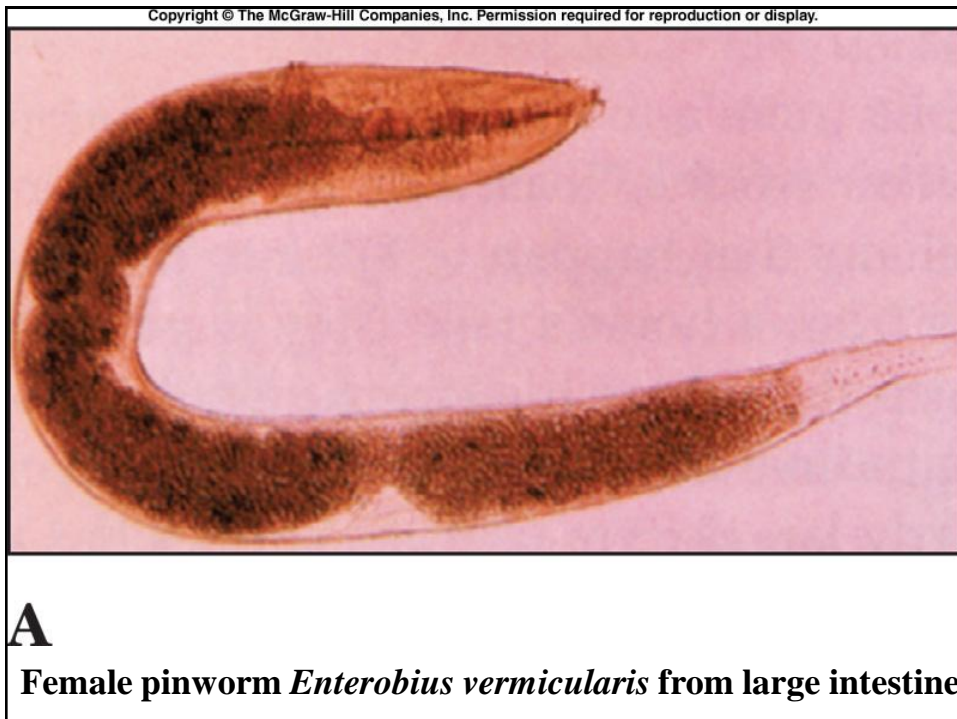
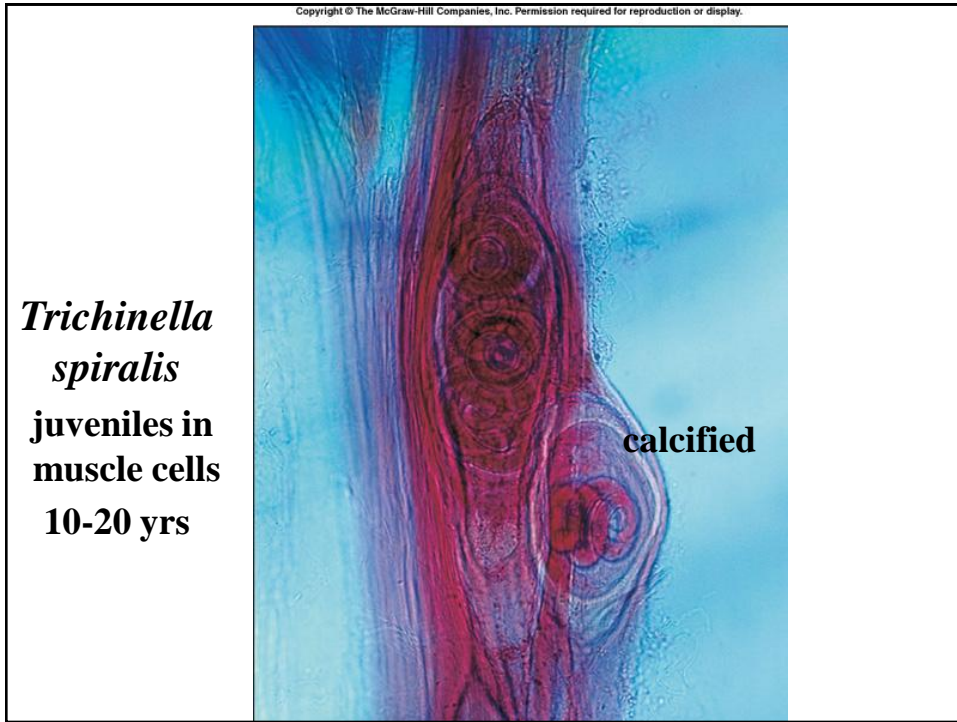
**B**

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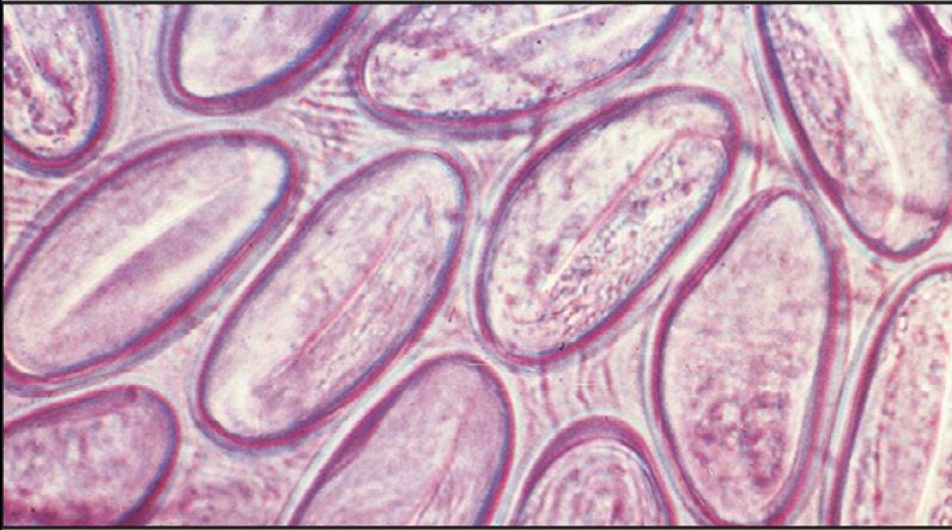


*Trichinella spiralis*

cause of trichinosis

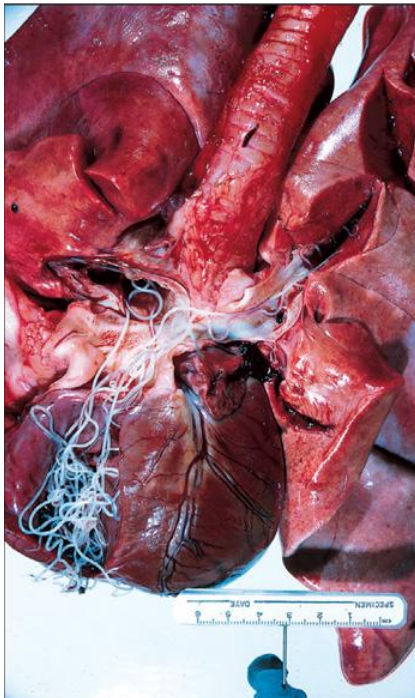


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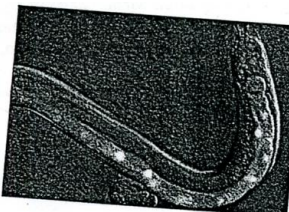


**B** Pinworm eggs passing out of anus;  
Scratching anus re-infection through fingernails or clothing

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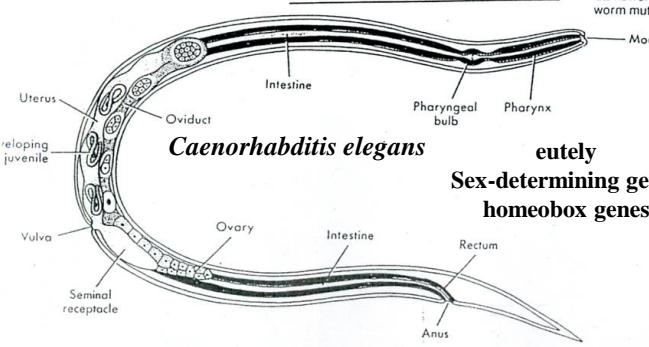


*Dirofilaria immitis*  
In right ventricle with worms  
extending up into right &  
left pulmonary arteries of  
8 yr old Irish setter



**MUTANT WORM:** A male *mab-3* mutant worm that is expressing yolk (green) in the intestine. Yolk normally is expressed only in hermaphrodites.

**SEX-DETERMINING GENE**  
 Homology can be humbling. David Zarkower, an assistant professor in the Institute of Human Genetics at the University of Minnesota Medical School in Minneapolis, and coworkers have identified a shared DNA-binding region in a sex-determining gene in the nematode *Caenorhabditis elegans*, the fruit fly *Drosophila melanogaster*, and maybe humans (C.S. Raymond et al., *Nature*, 391:691-5, 1998). This is surprising, because sex determination differs substantially among animals. Centuries past, whether conception produces a male or female has been attributed to the phase of the moon, the direction in which the successful sperm comes, or how passionately the parents act. Today we know that specific genes determine sex. Zarkower and colleagues noted similarities between the sex-determining gene in the worm mutant *mab-3* and the fly mutant *doublesex*. They discovered that the two genes share a DNA region called the DM domain. In *Drosophila*, the DM domain found a gene containing a DNA sequence that is expressed in human and mouse embryos, and mapped it to a band on chromosome 9, calling it *DMT1*. The *DMT1* gene in humans is already known to be absent in individuals who are XY females. Patients deleted for *DMT1* in XY females with intersex conditions had sex-reversing degrees. We are now looking for *DMT1* in XY females with deletions to find a microdeletion mutation," says Zarkower. Finally, a small-scale mutation will delete the *DMT1* gene, fished out using parts in flies and worms, is required in two copies in a human male.



***Caenorhabditis elegans***  
 Sex-determining genes  
 homeobox genes

