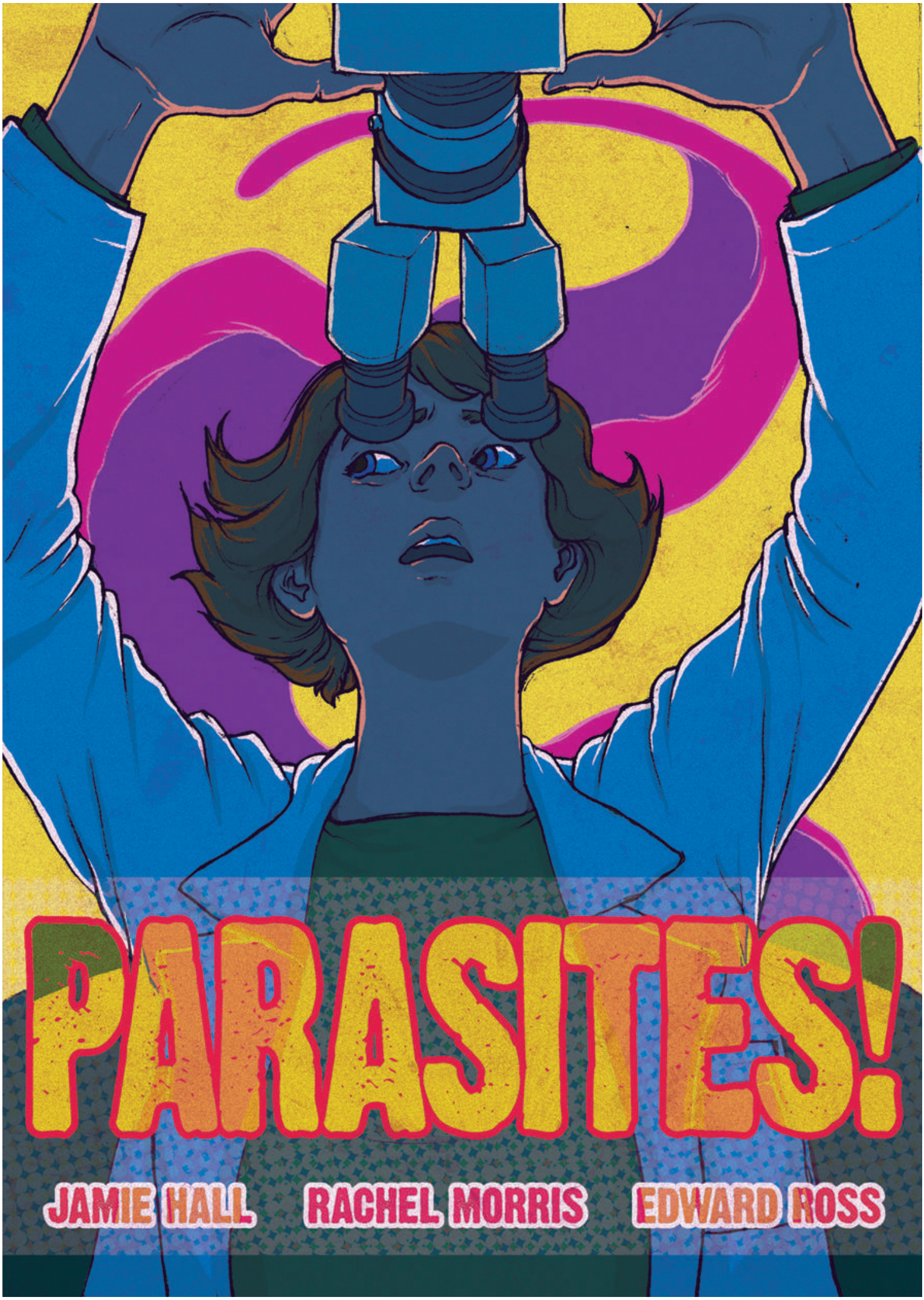
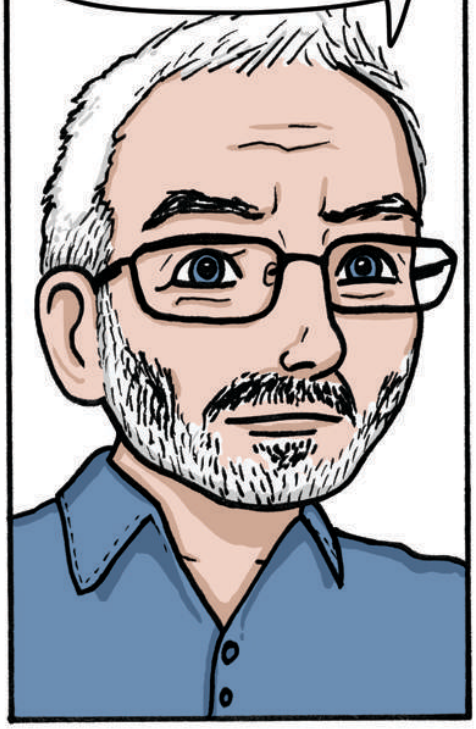

PARASITES!
JAMIE HALL
RACHEL MORRIS
EDWARD ROSS

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

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

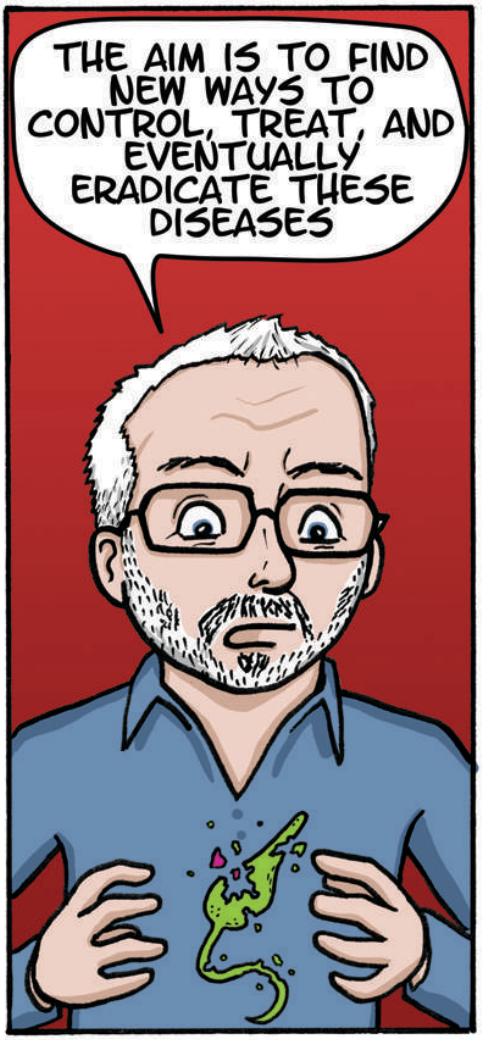
TRYPANOSOMA BRUCEI

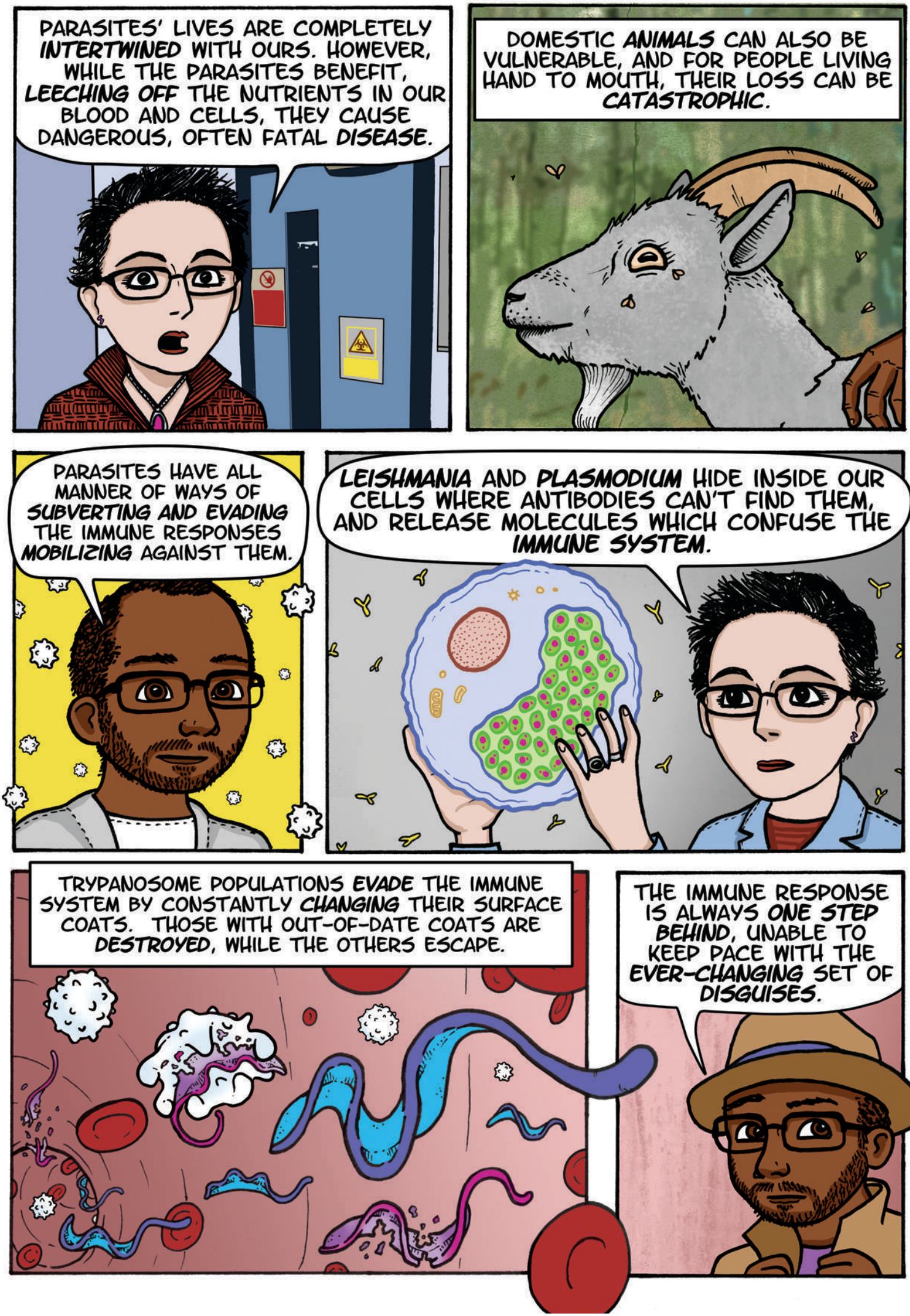
CAUSES **SLEEPING SICKNESS** – A DISEASE OF LETHARGY, INSOMNIA AND **IRREVERSIBLE COMA** WHEN THE PARASITES INVADE THE BRAIN.

LEISHMANIA

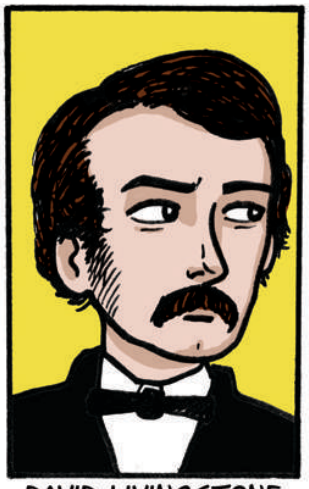
LEISHMANIASIS RANGES FROM PAINFUL BOILS TO **LETHAL 'KALA-AZAR'** WHICH DESTROYS THE INTERNAL ORGANS. IT'S SPREAD BY **TINY SANDFLIES.**

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

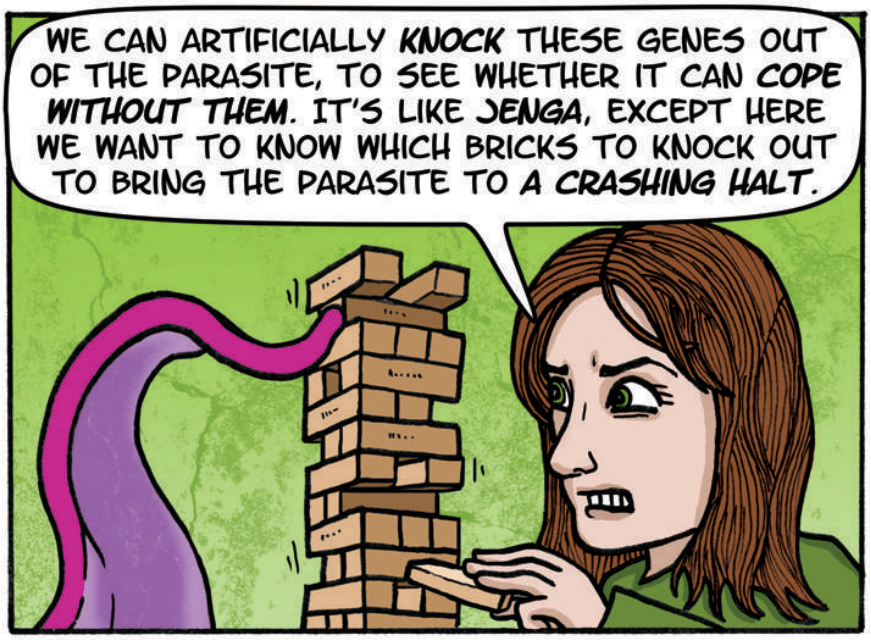
WILLIAM LEISHMAN

PATRICK MANSON

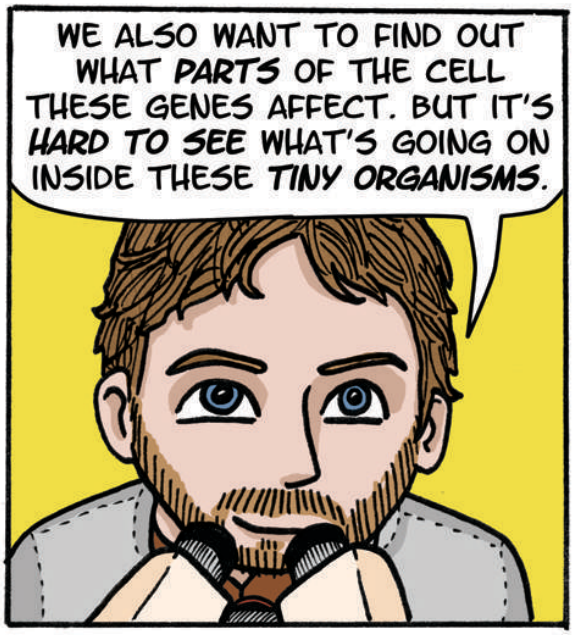
WE ARE LOOKING FOR THE PARASITE'S *WEAK SPOTS*: VITAL *GENES* WE CAN TARGET TO *KILL* THEM OR *PREVENT THEIR GROWTH*.

TARGET ACQUIRED.

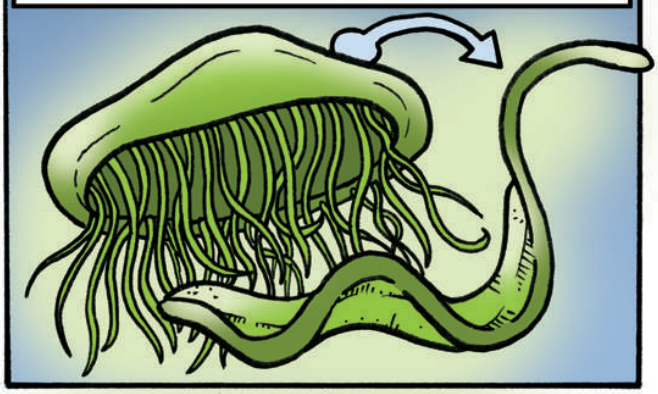
WE CAN ARTIFICIALLY *KNOCK* THESE GENES OUT OF THE PARASITE, TO SEE WHETHER IT CAN *COPE WITHOUT THEM*. IT'S LIKE *JENGA*, EXCEPT HERE WE WANT TO KNOW WHICH BRICKS TO KNOCK OUT TO BRING THE PARASITE TO *A CRASHING HALT*.



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.

COLLECTED FROM A *TSETSE FLY*, UGANDA/KENYA BORDER, *1960*

COLLECTED FROM A *HUMAN*, KENYA/UGANDA BORDER, *1977*.

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.**

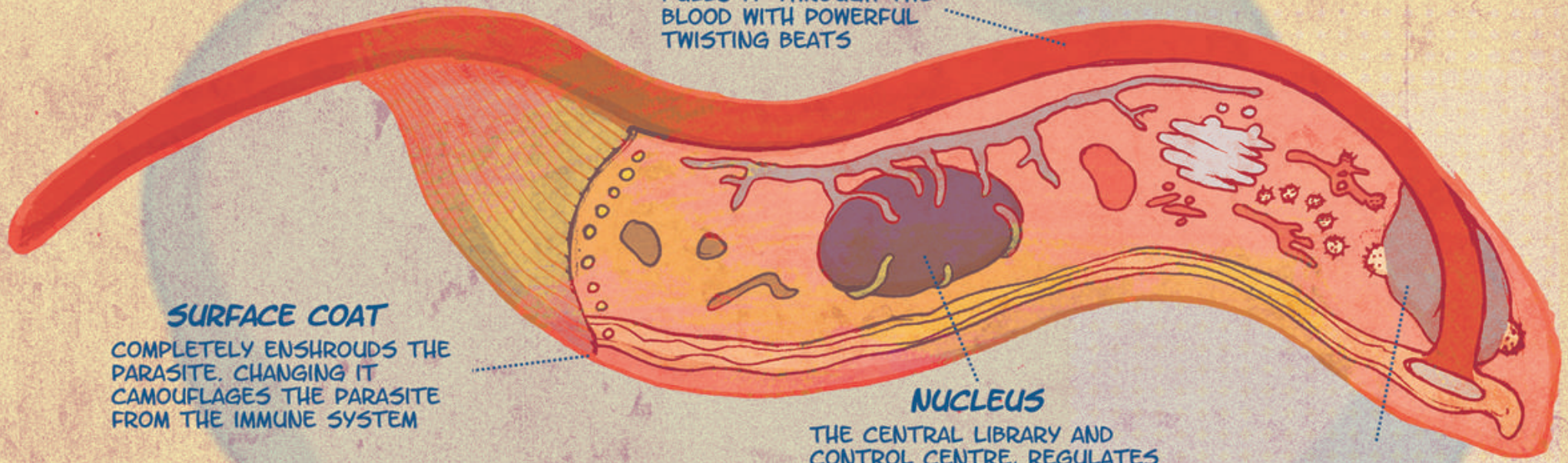
POISON

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



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