

# INTRODUCTION TO PARASITOLOGY

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# Lecture outline

- Medical Microbiology
- Scope of Medical Parasitology
- Terms in parasitology
- Classification of parasites
- Distribution of parasitic infections
- Principles in Diagnosis of parasitic infections
- Principles in Control of parasitic infections

# Medical Microbiology

The study of microorganisms that cause **infectious diseases of humans.**

**Encompasses** – Parasitology, Bacteriology, Mycology, Virology

- **Aetiology,**
- **Pathogenesis,**
- **Diagnosis,**
- **Treatment**
- **Control and prevention**

# Nomenclature of microorganisms

- Each microorganism has two names i.e. a generic (genus) and a specific (species)
- The genus begins with an initial capital and the species with an initial small letter

Examples:

- Parasites - *Ascaris lumbricoides*, *Plasmodium falciparum*
- Bacteria - *Clostridium tetani*, *Neisseria gonorrhoea*
- Fungi - *Candida albicans*, *Cryptococcus neoformans*

# Medical Parasitology

# Scope

*Medical Parasitology - the study of parasites of medical importance and comprises of helminthology, protozoology and medical entomology/ arthropodology*

- Distribution, morphology, physiology, life cycle, pathogenesis, clinical presentation, diagnosis, treatment, prevention and control of parasites of medical importance
- Diagnostic laboratory techniques including research diagnostic techniques

# Key terms

- Symbiosis
- Parasite
- Host
- Zoonosis
- Vector
- Ecto-parasite
- Endo-parasite
- Facultative parasite
- Obligatory parasite
- Accidental parasite
- Aberrant parasite

# Key terms - 1

- **Symbiosis** is the living together or close association of two dissimilar organisms. There are three forms of the symbiosis: mutualism, commensalism and parasitism.
- *Parasitism* is symbiosis in which one party (parasite) benefits at the expense of the other (host).



# More terms

## *Definitive host:*

- Either harbors the adult stage of the parasite or where the parasite *utilizes the sexual method of reproduction.*

## *Intermediate host:*

- Harbours the larval/asexual stages of the parasite eg Man for malaria.
- In some cases larval developments are completed in two different *intermediate hosts which are referred to as first and second intermediate hosts respectively e.g Diphylobothrium latum*

## *Paratenic host :*

- An accidental host where the parasite remains viable without further development.

# More terms

- **Zoonosis:** “a parasitic disease in which an animal is normally the host - but which also infects man”
- **Vector:** “a living carrier (e.g.an arthropod) that transports a pathogenic organism from an infected to a non-infected host”. A typical example is the female *Anopheles* mosquito that transmits malaria

# The basic factors of transmission of parasitic diseases

- Source of infection
- Transmission
- Susceptible host

The combined effect of these factors determine the distribution and the prevalence of the parasites at a given time and place and regulate the incidence of the parasitic diseases in populations.

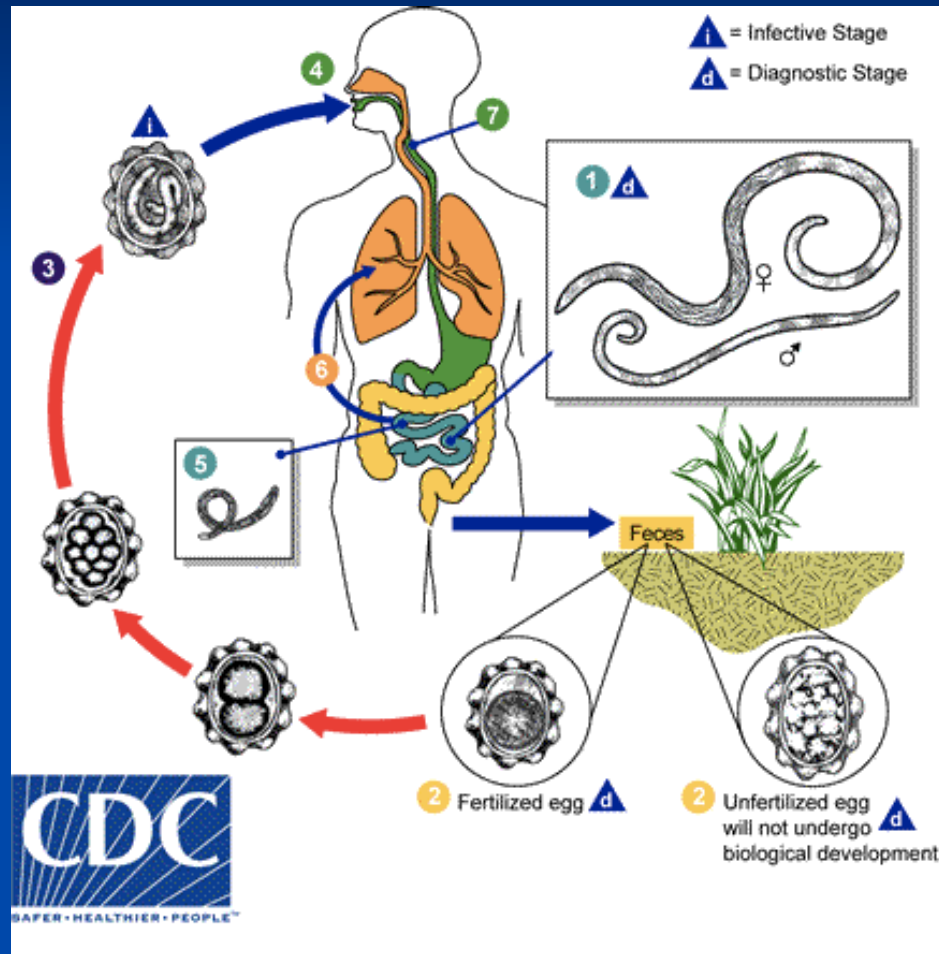
# Life cycle of parasites

## Life cycle:

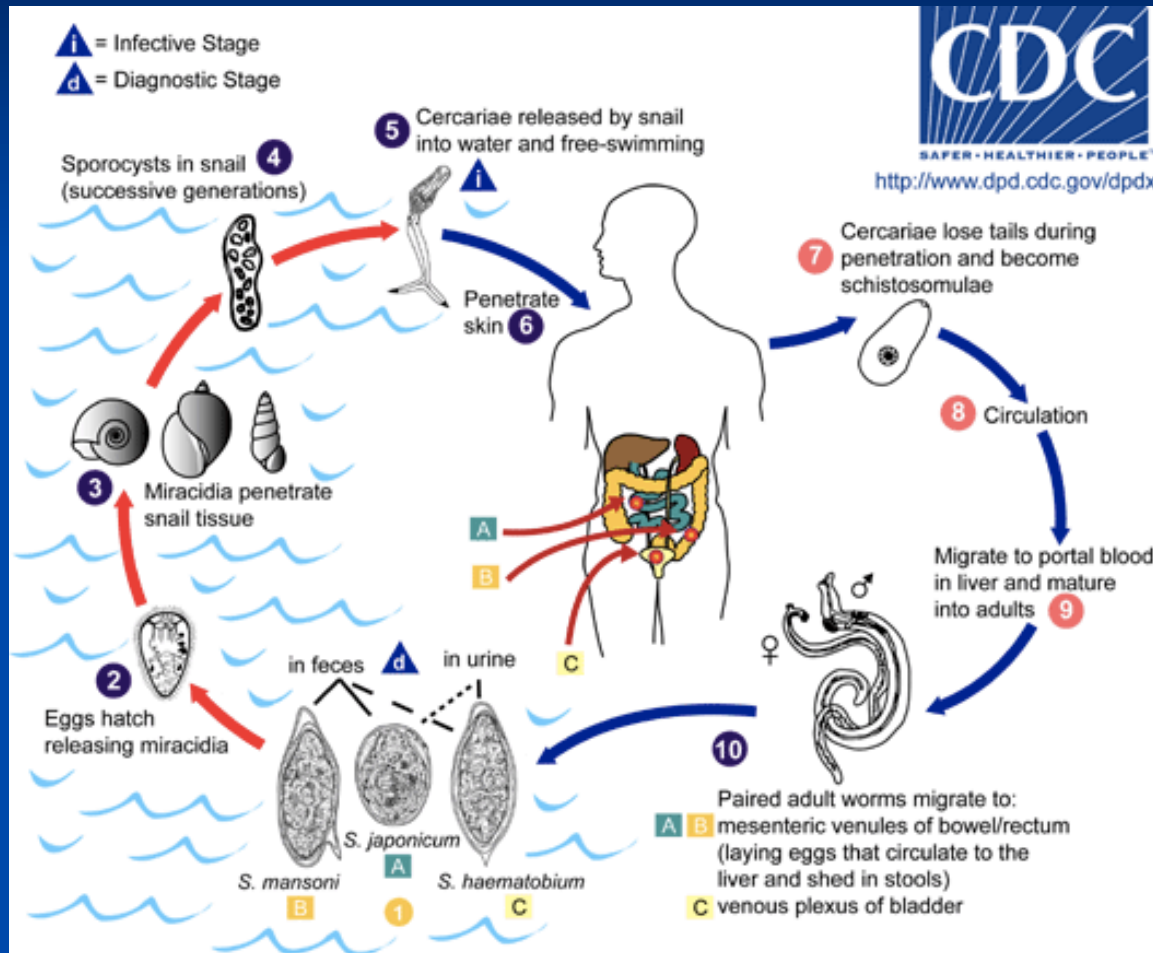
The whole process of parasite growing and developing

- **Direct life cycle** – parasite has only one host (no intermediate host).
- **Indirect life cycle** – parasite's life cycle involves more than one host

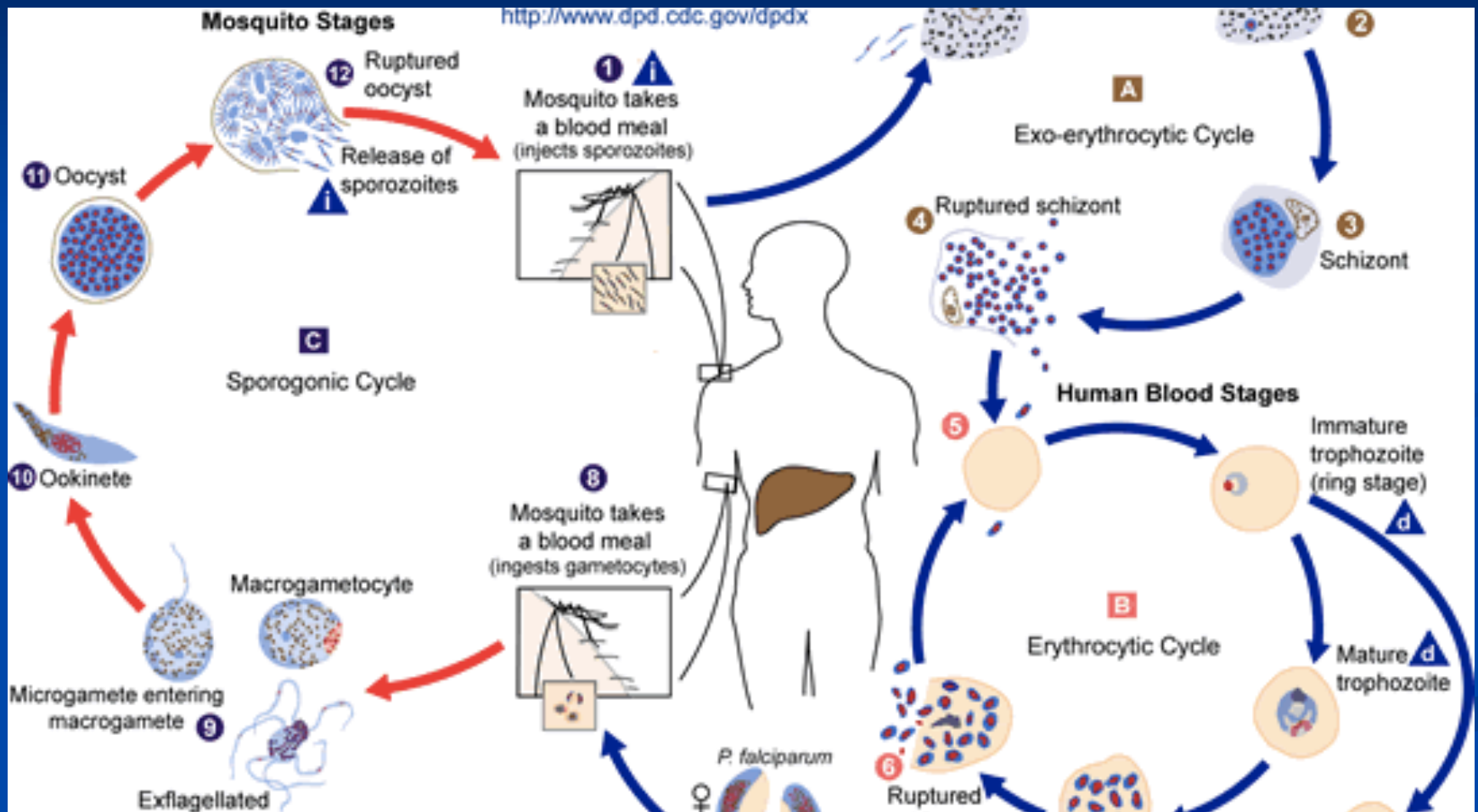
# Example 1: Life cycle of Ascaris



# Example 2: Life cycle of Schistosoma



# Example 3: Life cycle of Plasmodium



# Pathogenesis

- Trauma
- Host response
- Nutrients/Blood loss
- Secondary infections
- Lytic action
- Toxins



# Classification of parasites

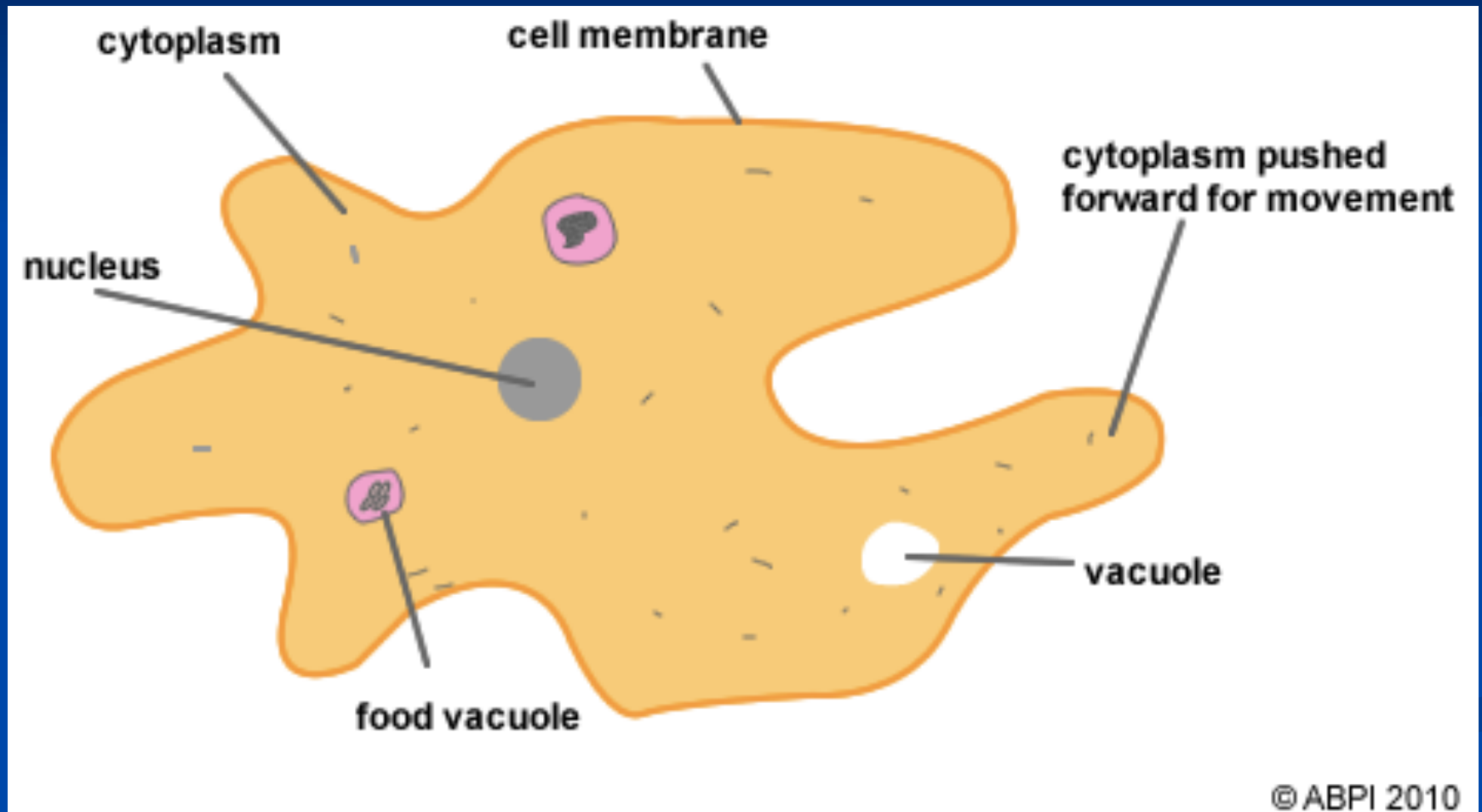
- Taxonomic
- Morphologic
- Physiologic
- Mode of transmission
- Location/site in host
- Combinations of any of the above

# Classification of Parasites

- Parasites are classified into 2 sub-kingdoms: protozoa (unicellular) and metazoa (multicellular)
- Protozoan (unicellular) parasites are classified according to morphology and means of locomotion.
- Metazoa (multicellular) include the helminths and arthropods

# PROTOZOA

## Morphologic characteristics



# *Sarcodina (Amobae)*

- Typically amoeboid and include Entamoeba, Endolimax, Iodamoeba, Naegleria, Acanthamoeba, etc.
- Morphology - shapeless mass of moving cytoplasm which is divided into granular endoplasm and clear ectoplasm.
- Motility – move by pushing out the ectoplasm to form pseudopodia (false feet)
- Asexual reproduction by binary fission

# *Mastigophora (Flagellates)*

- They have one or more whip like flagella for locomotion at some stage of their life cycle. In some cases, there is the presence of undulating membrane (Eg. Trypanosoma).
- The mastigophore includes the intestinal and genitourinary flagellates and the blood and tissue flagellates.
- The intestinal and genitourinary flagellates are Giardia, Trichomonas.
- The blood and tissue flagellates are Trypanosoma, Leishmania, etc.
- They reproduce asexually by binary fission.

# *Apicomplexa (Sporozoa)*

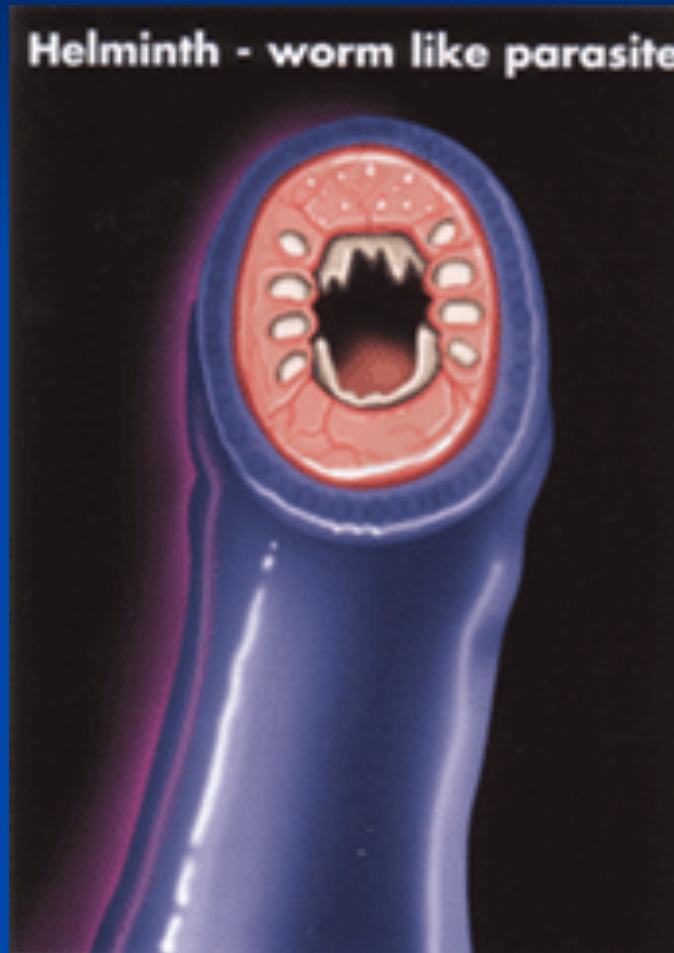
- The members of this super-class undergo complex life cycle with alternating sexual and asexual reproductive phases involving two different hosts.
- Are intracellular parasites that reproduce asexually and sexually
- Class Coccidia includes Isospora and Toxoplasma
- Class Haematozoa includes Plasmodium species.

# *Ciliophora*

- Have cilia (short hairs) distributed in rows or patches by which they move.
- Have two kinds of nuclei (macronucleus and micronucleus) and a large contractile vacuule.  
Example - *Balantidium coli*, a giant intestinal ciliate of humans and pigs

# HELMINTHS

Helminth - worm like parasite





# Nematodes

- Their body is elongated, cylindrical and unsegmented.
- Appear round in cross section
- Have body cavity
- Have an alimentary canal and an anus
- Sexes are separate (dieocious).



# *Cestodes*

- These are tape-like, segmented (proglottids)
- Consist of a head (scolex) with sucking organs
- No alimentary canal
- Body is segmented
- Each body segment is a hermaphrodite
- Examples are *Diphyllobothrium*, *Taenia*, *Echinococcus*, *Hymenolepsis*, etc.

# *Trematodes*

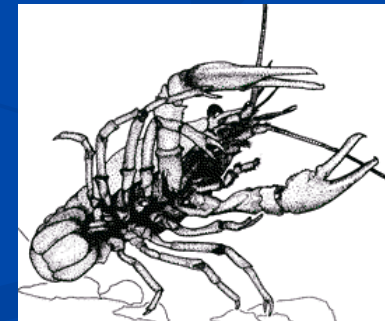
- They are leaf-like unsegmented, no distinct head
- Alimentary canal incomplete (no anus)
- Have 2 suckers
- The body cavity is absent.
- Sexes are not separate

Schistosomes are an exception. They are thread-like, and have separate sexes

- Examples are *Schistosoma*, *Gastrodiscoides*, *Fasciolopsis*, *Fasciola*, *Clonorchis*, *Heterophyes*, etc.

# ARTHROPODS

- Invertebrate animals that have jointed limbs, a segmented body, and an exoskeleton.
- Examples are
  - Insects
  - Arachnids
  - Crustaceans



# Arthropods As Parasites

Certain insects and arachnids become parasites when they cause tissue damage, skin irritations, and produce toxins.



# Why study medical parasitology?

- ~ 2 billion people are infected with STH
- ~ 1.23 billion people threatened, 120M infected by LF
- up to 20% harbor amebae, 5-6% develop amoebiasis
- Giardia found in 4-16% - tropics; 2-50% IN institutionalized
- 17% of infectious diseases are vector borne
- 198 million cases of malaria in 2013; ~584 000 deaths

# Determinants of geographical distribution

- Host / intermediate host factors, availability
- Vector availability
- Environmental – weather, temperatures, vegetation, etc for parasite/vector survival
- Socioeconomic – host behaviour/habits, poverty,

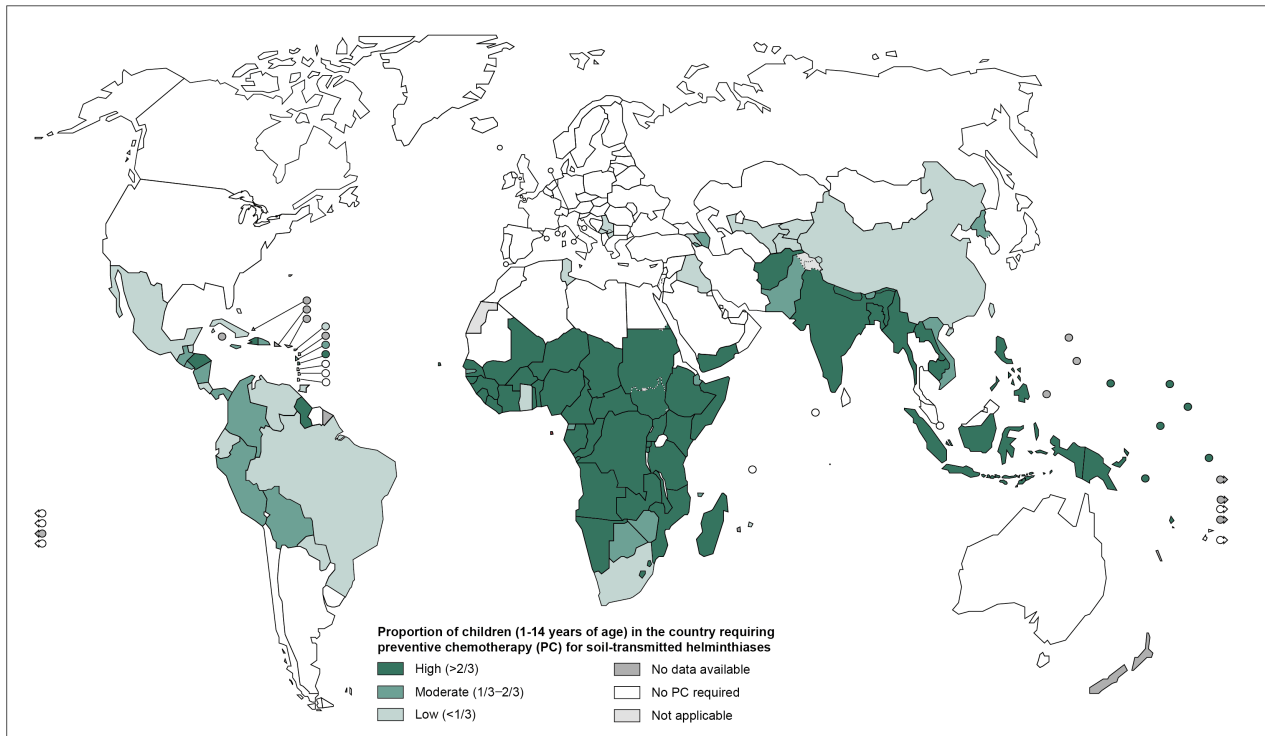
# *Malaria*





# STH

## Proportion of children (1-14 years of age) in the country requiring preventive chemotherapy (PC) for soil-transmitted helminthiases, worldwide, 2013



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Data Source: World Health Organization  
Map Production: Control of Neglected  
Tropical Diseases (NTD)  
World Health Organization



# Diagnosis of Parasitic Infections

- **Clinical diagnosis**
- **Laboratory diagnosis**
  - **Involves variety of specimens**
  - **Type of specimen dependent on site of infection**
  - **Specimen collection and processing depends on type of specimen**
  - **Instruments/Equipment used varies with specimen type and type of lab test**

# Types of specimens used for diagnosis of parasites

- Stool
- Secretions - sputum, intestinal, urogenital
- Urine
- Blood
- Tissue biopsies.

# Microbiological diagnostic techniques

- **Direct wet mounts**
- **Stained Mounts**
- **Culture**
- **Blood smears – Thin, Thick**
- **Serology**
- **Molecular techniques – PCR**
- **In Vitro Cultivation of Parasites**

# Control of parasitic infections

## Strategies

- Source of infection
- Transmission
- Susceptible host
- Health education