Introduction to Medical Parasitology

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Learning objectives

After class, students be able to
1. Explain parasitological terms
2. Explain the impact of parasitic diseases
3. Apply knowledge to upcoming lessons
Two animals living together

= Commensalism

Host  Commensal

= Parasitism

Host  Parasite
• “Parasitology” - a study of the relationship between parasites and hosts

• Parasites - animals that live in or on the hosts for food and shelter. Parasites are dependent on their hosts.

• Hosts - animals (usually bigger) which provide food and shelter for parasite. Sometimes, they get sick.
The principal aim in parasitology to acquire knowledge about parasitism in natural populations to control or eliminate parasite from unnatural populations, both of the people and of the animals on which the people depend.”

Parasites

• Facultative parasites
  – Can live and reproduce
    • outside host (free-living) and
    • Inside host (parasitic phase)
    • Examples: *Strongyloides* and *Naegleria*

• Obligatory parasites
  – Only parasitic phase
  – Example: Beef tapeworm
• *Incidental* parasites
  – Accidentally enter unusual host
  – Example: *Toxocara*

• *Intermittent* parasites
  – Temporary (antonym = Permanent)
Parasites (continued)

• Pseudoparasites (artefacts)
  – “Look alike”, e.g., pollen grains
• Coprozoic (spurious) parasites
  – Organisms eaten and found in faeces
• Opportunistic parasites
  – Immunocompetent host: no or self-limited disease
  – Immunocompromised host: severe disease
  – Examples: Cryptosporidium, microsporidia
Parasite systematic classification

- Kingdom Animalia
  - Subkingdom Protozoa
  - Subkingdom Metazoa
    - Phylum Platyhelminthes
    - Phylum Nematoda
    - Phylum Arthropoda

- Order, Class, Family, Genus, Species
Simple classification

• Protozoa
  – Amoeba, flagellate, ciliate, sporozoa

• Helminths
  – Nematodes, trematodes, cestodes

• Arthropods
  – Insects, spiders, ticks, mites, etc.

• Acanthocephalans
  – Thorny-headed worms
<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan 20</td>
<td>Apicomplexa: Malaria</td>
</tr>
<tr>
<td>Jan 27</td>
<td>Apicomplexa: Coccidia</td>
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<tr>
<td></td>
<td><em>Pneumocystis</em> spp.</td>
</tr>
<tr>
<td>Feb 3</td>
<td>Flagellates I: Genito-urinary and intestinal flagellates</td>
</tr>
<tr>
<td>Feb 10</td>
<td>Flagellates II: Hemoflagellates</td>
</tr>
</tbody>
</table>
# Hosts

<table>
<thead>
<tr>
<th>Terminology</th>
<th>Parasite stage in host</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definitive hosts</td>
<td>Adult</td>
</tr>
<tr>
<td>Intermediate hosts</td>
<td>Larva- develop to infective stage</td>
</tr>
<tr>
<td>Paratenic hosts</td>
<td>Larval stage (infective)/ no development</td>
</tr>
<tr>
<td>Reservoir hosts</td>
<td>Adult/ Source for human infection</td>
</tr>
<tr>
<td>Accidental hosts</td>
<td>Adult or larva/ Dead end of parasite</td>
</tr>
</tbody>
</table>
Parasite Life Cycle

• Simple (homoxenous)
  – do not require intermediate host

• Complex (heteroxenous)
  – one or more intermediate host
Fish tapeworm
Adults In the small intestine

Eggs

Coracidium

Procercoid larva

Copepod

Fish 1

Plerocercoid larva

Fish 2

Plerocercoid larva

Fish eating mammals

Human
Terminology

- Human is .................... host
- Fish-eating mammals are .................... host
- Copepod is ............................. host
- Fish 1 is ............................. host
- Fish 2 is ............................. host
- The tapeworm infective stage is ....................
Source of Parasite Exposure

- **Environment**
  - Contaminated water and soil (waterborne/ soil-transmitted)
  - E.g., amoeba in soil and water

- **Man**
  - Infected persons or self (person-to-person/autoinfection/vertical transmission)
  - E.g., *Giardia* in salad prepared by infected food handler

- **Animal**
  - Domestic or wild animals (zoonosis)
  - *Toxoplasma* cysts in chicken meat

- **Arthropod vector**
  - Malaria (mosquito-borne)
Zoonotic status of man’s parasite

- **Man**: 26%
- **Mammals**: 51%
- **Environment**: 6%
- **Unknown**: 12%
- **Reptile**: 2%
- **Birds**: 3%

**Zoonosis**

Period

• Prepatent period (Biological incubation period)
  – Parasite enters to parasite or its products detected
• Latent period or dormancy
  – Duration parasite not detected, but it’s there
• (Clinical) Incubation period
  – Parasite enters to appearance of signs and symptoms
Prepatent period

– Time from acquiring parasite until parasite or its products detected
– Mosquito bite until blood smear positive

www.niaid.nih.gov/.../bugborne01/malaria.htm

www.ma.uni-heidelberg.de/inst/imh/leistungen/...
Incubation Period

- Time from acquiring parasite until appearance of signs and symptoms

Example

- Vivax malaria
- Prepatent period 11-13 days
- Incubation period 12-17 days
- Useful for presumptive diagnosis
- IP usually longer than PP except some diseases
Damage

- Destruction of tissues by parasite’s enzymes
- Mechanical injury
  - Large worm - obstruction
  - Ciliate - penetrating intestinal wall
- Immunological reaction to parasites or their metabolites
- Others
Importance of parasitic diseases

- Death
- Chronic illness
  - E.g., gnathostomiasis
- Deformities
  - E.g., leishmaniasis
- Symptomless
  - E.g., liver fluke infection

Economic loss
- Health loss
- Disability adjusted life year (DALY)

Health loss
Disability adjusted life year (DALY)

Drug cost, income loss
Ascariasis

- 1,472 million people infected worldwide
- 335 million people got sick (morbidity)
- 23,000 people die (mortality)
Factors influencing parasite fauna

• Climate (Temp/Humidity)
  – Tropics, subtropics, temperate, polar
  – Very wet to arid

• Fauna - Animal
  – Palearctic, Nearctic, Neotropical, Oriental, Australian, Ethiopian

• Flora
  – Rain forest, evergreen forest, savanna
Faunistic areas

Disease outbreak

• Change of human behavior, travelling, globalization
• Emerging diseases- never seen before
• Re-emerging diseases- used to be, then come back
• Imported disease- acquire from abroad
• Autochthonous infection- acquire in country
• Zoonosis- acquire from animal
• Endemic area- continuing transmission of disease
Parasite systematic classification

• Kingdom Animalia
  – Subkingdom Protozoa
  – Subkingdom Metazoa
    • Phylum Platyhelminthes
    • Phylum Nematoda
    • Phylum Arthropoda

• Order, Class, Family, Genus, Species
Simple classification

• Protozoa – Unicellular parasite
  • Amoeba, flagellate, ciliate, sporozoa, microspora

• Helminths - worms
  • Nematodes (roundworms), Cestodes (tapeworms), Trematodes (flukes),

• Arthropods - with appendages

• Acanthocephalans - thorny-headed worms
Writing name

• Common name
  – ผยาธิแส้มม้า Whipworm

• Scientific name
  – *Trichuris trichiura*
  – *Trichuris* = ชื่อ genus
  – *Trichiura* = ชื่อ species

• Disease- genus + asis/ osis
  – Trichuriasis/ trichuriosis
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<td>12 Jan</td>
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Scope of lecture

- Morphology
- Life cycle
- Disease, signs and symptoms
- Epidemiology
- Diagnosis
- Prevention and control
- Treatment
Lab session

• Parasite demonstration
  – Preserved specimen
  – Gross & microscopic

• Examination
  – Indicate Genus and Species of parasites
Artefacts
Further readings

Parasite homepage

Welcome to Chiang Mai Parasite Homepage!

This site has been selected by ISI for inclusion in Current Web Contents

- Founded in 1970, now the department consists of 16 teaching staffs, 4 academic assistants, 1 permanent employees and 4 temporary employees in the department. The primary responsibility is teaching medical parasitology to medical and health science students.

- Major fields of research include immunology and molecular biology of parasites, epidemiology of parasitic infections, mosquito ecology, mosquito genetics and mosquito taxonomy. Many publications have been made.

The department also offers a short-course training program in Medical Parasitology for foreign scientists upon request.

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Medical Curriculum
Parasite web link
Lecture notes (Intranet)
Parasite e-learning system
Webmaster
Faculty Home Page

http://www.med.cmu.ac.th/dept/parasite/default.htm
The End