VMP 930
Veterinary Parasitology

(aka Infection & Immunity III)

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(Office hours by appointment)
Studies in Infectious Diseases

- Microbiology
  - Virology
  - Bacteriology
  - Mycology
- Parasitology
  - Medical & Veterinary Protozoology
  - Helminthology
  - Medical & Veterinary Entomology
Parasites in Practice

- In a veterinary practice how much effort & time is spent on Parasite issues?
  - What parasites are often diagnosed in a veterinary practice?
  - What parasites do veterinary practices often try to manage?
Parasitism

- Intimate relationship between two hetero-specific organisms, in which the parasite, usually the smaller symbiont, is metabolically dependent on the host.

- One symbiont (host) is harmed, while the other symbiont (parasite) benefits.
Parasite Impact on the Host

- Pathogenesis
  - Production or Development of Disease

- Forms of Pathogenesis
  - Trauma
  - Nutrient Robbing
  - Toxin Production
  - Interactions with Host immune / Inflammatory responses.

- Etiologic Agent - the agent that elicits DZ
Important concepts of Parasitic Infections

- Infection = presence of an agent that has the ability to cause disease
- Disease = the occurrence of dysfunction
- Infectious = capable of causing infection
- Infection ≠ Infectious ≠ Disease
Infection, Disease, and/or Infectious?

A. The dog showed no adverse symptoms to the 2 female *Dirofilaria immitis* in its right ventricle.  
   **Infection**

B. 1,000 juvenile *Haemonchus contortus* were causing severe anemia in the lamb.  
   **Infection + Disease**

C. Cats suffering from large bowel diarrhea due to *Tritrichomonas blagburni* pass active trophs in their stool.  
   **Infection + Disease + Infectious**

D. After using the bathroom, she was horrified to see that she had passed several active proglottids of the beef tapeworm, *Taenia saginata*.  
   **Infection**
Protozoa

**Microparasites**
- Small (single cell) parasites
  - (Protozoa, [bacteria, viruses])
- Intracellular & Extracellular
- Individual organisms *Multiply in the host.*
  - “mechanism” of protozoan induced pathology
Giardia sp. & other extracellular protozoa

Pathology:
Host organ dysfunction

Replication (binary fission)
Coccidian Pathology

Pathology:
Cellular trauma
Organ dysfunction
Babesia canis

Injected when tick takes a blood meal

Tick Intermediate Host

Organisms within Erythrocytes

Ingested when tick takes a blood meal
Trematodes

- Macroparasites
  - Large parasites
  - Individual ADULT organisms do Not multiply in the host.
Fasciola hepatica
Dicrocoelium dendriticum

Prepatent
80 days
Cestodes

- Macroparasites
  - Large parasites
  - Individual ADULT organisms do **not** multiply in the host.
Taenia pisiformis

Prepatent 56 days
Nematodes

- **Macroparasites**
  - Large parasites
  - Individuals do Not multiply in the host.
**Strongyloides ransomi**

- Oral penetration
- Skin penetration
- Transmammary to piglets via arrested larvae in maternal tissues
- Prepaeptent in 5-7 days
- Ova in Piglet Feces
- Infective L3 larvae
- Homogonic Cycle 1 day
- L2 Environment
- Male & Female in the Environment
- Heterogonic Cycle 3 days
- L1 Environment
- L1 in Environment
- Free-living larvae in the Environment
Trichuris vulpis

Ingestion

Prepatent period: 3 months

about 1 month to infectivity
**Haemonchus contortus**

1. **L3 Larvae ingested while host is grazing**
2. **Prepatent in 3 weeks**
3. **L1 to L3 Larvae in the Environment**
4. **Intectivity in 4 to 6 days, pending environmental conditions**
5. **Ova passed in the feces**
6. **Ovum**
**Ancylostoma caninum**

- **Ingestion of infected paratenic host**
- **Adult worms in the small intestine.**
- **Transmammary to puppies via arrested larvae in maternal tissues**
- **Prepatent in 15 to 18 days**

**Migrating larva can cause Cutaneous Larval Migrans**

**Infective larva penetrates the skin or are ingested.**

**Infective larva penetrates exposed skin**

**Develop to Infective Larvae in 5-7 days**

**Ovum**

**Ova passed in the feces.**

**Infective larvae in the environment.**

**Reptiles Paratenic Hosts**

**Rodents**
Toxocara canis

Ingestion of infected paratenic host

Reptiles
Rodents
Paratenic Hosts

Transuterine
Prepatent 3 weeks if transuterine
4-5 weeks if ingested

Transmammary very minor

Ingestion of infective egg

Migrating larvae can cause Visceral Larval Migrans

Infective in 4 weeks

Ova in Feces

Ingestion of infective egg

Ingestion of infective egg

Ingestion of infective egg

Ingestion of infective egg

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**Oxyuris equi**

- **Ingestion**
- **Prepatent period**: 5 months
- **Infected in**: 4 to 5 days
- **Ova deposited on perianal area**
- **Ova on environmental structures & in Feces**
- **Irritated horse rubs ova on environmental structures**
Physaloptera rara

Paratenic Hosts

Intermediate Host

Ingestion

Prepatent 2 to 3 months

Ova in Feces

Infective L3 Larvae in Beetle

Ingestion

Ingestion

Ingestion

Ingestion

Ingestion

Ingestion

Ingestion

Ingestion

Ingestion
**Dirofilaria immitis**

- **Mosquito Intermediate Host**
  - (Microfilaria to Infective L3)

- **L3 Larvae** enter dermis when infected mosquito feeds.

- **Prepatent Period**
  - 6 Months

- **Ingestion of Microfilaria**

- **Microfilaria in Blood Stream**
Arthropods

- **Macroparasites**
  - Large multicellular parasites
  - *Individual organisms* do *Not multiply* / replicate in or on the host.
  - Although the pathology of some arthropods (mites & lice) is due to their reproduction on the host.
  - **Vectors for other disease agents**
**Trichodectes canis**

- **Adults**
  - Eggs (Nits) attached to Hair
  - All Stages occur on the Host's Integument
  - Nymphs hatch from nits in about 5 days

- **Transmission to Other Hosts** via Direct Contact or Infested Grooming Tools
Ctenocephalides felis

- Adult
- Eggs & Flea frass in Environment
- Larvae & Flea frass in Environment
- Pupae in Cocoons in Environment
Demodex canis

- Eggs
- Larva
- All Stages occur in the Host's Follicles and Sebaceous Glands
- Protonymph
- Deutonymph
- Adults
- Transmission to Other Hosts via Direct Contact
Dermacentor variabilis

Adults attack, feed, & mate on 3rd host

Engorged female drops off host & lays eggs

Eggs hatch in environment

Larvae attack & feed on 1st host

Larvae drop off & molt to nymphs

Nymphs attack & feed on 2nd host

Nymphs drop off & molt to adults
Controlling Parasites

Assume you are working at a Wildlife Rehab facility with limited funds for the treatment of parasites.

1. Which of the following 3 parasites would likely cause the most concern for re-infection & a build-up of parasites?

2. What steps would you take to control reinfection?
Concern for reinfection, build up of large parasite population in the host?

- low concern
- ++ moderate concern
- +++ high concern

Cruzia americana

Ingestion

Ova in Feces
Didelphodiplostomum variable

Concern for reinfection, build up of large parasite population in the host?

+ low concern
++ moderate concern
+++ high concern
Concern for reinfection, build up of large parasite population in the host?

- low concern
- ++ moderate concern
- +++ high concern

**Physaloptera turgida**

Ingestion

Paratenic Hosts
- Frogs & Toads
- Rodents
- Reptiles

Intermediate Host
- Ova in Feces
- Infective L3 Larvae in Beetle

Ingestion
Take Home

Importance of knowing life cycles for successful clinical cases and disease control.

Concepts that should become “second nature”:

- Infection v/s Infectious v/s Disease
- Host Specificity: Low v/s High
- Life Cycles: Direct v/s Indirect
Take Home

- **Concepts & Definitions that should become “second nature”:**
  - Patent v/s Prepatent
  - Stage: Larval v/s Adult
  - Hosts: Definitive v/s Intermediate v/s Paratenic
  - Zoonosis