Microscopic single celled parasites called Trypanosomes infest the blood, causing deadly sleeping sickness.

The bite of a tsetse fly is enough to deliver a fatal dose.

These microscopic beasts only affect people in sub-Saharan Africa.

So what are they doing today in cold, wet Glasgow?
The Wellcome Trust Centre for Molecular Parasitology, just off Byres Road, Glasgow. A thriving enclave of tropical disease.

Parasites are one of humankind’s oldest foes, and in many places their presence remains a major obstacle to development.

Malaria, sleeping sickness and kala-azar cause untold suffering, misery and death. Behind each of these horrible diseases are thousands of tiny parasites making our bodies their homes.

We want to understand how these parasites work, the molecules and interactions that make them tick.

Plasmodium, Trypanosoma brucei, Leishmania.

Plasmodium is transmitted by mosquitoes and causes malaria. Hundreds of millions are infected every year, and it takes a life every 30 seconds.

Trypanosoma brucei causes sleeping sickness - a disease of lethargy, insomnia and irreversible coma when the parasites invade the brain.

Leishmaniasis ranges from painful boils to lethal ‘kala-azar’ which destroys the internal organs. It’s spread by tiny sandflies.

The aim is to find new ways to control, treat and eventually eradicate these diseases.
Parasites’ lives are completely intertwined with ours. However, while the parasites benefit, leeching off the nutrients in our blood and cells, they cause dangerous, often fatal disease.

Domestic animals can also be vulnerable, and for people living hand to mouth, their loss can be catastrophic.

Parasites have all manner of ways of subverting and evading the immune responses mobilizing against them.

Leishmania and Plasmodium hide inside our cells where antibodies can’t find them, and release molecules which confuse the immune system.

Trypanosome populations evade the immune system by constantly changing their surface coats. Those with out-of-date coats are destroyed, while the others escape.

The immune response is always one step behind, unable to keep pace with the ever-changing set of disguises.
The fight against tropical diseases has a long history in Scotland. Today, although technologies have changed, the tradition continues. We are looking for the parasite’s weak spots: vital genes we can target to kill them or prevent their growth.

We can artificially knock these genes out of the parasite. To see whether it can cope without them. It’s like Jenga, except here we want to know which bricks to knock out to bring the parasite to a crashing halt.

We also want to find out what parts of the cell these genes affect, but it’s hard to see what’s going on inside these tiny organisms.

Certain jellyfish produce fluorescent molecules to glow in the dark. We can take the gene for this and attach it to the genes we’re interested in to illuminate their interactions.

This is actually quite easy to do. We use a machine that electrocutes the parasites, creating small pores in them through which this DNA seeps to combine with their DNA.

All this information gives us a detailed picture of the inner workings of these complex organisms, and tells us which parts are worth targeting.
But parasites are not a static foe. In the wild, natural selection shapes parasite populations and better-suited strains survive and diversify in turn.

As parasites evolve to cope better with their hosts and their environment they develop new ways of evading our immune systems, resisting our drugs, and getting transmitted between us.

I'm trying to follow this process by comparing the genomes, the entire genetic code, of different trypanosome strains.

Genome sequencing used to take years, but it's become so much cheaper and quicker we can get all this information in just a few months. The hard part now is getting meaningful answers from it.

You see, the world is changing. People move, forests come and forests go, parasites thrive or die, hitching a ride from place to place, weather permitting.

These diseases are currently found in the tropics, but as ecosystems change, we shouldn't be surprised when parasites adapt and change too.
Parasitic diseases mostly affect poor people in developing countries, and so they are generally neglected by drugs companies.

It's bad business spending time and money producing treatments that people can't afford.

$1 billion

Cost to bring a new drug to market.

50%

Proportion of people in developing countries living on less than $2 a day.

Most of the drugs developed to treat sleeping sickness are relics from the days of empire. Melarsoprol, still commonly used today, is based on arsenic and the principle that the drug will kill the parasite before it kills the patient.

We're fascinated by these organisms and driven by a desire to understand them better.

Working closely with labs, clinics and field stations around the world, we hope that these studies will open the door to new ways of controlling these parasites and curing the terrible diseases they cause.
TRYpanosoma BRUCEI

Front

Flagellum
The tail of the parasite, pulls it through the blood with powerful twisting beats

Surface Coat
Completely ensnare the parasite, camouflages the parasite from the immune system

Nucleus
The central library and control centre, regulates the parasite's activity and contains the plans for its molecular machinery

Flagellar Pocket
The heavily fortified portal through which the parasite takes up nutrients and expels waste

1/100 Millimetre

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For more information visit: www.gla.ac.uk/centres/wcmp