

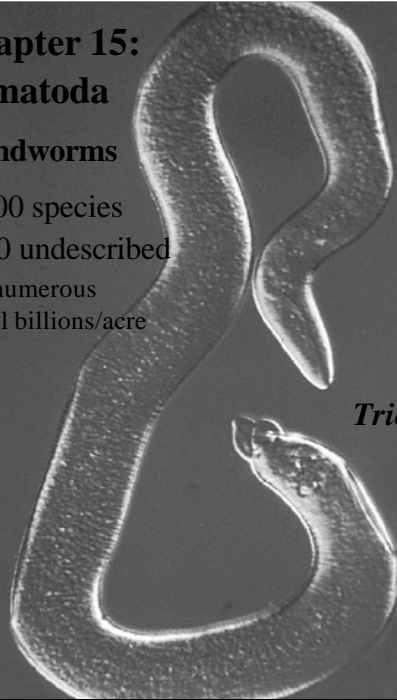
Fig.

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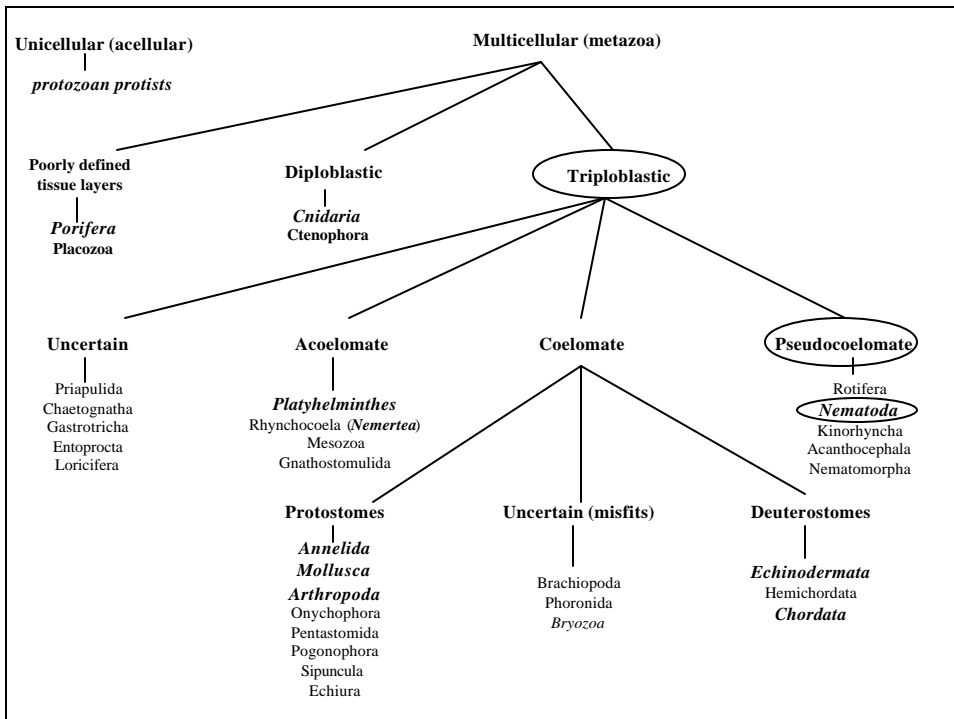
# Chapter 15: Nematoda

## Roundworms

25,000 species  
500,000 undescribed  
most numerous  
e.g. topsoil billions/acre



*Trichinella spiralis*



## 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

Figure 15.01

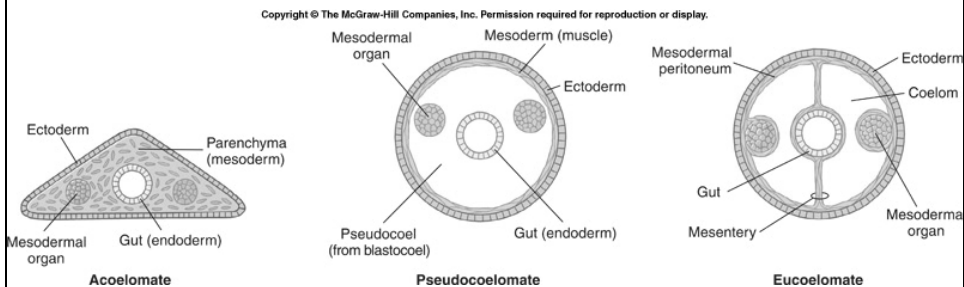


Figure 15.02

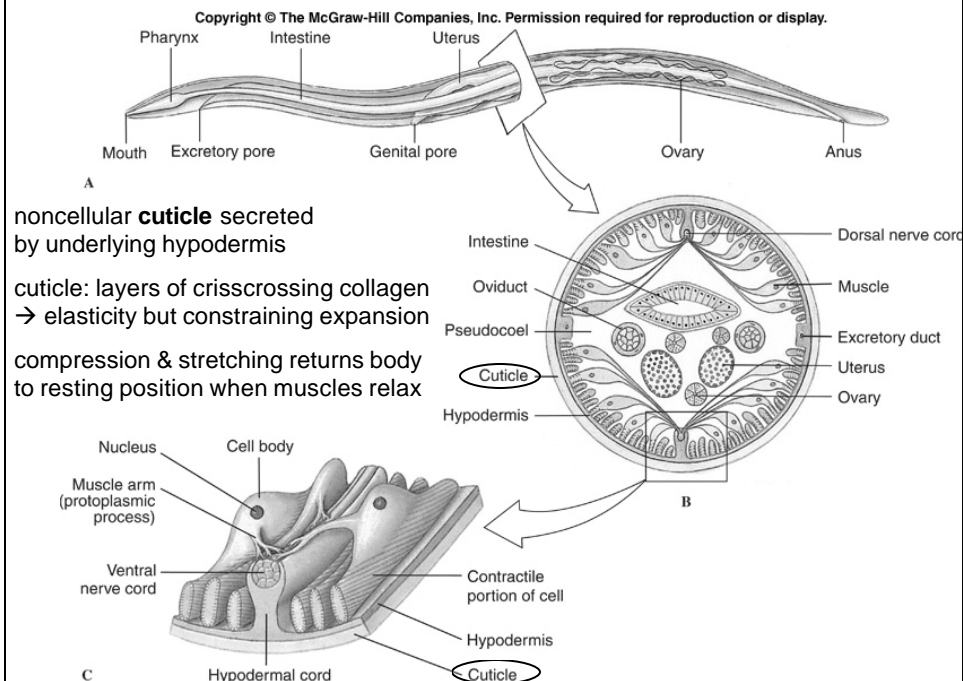
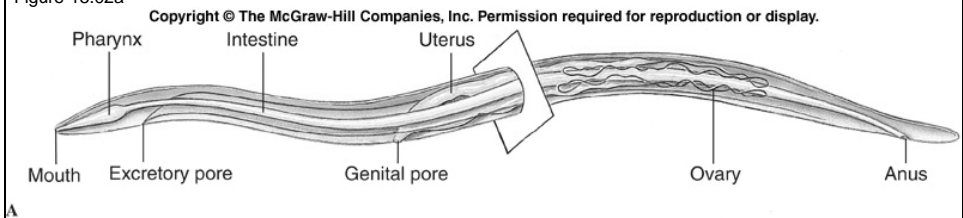


Figure 15.02a



complete gut: mouth, pharynx, a non-muscular intestine, short rectum & anus

muscular pharynx sucks food in

intestine: one cell thick; food moves back as new food enters & body moves

defecation: opening anus & allowing pseudocoelomic pressure to expel feces

Figure 15.02c

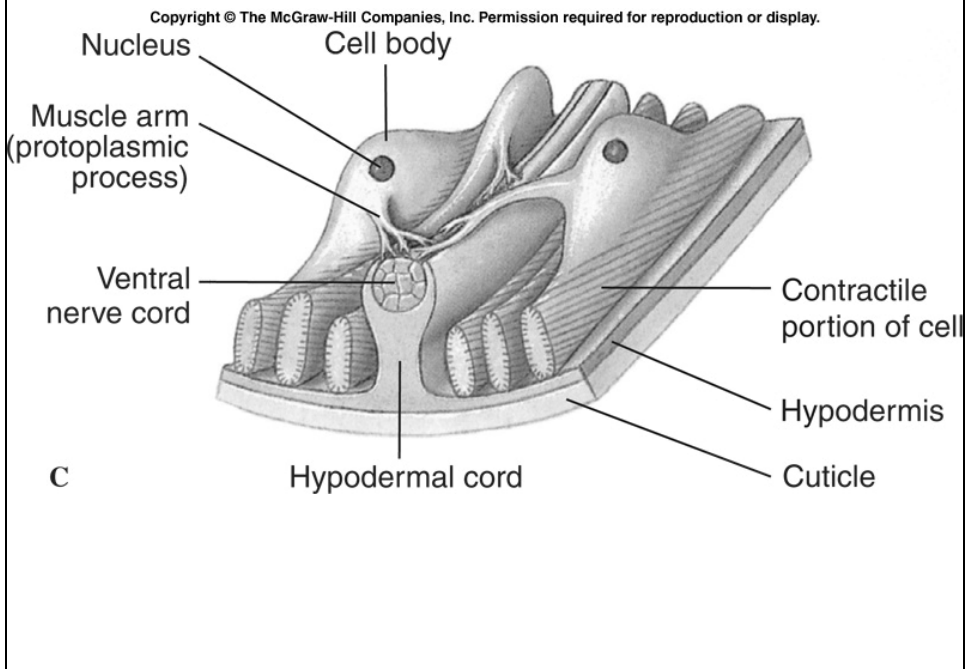


Figure 15.03

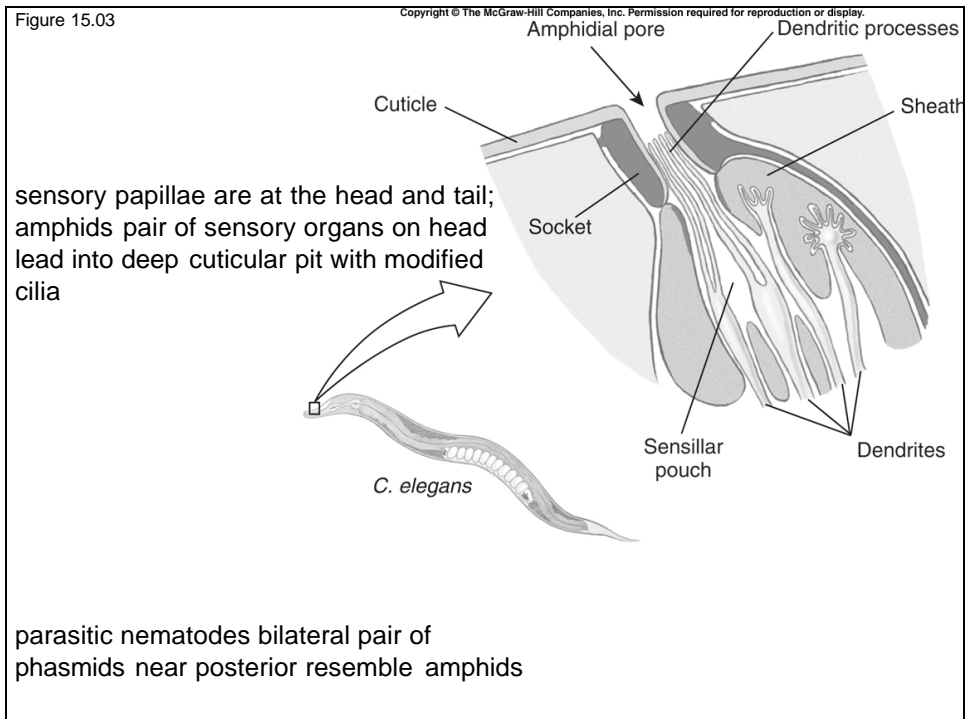


Figure 15.04

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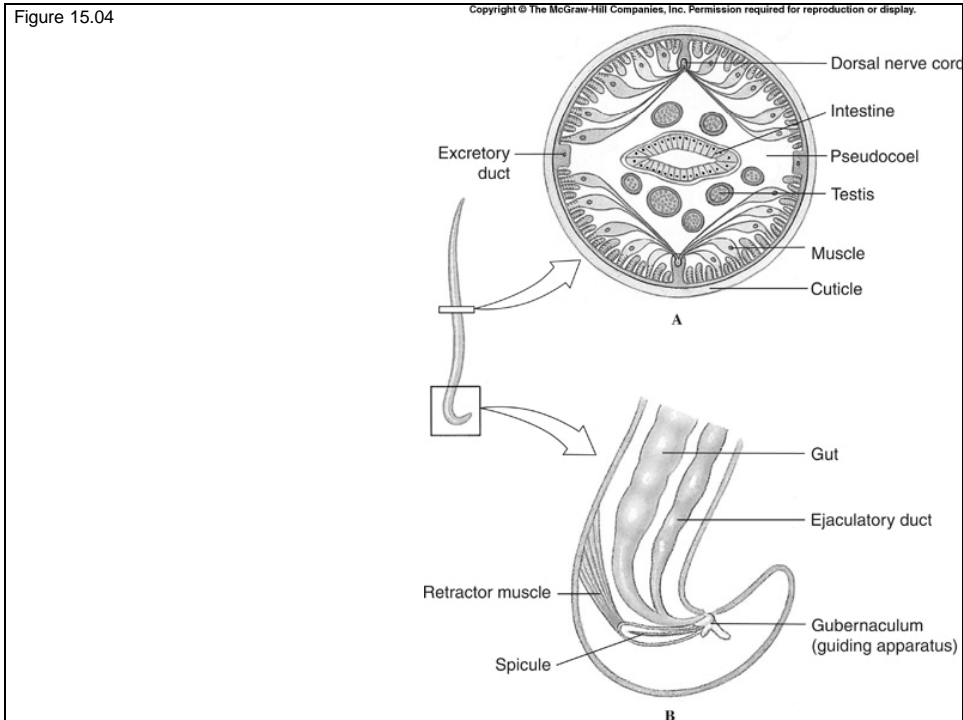


Figure 15.04a

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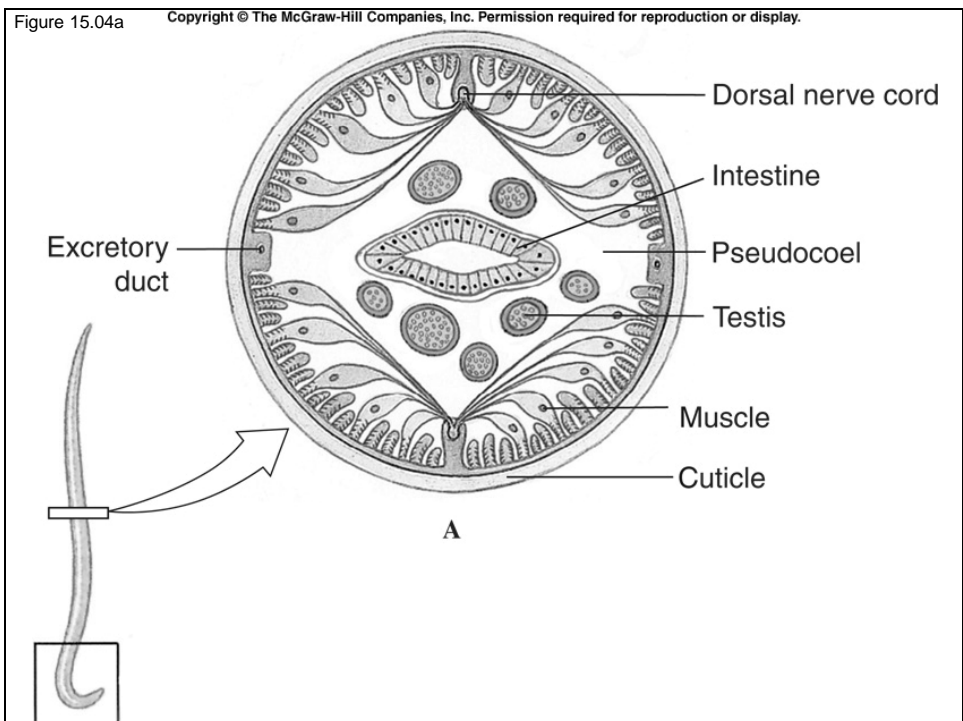


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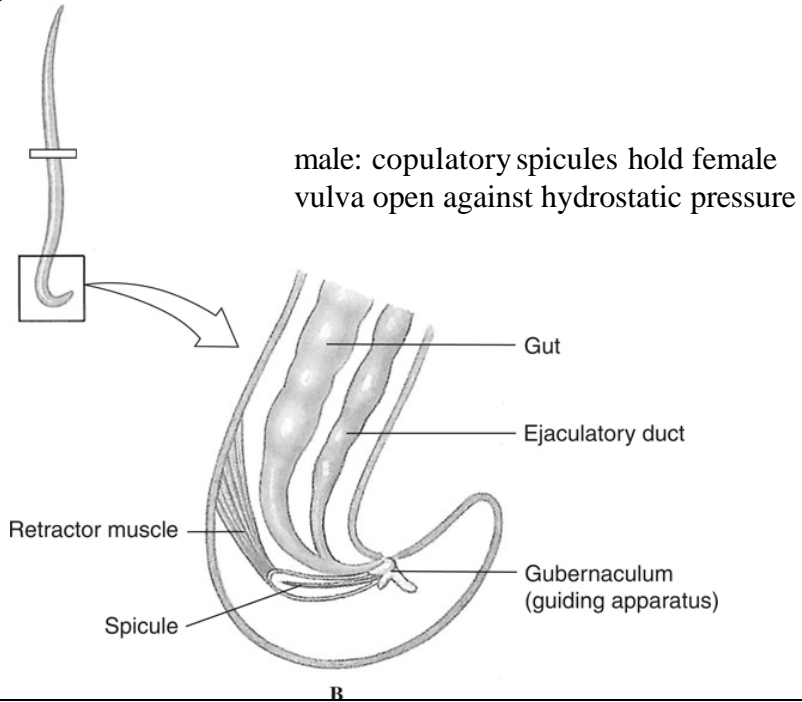
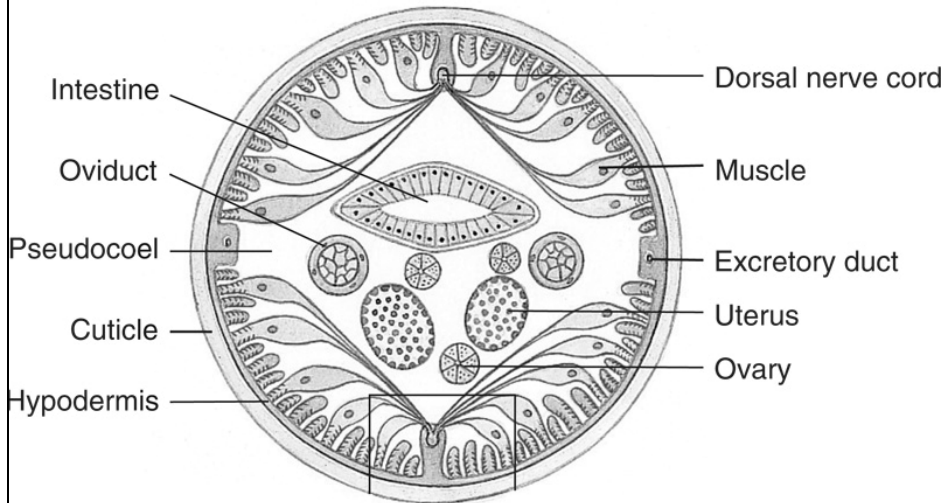


Figure 15.02b

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internal fertilization: eggs stored in the uterus until deposited

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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> ) Pinworm ( <i>Enterobius vermicularis</i> )	Contact in soil with juveniles that burrow into skin; common in southern states 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

Figure 15.07

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Life Cycle of Hookworms

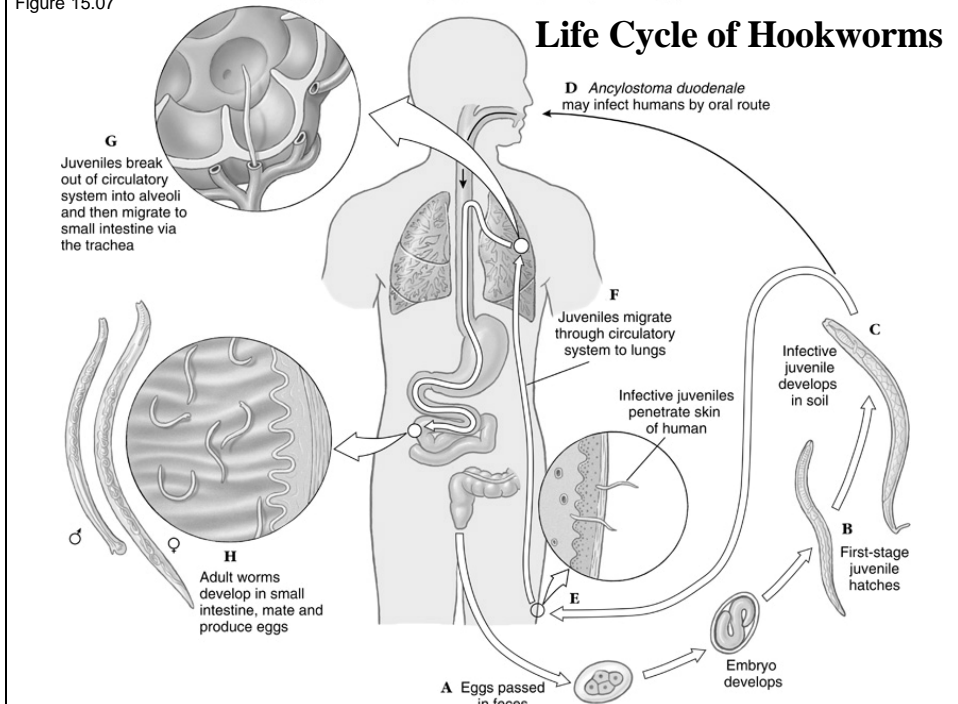
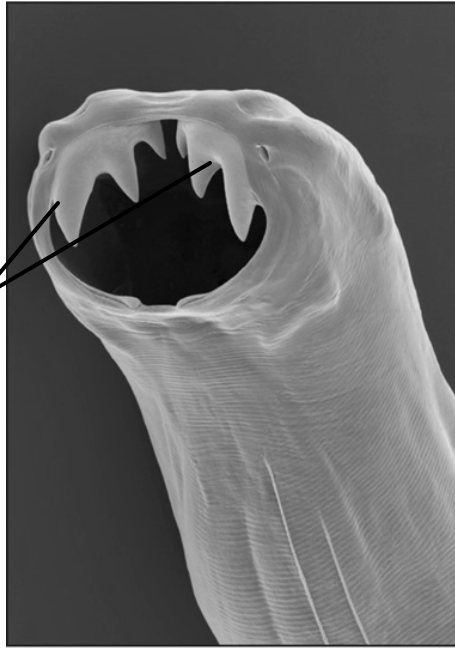


Figure 15.06a

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**mouth of  
hookworm**

**cutting plates**



**A**

Figure 15.06b

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**Plates**

**Muscular pharynx**

**Esophageal glands  
Secrete anticoagulant**



**B**

## Nematode Parasites



caduceus

### 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*)

Figure 15.10

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### Life Cycle of *Wuchereria bancrofti*

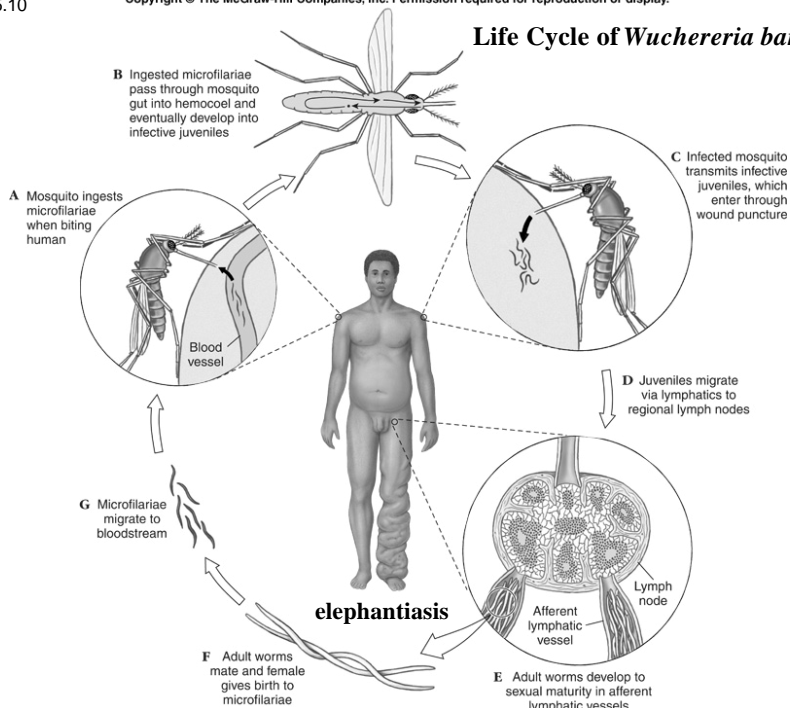


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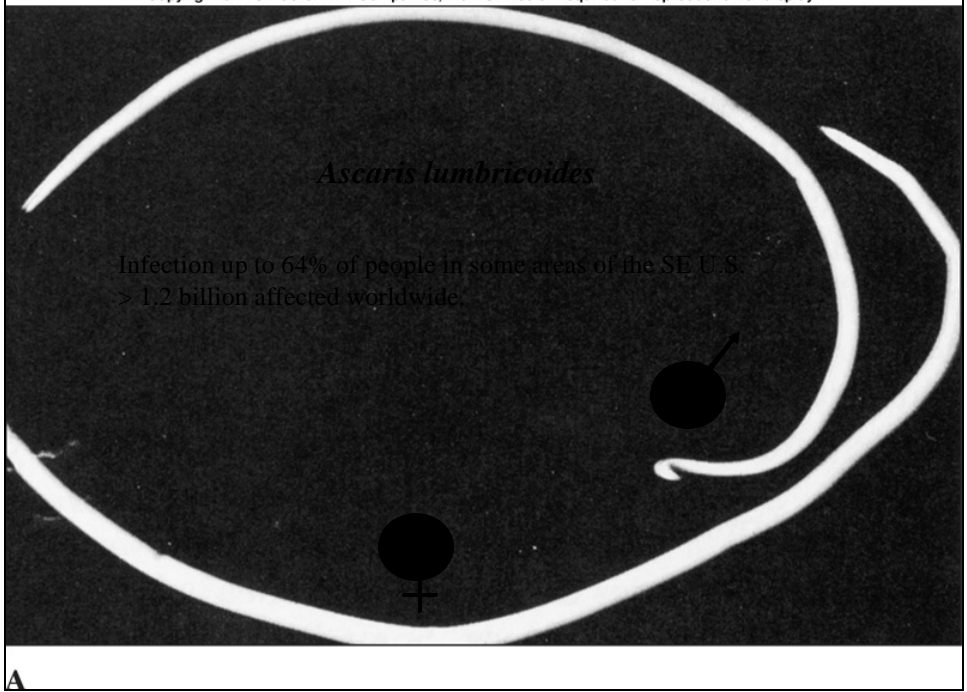


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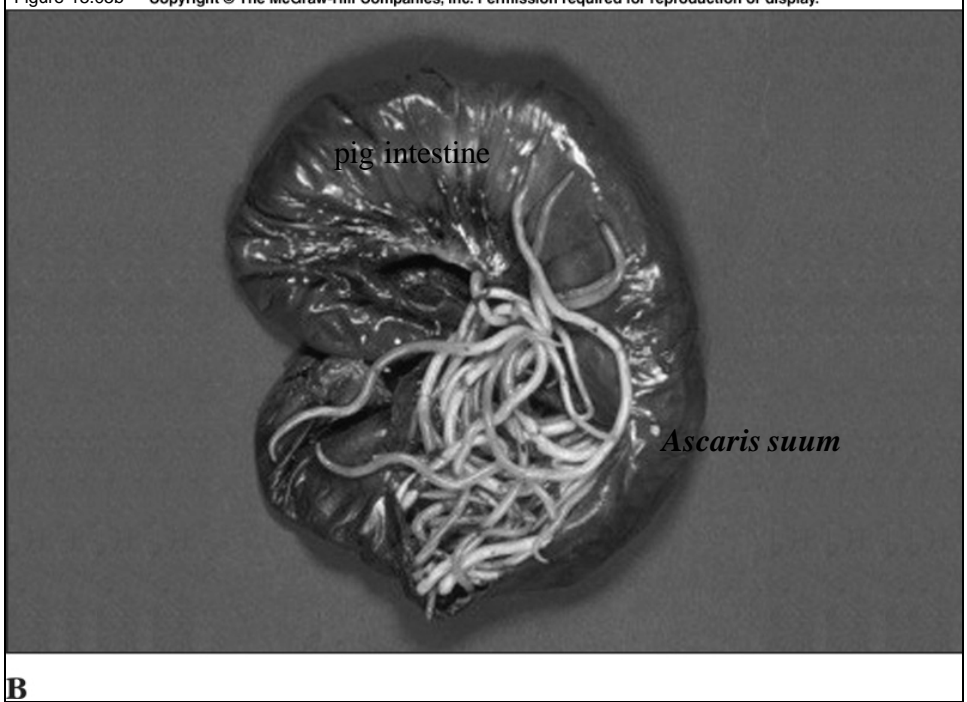


Figure 15.co

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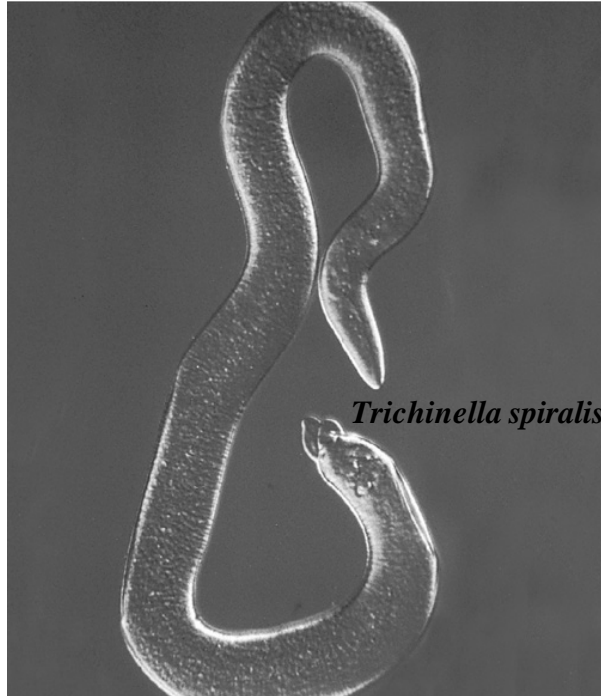


Figure 15.08

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*Trichinella spiralis*

juveniles in  
muscle cells

10-20 yrs

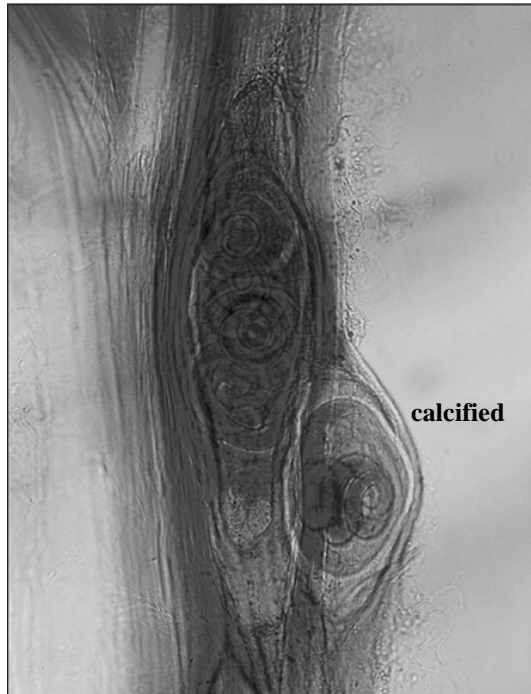
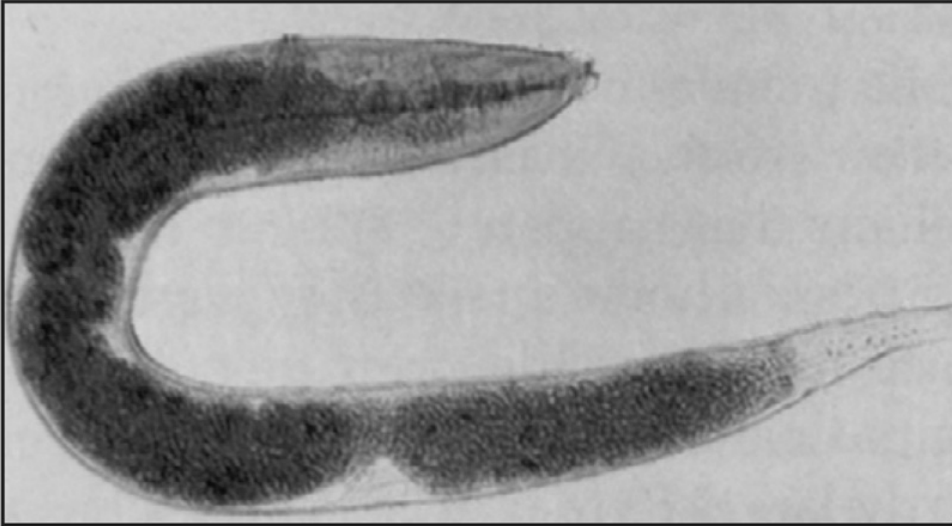


Figure 15.09a

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**A**

Female pinworm *Enterobius vermicularis* from large intestine

Figure 15.09b

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**B**

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

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**elephantiasis**

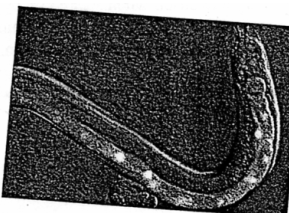


Figure 15.12

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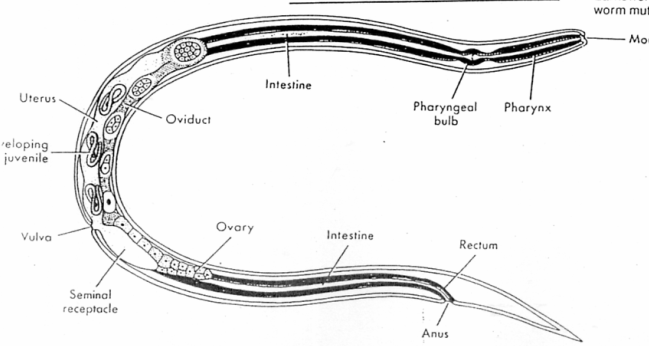
***Dirofilaria immitis***  
In right ventricle with worms  
extending up into right &  
left pulmonary arteries of  
8 yr old Irish setter





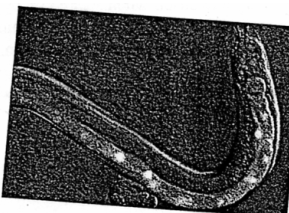
**MUTANT WORM:** A male *mab-3* mutant worm that is expressing yolk (green) in the intestine. Yolk normally is expressed only in hermaphrodites.

**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. For example, in humans, sex is determined at conception, whether conception produces a male or female, while in flies, sex is determined at the phase of the moon, the time of day, or how passionate the parents are. Today we know that specific genes determine sex in flies and worms, and Zarkower and colleagues noted similarities between the worm mutant *mab-3* and the fly mutant *doublesex* that the two genes share a DNA-binding region called the DM domain. In humans, they found a gene containing this domain that is expressed in human males and mapped it to a band on chromosome 9, calling it *DMT1*. The *DMT1* gene, which has been known to be absent in individuals who are XY females. Patients deleted for this gene 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 a gene required in two copies in a human male.



***Caenorhabditis elegans*: model genomics & cell development & differentiation**

**eutely sex-determining genes**  
**homeobox genes**



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

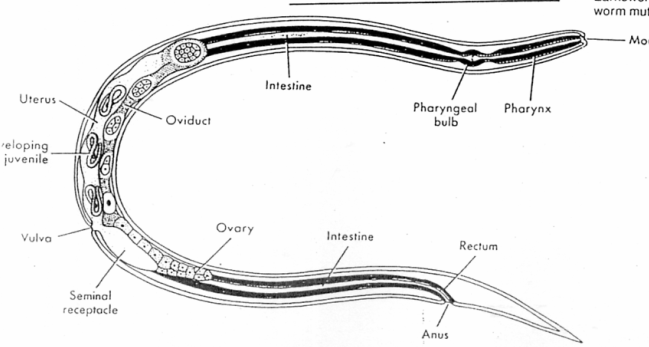


Figure 15.24

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