Introduction to

MEDICAL PARASITOLOGY

Bushehr University of Medical Sciences
Department: Medical Microbiology and Parasitology
Module: Medical Parasitology
Semester: 2 (1392-93)
Instructor: Dr. Mohammad Rayani
Protozoa

Helminths

Egg

Larvae

Worm

Entamoeba histolytica

Trophozoite

Cyst

Ancylostoma duodenale
Nematodes

Cestodes

Trematodes
Introduction to parasitology

- Parasitology is a type of SYMBIOSIS (living together)

  - Man and other living things on earth live in an entangling relationship with each other; interdependent.

    (Any plant, animal, or protist that is intimately associated with another organism of a different species; each member is termed a SYMBIONT).

- Commensalism, Mutualism and Parasitism are various type of symbiosis.
COMMENSALISM

- (when one symbiont, the COMMENSAL, benefits and the other animal is neither helped nor harmed.

- An association in which the commensal takes the benefit without causing injury to the host.

- E.g. most of the normal florases of the humans’ body can be considered as commensals.
MUTUALISM

- (each member, a MUTUALIST, depends upon the other; obligatory or facultative) many examples in nature.

- An association in which both partners are metabolically dependent upon each other and one cannot live without the help of the other; however, none of the partners suffers any harm from the association.

- For instance, flagellates produce cellulase in gut of termites; ciliates in ruminants.
PARASITISM

(Where one member, the PARASITE, lives in or on another organism, the HOST)

An association where one of the partners is harmed and the other lives at the expense of the other.

E.g. worms like *Ascaris lumbricoides* reside in the gastrointestinal tract of man, and feed on important items of intestinal food causing various illnesses.
PARASITOLOGY

- The study of the relationship between a parasite and its host.

- Medical parasitology is the science that deals with organisms living in the human body (the host) and the medical significance of this host-parasite relationship.

- In medical parasitology we will focus on most of the disease causing (pathogenic) parasites.
ASSOCIATION BETWEEN PARASITE AND HOST

- A parasite is a living organism, which takes its nourishment and other needs from a host;

- The host is an organism which supports the parasite.

- The parasites included in medical parasitology are protozoa, helminths, and some arthropods.
انگل‌ها: (Parasites)

موجودات زنده ای که انواع مختلف داشته‌اند به‌نظر درجه تکاملی پست‌پوست و قادر به تامین احتیاجات زیستی خود (غذا، مسکن، رطوبت و درجه حرارت) نیستند و برای این منظور وابسته به موجودات دیگر (میزبان) هستند و گاهی به آن صدمه می‌رسانند.

انواع انگل‌ها

- تک‌پایه‌ها (Protozoa)
- کرم‌ها (Helminths)
- بندپی‌پایان (Arthropoda)
DIFFERENT KINDS OF PARASITES

- **Ectoparasite** – a parasitic organism that lives on the outer surface of its host, e.g. lice, ticks, mites. Appropriate terminology includes the terms "infected" and "infested".

- **Endoparasites** – parasites that live inside the body of their host, e.g. *Entamoeba histolytica*. Appropriate terminology is "infected"; roundworms in gut.

- **Obligate Parasite** - This parasite is completely dependent on the host during a segment or all of its life cycle; e.g. *Plasmodium spp.*

- **Facultative parasite** – an organism that exhibits both parasitic and non-parasitic modes of living and hence does not absolutely depend on the parasitic way of life; e.g. *Naegleria fowleri*. 
DIFFERENT KINDS OF HOSTS

- **Definitive or final host** – a host that harbors a parasite in the adult stage or where the parasite undergoes a sexual method of reproduction. (parasite reaches sexual maturity and reproduces).

- **Intermediate host** - harbors the larval stages of the parasite or an asexual cycle of development takes place. (some development in host, but does not reach sexual maturity; often asexual stages).

- **Reservoir host** – a host that makes the parasite available for the transmission to another host and is usually not affected by the infection. (non-human animals that serve as sources of infection to humans).
Typical ways parasites transmitted:

- **INGESTION** from food or water / inhalation
- **DIRECT PENETRATION** of skin from environment
- **VECTORS** (transmits parasites from host to host)
  - **BIOLOGICAL VECTOR** (essential in life-cycle of parasite)
  - **MECHANICAL VECTOR** (unessential in life-cycle of parasite)
BASIC CONCEPTS IN MEDICAL PARASITOLOGY

In medical parasitology, each of the medically important parasites are discussed under the standard subheadings of morphology, life cycle/means of infection, pathology/clinical manifestations of infection, laboratory diagnosis, treatment, geographical distribution/epidemiology, preventive/control measures of parasites.
Nomenclature

Describing animal parasites follow certain rules of zoological nomenclature and each phylum may be further subdivided as follows:

- Phylum → Subphylum → Class → Order → Family → Genus → Species
CLASSIFICATION OF MEDICAL PARASITOLOGY

- **Medical Protozoology**
  Deals with the study of medically important protozoa (the microscopic single-celled eukaryotes).

- **Medical Helminthology**
  Deals with the study of helminths (worms- macroscopic, multicellular worms possessing well differentiated tissues and complex organs) that affect man.

- **Medical Entomology**
  Deals with the study of arthropods which cause or transmit disease to man.
PROTOZOA

- Protozoan parasites consist of a single "cell-like unit" which is morphologically and functionally complete and can perform all functions of life.

- They are made up of a mass of protoplasm differentiated into cytoplasm and nucleoplasm.

- The protozoal parasite possesses the property of being transformed from an active (trophozoite) to an inactive stage (cyst). The cyst is the resistant stage of the parasite and is also infective to the human host.
CLASSIFICATION OF MEDICALLY IMPORTANT PARASITES

PROTOZOA

- Sarcodina (Amoebae) - آمیبها
  - (a) Genus, *Entameba* e.g. *Entameba histolytica*
  - (b) Genus *Endolimax* e.g. *Endolimax nana*
  - (c) Genus *Iodameba* e.g. *Iodameba butchlii*

- Mastigophora (Flagellates) - تازکداران
  - (a) Genus *Giardia* e.g. *G. lamblia*
  - (b) Genus *Trichomonas* e.g. *T. vaginalis*
  - (c) Genus *Leishmania* e.g. *L. Donovani*

- Sporozoa - اسپروزوآ
  - (1) Genus *Plasmodium* e.g. *P. falciparum*
  - (2) Genus *Toxoplasma* e.g. *T. gondi*
  - (3) Genus *Cryptosporidium* e.g. *C. parvum*

- Ciliates - مزه داران
  - (a) Genus *Balantidium* e.g. *B. coli*
<table>
<thead>
<tr>
<th>Type and location</th>
<th>Species</th>
<th>Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intestinal tract</td>
<td><em>Entamoeba histolytica</em></td>
<td>Ambiasis</td>
</tr>
<tr>
<td></td>
<td><em>Giardia lamblia</em></td>
<td>Giardiasis</td>
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<tr>
<td></td>
<td><em>Cryptosporidium parvum</em></td>
<td>Cryptosporidiosis</td>
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<tr>
<td></td>
<td><em>Balantidium coli</em></td>
<td>Balantidiasis</td>
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<tr>
<td></td>
<td><em>Isospora belli</em></td>
<td>Isosporiosis</td>
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<tr>
<td></td>
<td><em>Cyclospora cayatanensis</em></td>
<td>Cyclosporiasis</td>
</tr>
<tr>
<td>Urogenital tract</td>
<td><em>Trichomonas vaginalis</em></td>
<td>Trichomoniasis</td>
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<tr>
<td>Blood and tissue</td>
<td><em>Plasmodium species</em></td>
<td>Malaria</td>
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<tr>
<td></td>
<td><em>Toxoplasma gondii</em></td>
<td>Toxoplasmosis</td>
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<tr>
<td></td>
<td><em>Trypanasoma species</em></td>
<td>Trypanosomiasis</td>
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<tr>
<td></td>
<td><em>Leishmania species</em></td>
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<td></td>
<td><em>Naegleria species</em></td>
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<td></td>
<td><em>Acanthamoeba species</em></td>
<td>Amoebic Meningoencephalitis</td>
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<tr>
<td></td>
<td><em>Babesia microti</em></td>
<td>Babesiosis</td>
</tr>
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HELIMINTHS

- The helminthic parasites are multicellular organism (metazoa).

- Cause of high morbidity and mortality of people worldwide

- Medical helminthology is concerned with the study of helminthes or parasitic worms.
CLASSIFICATION OF MEDICALLY IMPORTANT PARASITES

METAZOA (HELIMINTHS)

کرم ها

1. Platyhelminthes کرم های پهن

Trematoda - کرم های برگی شکل

- (a) Genus Schistosoma e.g. S. mansoni
- (b) Genus Fasciola e.g. F. hepatica

Cestoda - کرم های نواری شکل

- (a) Genus Taenia e.g. T. saginata
- (b) Genus Echinococcus e.g. E. granulosus
- (c) Genus Hymenolepsis e.g. H. nana

2. Nemathelminthes - کرم های نخی شکل

- (a) Intestinal Nematodes نماتودا e.g. A. lumbricoides
Classification based on modes of transmission

- Soil-transmitted helminths (*Ascaris*, *Hookworms*)
- Arthropod-transmitted helminths (*Filaria*, *Dracunculus*)
- Food and animal-transmitted helminths (*Taenia*)
- Snail-transmitted helminths (*Fasciola*, *Schistosoma*)
- Direct or contagious-transmitted helminths (*Enterobius*, *Hymenolopis*)
References:

1) Brown & Neva. Basic Clinical Parasitology
2) Markell & Voge. Medical Parasitology

http://dpd.cdc.gov/dpdx/Default.htm
http://www.who.int/tdr/diseases-topics/en/