

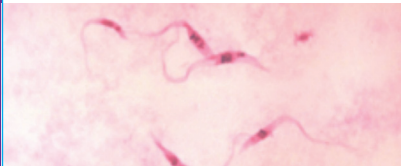
PARASITES

MANCHESTER
1824

The University of Manchester



Chagas Disease



Length of Parasite	20 μm
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Number Infected	8 million
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Deaths Per Year	50,000
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Number of Life Cycle Stages	4
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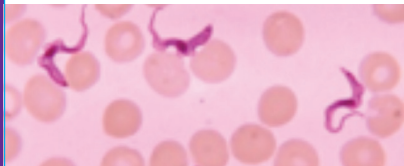
Geographical Distribution (Countries)	26
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Causative agent: *Trypanosoma cruzi*

Vector/Transmission: *Triatomine bugs* or “kissing” bugs

Up to 30% of chronically infected people develop heart problems and up to 10% develop gut, neurological or mixed alterations.

Sleeping Sickness



Length of Parasite	30 μ m
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Number Infected	300,000
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Deaths Per Year	9000
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Number of Life Cycle Stages	4
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Geographical Distribution (Countries)	36
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Causative agent: *Trypanosoma brucei*

Vector/Transmission: *Tsetse fly*

Sleeping Sickness, has two causative agents, which are both subspecies of the protozoan *Trypanosoma brucei*; *T.brucei gambiense* (90 %) and *T.brucei rhodesiense* (10 %).

Toxoplasmosis



Length of Parasite	6 μm
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Number Infected	6 billion
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Deaths Per Year	Rarely fatal
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Number of Life Cycle Stages	4
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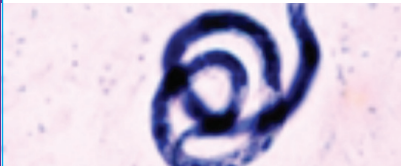
Geographical Distribution (Countries)	Worldwide
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Causative agent: *Toxoplasma gondii*

Vector/Transmission: *Cat faeces, infected meat or congenitally*

Humans are infected by eating infected meat, eating food or water contaminated with infected cat faeces, or by transmission from mother to foetus.

Lymphatic Filariasis



Length of Parasite	90 mm
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Number Infected	120 million
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Deaths Per Year	Rarely fatal
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Number of Life Cycle Stages	5
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Geographical Distribution (Countries)	73
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Causative agent: *Wuchereria bancrofti* or *Brugia malayi*

Vector/Transmission: *Mosquito*

Disease is also known as elephantiasis and is a leading cause of permanent and long-term disability.

Cutaneous Leishmaniasis



Length of Parasite	10 μm
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Number Infected	1.2 million
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Deaths Per Year	Rarely fatal
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Number of Life Cycle Stages	2
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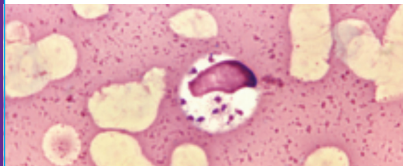
Geographical Distribution (Countries)	41
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Causative agent: *Leishmania major*

Vector/Transmission: *Sand fly*

There was a high incidence of leishmaniasis in World War II.

Visceral Leishmaniasis



Length of Parasite	10 μm
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Number Infected	400,000
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Deaths Per Year	50,000
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Number of Life Cycle Stages	2
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Geographical Distribution (Countries)	28
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Causative agent: *Leishmania donovani*

Vector/Transmission: *Sand fly*

Mis-diagnosis of visceral leishmaniasis leads to a mortality rate near 100%.

Onchocerciasis



Length of Parasite	42 cm (female)
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Number Infected	18 million
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Deaths Per Year	Rarely fatal
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Number of Life Cycle Stages	5
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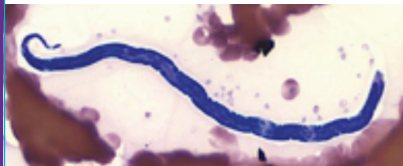
Geographical Distribution (Countries)	36
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Causative agent: *Onchocerca volvulus*

Vector/Transmission: *Black fly*

It is estimated that 120 million people are at risk of onchocerciasis or river blindness – 96 % of these in Africa.

Loiasis



Length of Parasite	55 mm (female)
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Number Infected	13 million
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Deaths Per Year	Rarely fatal
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Number of Life Cycle Stages	5
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Geographical Distribution (Countries)	12
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Causative agent: *Loa loa*

Vector/Transmission: *Deer fly or Mango fly*

This is also known as the African eye worm.

Giardiasis



Length of Parasite	15 μ m
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Number Infected	200 million
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Deaths Per Year	Rarely fatal
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Number of Life Cycle Stages	2
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Geographical Distribution (Countries)	Worldwide
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Causative agent: *Giardia lamblia*, *Giardia intestinalis*, *Giardia duodenalis*

Vector/Transmission: *Ingestion of infected cysts*

In the USA, giardia is the most common parasitic infection affecting adults. The disease can cause severe diarrhoea and smelly stools.

Trichuriasis: Whipworm



Image: R. Grencis,
University of Manchester

Length of Parasite	4 cm
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Number Infected	790 million
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Deaths Per Year	rarely fatal
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Number of Life Cycle Stages	5
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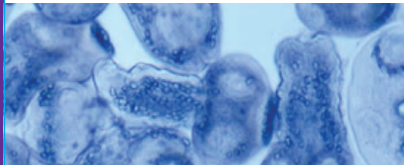
Geographical Distribution (Countries)	150
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Causative agent: *Trichuris trichiura*

Vector/Transmission: ***Ingestion of infective parasite eggs in contaminated water or food***

This is the third most common roundworm of humans.

Hydatid Disease: Tapeworm (dog)



Length of Parasite	6 mm
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Number Infected	1 million
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Deaths Per Year	Rarely fatal
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Number of Life Cycle Stages	6
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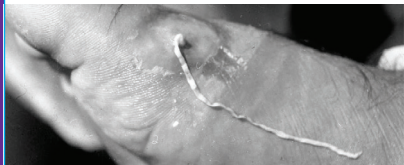
Geographical Distribution (Countries)	Worldwide
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Causative agent: *Echinococcus granulosus*

Vector/Transmission: *Ingest eggs in contaminated food or water*

Humans are accidental intermediate hosts and are not able to transmit the disease.

Dracunculiasis



Length of Parasite	1 m
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Number Infected	542
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Deaths Per Year	Rarely fatal
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Number of Life Cycle Stages	2
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Geographical Distribution (Countries)	5
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Causative agent: *Dracunculus medinensis*

Vector/Transmission: *Ingestion of infected water fleas*

Often referred to as Guinea worm disease. In the 1980s 3.5 million people were infected but education has almost eradicated this disease.

Ascariasis: Roundworm



Length of Parasite	35 cm
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Number Infected	1,000 million
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Deaths Per Year	3,000
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Number of Life Cycle Stages	5
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Geographical Distribution (Countries)	150
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Causative agent: *Ascaris lumbricoides*

Vector/Transmission: *Ingesting food and water contaminated with roundworm eggs*

Gut worms like Ascaris are a major reason school children miss school and their education.

Hookworm Disease



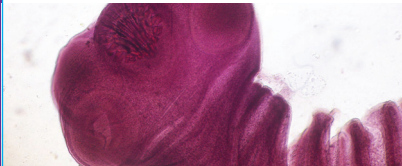
Length of Parasite	12 mm
Number Infected	600 million
Deaths Per Year	rarely fatal
Number of Life Cycle Stages	5
Geographical Distribution (Countries)	150

Causative agent: *Necator americanus*

Vector/Transmission: ***Walking barefoot through areas contaminated with larvae***

In the early 20th century hookworm was prevalent in the USA. Hookworm is a parasitic vampire, living off the host's blood!

Taeniasis 1: Beef Tapeworm



Length of Parasite	10 m
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Number Infected	60 million
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Deaths Per Year	Rarely fatal
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Number of Life Cycle Stages	5
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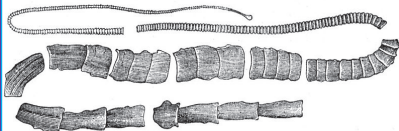
Geographical Distribution (Countries)	Worldwide
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Causative agent: *Taenia saginata*

Vector/Transmission: *Eating raw/uncooked infected beef*

Beef tapeworm is common where raw meat is eaten.

Taeniasis 2: Pork Tapeworm



Length of Parasite	3 m
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Number Infected	50 million
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Deaths Per Year	50,000
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Number of Life Cycle Stages	5
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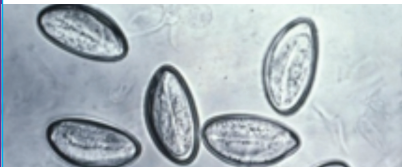
Geographical Distribution (Countries)	Worldwide
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Causative agent: *Taenia solium*

Vector/Transmission: *Eating raw/uncooked infected pork. or worm eggs from infected people*

Ingestion of worm eggs can cause the serious disease cysticercosis.

Enterobiasis: Thread/Pin Worm



Length of Parasite	1 cm
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Number Infected	1,000 million
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Deaths Per Year	Rarely fatal
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Number of Life Cycle Stages	3
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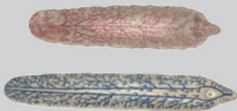
Geographical Distribution (Countries)	Worldwide
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Causative agent: *Enterobius vermicularis*

Vector/Transmission: *Ingesting eggs from contaminated clothing, bedding or objects*

School aged children have the highest prevalence of thread worm infestation. It gives you a very itchy bum!

Fascioliasis



Length of Parasite	3 cm
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Number Infected	2.4 million
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Deaths Per Year	Rarely fatal
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Number of Life Cycle Stages	5
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Geographical Distribution (Countries)	70
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Causative agent: *Fasciola hepatica* or *Fasciola gigantica*

Vector/Transmission: *Eating larvae attached to raw or uncooked vegetables or in water*

The World Health Organisation have estimated a further 180 million people are at risk of fascioliasis.

Strongyloidiasis



Length of Parasite	2 mm
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Number Infected	100 million
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Deaths Per Year	Rarely fatal
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Number of Life Cycle Stages	5
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Geographical Distribution (Countries)	150
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Causative agent: *Strongyloides stercoralis*

Vector/Transmission: **Contact with soil that is contaminated with worm larvae**

Many veterans from World War II developed this disease.

Malaria



Length of Parasite	6 μm
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Number Infected	207 million
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Deaths Per Year	627,000
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Number of Life Cycle Stages	4
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Geographical Distribution (Countries)	99
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Causative agent: *Plasmodium species*

Vector/Transmission: *Female Anopheles mosquito*

Malaria kills one child every minute in Africa.

Schistosomiasis



Length of Parasite	17 mm
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Number Infected	243 million
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Deaths Per Year	200,000
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Number of Life Cycle Stages	6
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Geographical Distribution (Countries)	78
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Causative agent: *Schistosoma japonicum*, *Schistosoma mansoni*, *Schistosoma haematobium*

Vector/Transmission: *Water snail*

Schistosomiasis may also be referred to as 'snail fever' as fresh water snails act as vectors of the parasite.

How to play

- The cards are shuffled and dealt out among the players face down. Traditionally players do not look at their cards or rearrange their order.
- Players may only look at the top card in their own pile.
- The player to the left of the dealer will choose a category from their top card and read out the value.
- All the other players will then read out their values for the same category on their top card.
- The player with the best value* wins the round and receives everyone else's top card. *This is usually the largest figure, but not always. The key should indicate whether a higher or lower value is 'better'.
- The winner places the cards they receive at the bottom of their hand and then chooses the category for the next round.
- If there is a draw and two or more cards have the same value, all the top cards are placed in the centre and a new category is chosen by the same player. The winner of this round gets the top cards as usual plus the ones in the centre.
- Players are eliminated when they lose their last card.
- The winner is the player who ends up with all the cards.

Key

Length of parasite: This is the length of the parasite. Note the units are different so $\text{nm} < \mu\text{m} < \text{mm} < \text{cm} < \text{m}$

Number infected: This refers to the numbers of cases reported of the disease. The actual people at risk of disease is often much higher than the number of cases of disease.

Deaths per year: This is how many deaths the diseases causes. If a disease (card) does not have a mortality rate then this category scores zero.

Number of different life cycle stages: Many parasites have multiple stages of their life e.g. from egg to worm. This is the number of life cycle stages it has but does not include the number of larvae moults.

Geographical distribution (countries): This refers to the number of countries the parasite is found in. If a disease (card) occurs worldwide then this category wins.

Useful/further information

A parasite is an organism that lives in or on another organism (its host) and takes benefit from that organism without necessarily returning anything back. All animals have parasites associated with them and most animal will be parasitized at some point in their life. Parasites are in fact the most common way of life on our planet! Some parasites have complicated ways of life and need to live in more than one host during their lifetime. Parasites have also adapted lots of ways to get into their hosts and hide there!

Understanding the scale of microorganisms:

- Micrometre (μm), Millimetre (mm), Centimetre (cm), Metre (m)
- One micrometre is 0.000001 metre
- There are 1000 micrometres in a millimetre
- One thousand = 1,000
- One million = 1,000,000
- One billion = 1,000,000,000

At Manchester University we study how the body's defence system (immune system) fights parasitic infection. Find out more at www.mig.ls.manchester.ac.uk

This resource was created by Emma Bartram, Professor Richard Grencis and Dr Sheena Cruickshank in the Faculty of Life Sciences at the University of Manchester.

Data correct at date of publishing: 2014