Bilharziology with Anouk N. Gouvras
Ologies Podcast
January 19, 2021

Oh heeey, it's the ghost of podcasts past, Alie Ward. I'm bringing you an early lost episode from 2017 for today, 2021. I never, ever, ever thought I'd air this one. This one was dead to me. It has been sealed tightly in a vault for three and a half years, in shame.

It's one of the very, very first interviews I ever did for *Ologies* before the podcast even really existed, before there was, like, a format, before I figured my shit out, before any pandemics, and definitely before I knew how to use sound recording equipment. So I need to warn you, if this is your very, very first episode of *Ologies* you're ever listening to, please go away, just stop, just put a pin in this episode, turn around, pick another episode.

Okay, ologites, people who have been around long enough to know all my secrets and call me Dad, this one's for you. This episode, again: dead and gone. Every time I thought about this interview, I cringed. Even now, I literally got tingles up my spine and I shuddered. I'm 100% honest.

So here's what happened: It was June 2017 before I ever released the first *Ologies* episode. I went to London for work and I packed all my audio equipment just for this interview. And I met up at the Natural History Museum of London for an interview about parasitology. I did the mic check, not realizing that the two handheld microphones were picking up nothing and instead it was just the little built-in mic capturing us talking. We were able to sweeten the sound, make it work a little bit.

Before I tell you the rest, just a really quick thanks to all the folks on Patreon.com/Ologies, thank you, everyone. To everyone who rates and subscribes, especially people who write reviews such as this one from Hi My Name Is, who listens while boiling coyote bones in a lab, they say, and they wrote:

> *I'm truly in tears thinking about how Ologies has filled my heart and brain with excitement and joy while living some of my darkest days of this year.*

Thank you, Hi My Name Is. Please don't make me cry.

So the topic is Bilharziology, and you're like "the fuuuck is that?" Okay so, bilharzia are types of parasitic worms. And bilharzia comes from the name of the guy who first identified these little critters. A German dude named Theodor Bilharz, really the world's first Bilharziologist.

And because I was not great at interviewing yet, the questions are all over the place. We talk about parasites but mostly bilharzia, which cause schistosomiasis. So I checked 'bilharziology', and bam. One Google result. This word has been used *one* time before in a typewriter-written, 1960 World Health Organization report, in regard to bilharziologists, or scientists who study the disease caused by blood flukes. It's on.

So this ologist has likely completely forgotten that they sat down for a 2017 interview for a podcast that didn't exist yet. But in her email agreeing to do it, she promised, "I will bring you some lovely/nasty specimens," and that she did.

She is Communications and Program Manager for the Global Schistosomiasis Alliance and her background is in tropical diseases and biomedical research. She did a postdoc at the Natural History Museum where she still does research. So curl up, put on your skinny jeans from four years ago, (I still wear mine), and get ready to ingest some lost episode, vintage, baby *Ologies* banter about curly worms, vials of vile creatures, snails, flatworm drama, febrile delirium, spooning, outmoded gender

roles, historical weight loss pills, unfortunate snacks, and some new therapies with parasite researcher and Bilharziologist, Dr. Anouk Gouvras.

Alie Ward: Well we're recording but again, we're going to cut all this out. Do you want to test your levels?

Anouk Gouvras: Okay? Uhh not entirely sure what to say but…

Alie: It's good! Your level looks good!

Aside: [*"As it turns out…"*] her levels were not good.

Anouk: I'm Anouk Gouvras.

Alie: Got it.

Aside: Also in 2017, I hadn't yet started asking the guest's pronouns, but I checked, and her Twitter bio says she/her.

Anouk: So currently I am the Communications and Program Manager for an organization called the Global Schistosomiasis Alliance, and that is going to require some explaining. [*laughs*] So, I'm based at the museum but it's actually an independent body that looks at a particular parasite and the particular parasitic disease called schistosomiasis that infects 250 million people worldwide, particularly in Sub-Saharan Africa. It's caused by a parasitic worm called *Schistosoma* or schistosomes, which I have some samples of here.

Alie: We're looking at jars in front of us and it looks like there's just, squiggles, evil squiggles, evil white squiggles in the bottom of them.

Anouk: Yep, they're evil white squiggles.

Alie: What is the name *Schistosoma*… Where does that come from?

Anouk: *Schistosoma*, I think it comes to describe the actual body of these worms. They're quite unusual looking in that they look round, like roundworms, but they are actually flatworms that are curved in, well the males are. They're flat and curved in and they create this little groove. The female worm, who is round, sits in that groove and it's sort of like a split body. There's another stage, their larval stage, which also has a split tail. So that also is like a schist. So a schist is a split.

Aside: So *schist*: split. *Soma*: body. Though there are over 25 recognized species, only a small handful infect humans. The size varies depending on the species. But in their tiny jars in front of us, they look like short, errant threads, picked off a cotton sweater. Now, under a microscope, the paired couples looked kind of like a pink green bean, slightly ajar, and acting as a hammock for another, much smaller pink green bean, which is just nestled in a sexy patriarchal groove that scientists call a gynecophoric canal. They're the couple engaged in uncomfortable PDA at a dinner party. Too close.

Alie: What are the ladies doing curled up in that?

Anouk: So, they have a very traditional lifestyle. [*Alie laughs*] They pair up, male and female, and they actually reside in the blood system of mammals. The male is strong and muscular and he holds onto the vein wall and feeds the female, protects the female. The female just sits there and produces eggs. She just sits in this grove that he's made for her and produces eggs, that's all she does.

Alie: That's so like, atomic family

Anouk: [*laughs*] Yes.

Alie: That's so traditional. How come these ladies aren't getting out?

Anouk: There have been documented cases of evidence that they do swap partners, but the females actually cannot produce eggs and become quite stunted if they're not paired up with males. They clearly have to actually exist paired up with a male in order to feed themselves adequately. So yeah, it's quite interesting.

Alie: That's not very empowering.

Anouk: No, it's not empowering at all. [*laughs*]

Aside: So I was wondering how they pick mates in the dark, sticky tunnels of our blood vessels. Luckily, I found a 2009 *International Journal of Parasitology* paper titled "The sex lives of parasites: investigating the mating systems and mechanisms of sexual selection of the human pathogen Schistosoma mansoni" and it had everything I never knew I wanted.

Okay, first off, they are mostly monogamous. Wait, mostly? Your soulmate lives in your body! Now, in this study it was observed that the guys can stuff their groove with multiple ladies and only actually mate with one of them, while the other ones are just crammed in there like sister worms, wondering if they should have frozen some larva.

Does this mean that there are shy worms with no one to nap in their sex canal? Well, the study continues, that, "Male body size was positively related to reproductive success." So, wow, worms, I thought you were above it. But worm gossip is not over yet.

So sometimes, long-term pairs get a divorce and the lady squirms out of the dude because there's another mate less related to her. So she's like, "Thank you so much for all the nutrients that you sucked from this person, but I gotta peace because that guy is not my cousin like you are, and I wish you nothing but the best. Please do not text me." Now hopefully, another mate will come along and catch their eye, or whatever.

Anouk: They don't particularly have eyes or anything like that. Living in the blood system, it's all done by chemical cues. [*laughs*]

Alie: So they just sniff it out.

Anouk: Yeah. [*laughs*]

Alie: So, okay… Now, they are flatworms.

Anouk: Yes, so they're trematodes or flatworms, sort of like the liver fluke but the liver fluke lives in the liver, whereas schistosomes are blood flukes. They live in the blood system of mammals, including humans, and also birds actually. You get some schistosomes that infect birds.

Alie: Not the same ones though?

Anouk: Different species, so even the evil squiggly worms I've got in tubes right here… We have three different species that infect cattle in front of us. Then this one here is the species that infects humans, it's called *Schistosoma mansoni.* It causes a disease called intestinal schistosomiasis which can be found in a variety of countries, but mainly in Sub-Saharan African countries and also in Brazil.

It's quite nasty. It can cause quite severe organ damage. But it's a very gradual disease, so it builds up over time and people get more and more infected, they get more and more damage to their organs. They get infected when they're maybe children and then by the time they're the age of 30 they have lots of complications; organ complications like they could potentially have a swollen and damaged liver, so their liver isn't functioning properly and it could lead to liver failure. But they can also get damage in the lungs, damage in the spleen, lots of complications that way.

Another similar species called *Schistosoma haematobium,* causes urogenital schistosomiasis.

Alie: Oh that sounds painful.

Anouk: That is very painful, very nasty, and can lead to bladder cancer, kidney failure. It can cause sterility, can potentially increase HIV transmission, and is quite nasty.

Alie: So how did you get… What did you study? How did you get involved in…

Anouk: In parasites and schistosomes?

Alie: Yeah, because you're a parasitologist.

Anouk: Yes I'm a parasitologist. I didn't start off as a parasitologist. I always liked animals as a kid and I always liked the marine environment. I first started doing marine zoology, studying animals of the sea, but we also had some general biology lectures, and it was in one of those that we started learning about parasitic infections.

It wasn't schistosomes, it was a different parasite that we were learning about, one that was transmitted by insect bites. I found it so fascinating that I suddenly decided that maybe I would pursue that a little bit more. And I started going to the parasite-based lab sessions that they had. I then decided to do my master's in parasites and the biology and control of parasites at the Liverpool School of Tropical Medicine.

Aside: So yes, she got a Bachelor of Science at the University of Wales, and a Master's at the Liverpool School of Tropical Medicine and Hygiene, and then her PhD from Imperial College London in the Department of Infectious Disease Epidemiology. Now, did she always have an aptitude for bilharziology? Was it in her blood, proverbially?

Alie: What was your gateway parasite? What was the one from insects, do you remember?

Anouk: Yeah, it must have been trypanosomiasis. That's a long word. All of these parasites have long words. [*laughs*]

Alie: Right, very fancy titles.

Anouk: Yeah, but it's also known as Chagas disease. It occurs in South America and it's really nasty.

Alie: I've heard of this.

Anouk: They're transmitted by these big 'kissing bugs' or 'assassin bugs' they're also called, and they can cause quite a lot of damage to people and gradually make them very, very ill. Again, these are all gradual diseases but Chagas can be very fatal.

Alie: Did Darwin possibly have that?

Anouk: Yes! He did actually. There is this sort of myth that he even collected the insect that bit him and it's in our collections.

Alie: No!

Anouk: I wouldn't say that it's absolutely certain. It is an insect, one of these assassin bugs that he collected. Now, whether it's the one that bit him, I don't know. [*laughs*]

Alie: Did he die from that? Or did he suffer from Chagas disease?

Anouk: That's a good question, actually. I think he did suffer from it, but I don't think he died from it. But I might be wrong.

Alie: I remember a story about him being so excited about collecting bugs that he ran out of hands and so he put one in his mouth. People were like "That's not a good place for…"

Anouk: Ohhh no!

Alie: I know.

Aside: Okay, so, I fact-checked this, and aside from unraveling the mysteries of evolution, Darwin was also that friend you had who's always trying to figure out why they were sick. This dude was out there on boats trying to collect creatures while also barfing after every meal. He had CVS, which is not a disorder of elongated cash register receipts, but rather, cyclic vomiting syndrome. Augh! Poor dude! As well as ailments that modern-day physicians looking back suspect were H. pylori bacteria, which causes ulcers, and yes, Chagas disease, which may have led to heart problems that led to his death.

Now, given that poor Chuck was prone to fits of upchuck, it is no wonder he penned my most favorite journal snippet in 1861:

I am very poorly today, and very stupid, and I hate everybody and everything.

That is some relatable content.

Okay, now, back to schistosomes.

Alie: So that got you interested?

Anouk: Yeah, learning about how the control of this bug was controlling the disease in South America.

Alie: What is it about… I mean, this is maybe a stupid question, but what is different from just being infected with, say, a bacteria versus a parasite? When does something become parasitic?

Anouk: Ah, that's a really good question. Loads of people will argue that maybe bacteria are also parasites, or viruses are parasites. But parasites tend to be… Things like malaria, like a protozoan. Malaria is a protozoan. It's a simple cellular organism that lives in the blood, but then you can get other parasites that are like these schistosome worms, which are clearly much more complicated, much bigger multicellular organisms. They have evolved a very specific survival strategy.

With parasites, it's more of a life strategy than a particular type of organism, so it very much has to do with anything that lives in or on another organism, taking nutrients and benefitting from that but to the detriment of the host. There will always be a host-parasite relationship. That's why some people argue that bacteria are similar. There are a lot of free-living bacteria, and bacteria may or may not cause you damage.

Aside: Part of being a parasite is the effect that it has on the host, and dictionaries define a parasite as something that lives off a host "without making a useful or adequate return."

So, they're not just the ones who don't chip in on the big dinner bill, but they *never* chip in. You can rely on them to not be reliable to chip in.

Anouk: There's also an interesting relationship between the parasite and the host in that it's not in the parasite's interest to kill you, the host, outright. It wants the host to survive as long as possible so that it can reproduce. It's not an immediate killer like some other infections. Anthrax, for example, will want the body to go straight back into the earth, [*laughing*] so it kills straight away. [*Alie squeaks in terror*]

Aside: Anthrax, by the by, is a thrash metal band from the '80s, whose name was chosen because one of the members read about a spore releasing bacterium of the same name, that, if weaponized and inhaled, kills 85-90% of patients who don't get treatment. The band said they liked the name Anthrax because it sounded sufficiently evil, and now I agree with them.

Anouk: Whereas the parasite wants the host to survive as long as possible so they can continue to reproduce and continue to send their offspring out there in whichever way it does, whether it's through another insect carrying its offspring off or whether the offspring come out, in the case of schistosomes, with stool and urine entering the environment. [*laughs*] There are different ways that parasites can transmit and continue their life cycle.

Alie: Do you ever overly apply the strategies of parasites to psychological things in your life? Did you have a roommate where you were like, "This roommate is a parasite. [*Anouk laughs*] They're taking my nutrients."? Does that ever relate into your psychology?

Anouk: Um, no. I don't think so. I tend to not really think of parasites in terms of humans, but I think potentially I might… in terms of some relationships, particularly when it comes to what parasites and hosts do, which is an evolutionary arms race. It's based on what is also called the Red Queen hypothesis.

The Red Queen hypothesis comes from Lewis Carroll, where you have to run as fast as you can in order to stay in the same place. The parasite is constantly finding ways to infect the host, the host is constantly trying to find ways to prevent parasitic infections. So they constantly have this battle where every time the host finds another way to stop infections or stop the parasite from spreading, the parasite will find another way to get past that hurdle. They're both running as fast as they can to stay in the same place; the Red Queen hypothesis.

Alie: Oh wow.

Anouk: And you can see that in a lot of things in how the world works. We are constantly doing that, so… [*laughing*]

Alie: It's such drama, isn't it? Who would have thought that vials of these tiny curvy little worms could cause such drama?

Aside: Who would have thought, Alie? Maybe the 250 million people globally who have schistosomiasis, or maybe the scientists who have dedicated their lives to finding treatments and cures. But yes, lady who has never risked these parasitic flatworms spooning and boning in your lifeblood, they do cause drama.

Anouk: Yeah. I might be slightly focusing on the negative aspects of parasites. There are, believe it or not, some positive aspects of them as well. You can use them in positive ways.

Alie: [*surprised*] How?!?

Anouk: [*laughing*] How can you use them in positive ways? Okay, to give an example, I think our museum curator sometimes gets called in with live animals that have been confiscated from people who brought them into the country or different countries. The people who have confiscated these animals don't know if the animal is coming from the wild, or if it has indeed, as has been claimed by the paperwork, by the person bringing them in, been bred domestically and therefore can be traded.

Alie: Are we talking like baby tigers or squirrels or…?

Anouk: Well, no baby tigers, but chameleons, for example.

Alie: Okay.

Anouk: Madagascan chameleons, which people can have as a pet if they are bred domestically but you can't collect them from the wild. If you look at the parasites that live inside them, you can tell pretty quickly… If it's a parasite that only exists in the wilds of Madagascar, then you know that the chameleon couldn't possibly have been bred domestically.

Alie: It was abducted.

Anouk: So it was abducted, it wasn't a real domestically bred chameleon because there's no way it could have picked up those parasites anywhere else.

So that is one aspect, for example. There's also another aspect where you get parasites that can control insects that damage crops. That's another thing that you can potentially use parasites for.

Alie: I'm still not convinced that the forensic science of chameleon parasites is a good thing. [*Anouk laughs*] The chameleon doesn't like it, but our trafficking…

Anouk: Yeah, we can control it. Again, you'll get really nasty parasites and you'll get parasites that aren't so nasty, so maybe the chameleon's like, "Oh, I don't like that parasite, but it's not completely messing up my life." [*laughs*]

Aside: So okay, again, this was an early interview and we're talking about chameleon parasites right now which then led me down a rabbit hole, reading a 2007 news article about a guy from Croatia who vacationed in Thailand. He was caught in customs with a wriggling suitcase that authorities discovered was filled with 175 chameleons.

Let's not do that, humans. But one thing we can do is donate to a charity of the ologist's choosing. And this episode was so long ago, the benefit of your episode being on a shelf for three-and-half years is now, in honor of Dr. Gouvras, we're sending a donation to The Global Schistosomiasis Alliance, which is an alliance of partners working together to accelerate the progress toward schistosomiasis control and elimination. You can find out more at EliminateSchisto.org. That link is in the show notes, and that was made possible by sponsors of the show who you may hear about now.

[*Ad Break*]

Back to the blood flukes. Let's learn about the asses of the hour, bilharzia. And no, there are not Patreon questions because at the time I did not know what I was doing. If you don't believe me, just wait to see how this episode ends.

Okay, onward.

Anouk: Another thing that happens to these parasites – particularly things like worms, intestinal worms, or blood flukes – they are incredible at manipulating the host's immune system.

They will find ways to dampen the host's response so that the host's immune system doesn't attack them. That can have a secondary effect in that you won't get allergic reactions quite so strong. Worms have been linked to potentially dampening down the effect of irritable bowel syndrome, Crohn's disease, asthma and eczema, and that kind of autoimmune stuff.

There does seem to be a link between having a lot of parasitic worms and having less of these allergies, but areas like here [the United Kingdom] where you don't have any of these worms, a lot more people are suffering from autoimmune disease. People are doing a lot of research looking at what it is exactly in the parasite worm that is dampening down this immune system, and is there a way of making it into a safe medicine for people to take?

I would not advise people to go and infect themselves with worms. [*Alie laughs*] The risk of getting complications, even if it's just one worm, can be quite severe, and particularly for pregnancy, it can be quite dangerous as well.

Alie: Yeah, don't y'all go infect yourselves with worms. [*Anouk laughs*]

Anouk: I wouldn't say go and infect yourself with worms. I know that there are people who will do that.

Alie: Hell no! I mean, there were tapeworms used as a diet aid...

Anouk: Yeah, exactly that as well.

Alie: I remember seeing an old ad from, like, the '20s where…

Anouk: "Take one of these tapeworms!"

Alie: Yeah, and then the tapeworms would just gobble up your food for you.

I mean, do you hear stories? I actually know a girl who had some bad sushi and ended up with a legit tapeworm. Do people come to you because they know, they're like, "She deals with parasites."?

Anouk: I think I have had that once or twice ages ago, emails saying like, "Oh my god I think I have this parasite. What should I do?" We're not doctors, we're not allowed to tell them "You should go and take this." We're not trained that way. We'll give advice about "Okay, there's the London Hospital of Tropical Diseases, go there and tell them where you've been and they'll treat you." They have a walk-in clinic for people who've just come back from traveling. But you do get cases as well where it will be a museum staff member, and we've actually got a specimen from a museum staff member who got infected with a worm. [*"Please tell me everything."*]

After he took the treatments and pooped it out, he cleaned it and brought it in. We've got it preserved in some alcohol. [*both laugh*]

Alie: He really took his work home with him! I mean, that's very generous of him. To know that it's straight out of your butt!

Anouk: [*laughing*] Nice collection there.

Alie: Have you gotten to do any fieldwork at all?

Anouk: Yeah, for my previous job at the museum… So, I was a postdoctoral researcher on a project on schistosomes. For that project, which I did for five years, I traveled every year to a sub-Saharan African country, Tanzania, to do fieldwork. And before, for my PhD, I traveled to

different African countries to do fieldwork there. That was definitely an attraction for me in terms of parasitology as a discipline. You can, if you're a field parasitologist like I am, travel to lots of different countries and experience different cultures.

Also, whilst you're doing that, you get to help with a particular health problem in that country and your research can feed into how that country and how the ministry of health is dealing with that particular disease. I like the application side; how you can apply this parasite knowledge in the health area.

Aside: Remember: lost episode of baby zygote Ologies. I still haven't even asked about schistosomiasis really, so let's actually get into it.

Alie: Give me a really brief rundown of schistosomiasis. From what I understand, and I learned this in seventh grade and it still haunts me, the worm drills into the foot? How does this work?

Anouk: So yeah, it's got a complicated life cycle. It's got a two-host life cycle. The human or the mammal is the main host. The males and females pair up and they produce eggs. The eggs come out into the blood system but then they pierce the barrier between the blood system and the urinary tract, or the intestinal tract depending on which species they are.

The eggs come out with urine and stool when a person goes to the bathroom, and in a lot of the areas where schistosomiasis occurs, there is no infrastructure for toilets and sewage and things like that so people will defecate and urinate outdoors, and often will go and wash themselves in a river and that's how the eggs enter the river.

It's when they're in water that they will hatch out, and these larval stages, little baby schistosomes, will come out of the eggs and start swimming around in the water and they're actually looking for a very specific snail species to infect.

Alie: That is so complicated!

Anouk: It's very complicated. You've got this snail species, and when they find them they go inside and they are able to multiply thousands of times inside the snail. And they'll come out of the snail, and when somebody comes to wash themselves, or their clothes, or their dishes in that water body, this next stage that comes out of the snail will locate them, again using chemical cues. They will locate the human and pierce the skin.

So it might be the foot, but it could be any other part of the body, and they have these… they'll go down like a hair follicle and then they have these little enzymes that they'll release which will break down the skin and they can just snip into the blood system under the skin and that's when they'll travel around the body getting bigger and bigger and then finally pair up with their opposite sex and produce kids. [*"Romantic."*]

Alie: What selfish, little assholes. Why this snail? Why this particular snail? Is the snail like, "Why am I involved?"

Anouk: Yeah, absolutely. And poor snail as well, a lot of control programs also look at controlling the snails, so the snail gets killed off in order to prevent the parasite.

Aside: So the schistosomes are boning in your blood vessels, and then the female blurps out some eggs, which are called miracidia, which sounds like a beachy town outside of San Diego. But those eggs get into snail tissue, the snail releases cercaria: a larval form that looks like an egg with a forked tail. It's kind of like a tiny, swimming IUD. But while they're still looking for a snail, those little baby eggs are watching the clock, just scrambling.

Anouk: These larval stages, they can't feed. So they don't survive very long in the water, maybe 24 hours, and they get weaker and weaker. So they'll start getting desperate towards the end and they'll try to infect anything, any snail species. But once they do that, they won't be able to overcome that other snail species' immune system and they'll die inside the snail. Whereas in this particular species, they have evolved to adapt to that immune system and they can overrun it, basically, and just get away with using the snail as a big sex party, basically. [*Anouk and Alie laugh*] Well, not quite, it's clonal. It's not sex. That's not correct.

Aside: Pairings, you got breakups, spooning with your cousin… Someone get these worms a TLC show.

Alie: Oh my god! Okay, so how do you do fieldwork and not worry about these little dudes getting…

Anouk: Getting infected? Well, because I'm an expert in schistosomes, I know how to avoid getting infected with schistosomes. Other parasites are another matter, but with schistosomes at least I can avoid getting them. So when we do fieldwork, we do two types of fieldwork. We do one where we collect the snail, and that's where we're most likely to get infected.

Collecting the snail involves going into the water body and we wear… You know how fishermen have these big, huge waders? We wear these waders and depending on how deep the water is, we'll either wear wellies or waders that come up to your thighs or sometimes even chest waders. And you go in there with a net, a special net, and you scoop around amongst all the vegetation and marshy habitats and pull out loads of different snails. And you've got to pick out the snails that you know are the ones that can get infected.

Then another type of fieldwork, which is worse, is that I go into schools, and this is working with local research institutes or ministries of health, ministries of education. I go into schools and I ask a hundred kids to provide stool samples or urinary samples, and then I filter out the eggs in those infected kids. It's quite gruesome work. It's not very glamorous.

Alie: Do you have to keep them numbered or…?

Anouk: Yeah. They all have to have IDs. All the kids' data is pretty protected. These IDs, we can link that to what's the parasite species that we collected from this child. And then here at the museum we do a lot of parasite DNA work, so we can link that parasite DNA to that infection from that area. It's actually quite useful because we work alongside treatment programs.

Anywhere we go where we do our research, anybody who's infected will get treated. [*applause*] So any school we go to, to collect from infected children, those kids will then get treated afterward by either the national control program or by various NGOs that we work with that will treat children.

Alie: That's an incentive.

Anouk: Yeah. At least I know those kids are being treated, which is great. The thing is that they'll go back in the water and get infected again. So something that we do is, we monitor how the parasite might genetically be changing with ongoing treatment programs. You know, I told you about this evolutionary arms race? One of the selection pressures we're putting on is that we're treating lots of people with this drug, and it's our only drug, and the parasite might start resisting, getting resistance, or being less sensitive to this drug. In

which case we've got a massive problem because it's the only drug we have and it's currently being donated for free. We don't want that drug to not work anymore. So you've really got to monitor what's going on.

Alie: How does it work as it is?

Anouk: [*laughs*] This is one of the embarrassing stories of research. Nobody knows. It was originally developed as a malaria treatment, but when they were testing it out they said, "Well, it clearly doesn't stop malaria, but hmm, something's going on with schistosomiasis." So that's how they worked out that it does kill the schistosome worms, but only the adult schistosome worms, not the younger stages. They think it's got something to do with the worms' calcium channels, that it disrupts them, and then the worms just sort of wither away and die. But it's an accident and they're still trying to work out the exact mechanism. [*laughs*] Loads of people are spending years researching this aspect.

Aside: And yep, that is still being investigated. The drug has been given out for free by its maker, Merck, which just crossed the 1 billionth free tablets line, which is estimated to have treated 400 million since 2007. Still, 200,000 people every year, globally, die from this parasite. But I was looking for recent news on it and in the *Journal of Ethnopharmacology* last week, there was an article citing the anti-parasitic effects of red propolis, which is bee spit mixed with their beeswax and tree resins. Do I need to do an Ethnopharmacology episode? Yes, I do.

As we're talking about eggs, and poo, and willowy white worms, I just need you to know that I took a break to get a snack while researching this, and this week I was so on top of my snack game that I pre-made some chia puddings. But now I'm sitting here eating some globby mush containing a constellation of slimy chia seeds that look like eggs and also threads of shredded coconut that look like worms. And I need to tell you, in context, it is not awesome. My sludge aside: back to research on therapies, which has its own set of complications.

Anouk: So you try to use hamsters, which doesn't work very well and isn't very nice, but there's no way of keeping that parasite lifecycle without having a host. So it makes researching these sorts of things a lot harder to do, both from a financial point of view and also a regulation point of view.

Alie: Yeah. They're like, "Hey, do you want to sign up for this study? We're going to give you schistosomes. This stuff may or may not work."

Anouk: [*laughs*] Exactly. It's very difficult to get that through ethical approval.

Alie: "You get a gift card to Starbucks and a donut if you participate." People would be like, "No, I'm not doing that."

Aside: Anouk says that she's working on neglected tropical diseases, which despite affecting 1 billion people annually, get very little funding and attention for all of the infuriating and heart-breaking reasons you would suspect.

Anouk: Quite a lot of the time because the people they infect tend to be poor and in poor communities, and also because they're not immediate killers like malaria, for example. For children, it can kill pretty quickly, whereas in things like schistosomes it builds up gradually and it just means the person is sick for a very long time, and that will affect their physical growth and also their cognitive ability. And it will then impact on their economic

ability, and eventually it'll lead to being quite a risk, causing quite a restraint on health systems that are already pretty weak in these poor communities. So it's like a gradual thing that happens with these neglected tropical diseases, but they're not sexy. [*laughs*] That's the problem, they're not really sexy as a topic. So that's why they're called neglected.

Alie: What kind of impact do you think your particular work has had?

Anouk: So there are different… Ooh, that's a good question! [*laughs*] There's sort of different streams of impacts that our research can have. One of them is that, with all the research we do, the child gets treated or the person gets treated afterward. So that's one impact and that's great. And it could be that in those areas, they wouldn't get treated, so that's one impact. An impact of the actual research that we do is that we're able to inform local governments and local ministries of health of what snail species they're dealing with, where that snail is predominantly found, and how best they could potentially control the snail. We also train local researchers on this parasite; how to identify this parasite and how to study it.

Aside: They also store wild-collected specimens for further research to see if a vaccine will work on it. I was like, "Wait, these things are alive???" And no they're not alive. They are very dead. But having dead ones on hand, or rather, I guess, in vials, is helpful because…

Anouk: What you can do is… because a lot of these things are tested out on laboratory strains, and laboratory strains do not reflect the diversity of the parasite in the field. So you'll develop this great vaccine based on a particular part of the DNA of this lab-strain parasite, like, "Yeah! This is great! This is going to work!" And then you'll test it out in the field and it doesn't work at all because that part of the DNA is only a small fraction of the population that's actually out there.

So you can actually use these collections at museums to look at how diverse field specimens are and get a better indication, a better idea, of how effective your vaccine's going to be, if at all. As well as looking at museums, there's a lot on evolution and looking at how parasites adapt in changing environments, for example. That's all done with DNA work.

Alie: And that's the big thing about parasites is that they do adapt.

Anouk: Very, very, good at adapting. It's scary, actually.

Aside: Okay, and here's a *whopper* of a question I asked three *years* before a global pandemic:

Alie: Are you kind of a germaphobe at all because of your work? Or are you less of a germaphobe?

Anouk: I think I'm… No, I wouldn't say I am less of a germaphobe. I take precautions, so I get vaccinated. I love vaccinations, I have all of them. If they're available, I'll get it. And I'll definitely be careful in terms of wearing gloves, and wearing wellies, and protecting myself. I have a bit more of a, like, "Well, you know…" [*laughs*]

Alie: When you're on the train, are you like, "Meh…"? Are you more or less likely to hold onto a rail on the tube?

Anouk: I'll hold onto a rail. I'll just wash my hands before I eat. Or before I touch my eyes, for example.

Aside: Ah, such simple times, when you could just gab face to face with a worm expert, and also, just leave your house.

Anouk: There are times when I've gotten sick. Everybody that does fieldwork will get a stomach bug at some stage or another, and it's not fun. Most travelers get it, I think. I've had malaria as well, which wasn't a good experience. Do not recommend it. Definitely get lots of insect repellant.

Alie: Did you have fevered hallucinations?

Anouk: Yeah. I was doing my PhD and I was working in Kenya. I remember the fieldwork was really intense, and we take a preventative antimalarial to prevent us from getting malaria. I think what happened was the fieldwork was so intense that I forgot to take the pill, and if you forget it you're not covered that well that particular day; it's got a very short half-life. I remember that I was bitten by a lot of mosquitoes as well because I didn't have time to reapply insect repellent, you know? But I didn't think about it. I thought, "Oh I've been to Africa loads of times. It'll be fine."

When I came back to the UK, I stayed for a week and then I went to West Africa, Tunisia. And the day I arrived I started feeling quite feverish. I thought, "Oh, I've got the flu! So annoying. I've got to do fieldwork." It started getting progressively worse. I then had to let the teams go out to the school and I stayed behind in this building that used to be a hospital but the money had stopped so it was just an empty building that was near the villages where we were. We were in the middle of nowhere. So I stayed behind there, and slept on the ground, and hallucinated a bit, and just felt so weak.

I wasn't quite aware that the teams were getting really worried about me. I think we left the site early. But I had already started feeling better, so I thought, "Oh, it must have been one of those bugs I got and I'm sure it's all going to be fine now." The teams were thinking, particularly this team leader, "Oh, it looks like malaria, but she's only just come from the UK, she can't possibly have had malaria." And I of course didn't tell her that I was in Kenya two weeks before.

I started feeling better, which is a cycle… Malaria happens in cycles. So you hallucinate, get the fever, then you're a bit better, then you get even worse. I was better for a while and said, "No, I'm fine, let's continue." We went to the next place in the middle of nowhere and suddenly it started getting worse; *really* bad. I couldn't really get up. That's when she, this lady, asked me, "Were you in Africa recently?" And I was like, "Oh yeah…"

Aside: She told her, "Yeah, I was in Kenya… without totally wearing insect repellant or taking all of the antimalarials… Why?" [*laughs sheepishly*]

Anouk: She gave me a look like, "I am going to kill you…" [*both laugh*] And malaria has a two-week period for it to develop in your body before you show symptoms. So, she immediately took a blood smear from me and looked under the microscope, and apparently it was full of malaria parasites. And they were scared that I was going to freak out so they didn't tell me. I was hallucinating anyway. I was out of it so I wouldn't have really known.

Alie: Good hallucinations, like cool ones? Or bad ones?

Anouk: Very weird ones, just mixed up. I wasn't sure when it was day or when it was night. I would think that I had gone up and done something, but I in fact hadn't, just that kind of

stuff. Just lying down, and I thought I had gone and gotten a drink of water, but in fact I hadn't moved. That kind of thing. She put me immediately on treatment and told me, "Just take these pills." I took the pills and I started getting better, and that's when they told me that I had malaria. And apparently I went, "Oh, cool!" [*laughs*] Because I knew that once you diagnosed it, that you're out of the danger zone, and it's also that thing of knowing what you have. When you know that it's not going to kill you, you feel really relieved.

Alie: Is that a direct quote? "Oh, cool!"?

Anouk: Yeah! [*laughs*] I think I said it in French, though, because I was in…

Alie: Wow! Oh my god! So did you ask to save the blood smear?

Anouk: No, I didn't. I wish I had! But I didn't. We were in a hospital out in the middle of nowhere, and they didn't really have a lot of facilities, so I think they probably just cleaned the slide and…

Alie: They went, "Next!" How often do you do that, where you have a microscope and you're like, "Might as well look in here and see some of my…" Do you ever do that?

Anouk: My own stuff? No, not really. I think that was probably the only time, really, that I did that. She effectively saved my life…

Aaaand that is where my batteries died. So we continued talking for another 20 minutes without me realizing that my batteries had just croaked mid-conversation. So this is where our episode concludes. Just with a lesson to travel across continents and oceans for answers, asking smart people simple questions, and also, learn how to use your sound equipment before doing so.

But also, I want you to know the lesson here? No failure is as bad as you think it is. I mean, here we are… I thought this episode would never, ever be heard. But here we are! I decided, "You know what? Let's just share this nugget of vintage *Ologies*." I have plenty of episodes banked, but just having this one on the shelf has been gnawing at me for too long.

You can follow intrepid bilharziologist Dr. Anouk Gouvras on Twitter @SciAnouk and find more links to her work at AlieWard.com/Ologies/Bilharziology. (Yes, there is a link to that in the show notes). And we are @Ologies on Instagram and Twitter. I am @AlieWard on Instagram and Twitter. Please do say hello there.

If you listened to the end of the episode to last week's secret, there's more info on that secret on my Instagram @AlieWard, so do say hi. Merch is available on AlieWard.com. Thank you, Shannon Feltus and Boni Dutch the comedy podcast *You Are That* for managing that. Thank you Erin Talbert for adminning the big, huge group of listeners on the Ologies Podcast Facebook page. Thank you to every single patron at Patreon.com/Ologies for making this show possible.

Thank you, Emily White and all the transcribers, for making transcripts available. Caleb Patton bleeps them. Transcripts and bleeped versions are on the website for free, the link is in the show notes. Thank you to Noel Dilworth for doing so much scheduling and various lifesaving. And of course, to assistant editor and Chief Executive Cheerleader, Jarrett Sleeper, who has taken up quarantine workouts every morning at 9am Pacific on Twitch. You can find him via my Instagram and just sweat along. Occasionally I do walk by with a coffee and a dog.

And of course to the grooviest worm in the tube, Steven Ray Morris for helping us patch this together each week. And the theme song is my Nick Thorburn, and if you like it you should check

out his band Islands. They're a good band. He also did the theme song for *Serial*, which is nuts, right? *Serial* with an S, not a C.

Now, if you stick around to the end of the episode, you know I tell you a secret. And this week it is a lifehack from Old DadWard. I realized this, this week, and I'm too excited about it. If your shower is vexed by soap scum, it is very gratifying to clean it with the edge of a razor blade. You just glide the razor edge across it and all the gross stuff just peels off in curls. And if you're like, "Wow, I actually have never had a lazy month or two where I ate a lot of spiced cakes, and bawled watching Christmas movies, and watched government buildings being breached, so I don't have soap scum," I'm really happy for you about that. And I will actually take your life hacks if you want to give them to me. Okay. Be safe out there and remember: Chin up, Masks on. We got this. Berbye.

Transcribed by:

Aveline in Poitiers, France

Wendy Fick

Emily Hillard

That one shirt you always wear first after laundry day, Elena Horne

Some more links which you may enjoy:

A donation went to the The Global Schistosomiasis Alliance: eliminateschisto.org

Dr. Anouk Gouvras on LinkedIn

Her NHM London link

"The sex lives of parasites: Investigating the mating system and mechanisms of sexual selection of the human pathogen Schistosoma mansoni"

What was ailing Darwin?

Charles Darwin: moody just like us

Okay but *define* parasite

A Croatian guy put 175 chameleons in his suitcase

A billion tablets given out

Red propolis and schistosomiasis

Another red propolis study

For comments and inquiries on this or other transcripts, please contact OlogiteEmily@gmail.com.