**MICROBIOLOGY 5 & 6**

**PARASITIC INFECTIONS**

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Strictly speaking a parasite is an organism that lives in (or on) (infects) the host and is dependent on it for nutrition, often causing damage/disease. Thus whilst **protozoal and helminthic** infections are commonly referred to as ‘**parasitic’** infections, viruses, bacteria and fungi are equally so.

Protozoa are single celled organisms and unlike prokaryotes are eukaryotic in that their genome is contained within a nucleus and their cytoplasm contains complex organelles.   
The pathogenesis (mechanisms by which they cause disease) is varied and many are carried by insect vectors. They **do not** produce eosinophilia in the host. By contrast, helminths are complex multicellular organisms (metazoa) can be free living, transmitted by vectors and their life cycle often involves an intermediate host. Humans are the definitive host. Adult worms lay eggs or produce microfilariae but cannot themselves multiply in man- therefore a cause of morbidity rather than mortality. Forms which invade the blood often cause an eosinophilia.

**Protozoa**

These can be divided into:

**1. Amoebae** e.g. *Entamoeba histolytica* can cause a bloody form of diarrhoea (dysentery) when it infects the colon and also can lead to abscess formation in the liver. These amoebae can ingest red cells. Other amoebae e.g. *Entamoeba dispar* are non pathogenic.

**2. Coccidia**

*Plasmodium* species e.g. *P. falciparum, vivax, ovale* and *malariae (* and most recently *knowlesi)* cause malaria. The life cycle involves the invertebrate (*Anopheles* mosquito) and vertebrate host (man). In man there is both a liver and a blood component to the cycle.   
The major disease forms are a febrile illness, cerebral malaria (alteration in conscious level), respiratory distress and severe anaemia.

*Toxoplasma* is another coccidian protozoa which can cause an illness (toxoplasmosis) in the newborn especially involving the retina in the eye, and in immunosuppressed patients (e.g. HIV infected) affecting the brain. Infection is commonly from animals e.g. kitten faeces or undercooked meat.

*Cryptosporidium*, another coccidian parasite can infect the small bowel and produces severe diarrhoea. Infection is commonly waterborne. Occurs in the UK.

**3. Flagellates**

*Giardia* infects the upper small bowel (jejunum) and leads to giardiasis, a troublesome prolonged diarrhoeal illness, sometimes causing malabsorption. The organism has a ventral sucker by which it attaches to the bowel wall and flagellae which provide motility.

*Trypanosoma* a flagellated protozoa, transmitted by tsetse flies (often in the vicinity of animals e.g. game parks), lead to a febrile illness with lymphadenopathy and ultimately invades the nervous system leading to alterations in consciousness (sleeping sickness).

*Leishmania* are transmitted by sandflies and can lead to a skin or organ (liver, spleen and bone marrow) form of disease (cutaneous and visceral leishmaniasis respectively). Apart from the tropics, the disease also occurs around the Mediterranean and is associated with HIV infection.

*Trichomonas* is the commonest protozoal in the UK causing a vaginitis.

**4.Ciliates**

*Balantidium* is an unusual pathogen in man causing diarrhoea.

**Metazoa (Helminths; worms)**

Helminths have developed immune evasion mechanisms which allow them to cause chronic illness. Invasive forms lead to eosinophilia (an increase in eosinophil count- one of the granulocytic white blood cells found in the blood).

1. **Round worms (Nematodes)**

*Ascaris* leads to ascariasis in the bowel. Worms can cause obstruction especially of bile duct or if sufficient numbers, the bowel. No intermediate host.

*Filaria* can cause a variety of diseases. Lymphatic filariasis (elephantiasis), cutaneous filariasis (onchocerciasis) leading to blindness and loaiasis (eyeworm). Transmitted by *Aedes* mosquitoes, blackflies and mango flies, respectively.

*Strongyloides* is an important worm infestation because the eggs produced by the adults can hatch within the host and invade human tissue leading to severe illness especially when the host is immunocompromised. It is cause of diarrhoeal illness in the tropics.

1. **Flat worms (Cestodes)**

*Taenia* infestation (tapeworm) can be from pork (*Taenia solium*) or beef (*Taenia saginata*). The importance of the distinction is that the larvae from the eggs of the pig tapeworm can invade the host tissues especially the brain leading to a condition called cysticercosis- with fits and focal neurological signs (eg weakness).

1. **Flukes (Trematodes)**

***Schistosoma*** infection leading to bilharzia is the best example. Infection is acquired by contact with freshwater in which the invasive form (cercaria) penetrate the skin. The adult worms live in either the urinary bladder (*S. haematobium*) or bowel (*S. mansoni*) where they lay eggs. The eggs may spread to the liver where they cause an inflammatory reaction leading to fibrosis and obstruction to the portal vein draining the bowel which results in oesophageal varices (dilatation of the veins around the oesophagus) and later haemoptysis (the vomiting of blood).

**Conclusion**: Parasitic infections are indeed a fascinating and interesting field. They infect much of the world’s population and are an increasing problem in travellers (especially malaria and bilharzia). Where the infectious load is low, clinical presentations may be quite different from those depicted in classical textbooks of medicine. Some have a high mortality e.g. malaria whilst others have high morbidity (e.g. hookworm infection is the commonest cause of an iron deficient anaemia worldwide). These diseases inflict a huge economic burden on those who can afford it least i.e. in developing countries. Sadly they are amongst the greatly neglected diseases of mankind.