

Veterinary Parasitology

Dr. Asif

Objective 1

Describe the various symbiotic relationships between two species of organisms

Parasitology Goals

- Learn the **Life Cycles & Biology** of parasites
- Learn parasite **treatment and prevention fundamentals**
(Not Drugs)
- Learn **Client Education fundamentals**
 - What the client needs to know about cycles, biology, treatment & prevention of the common animal parasites

Definitions

- **Parasitology** – study of parasites & parasitism
- **Symbiosis** – any association between at least 2 different living organisms of different species
 - **Host** – usually larger of 2 species, harbors symbiont
 - **Symbiont** – smaller of 2 species, obtains food, and habitat from host

Types of Relationships

Relationship	Host	Symbiont
Mutualism	+	+
Commensalism	0	+
Parasitism	-	+
Predation	- (Death)	+

The Parasite

Location on the Host

Amount of Time on the Host

Types of Parasites



Location on the Host

Ectoparasite (**Infestation**)

Endoparasite (**Infection**)

Location on the Host

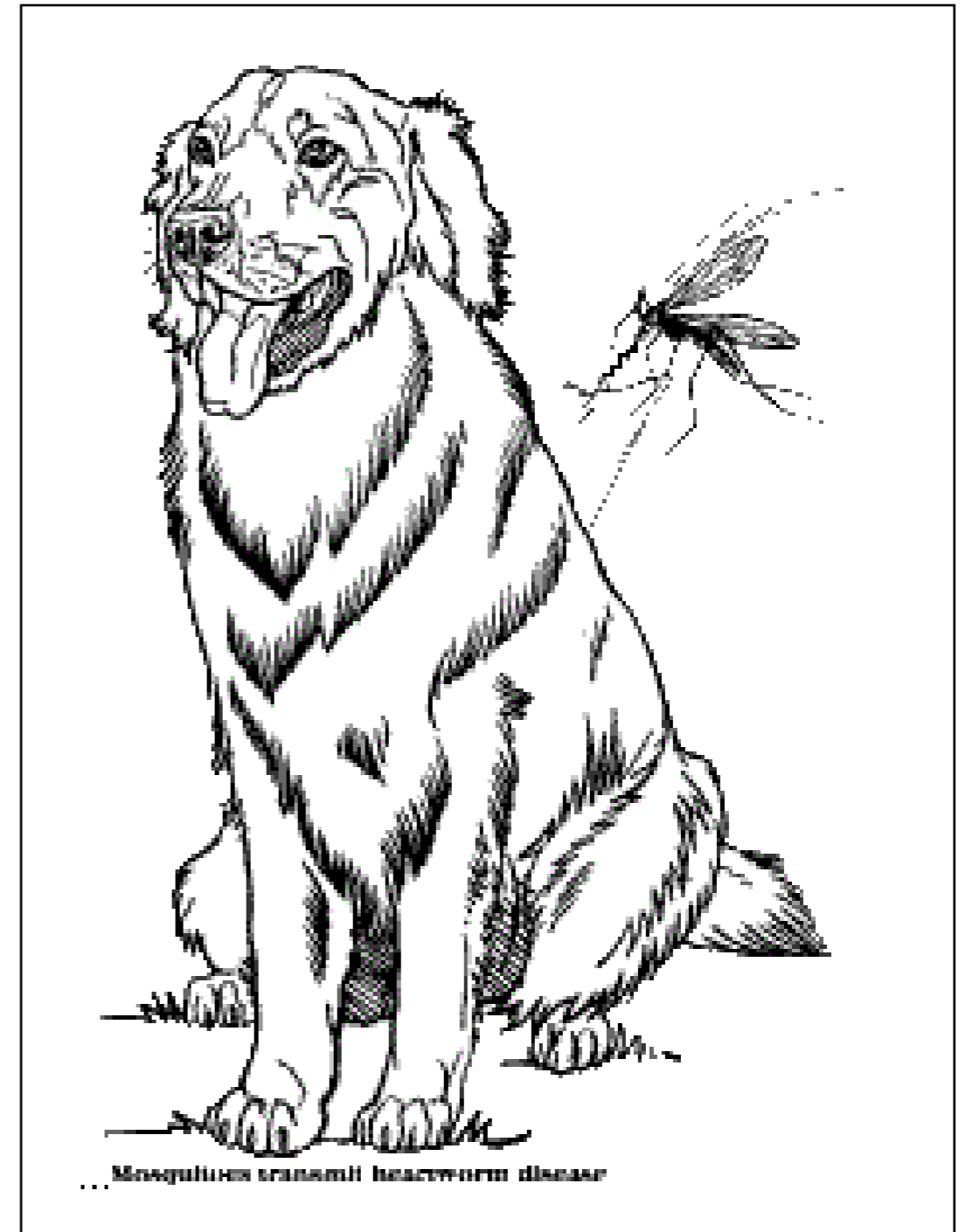
- Ectoparasite
 - On outside surface of body of host
 - Examples – fleas, mosquitoes, horse flies
- Endoparasite
 - Live in body of host
 - Examples – roundworms, whipworms, heartworms

Amount of Time on Host

Temporary
Stationary
Permanent

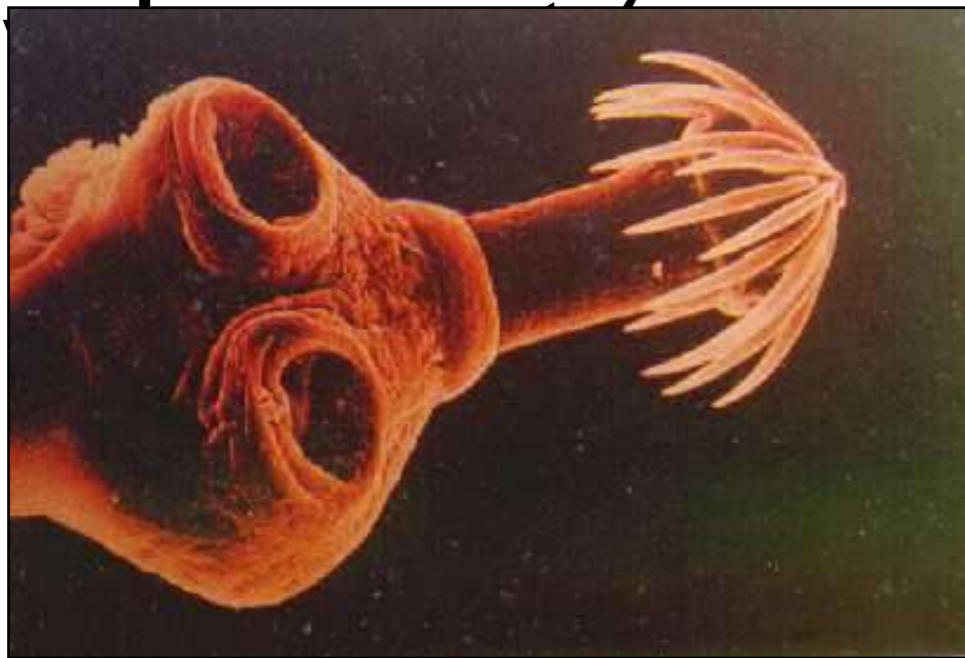
Temporary

- Visits host for food
- Examples
 - Ticks
 - Mosquitoes



Stationary

- Spends definite period of time in or on host
- Most parasites
- **Periodic** – leaves host to complete development cycle



Cuterebra



Permanent

- Spends entire life on host, except when transferring to another host
- Examples
 - Ear mites
 - Lice



Types of Parasites

Incidental (Accidental) Parasite

Erratic (Aberrant) Parasite

Obligate Parasite

Facultative Parasite

Pseudoparasite

Incidental Parasite

- Accidental parasite
- Appears in unusual hosts
- Examples –
 - Heartworms in man
 - Crab louse in dogs

Erratic Parasite

- Aberrant parasite
- Seen in unusual locations in hosts
- Examples –
 - Heartworm in eye
 - *Cuterebra* in brain

Obligate Parasite

- Must lead parasitic existence
- No free-living stages
- Examples
 - Lice
 - Ear mites
 - Some mites

Facultative Parasite

- Free-living organism that can become parasitic in certain hosts
- Examples
- Chigger mite larvae (microscopic)
- Ringworm in cats, calves

Pseudoparasite

- Organisms that appear to be parasites, but are not
- Examples – grain mites in fecals, pollen grains and air bubbles

The Host

Intermediate

Paratenic

Definitive (Final)

Incidental (Accidental)



Intermediate Host

- Immature (non-sexual) parasite undergoes development in this host
- Example – heartworm larva in mosquito
- **Control of this part of life cycle CRUCIAL to preventing parasite!**

Paratenic Host

- Intermediate host that serves as a **“transport”** host for parasitic larva
- Final host must eat this host for adult parasite to develop
- Examples – fleas or mice for certain tapeworms

Definitive Host

- Final host
- Harbors adult (sexually mature) parasite
- Often a carnivore (dogs & cats)
- Intermediate host carried parasite to this host

Incidental Host

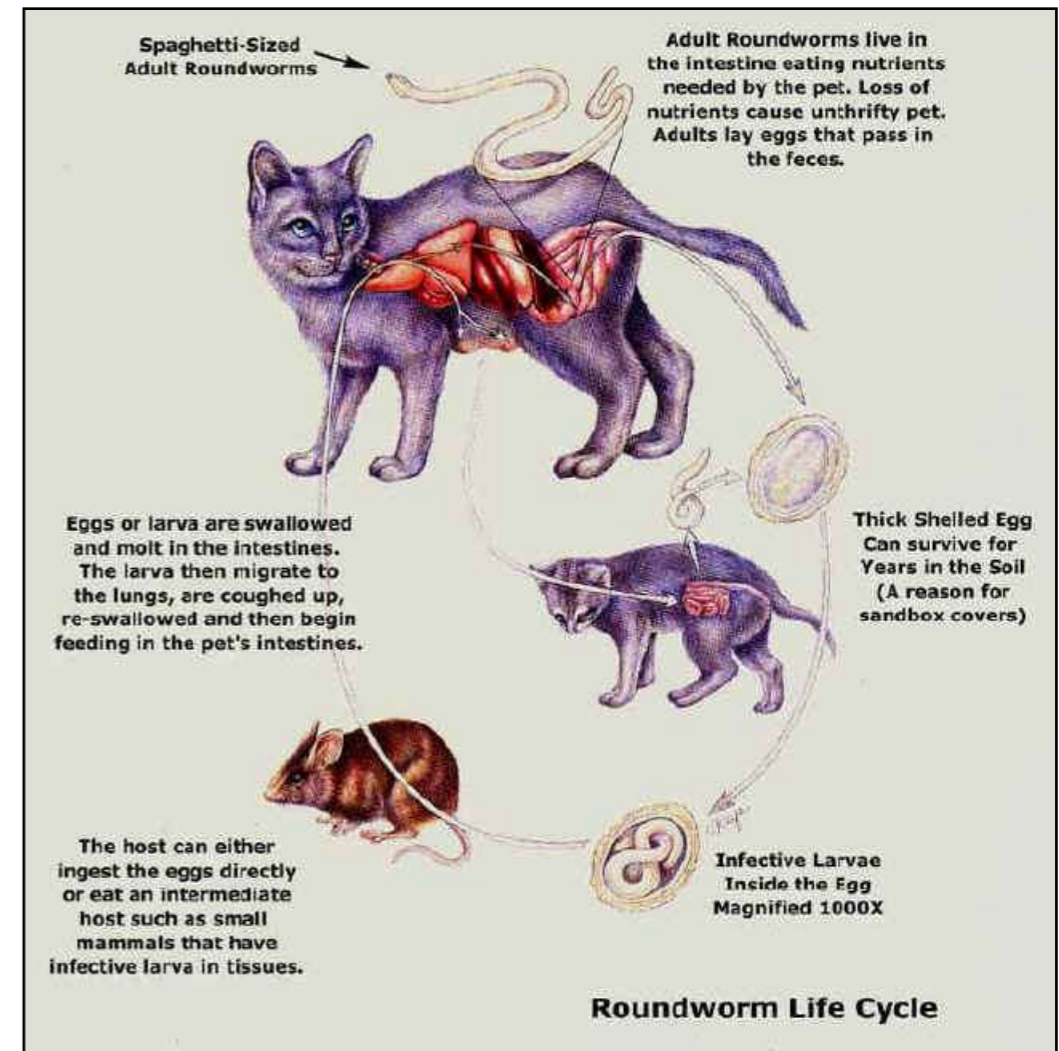
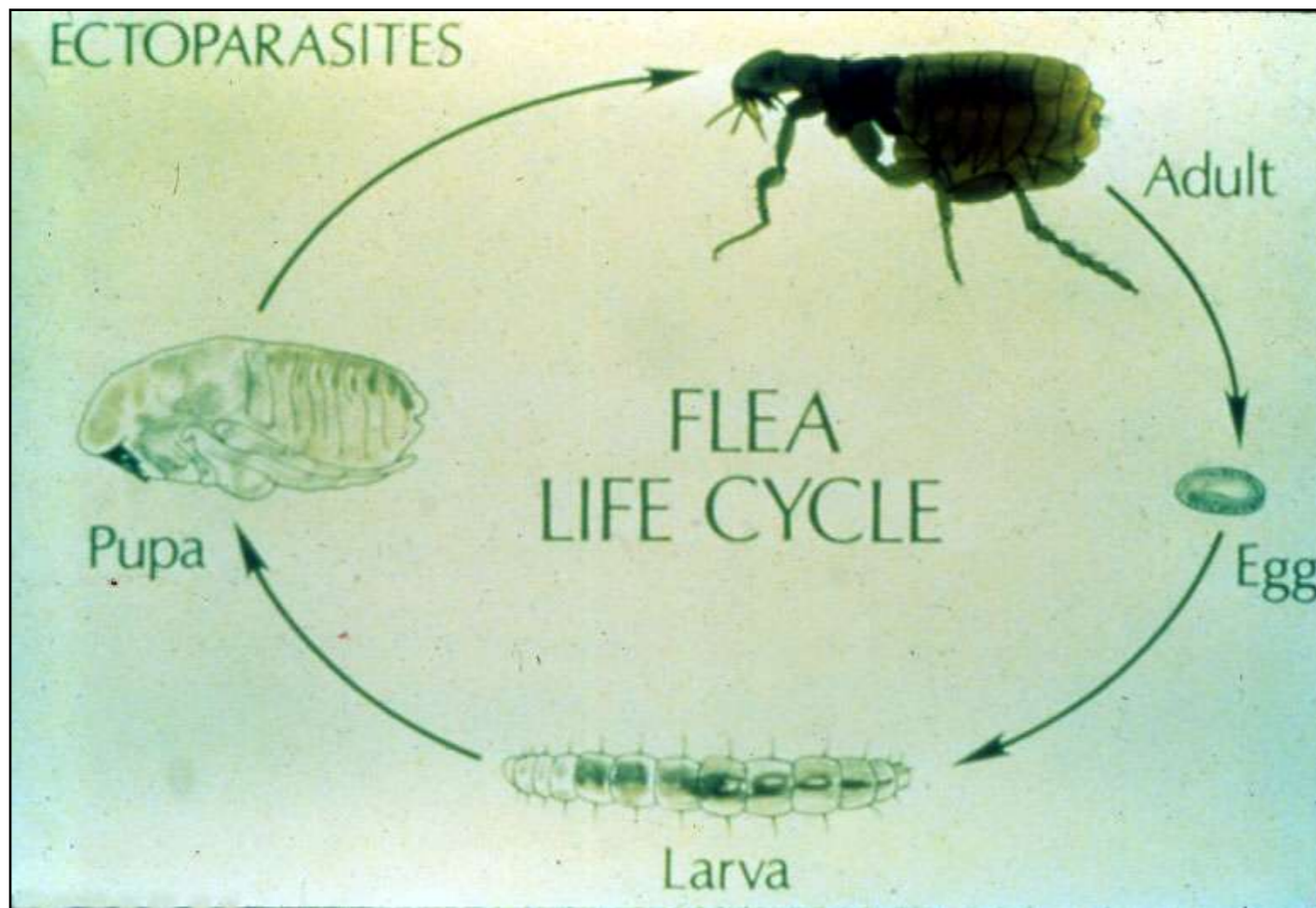
- *Accidental host*
- Wrong host species for this parasite
- If man – parasite is a **zoonosis**
 - Raccoon roundworms
 - Heartworms in cats.

Objective 2

Discuss types of parasitic life cycles

Life Cycles

Direct
Indirect

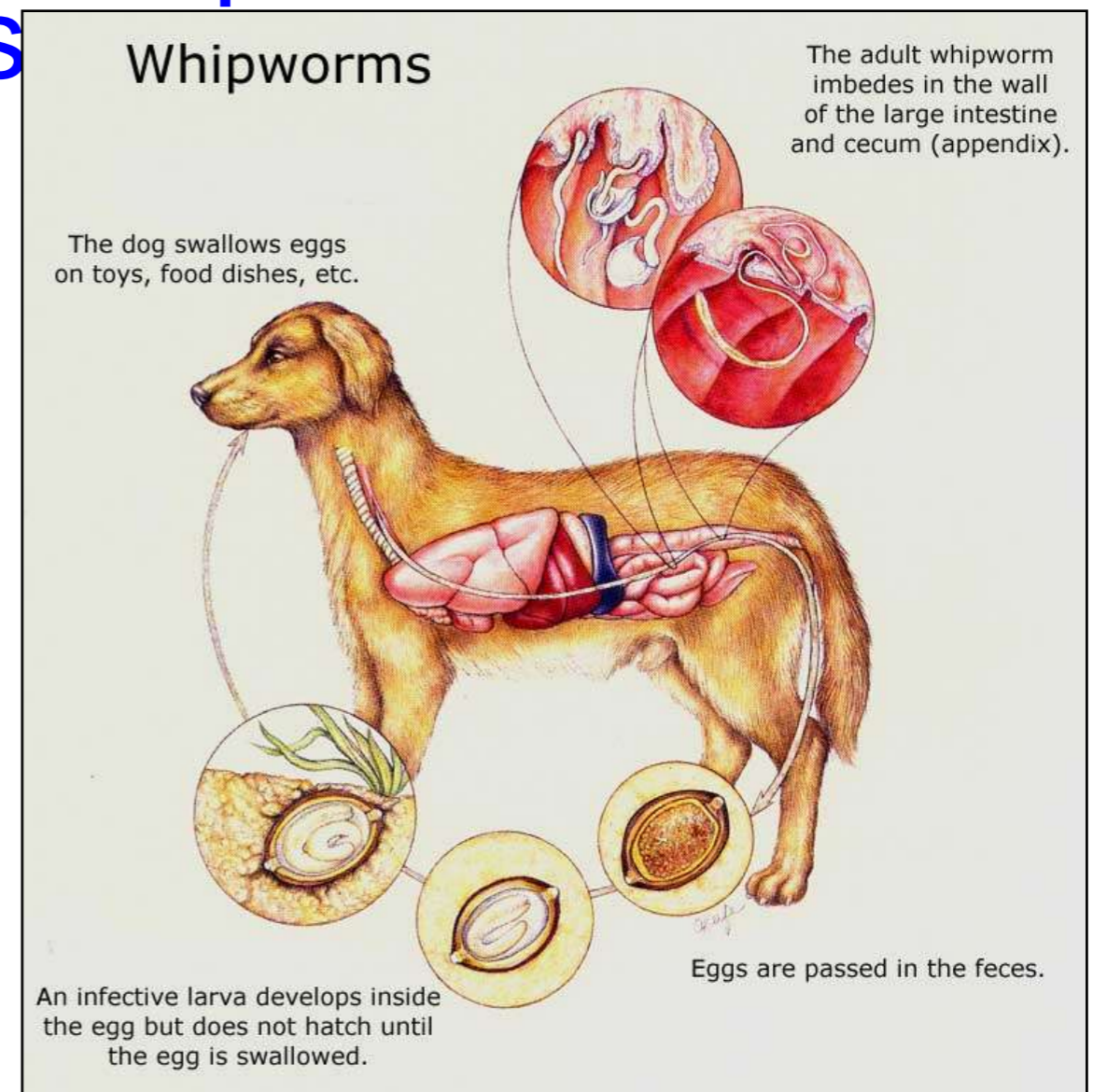


Life Cycles Overview

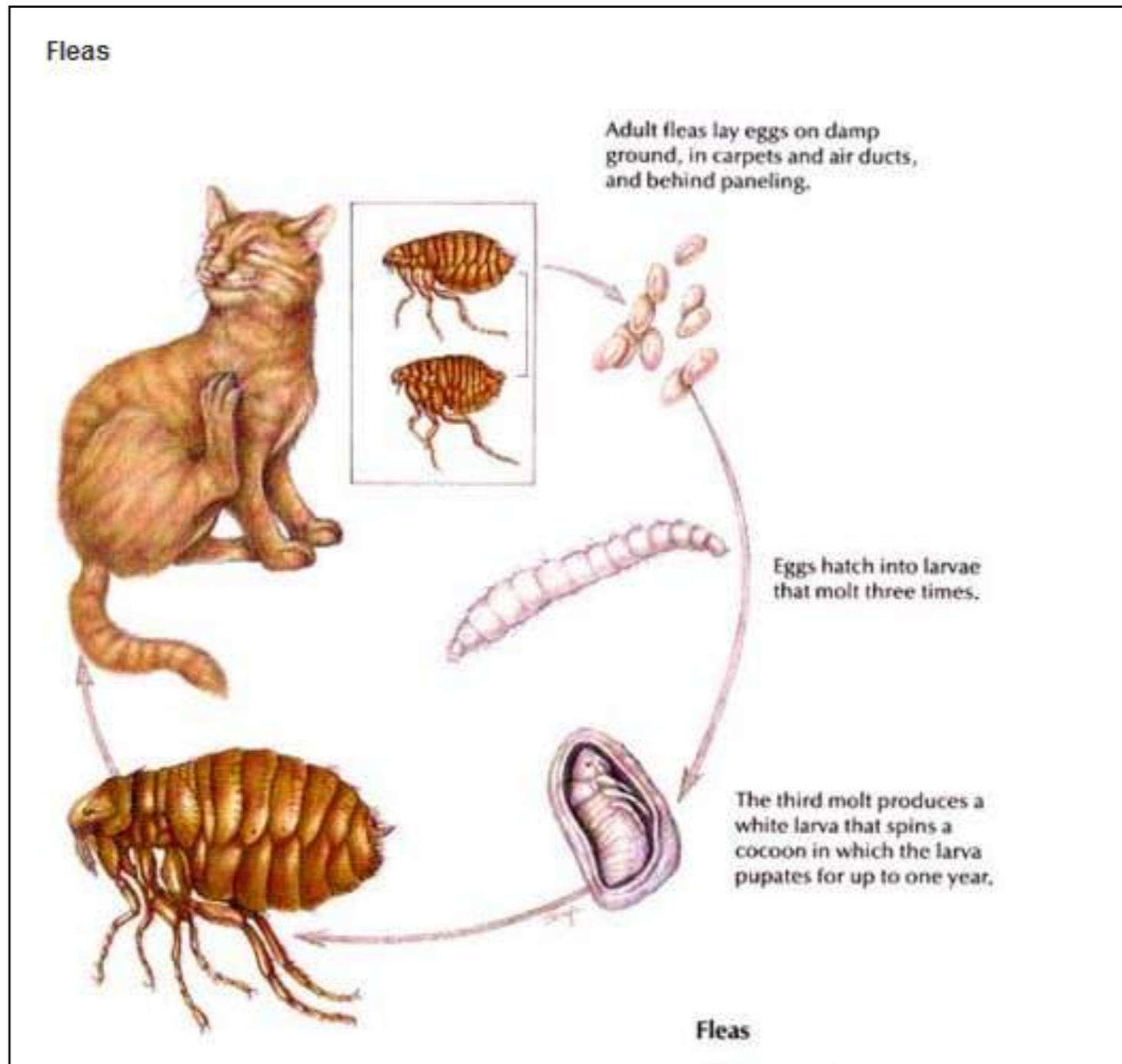
- Definition
 - The entire sequence of stages in the life of a parasite, from adults of one generation to adults of the next
- Parasite may be “Species Specific”
 - Affect only 1 species of host
 - Lice – species specific; fleas – not
- 2 types
 - Direct life cycles
 - Indirect life cycles

Direct Life Cycles

- Parasite transfers from one host to another **host of same s**
 - Dog to dog to dog, etc.
- **No intermediate hosts**
- Examples – fleas, whipworms



Direct Life Cycle – Fleas

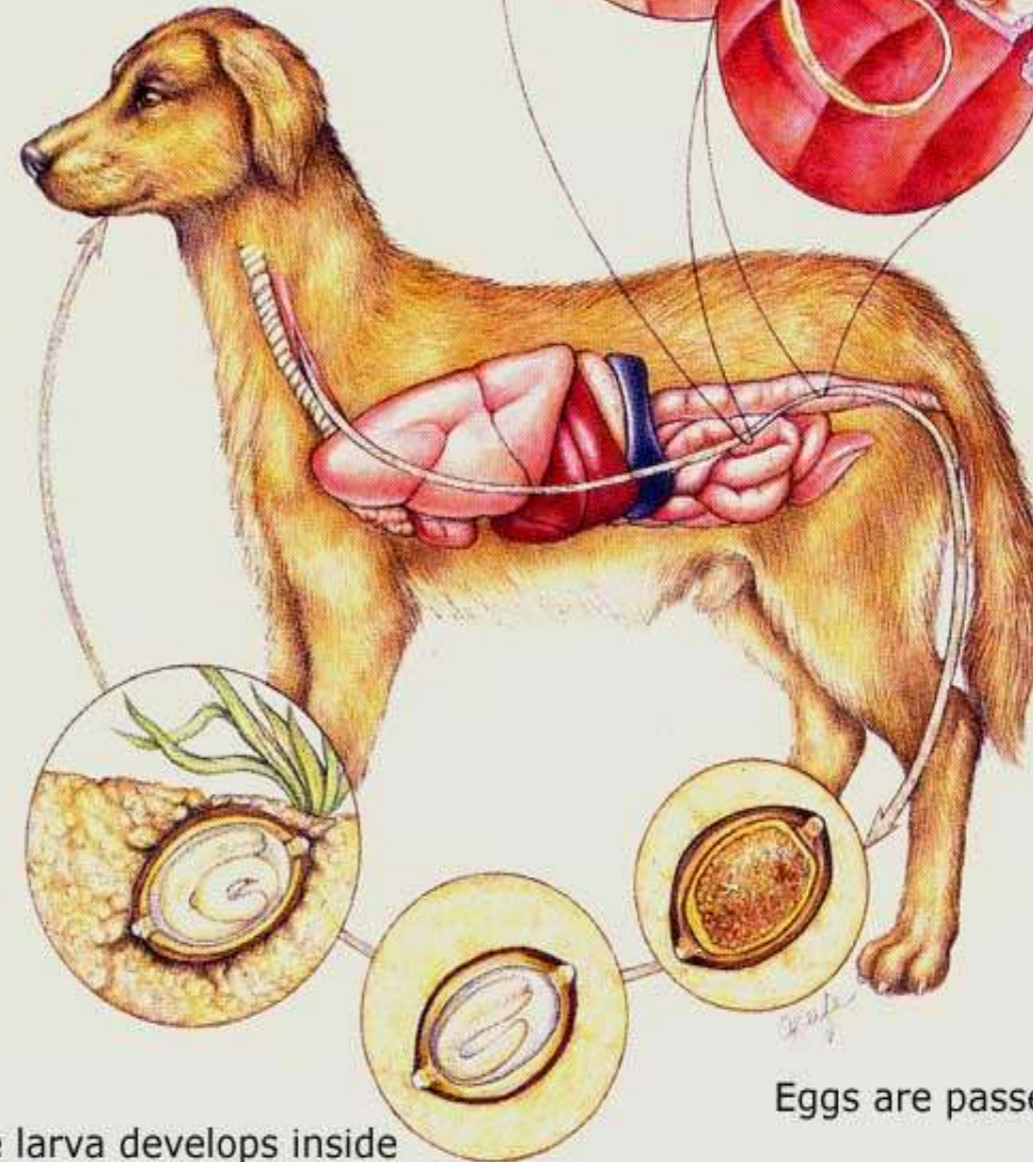


Direct Life Cycle – Whipworms

Whipworms

The adult whipworm imbeds in the wall of the large intestine and cecum (appendix).

The dog swallows eggs on toys, food dishes, etc.



Eggs are passed in the feces.

An infective larva develops inside the egg but does not hatch until the egg is swallowed.

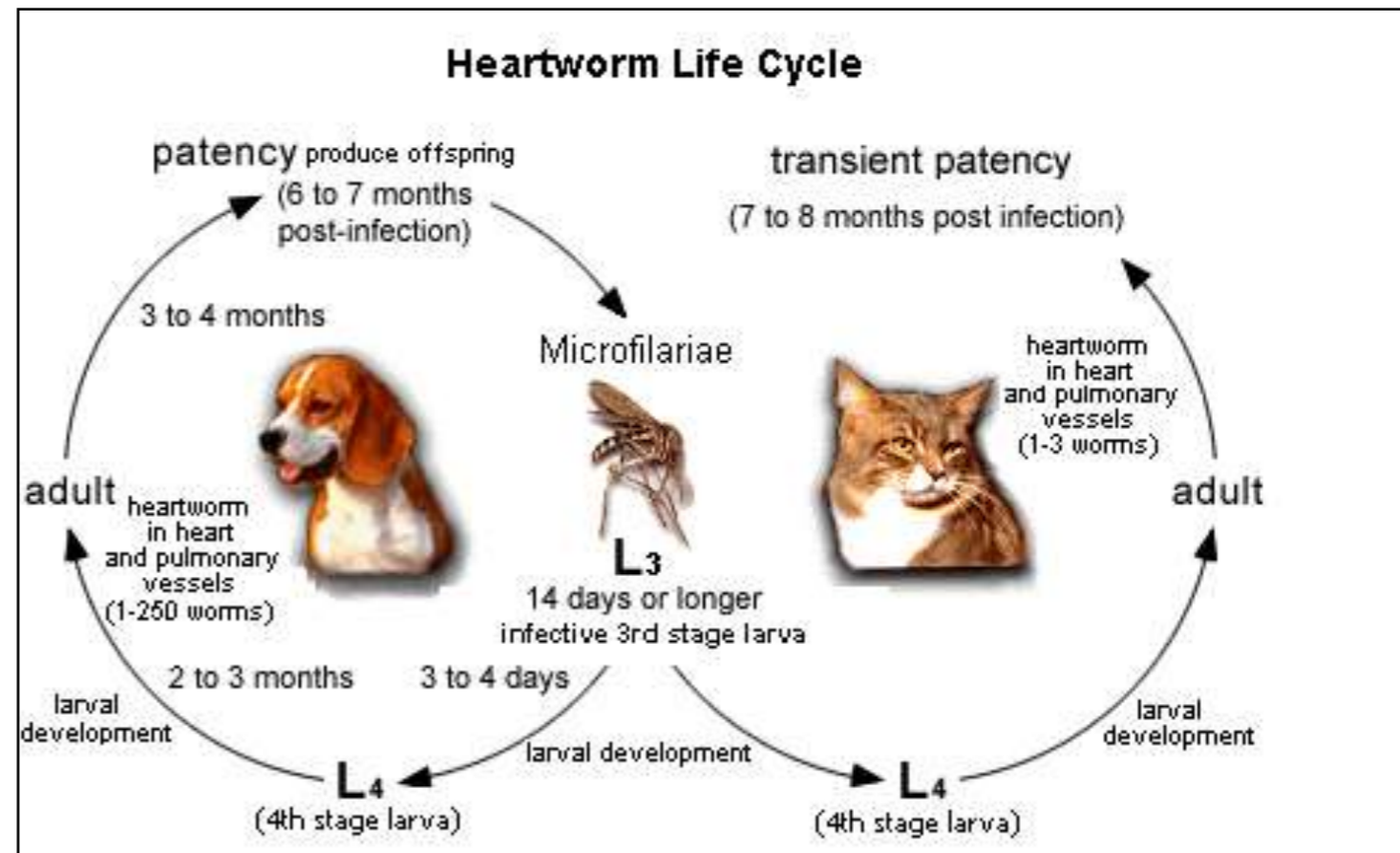
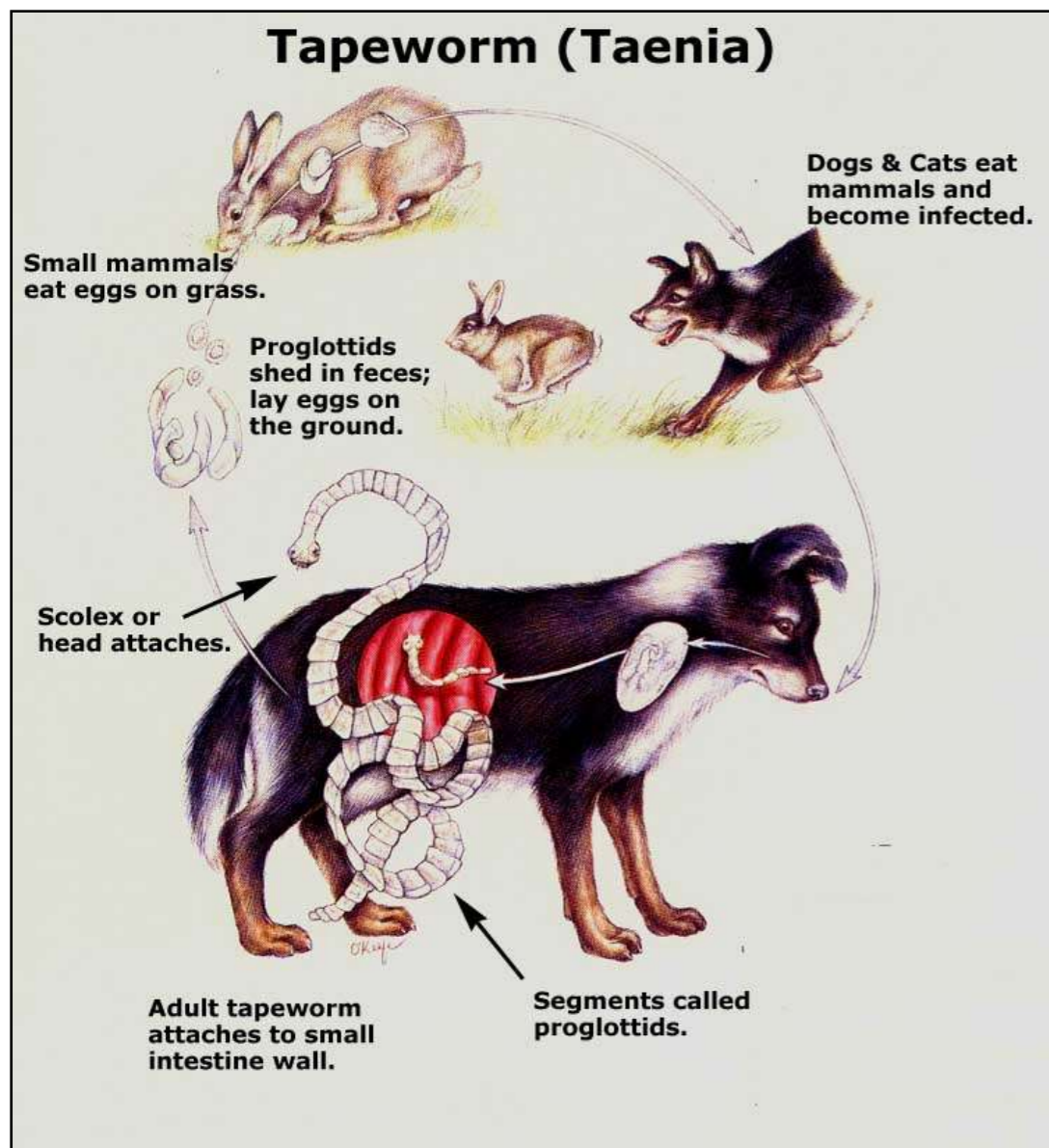
Indirect Life Cycles

(Figure 1-10, page 7)

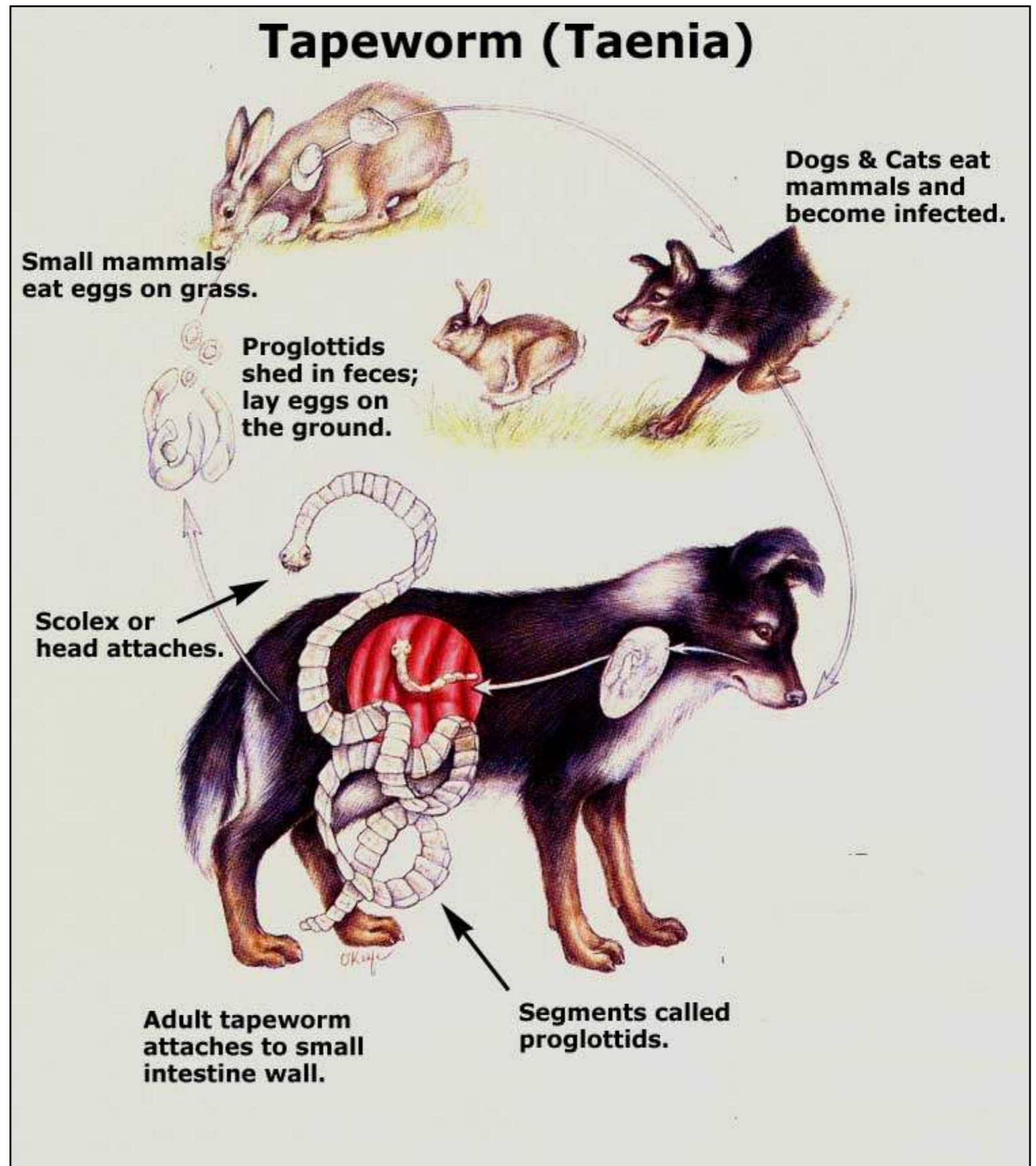
- Parasite requires at least 1 intermediate host to complete its life cycle
- Intermediate host harbors immature parasite
- Definitive host harbors adult parasite
- Examples – heartworms, **all tapeworms**, flukes
- **Client Education** – Best way to stop life cycle is to eliminate **intermediate host**

Indirect Life Cycles

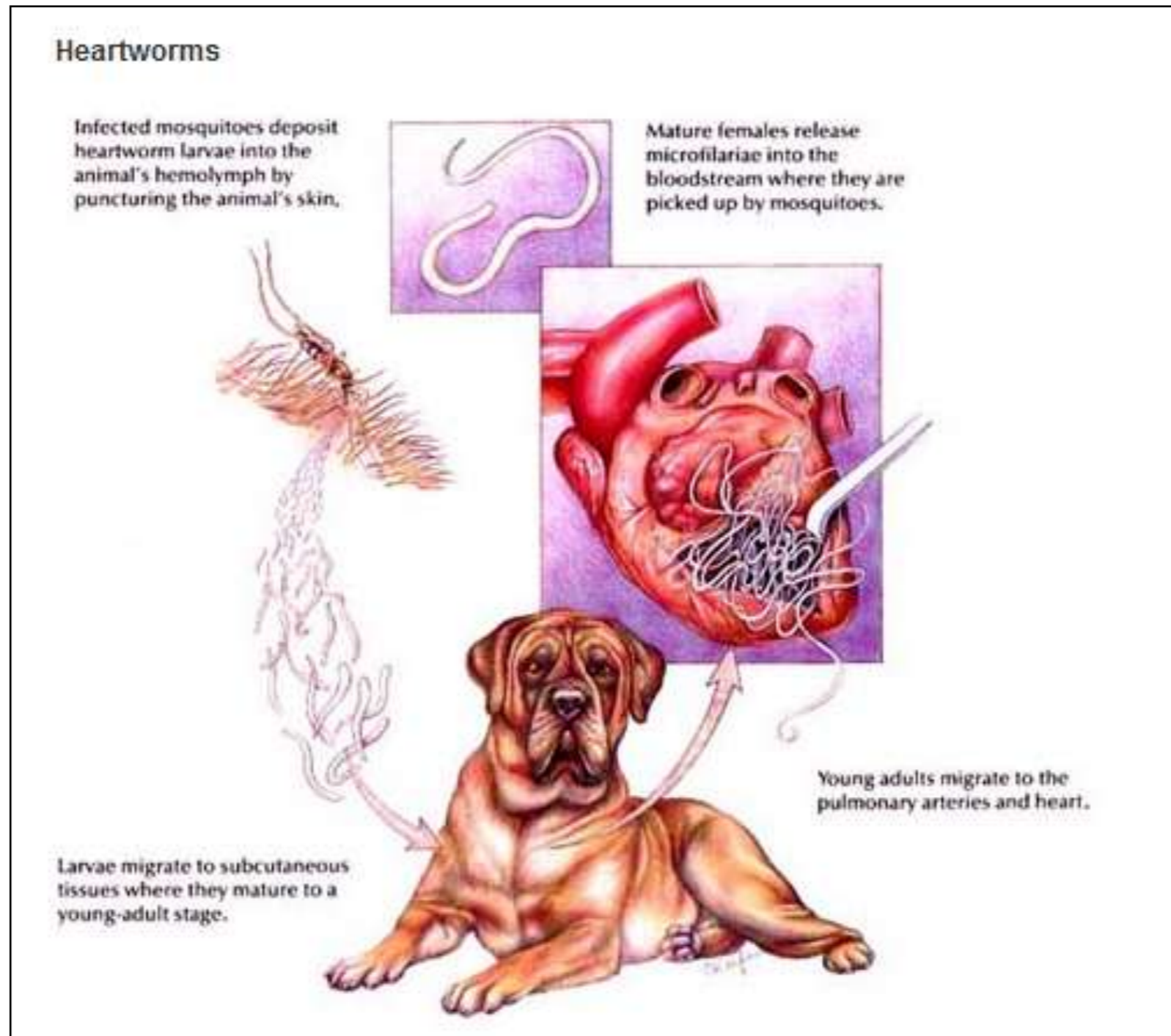
- Always have intermediate hosts



Indirect Life Cycle - Tapeworms

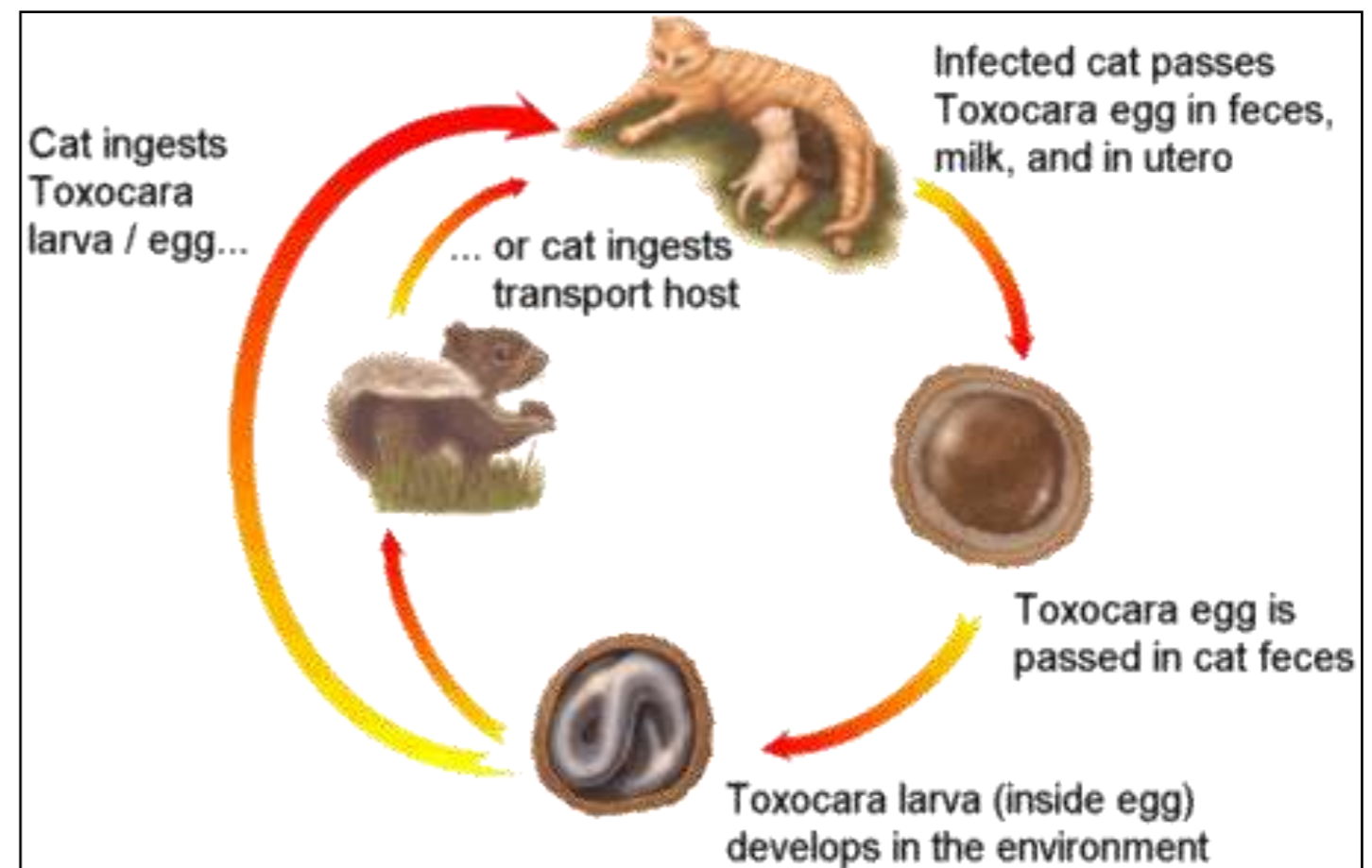
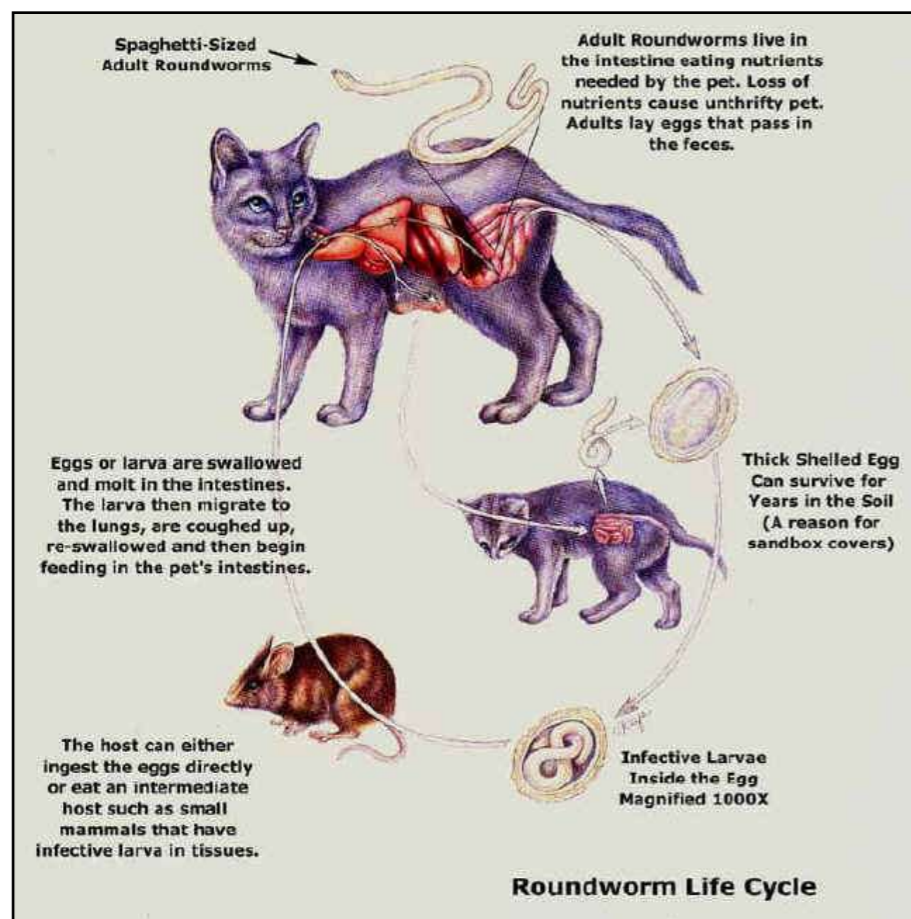


Indirect Life Cycle – Heartworms

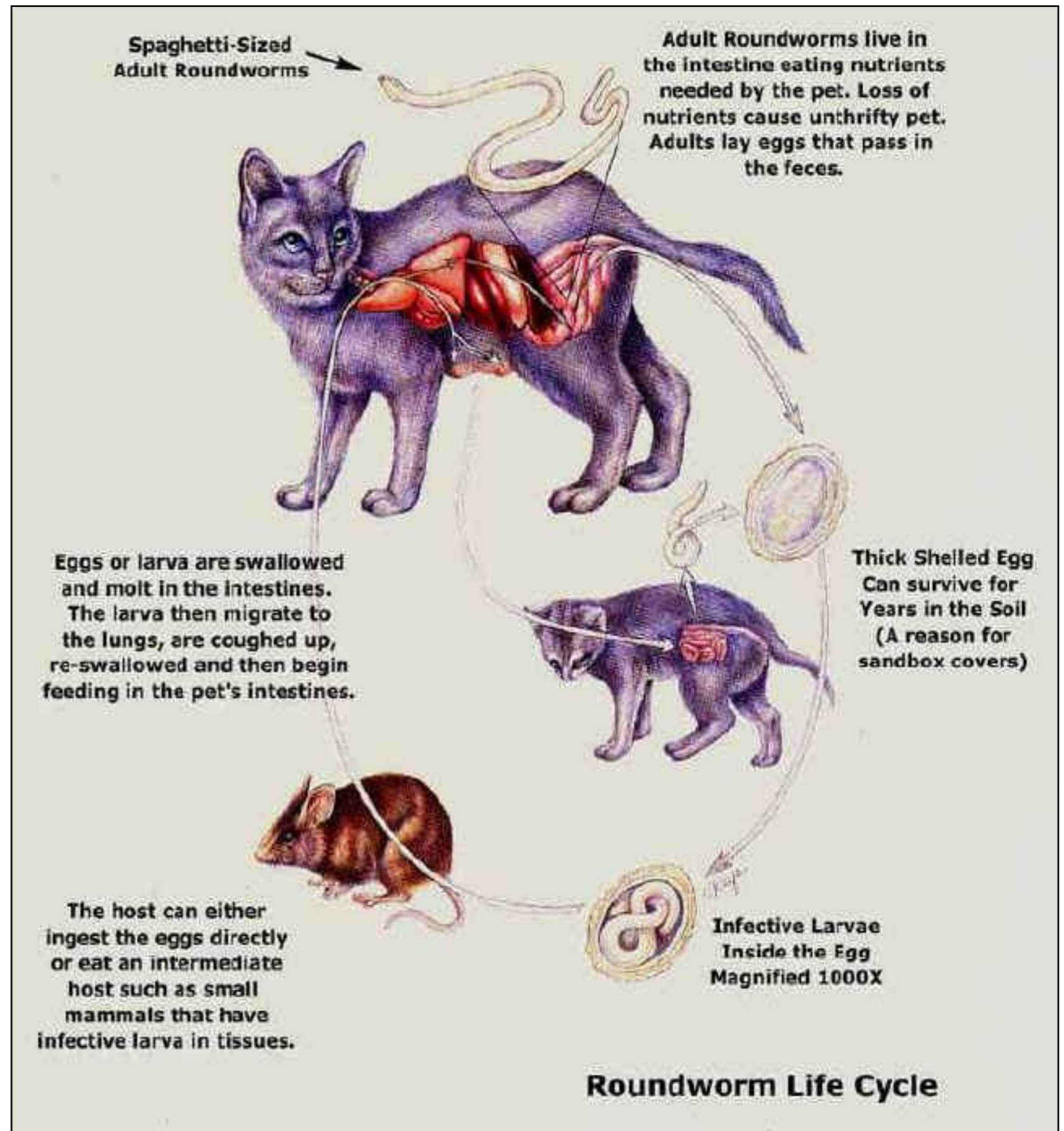


Parasites with Both Life Cycles

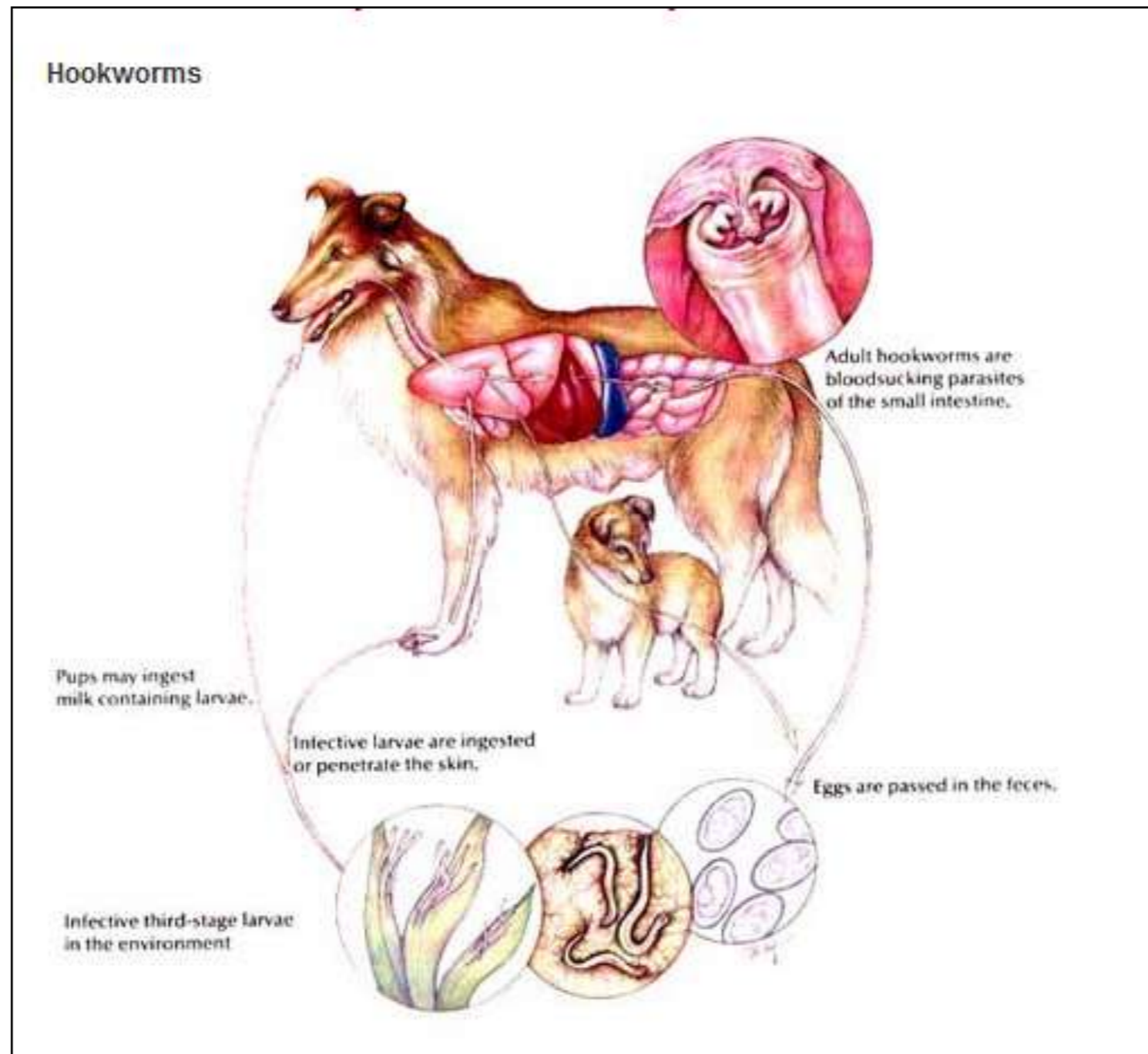
- Some parasites have both a direct as well as indirect life cycle
- Examples – roundworms, hookworms



Both
Direct and
Indirect Life
Cycles



Both Direct and Indirect Life Cycles – Hookworms



Parasite Transmission

Passive

Active

Inoculative

Passive vs. Active Transmission

- Definition – how parasites transfer from one host to another
- **Passive transmission**
 - Parasite does not travel to host
 - Usually ingested
 - Example – ascarids (roundworms)
- **Active transmission**
 - Parasite travels to host and/or aggressively penetrates host
 - Examples – fleas, hookworm larvae

Inoculative Transmission

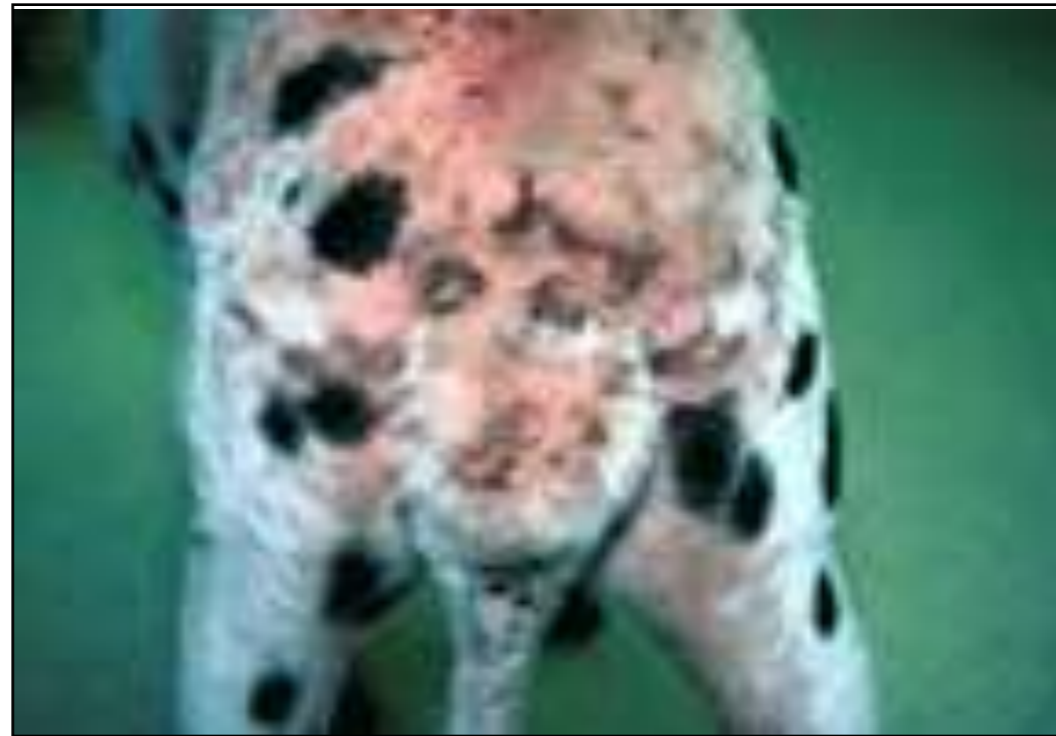
- Intermediate host “injects” parasite into definitive host
 - Called “vector”
 - Often takes blood from definitive host
 - Often has “sucking mouthparts”
 - Examples – mosquitoes, ticks, fleas?

Inoculative Transmission

- Blood-suckers!



Harmful Effects of Parasites



Harmful Effects of Parasites

- Blood loss
 - Hookworms, fleas
- Hypersensitivity (allergy)
 - Flea allergy dermatitis (FAD)
 - 15% of dogs & cats
 - Heartworms? Eosinophilia as high as 20%
- Toxicity
 - Maggots

Harmful Effects of Parasites

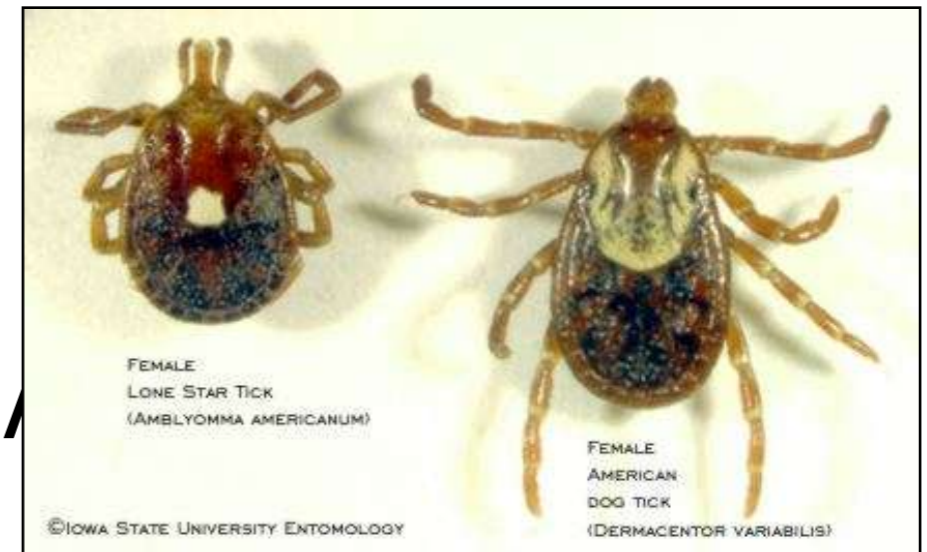
- Secondary invasion of pathogens
 - Bacterial infections after primary disease has begun
 - Example – generalized demodectic mange
- Disease transmission
 - Parasite vectors – carry disease to host
- Worry
 - Horse flies in the barn

Disease Vectors



- Mosquitoes

- Heartworms
- West Nile Virus
- Equine encephalitis
- Equine infectious anemia (EIA)

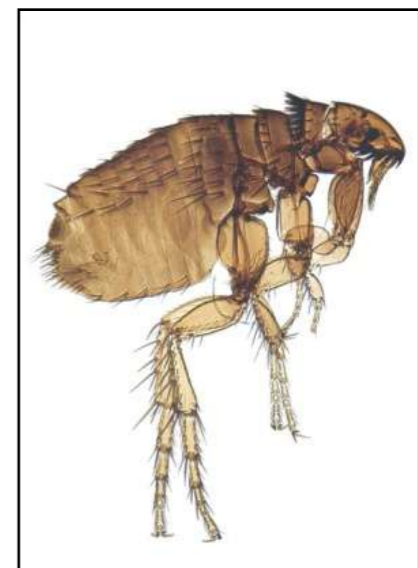


- Ticks

- Lyme disease
- Rocky mountain spotted fever

- Fleas

- Feline infectious anemia?



Objective 3

Describe the Linnaean
Classification Scheme used to
name and categorize organisms

Taxonomy

Scientific Classification of Parasites

Definitions

- **Taxonomy** – Branch of biology dealing with identifying, naming, and classifying species
- **Taxon** – One of the groups that organisms are classified into
- **Species** – Group of similar organisms capable of interbreeding and producing fertile offspring

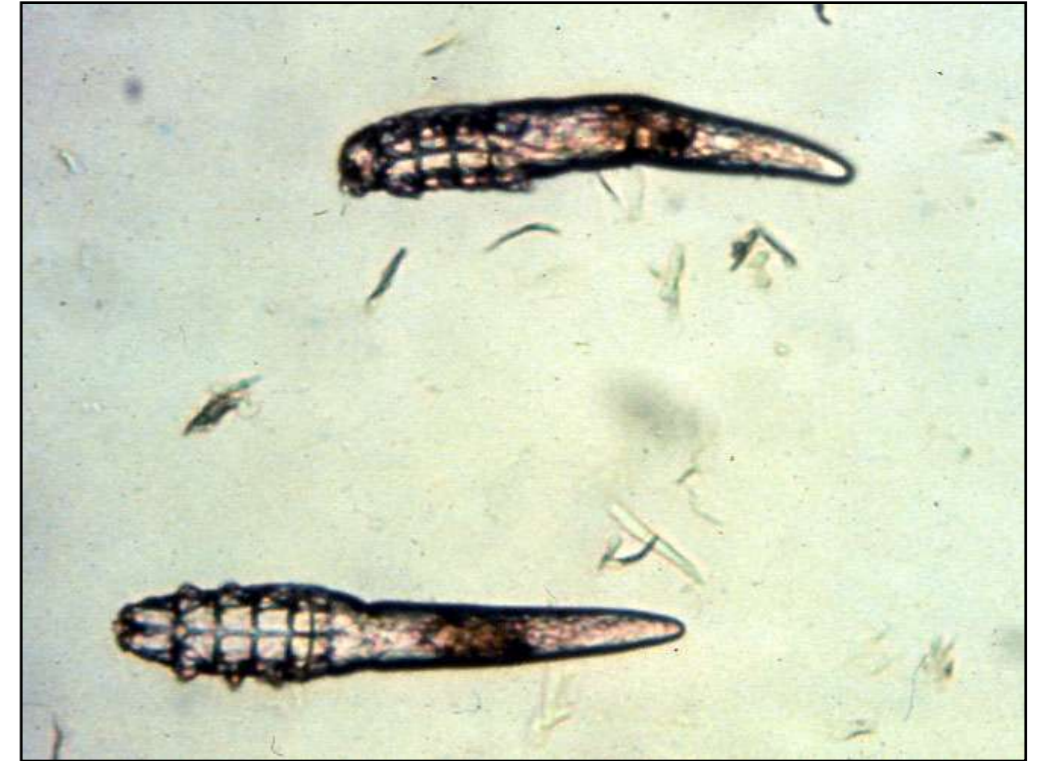
Classification of Parasites

- **Kingdom**
 - **Phylum**
 - **Class**
 - **Order**
 - » **Family**
 - Genus**
 - Species**

Worms!



Insects, Ticks, and Mites, Oh My!



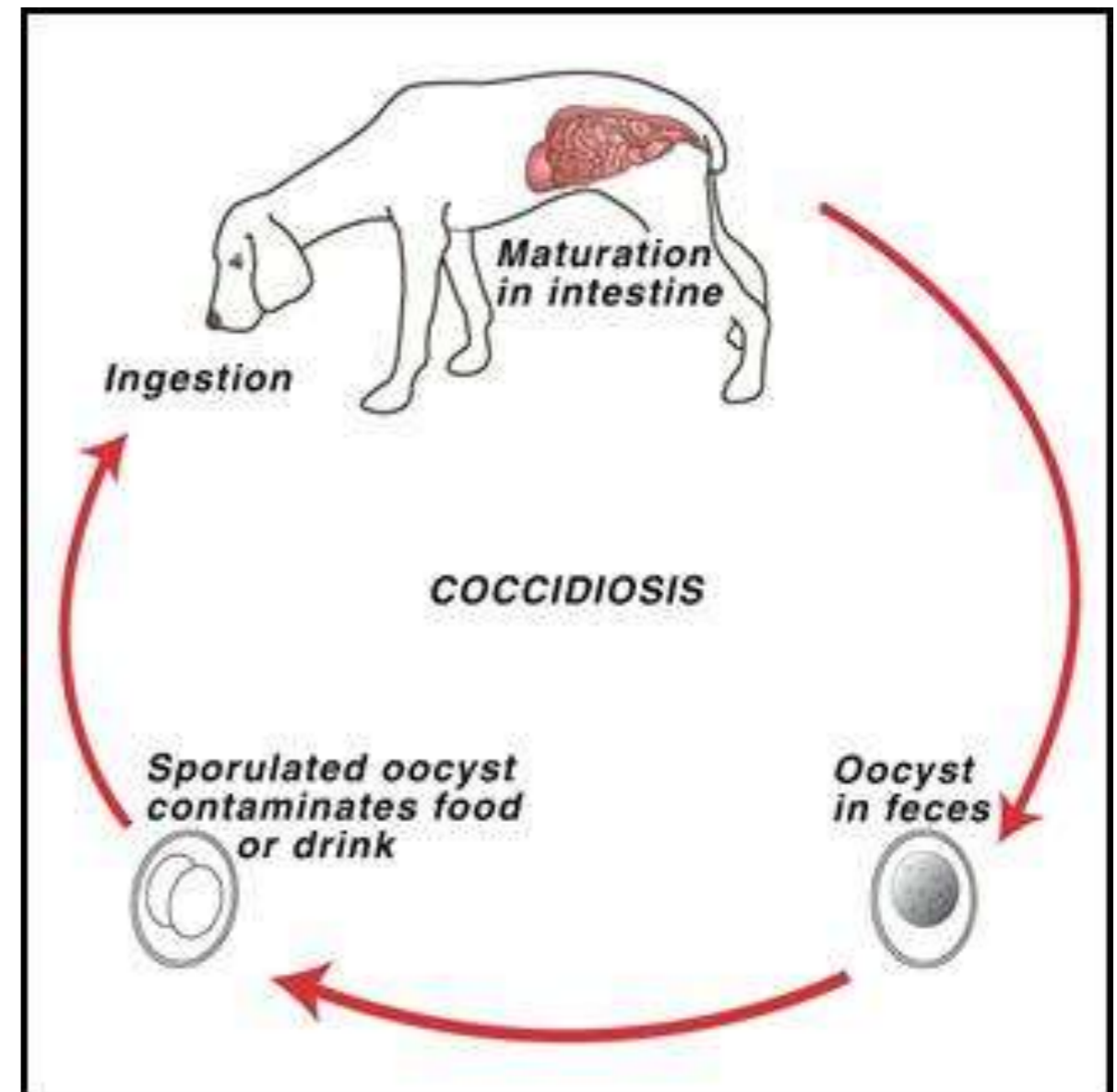


Protozoa



Toxoplasma
Full-Toxoplasma
Toxoplasma Full-Length cDNA Database
- *Toxoplasma gondii*

The illustration shows a silhouette of a pregnant woman. Inside her womb, a fetus is visible. Several oval-shaped oocysts are shown floating around the woman. Below the woman is a realistic illustration of a white cat with a red collar.



Classification of Parasites

- Kingdom **Protista** – single-celled organisms
- Kingdom **Animalia**
- Phylum
 - Platyhelminthes – flatworms – tapeworms
 - Archelminthes – nematodes
 - Arthropoda – animals with exoskeleton
 - Class Crustacea – no parasites here!
 - Class Insecta – fleas, flies, lice
 - Class Arachnida – ticks, mites

The Kingdoms

- **Protista** – Single-celled organisms
 - *Amoeba*
 - Coccidia
 - *Giardia*
 - *Toxoplasma*
- **Animalia** – Multi-cellular animals
 - Most parasites we will cover are here
 - Most animals are free-living, not parasitic

3 Phyla of Kingdom Animalia

- These 3 phyla have the parasites we will cover this semester
- Phylum Platyhelminthes – flatworms
- Phylum Archelminthes – roundworms (nematodes)
- Phylum Arthropoda – arthropods

- **Helminth** = “worm”
- Anthelmintic – wormer

Platyhelminthes – Flat Worms

- Characteristics

- Flat

- All hermaphrodites – need only 1 worm to continue life cycle

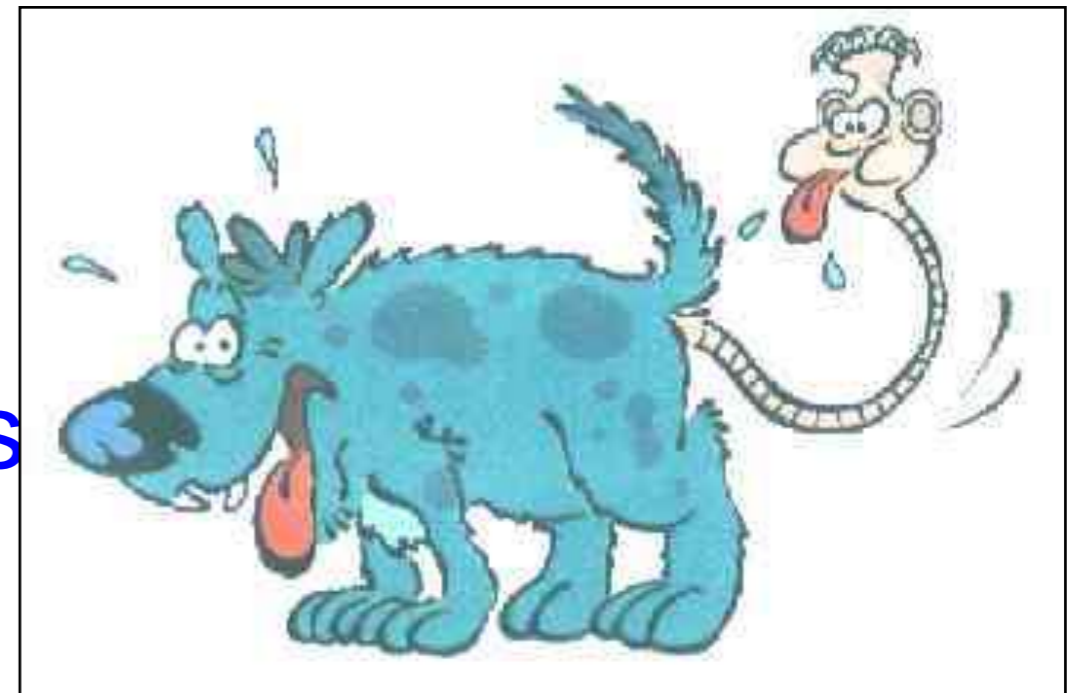


- Free-living – *Planaria*

- Parasites –

- Cestodes – all tapeworms

- Trematodes – flukes



Archelminthes – Nematodes

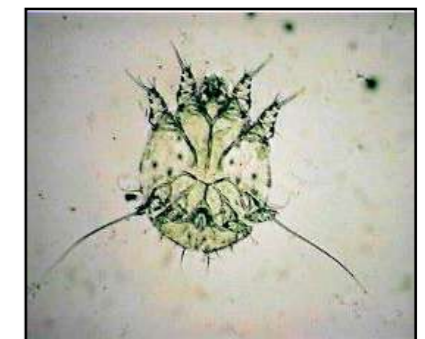
- Characteristics
 - Round (“roundworms”)
 - Separate male & female worms – Need at least 1 of each sex to continue life cycle
- Examples
 - Dog & cat ascarids (roundworms)
 - Hookworms (strongyles in horses)
 - Whipworms
 - Heartworms

Arthropods

- Characteristics
 - Jointed appendages
 - Exoskeleton (made of chitin)
- 3 classes in this phylum
 - Class crustacea – crustaceans – no parasites!
 - Class arachnida – arachnids
 - Class insecta – insects

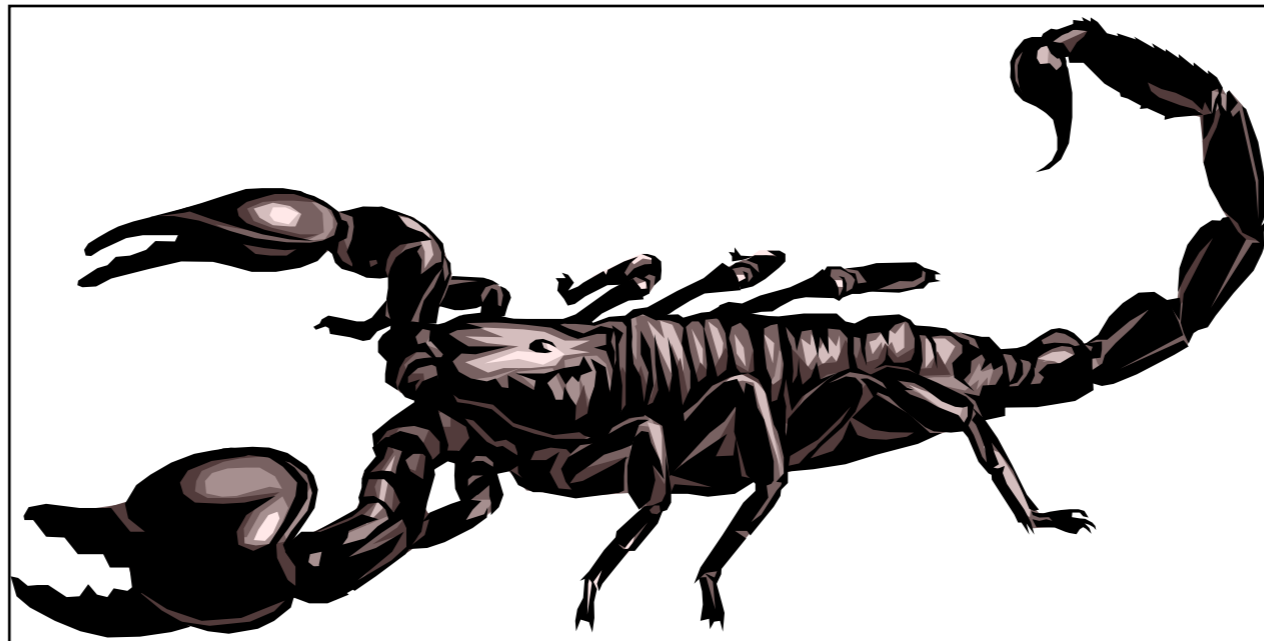
Class Arachnida

- Most free-living, some parasites
- Most live on land
- Characteristics
 - No wings
 - Most adults have 8 legs
- Examples
 - Spiders! 😊 (Arachnophobia anyone?)
 - Scorpions
 - **Ticks**
 - **Mites**



Arachnids

- Spiders – free-living
- Scorpions – free-living
- **Ticks** – parasites
- **Mites** – free-living & parasites



Scientific Names of Organisms

- Composed of 2 Latin names
 - 1st name – ***Genus***
 - 2nd name – ***species***
- Genus species
 - ***Genus*** name italicized, capitalized
 - ***species*** name italicized, NOT capitalized
- If italics are not used, each name must be underlined separately

Parasites of the Digestive Tract

Ascarids (Roundworms)	Host Species
<i>Toxocara canis</i>	Dog only
<i>Toxocara cati</i>	Cat only
<i>Toxascaris leonina</i>	Dog, cat
<i>Parascaris equorum</i>	Horse

Parasites of the Digestive Tract

Hookworms	Host Species
<i>Ancylostoma</i> spp.	Dog, cat
<i>Uncinaria stenocephala</i>	Dog, cat
<i>Strongylus vulgaris</i>	Horse
<i>Strongylus</i> spp.	Horse

Parasites of the Digestive Tract

Whipworms	Host Species
<i>Trichuris vulpis</i>	Dog only
<i>Trichuris suis</i>	Pig

Parasites of the Digestive Tract

Tapeworms	Host Species
<i>Dipylidium caninum</i>	Dog, cat
<i>Taenia</i> spp.	Dog, cat
<i>Echinococcus granulosus</i>	Dog only
<i>Diphyllobothrium latum</i>	Dog, cat

Parasites of the Digestive Tract

Protozoa	Host Species
<i>Isospora</i> spp.	Dog, cat
<i>Eimeria</i> spp.	Dog, cat
<i>Giardia</i> spp.	All animals, man
<i>Toxoplasma gondii</i>	Cat
<i>Trichomonas</i> spp.	Dog, horse

External Parasites – Class Insecta

- Fleas
 - *Ctenocephalides canis*
 - *Ctenocephalides felis*
- Lice
- Flies
 - Mosquitoes
 - Horse flies, deer flies, stable flies
 - Maggots
 - *Cuterebra* larvae
 - Screwworms

External Parasites – Class Arachnida

- Ticks
 - *Rhipicephalus sanguineus*
 - *Amblyomma americana*
 - *Ixodes* spp. – Lyme disease tick
 - *Dermacentor* spp.
- Spiders
 - **NO SPIDERS ARE EVER PARASITES!!!** 😊

External Parasites – Class Arachnida

Mites

<i>Otodectes cynotis</i>	Ear mite
<i>Demodex</i> spp.	Demodectic mange mite
<i>Sarcoptes scabiei</i>	Sarcoptic mange mite
<i>Cheyletiella</i> spp.	Walking dandruff mite
<i>Notoedres cati</i>	Cat mange mite
<i>Trombicula alfreddugesi</i>	Chigger mite

Parasites of Other Organ Systems

<i>Dioctophyma renale</i>	Giant kidney worm
<i>Capillaria plica</i>	Bladder worm
<i>Capillaria aerophila</i>	Lung worm
<i>Paragonamus kellyi</i>	Lung fluke
<i>Spirocerca lupi</i>	Esophagus worm
<i>Physaloptera rara</i>	Stomach worm
<i>Linguatula serrata</i>	Nasal cavity

Objective 4

Identify laboratory procedures
used to diagnose parasites

Your Domain as a Clinical Laboratory Technician

Common Laboratory Tests

Fecal Exams

Blood Testing

Skin Tests

Parasite Control Fundamentals at CAPC website

- Annual/semi-annual fecal exams
- Fresh daily stool pickup
- Sanitation & good personal hygiene
- Annual heartworm checks/year-round prevention
- Year-round flea/tick control if needed
- Zoonosis concerns