



# PARASITES!

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THE BITE  
OF A  
TSETSE  
FLY IS  
ENOUGH  
TO  
DELIVER  
A FATAL  
DOSE



MICROSCOPIC SINGLE  
CELLED PARASITES  
CALLED  
TRYPANOSOMES  
INFEST THE BLOOD,  
CAUSING DEADLY  
SLEEPING SICKNESS.



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



IS TRANSMITTED BY MOSQUITOES AND CAUSES MALARIA. HUNDREDS OF MILLIONS ARE INFECTED EVERY YEAR, AND IT TAKES A LIFE EVERY 30 SECONDS.

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 THOSE WITH OUT-OF-DATE COATS ARE DESTROYED, WHILE THE OTHERS ESCAPE.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.



DAVID LIVINGSTONE



WILLIAM LEISHMAN

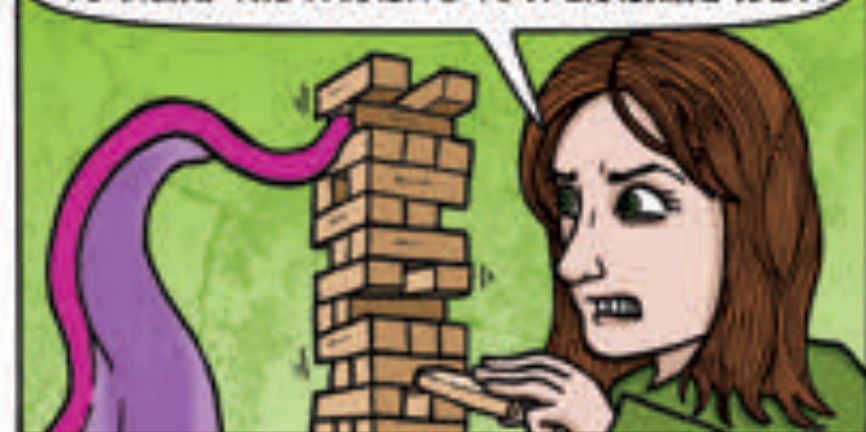


PATRICK MANSON

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.



HERE WE CAN STUDY WHAT'S IMPORTANT AND INTERESTING, EVEN IF IT'S NOT FINANCIALLY PROFITABLE.



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

## FLAGELLUM

THE TAIL OF THE PARASITE,  
PULLS IT THROUGH THE  
BLOOD WITH POWERFUL  
TWISTING BEATS

## SURFACE COAT

COMPLETELY ENSHOULDS THE  
PARASITE, CHANGING IT  
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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**welcome**trust