Introduction to the helminth parasites
BVM&S Parasitology
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Why are helminths important?
• Production losses due to
  – Competition for nutrients
  – Damage to body systems e.g. gut, liver
  – Death
• Animal welfare
  – Companion animals
  – Food animals
• Public health (zoonotic infections)

Lecture topics
• Diagnosis & disease
  – Morphology
  – Feeding
  – Reproduction
  – Behaviour in the host
• Epidemiology & control
  – Life cycles
  – Survival strategies

Morphology
• External features
  – Size
  – Shape
  – Functional anatomy
• Internal features
  – Outer layer
  – Structural
  – Functional

Taxonomic Relationships of the Helminth Parasites

<table>
<thead>
<tr>
<th>Parasitic Helminths</th>
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<tbody>
<tr>
<td>Platyhelminthes</td>
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<tr>
<td>“Flukes”</td>
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<tr>
<td>Cestodes</td>
</tr>
<tr>
<td>“Tapeworms”</td>
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<tr>
<td>Trematodes</td>
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<tr>
<td>“Liver flukes”</td>
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<tr>
<td>Nematodes</td>
</tr>
<tr>
<td>“Roundworms”</td>
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<tr>
<td>“Hookworms”</td>
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<tr>
<td>“Pinworms”</td>
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<tr>
<td>Acanthocephala</td>
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<td>“Spiny-headed worms”</td>
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</tbody>
</table>

Where do helminths live?

- Brain: Tapeworm larvae
- Muscle: Tapeworm larvae
- Lungs: Flukes, Tapeworm larvae
- Blood: Flukes, Filarial worms
- Liver: Fluke, Tapeworm larvae, Nematodes
- Abomasum: Nematodes
- Small intest: Nematodes, Adult tapeworms
- Large intest: Nematodes, Adult tapeworms
- Skin: Filarial worms
- In the environment: Tapeworm larvae

Introduction to the helminths
Same parasite - different appearance

- Adults
  - Males
  - Females
- Eggs
- Juvenile
  - Cysts
  - Larvae

Feeding

- Passive feeders
- Browsers
- Tissue feeders
  - Solid tissues
  - Blood

Reproduction

- Asexual
  - Multiplication
  - Parthenogenesis
- Sexual
  - Monoecious
  - Dioecious

Behaviour in the host

- Non-migratory
- Migratory
  - Hepato-tracheal
  - Somatic

Life cycles

- Direct
- Indirect
  - Definitive Host
  - Intermediate host
  - Arthropod (vector) borne

Example of a simple, direct life cycle

Adults

Egg

L1

L2

L3

L4

L5
Example of a complex, indirect life cycle

Definitive host ingests ant while grazing
Eggs pass out in faeces
Larval stage develops inside egg
1st intermediate host ingests egg
Larval stage passed out in slime ball
2nd intermediate host ingests slime ball

Introduction to the helminths

Host types

- **Definitive host**
  - Host where adult stages develop
- **Intermediate host**
  - Host where immature stages develop, indirect life cycle only
- **Transport host**
  - Immature stage not retained, no parasite development
- **Paratenic host**
  - Immature stage retained but no parasite development

Survival strategies

- **Permanent parasites**
- **Temporary parasites**
  - Morphological adaptations
  - Physiological adaptations
    - **Hypobiosis**
    - **Critical hatching conditions**
    - **Peripatruant rise**

Ascarid egg

Hypobiosis

- **Physiological - Toxocara**
  Larvae enter hypobiotic state in tissues
  Larvae reactivated during pregnancy in dogs & cats and infect foetus
- **Seasonal - Ostertagia**
  - Larvae taken in during Autumn overwinter in the gastric glands of the abomasum
  - Larval development resumes in Spring giving rise to new generation of adults

Critical Hatching Conditions

- Larvae overwinter on the pasture inside the egg stage.
- Larvae hatch onto pasture only after receiving an environmental trigger
- Trigger is usually a change in temperature.
Periparturient (Spring) Rise

- Increase in parasite egg counts around parturition time – usually spring in UK
- Impact – large numbers of infective larvae on the pasture when
  - Pasture conditions optimum for survival
  - Young animals available for infection

Trichinella

Characteristics of helminths

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<th></th>
<th>Trematode</th>
<th>Cestode</th>
<th>Nematode</th>
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<tbody>
<tr>
<td>Appearance</td>
<td>Leaf-like</td>
<td>Tape-like</td>
<td>Worm-like</td>
</tr>
<tr>
<td>Cross-section</td>
<td>Flattened</td>
<td>Flattened</td>
<td>Cylindrical</td>
</tr>
<tr>
<td>Body cavity</td>
<td>Absent</td>
<td>Absent</td>
<td>Fluid-filled</td>
</tr>
<tr>
<td>Gut</td>
<td>Blind sack</td>
<td>Absent</td>
<td>True gut</td>
</tr>
<tr>
<td>Life cycle</td>
<td>Indirect</td>
<td>Indirect</td>
<td>Direct &amp; indirect</td>
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<tr>
<td>Reproduction</td>
<td>Monoeicous</td>
<td>Monoeicous</td>
<td>Dioecious</td>
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Internal structure - Nematodes

Internal structure - Trematodes