



**KARA'S
TOP TEN
FAVOURITE
PARASITES**

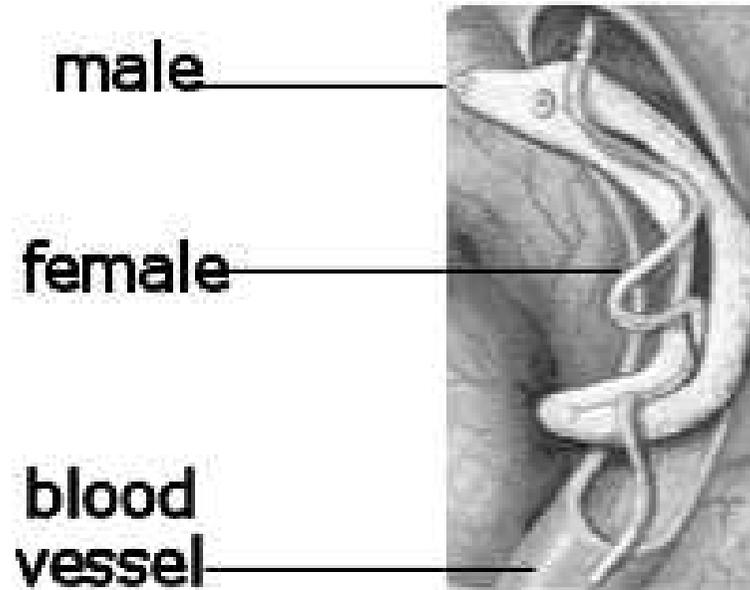
**A FIRST
PICTURE BOOK
FOR BUDDING
MICROBIOLOGISTS
BY KARA FILBEY**

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1. The Romantic Parasite

Schistosoma mansoni (Bilharzia)

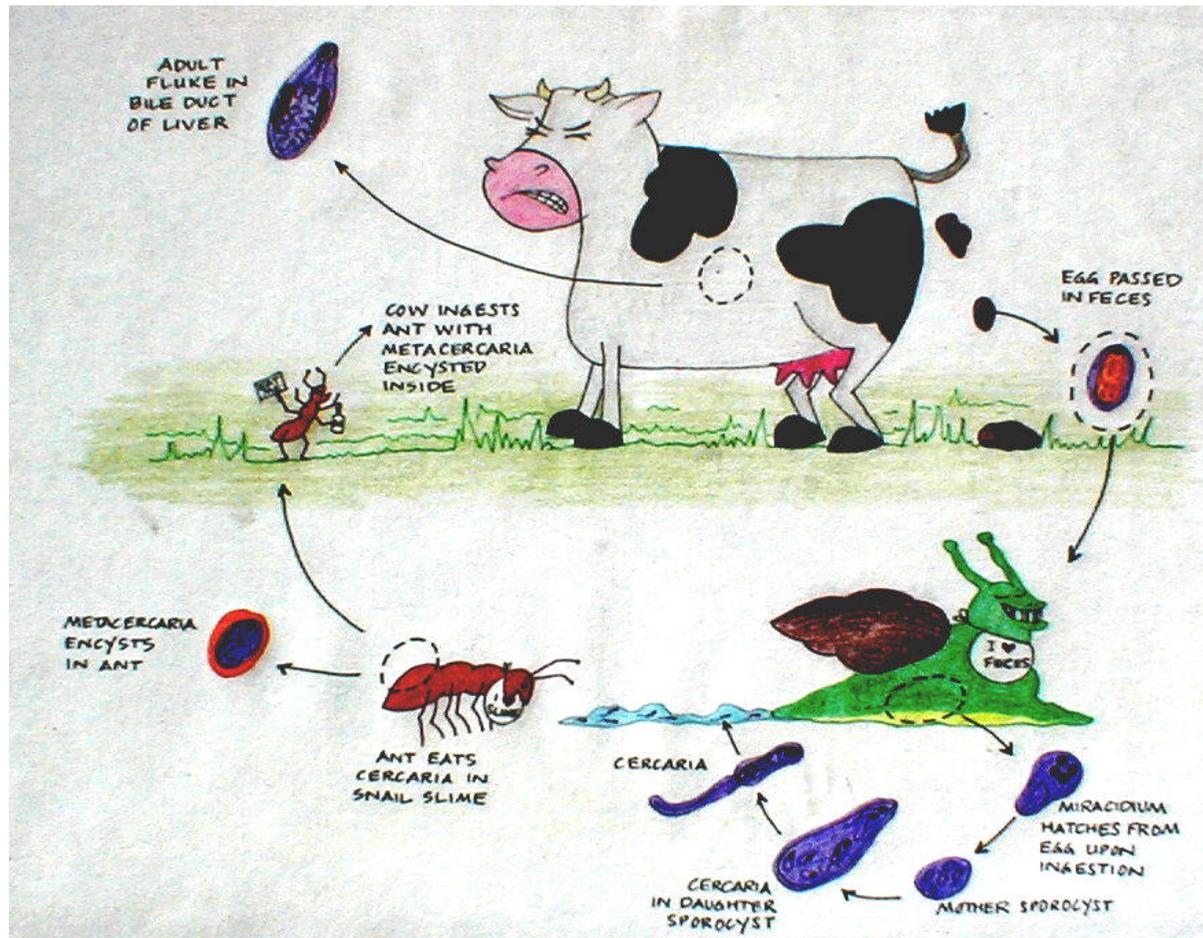


The female lies inside a groove along the male's body and they snuggle like that in blood vessels around the host's intestine. The female lays eggs that can burrow through the liver using evil spikes and cause horrible damage. The eggs that leave the host into water develop into little swimmers and enter the human again by burrowing through the skin!

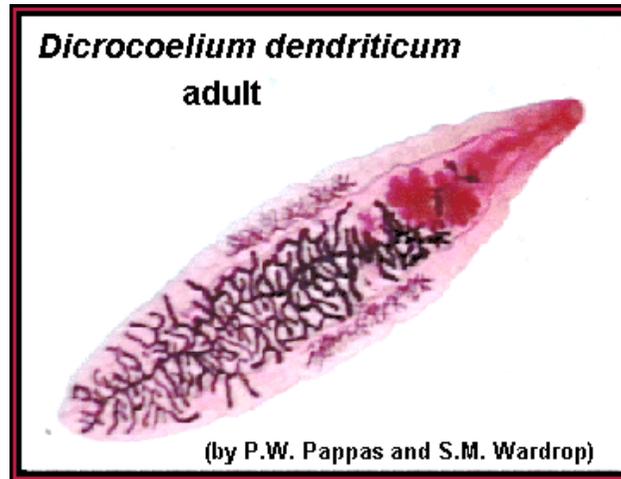
The amazing thing about this parasite is that females and males have to find each other in the precarious environment of the human body, and survive the treacherous world outside, but like any good love story, when they do they stick together – they have been known to stay in a host, closely intertwined and churning out eggs for 30 years or more!!

2. The Very Clever Parasite

Dicrocoelium dendriticum (Lancet liver fluke)



I love telling the story of the life cycle of this parasite and it always gets people round to my way of thinking – that parasites are the cleverest and most highly adapted creatures ever!! The number of amazing ways *Dicrocoelium* manages to stay alive in a terrestrial environment when all of its relations are aquatic is unbelievable!



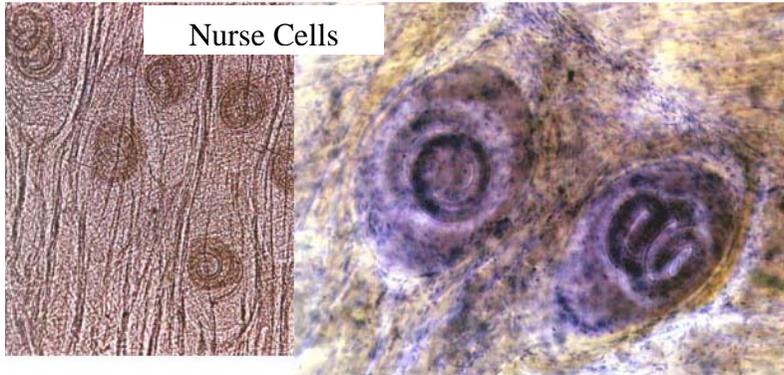
Adult flukes live in the bile ducts within the liver of sheep and cattle. Eggs containing miracidia are released with the feces. The land snail, *Cionella lubrica*, eats the egg, which then hatches in the gut, the miracidium penetrates the gut wall and develops into a sporocyst.

Sporocysts make cercariae, which are released in the snail mucus which is then eaten by a specific

species of ant, *Formica fusca*. The infective metacercariae then develop in the ant's nervous system which causes drastic behavioural changes – usually at the end of the day the ant would crawl back to its nest and sleep, but when infected it crawls up to the tip of a blade of grass and becomes paralysed there, so that grazing sheep and cows will eat the grass, ant and parasite altogether! The parasite migrates to the liver and starts the cycle again.

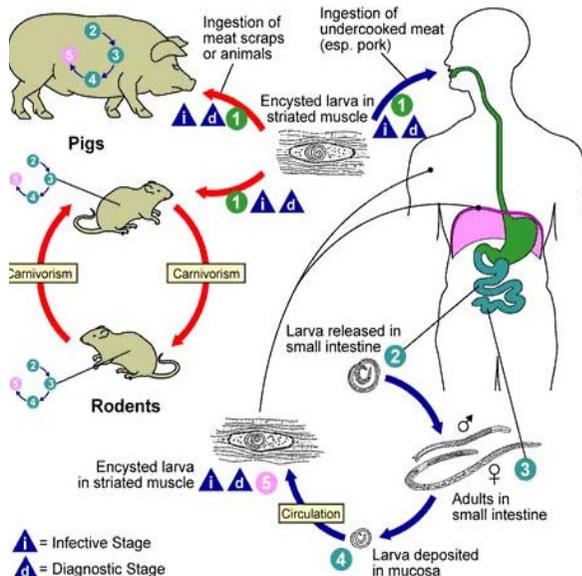
I find this astounding as without one piece of the puzzle, the parasite would die. As with all living things the whole point of life is to reproduce and carry on your genetic line, and *Dicrocoelium* has found a wonderful way to do it!

3. The Squatter Parasite



Trichinella spiralis

Animals and humans can be infected with *T. spiralis* when they eat undercooked or raw meat. The adults in the small intestine release larvae that travel to muscle tissue via the bloodstream. The larvae can enter a muscle cell and change it into a comfortable home (a nurse cell) that it can live in for years until a predator eats the animal. The parasite actually increases the chance of its host being eaten as the formation of lots of these muscle nurse cells and the damage they cause can make the animal a slower runner or even lame.



4. Disgusting, but ingenious!!!!

Leucochloridium paradoxum (snail parasite)

This is a cool parasite I've come across that uses a snail as its intermediate host. When parasite eggs are eaten by the snail they grow inside and end up in the snail's antenna where they grow large and throb different colours. The movement of the antenna and the size attracts birds to eat the snail and thus ingest the parasite too!!! Then the bird poos out the parasite eggs again for the snail to eat. Disgusting, but ingenious!!!!



5. It drives its host to suicide!

Spinochordodes tellinii (hair worm)



This one shows the extraordinary lengths a parasite can go to manipulate its host!! The parasite develops inside a grasshopper and when big enough (often much longer than the host itself!) it induces the host to commit suicide by secreting chemicals which interfere with the nervous system of the grasshopper and

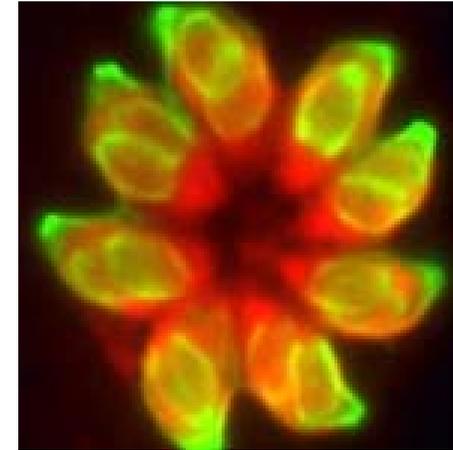
make it jump into water. Here the worm leaves its host and is then free living in the water, where it mates and lays eggs that are eaten by an intermediate host, and deposited onto grass in the faeces, and eaten by another grasshopper.



6. Manipulating the host

Toxoplasma gondii

A clever trick by some parasites is to change their hosts behaviour to make transmission of the next host more likely. An example is *Toxoplasma gondii* which has been found to alter a rat's sensitivity to smells, so much so that in a cage, they will be more attracted to the side with cat scent. This is obviously beneficial in real life as the rat will be eaten by the cat and the parasite passed onto its definitive host.

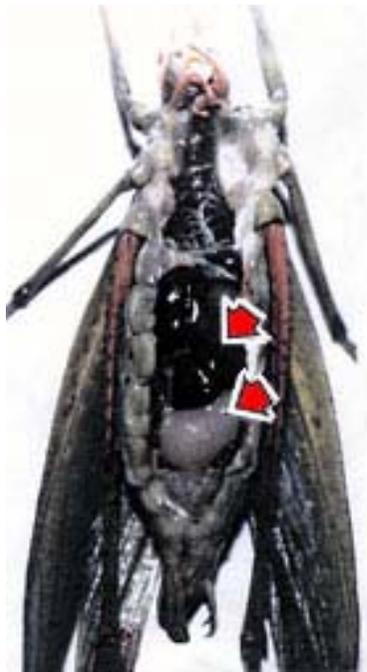


Another example is malaria. There are many suggestions that the presence of malaria parasites in a human may make them more attractive to mosquitoes - by scent of sweat or increased body temperature. Also, the presence of the parasites inside a mosquito alters the biting behaviour to make it bite more frequently and for longer, thus increasing the likelihood of successful transmission.

7. Hiding from the immune System

Stichotrema dallatorreanum

Evading the immune system of the host is essential for the survival and reproductive success of the parasite and there are diverse examples throughout nature. In basic terms, the recognition of the immune system

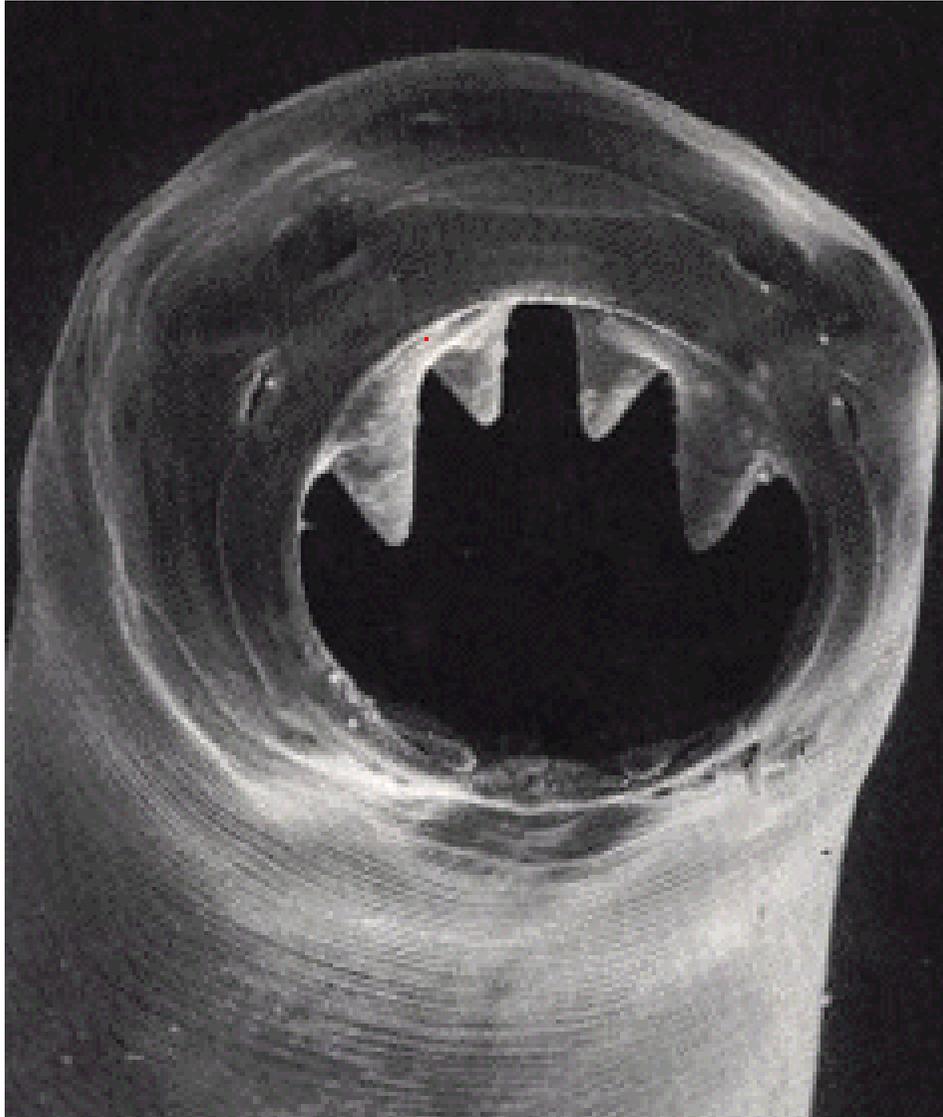


of something as foreign (or 'non-self') is the first step in eradicating harmful beasties, and many parasites can camouflage themselves so that they look like 'self' to the immune system. On a large scale this happens in the insect parasite *Stichotrema dallatorreanum*, which lays its larvae on the outer cuticle of another insect (a diverse range - wasps, ants, grasshoppers etc) which then burrow into the soft tissue and enclose themselves in a bag made of the hosts tissue! This allows them to live inside the host and feed on the nutrients in its stomach (see pic), but stay undetected by immune recognition mechanisms as they are surrounded by host 'self' tissue. At the same time the reproductive organs

of the host are completely destroyed and this gives a useful application to this gruesome story - scientists are looking into developing this system to eradicate crop destroying pests which harm both ecosystems and economics of an area.

8. Blood sucking parasites

Nippostrongylus brasiliensis



This fearsome looking hookworm is called *Nippostrongylus brasiliensis*.

This worm migrates through the body, and attaches to the gut wall of its victim where it fastens on with its big jaws and sucks blood, moving around to get optimal meals, leaving the open sores to bleed into the gut and making the poor host anaemic and ill!

9. Halfway parasites

Ampulex compressa

Parasitic wasps are fascinating because they show how parasitism has been taken on board by free living animals - they are kind of half way parasites!! They may give an insight into how parasitism evolves - most of the parasites you think about, you can't imagine them once being free living - they rely so heavily on their hosts.

This wasp has a horrible way of taking over its host - a cockroach.



The female, when ready to lay eggs stings the cockroach on its hind legs causing it to fall over, leaving the head section exposed for a second bite, into a specific part of the brain controlling 'escape'.

The venom doesn't cause paralysis, it just stops the insect from running away

of its own accord. **This is the amazing part** - the wasp then grasps one of the cockroach's antennae and directs it, like a joystick, into its burrow where it is used as larvae food. The egg is laid onto the cockroach and when it hatches the larvae burrows in and eats its insides! Then still inside, it forms a cocoon to develop into adulthood, and 4 weeks later you see a fully formed adult wasp emerge from inside the cockroach!!!
GRUESOME!!!!

10. How parasites can help us



Co-infection with a worm and malaria, which cause 'opposite' immune responses in the body, can balance each other out.

Co-infection with parasites has been shown to alleviate diseases such as the flu (caused by a virus called Influenza A, which damages airways, causes weight loss and immune system failure), inflammatory bowel disease (which is rare in tropical countries where worm infection is

high) and asthma and allergies. As well as skewing the response back to a safer, non-inflammatory one, worms can also bring about the production of cells which release regulatory chemicals. These dampen down any immune response towards the worm (another clever way that parasites manipulate our immune systems to help their own survival) and at the same time can decrease immune responses that are themselves unwanted as in the case of asthma or hayfever.

So there we have it! Parasites can be our friends as well as foes, and shouldn't always be thought of as horror films may sometimes present them, but also as fascinating and clever creatures that can help us understand and cure our bodies!



I love parasites.

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