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
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 foetus* 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
Coccidia (*Eimeria bovis*)

1. **Ingestion**
2. **Unsporulated oocysts passed in feces**
3. **Sporulation in 2-3 days**
4. **Sporulated Oocyst**
5. **Unsporulated Oocyst**
6. **Oocysts passed in the feces**
Macroparasites

Large parasites

Individual ADULT organisms do not multiply in the host.
Dicrocoelium dendriticum

Prepatent 80 days
Cestodes

- Macroparasites
  - Large parasites
  - Individual ADULT organisms do Not multiply in the host.
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
- Prepent in 5-7 days
- Ova in Piglet Feces

- Infective L3 larvae
- L2 Environment
- Homogonic Cycle 1 day
- L1 Environment
- L1 in Environment
- Heterogonic Cycle 3 days
- Free-living larvae in the Environment
- Male & Female in the Environment
- L1 in Environment

- Veterinary Parasitology Group
Trichuris vulpis

Ingestion

Prepatent period: 3 months

about 1 month to infectivity
Haemonchus contortus

L3 Larvae ingested while host is grazing

Prepatent in 3 weeks

L1 to L3 Larvae in the Environment

Intectivity in 4 to 6 days, pending environmental conditions

Ova passed in the feces

Ovum
Ancylostoma caninum

Migrating larva can cause Cutaneous Larval Migrans

Infective larva penetrates the skin or are ingested.

Develop to Infective Larvae in 5-7 days

Transmammary to puppies via arrested larvae in maternal tissues

Prepatent in 15 to 18 days

Infective larvae in the environment.

Ova passed in the feces.

Ingestion of infected paratenic host

Adult worms in the small intestine.

Reptiles Paratenic Hosts

Rodents

Infected larva penetrates exposed skin

Ovum

Ova
Toxocara canis

Ingestion of infected paratenic host

Reptiles
Paratenic Hosts

Rodents

Transmammary very minor

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

Ingestion of infective egg

Migrating larvae can cause Visceral Larval Migrans

Ingestion of infective egg

Infective in 4 weeks

Ova in Feces

Ingestion of infective egg

Ingestion of infective egg
**Oxyuris equi**

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

Paratenic Hosts

Intermediate Host

Ingestion

Prepatent 2 to 3 months

Ova in Feces

Infected L3 Larvae in Beetle

Frogs & Toads

Reptiles

Rodents

Ingestion
**Dirofilaria immitis**

- **L3 Larvae enter dermis when infected mosquito feeds.**
- **Prepatent Period 6 Months**
- **Mosquito Intermediate Host (Microfilaria to Infective L3)**
- **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

Eggs (Nits) attached to Hair

All Stages occur on the Host's Integument

Transmission to Other Hosts via Direct Contact or Infested Grooming Tools

Adults

Nymphs hatch from nits in about 5 days

VETERINARY PARASITOLOGY GROUP
Ctenocephalides felis

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

- Dog
- Cat
- Fox

**Veterinary Parasitology Group**
Demodex canis

- Eggs
- Larva
- Adults
- Deutonymph
- Protonymph

All Stages occur in the Host's Follicles and Sebaceous Glands

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_
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**

Paratenic Hosts

Frogs & Toads

Reptiles

Rodents

Ingestion

Intermediate Host

Ingestion

Ova in Feces

Ingestion

Infected L3 Larvae in Beetle
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