

The Parasite

is an organism that lives on or in a host organism and gets its food from or at the expense of its host. There are three main classes of parasites that can cause disease in humans: protozoa, helminths, and ectoparasites.

1/ Protozoa:

- Are microscopic, one-celled organisms that can be free-living or parasitic in nature. They are able to multiply in humans, which contributes to their survival and also permits serious infections to develop from just a single organism.

Transmission of protozoa that live in a human's intestine to another human typically occurs through a fecal-oral route (for example, contaminated food or water or person-to-person contact). Protozoa that live in the blood or tissue of humans are transmitted to other humans by an arthropod vector (for example, through the bite of a mosquito or sand fly).

- The protozoa that are infectious to humans can be classified into four groups based on their mode of movement:

- **Sarcodina - the ameba, e.g., *Entamoeba***
- **Mastigophora - the flagellates, e.g., *Giardia*, *Leishmania***
- **Ciliophora - the ciliates, e.g., *Balantidium***
- **Sporozoa - organisms whose adult stage is not motile e.g., *Plasmodium*, *Cryptosporidium***

❖ Plasmodium: Causative agent of malaria

- There are four species of *Plasmodium* that cause human malaria:

A- Widespread species:

1- *Plasmodium falciparum*

2- *Plasmodium vivax*

B- Less widespread species:

1- *Plasmodium malariae*

2- *Plasmodium ovale*

Transmission: _ Malaria parasites are transmitted by:

- 1- The bite of an infected female *Anopheles* mosquito.
- 2- Transfusion of infected donor blood.
- 3- Injection through the use of needles and syringes contaminated with infected blood.

The diagnosis of malaria is by:

- 1- Detecting and identifying malaria parasites microscopically in blood films.
- 2- Concentrating parasites in venous blood by centrifugation when they cannot be found in blood films.
- 3- Using a malaria rapid diagnostic test (RDT) to detect malaria antigen.



Positive test for *P.falciparum*:

P.falciparum: Pink pink line appears in both line appears in the C (Control) only.
the C (Control) and T (Test)



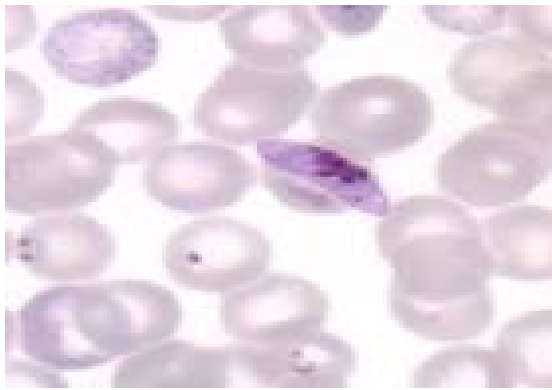
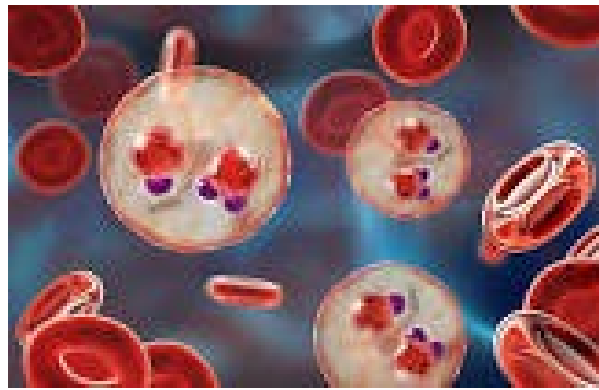
Negative test for

- **Collection of blood:**

Malaria blood films are best prepared directly from capillary blood.

- **Staining malaria parasites.** The stains most frequently used are:

- 1- Field's stain.
- 2- Giemsa stain.



***P.falciparum* inside Red blood cells**

❖ **Giardia:**

- is a genus of anaerobic flagellated protozoan parasites of the phylum Metamonada that colonise and reproduce in the small intestines of several vertebrates, causing giardiasis. Their life cycle alternates between a swimming trophozoite and an infective (resistant cyst).

- About 40 species have been described from different animals
 - *G. duodenalis*: infect humans and other mammals.
 - *G. muris*: is found from other mammals.
 - *G. ardeae* and *G. psittaci*: is found from birds.

- ***Giardia duodenalis***: The parasite attaches to the epithelium by a ventral adhesive disc or sucker, and reproduces via binary fission.

Giardiasis does not spread via the bloodstream, nor does it spread to other parts of the gastrointestinal tract, but remains confined to the lumen of the small intestine. Giardia has an outer membrane that makes it possible to retain life, even when outside of the host body, and which can make it tolerant to chlorine disinfection. *Giardia* trophozoites absorb their nutrients from the lumen, and are anaerobes. If the organism is split and stained, its characteristic pattern resembles the familiar "smiley face" symbol.

Transmission of human infection include ingestion of untreated drinking water (which is the most common

method of transmission for this parasite), food, and soil contaminated with human feces, as well as ingestion of sewage, a phenomenon particularly common in many developing countries. Contamination of natural waters also occurs in watersheds where intensive grazing occurs.



Symptoms:

Giardia infection (giardiasis) can cause a variety of intestinal symptoms, which include: Diarrhea, Gas, Foul-smelling, greasy poop that can float, Stomach cramps or pain, Upset stomach or nausea, Dehydration.

Diagnosis:

- Stool samples collected over a period of days. The samples are then examined in a lab for the presence of parasites.

2/ Helminths:

- They are large, multicellular organisms that are generally visible to the naked eye in their adult stages. Like protozoa, helminths can be either free-living or parasitic in nature. In their adult form, helminths cannot multiply in humans. There are three main groups of helminths that are human parasites:

- Flatworms (platyhelminths) : these include the trematodes (flukes) and cestodes (tapeworms).
- Thorny-headed worms (acanthocephalins) : the adult forms of these worms reside in the gastrointestinal tract.

The acanthocephala are thought to be intermediate between the cestodes and nematodes.

- Roundworms (nematodes): the adult forms of these worms can reside in the gastrointestinal tract, blood, lymphatic system or subcutaneous tissues. Alternatively, the immature (larval) states can cause disease through their infection of various body tissues.

1-Schistosoma: is a species of digenetic trematode (Flatworms).

- Causative agents of schistosomiasis or bilharziosis.
- The occurrence of schistosomiasis depends on the presence of suitable intermediate hosts (freshwater snails).

Transmission and life cycle:

Schistosoma species are transmitted by cercariae penetrating the skin when a person is bathing, washing clothes, fishing, or engaged in agricultural work or other activity involving contact with water that has been faecally contaminated and contains the snail hosts of the parasites. In its snail host the parasite multiplies and develops to its infective cercarial stage.

▪ Intestinal *Schistosoma* species:

- Damage to the liver and intestinal tract.
- Eggs of the following species can be found in faeces:

A- Widespread species:

widespread species:

- 1- *Schistosoma mansoni*
Schistosoma intercalatum
- 2- *Schistosoma japonicum*
Schistosoma mekongi

B- Less

1 -

2-

Laboratory Diagnosis:

The laboratory diagnosis of intestinal schistosomiasis is by:

- 1- Finding schistosome eggs in faeces.
- 2- Examining a rectal biopsy for eggs when they cannot be found in faeces.
- 3- Serological diagnosis.

▪ **Schistosoma haematobium (Urinary Blood Flukes):**

S. haematobium causes urinary schistosomiasis. The species contains several strains.

Transmission:

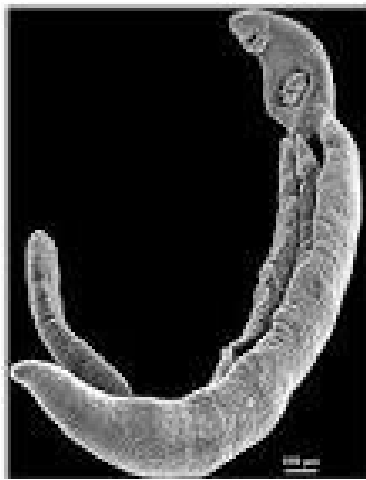
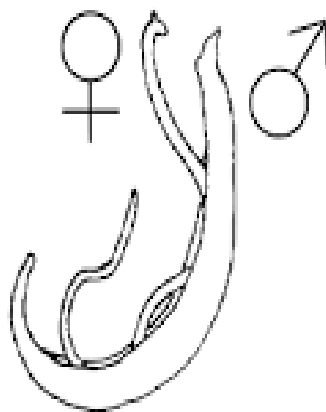
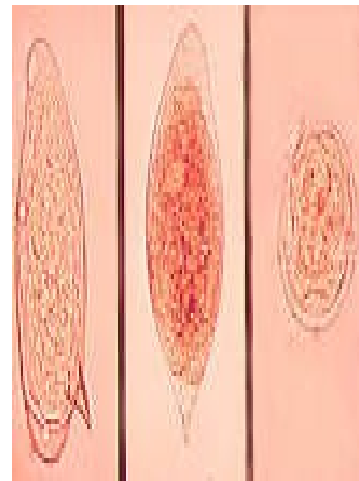
S. haematobium is transmitted by cercariae penetrating the skin when bathing, washing clothes, fishing, or engaged in agricultural work or other activity involving contact with contaminated water.

S. haematobium infection:

- Haematuria (blood in urine) caused by eggs penetrating through the wall of the bladder is a feature of urinary schistosomiasis.

Laboratory diagnosis of *S. haematobium* infection is by:

- 1) Finding the eggs of *S. haematobium* in urine.
- 2) Detecting eggs in a rectal biopsy or bladder mucosal biopsy.



Schistosoma mansoni
haematobium eggs

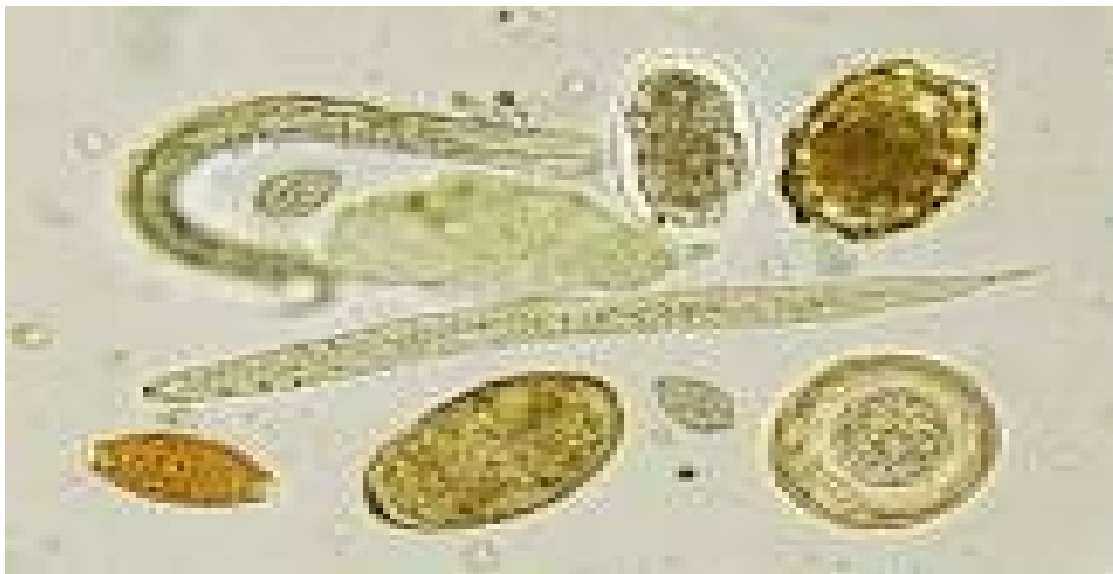
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❖ **Fecal Flotation test:**

- Fecal flotation is a routine test used to diagnose internal parasites or "worms." The test detects the eggs of mature parasites that live inside the body and pass their eggs to the outside by shedding them into the host's stool. Some

of these parasites are worm-like, while others are tiny single-celled organisms called protozoa. Most of the parasites live in the intestine, but a few live elsewhere in the body.

- Stool material is mixed with a special liquid that causes the parasite eggs to float to the surface. The eggs are collected from the surface using a coverslip placed on the tube. Let the coverslip set for 5 minutes, and then place it on a slide. Count all eggs under the coverslip using the 10x objective on the microscope. Once all of the eggs are counted, take that number and divide it by 3 to determine the eggs per gram (EPG) of feces. The appearance of the eggs identifies what type of adult parasite is present.



Types of adult parasites eggs

3/ Ectoparasites:

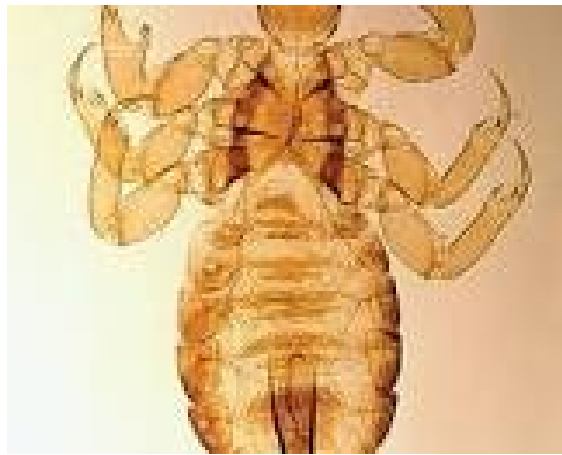
- It can broadly include blood-sucking arthropods such as mosquitoes (because they are dependent on a blood meal from a human host for their survival), this term is generally used more narrowly to refer to organisms such as ticks, fleas, lice, and mites that attach or burrow into the skin and remain there for relatively long periods of time (e.g., weeks to months).

- Arthropods are important in causing diseases in their own right, but are even more important as vectors, or transmitters, of many different pathogens that in turn cause tremendous morbidity and mortality from the diseases they cause.

❖ **Louse (plural: lice)** :

- Is the common name for members of the clade Phthiraptera, which contains nearly 5,000 species of wingless parasitic insect .
- Lice are obligate parasites, living externally on warm-blooded hosts which include every species of bird and mammal, except for monotremes, pangolins, and bats.
- Lice are vectors of diseases such as typhus
- Chewing lice live among the hairs or feathers of their host and feed on skin, while sucking lice pierce the host's skin and feed on blood and other secretions. They usually spend their whole life on a single host, cementing their eggs, called [nits](#), to hairs or feathers. The eggs hatch into [nymphs](#), which moult three times before becoming fully grown, a process that takes about four weeks.





❖ **Mites (*Sarcoptes scabiei*):**

- Scabies is a skin disease characterized by severe itching caused by a group of parasites called mites, one of the types of arthropods that multiply within the layers of the skin.
- One of the most prominent symptoms of scabies is severe itching of the skin, and its severity increases at night. Itching appears in children and the elderly more severely, and children may suffer from severe side effects on the surface of the skin.
- Sarcoptes scabiei is spread by direct contact with an infected person, and scabies may also be spread by using personal items, such as: a towel or bed linen from an infected person. Therefore, a number of family members may contract the disease in the same period, and an infected person may transmit the disease to another person before symptoms appear.
- The doctor can diagnose this disease by looking for signs of the presence of sarcoptic parasites, by taking a biopsy of the skin of the infected person. The doctor gently rubs the skin in the area that appears infected, then examines the sample under a microscope.

- Diagnosed by take a skin scraping are placed on clean and dry slide with one drop 10% sodium hydroxide and cover it with coversliple . Examine under low power of microscope.



Scabies

Sarcoptes scabiei