

WESTERN SCIENCE SPEAKS PODCAST SEASON 3, EPISODE 6

EPISODE TITLE

Parasitism: The Most Popular Lifestyle Choice on Earth

PODCAST SUMMARY

With a population in the millions of trillions, Parasites are able to evolve at a faster pace than just about anything on Earth. Through this extreme and rapid evolution, parasites are able to come up with increasingly innovative ways to attach to a host species; whether it be in the sky, or down on the ground. Beth MacDougall-Shackleton, a professor at the Western Department of Biology, studies the way in which parasites evolve in order to find hosts.

She brings her expertise to the Western Science Speaks Podcast to explain how parasitism became the most popular lifestyle choice on Earth.

INTERVIEW

You're listening to the Western science speaks podcast. Presented by Henry Standage.

Henry Standage 0:16

There are trillions upon trillions of parasites inhabiting Earth. This makes their evolution a lot more rapid than a species such as humans that are trying to defend against them. But how have parasites been able to spread so vastly? And what methods are they using? Beth MacDougall-Shackleton from the Department of Biological and Geographical Sciences joins the Western Science Speaks podcast to explain how parasitism became the most popular lifestyle choice on Earth.

Henry Standage 0:51

Can you explain to us in your own words what a parasite is and what you're specifically looking at?

Beth MacDougall-Shackleton 0:56

Sure. So, a parasite is simply an organism, a living thing, that lives either on something else, or inside something else. So, a parasite lives on or in its host. It takes resources or food from its host. And in doing that the parasite increases its own fitness. But it decreases the fitness, the health or survivorship of the host.

Henry Standage 1:19

So, it's born into this world needing to find something to attach onto?

Beth MacDougall-Shackleton 1:23

That's right, parasites can't survive, and they can't reproduce unless they get access to the host. The specific parasites that I'm most interested in, are a group of blood born parasites called avian malaria. What these are, are little single celled organisms that affect different species of birds all around the world.

Henry Standage 1:43

And you look specifically at how these parasites affect the evolution of its host. And so how do you measure that? What things do you look at?

Beth MacDougall-Shackleton 1:51

Yeah, so parasites have many different effects on their host. In the short term, many parasites can affect the behaviour of the host, everyone probably familiar with the idea that the zombie fungus, that an ant will become infected with and then it will take over the ants brain and use that ant to spread itself into more and more and more host organisms. Yeah, there's some really nasty ones. So, parasites have all kinds of tricks. We call them

adaptations in biology, but there's simply ways in which they can get from the body of one host individual into another. So that could be you know, examples of that would be like rabies virus, sort of taking over the behaviour of the dog. That's infected with the virus, making the dog produce more saliva making the dog behave more aggressively. All of these things are going to improve the ability of the rabies virus to jump into another individual. So, parasites can affect the behaviour of their host over the short term. They also as I mentioned, affect the survivorship of their hosts. So, it's bad to be parasitized, it makes you less likely to survive, less able to reproduce. And because of that, parasites are a really important part of their hosts environment. So, over the long term, over many generations, over long periods of evolutionary time, host populations have evolved a lot of different ways of defending against or curing parasitic infection. This is why we have a very, very fancy and complicated immune system. And that there's all sorts of behavioural tricks that helps us to get rid of parasites.

Henry Standage 3:36

I was about to ask about that, because it seems like this never-ending competition where the parasites I assume, are evolving on their own too, and becoming more intricate and how they managed to spread itself. And so, what kind of evolutionary processes do you study?

Beth MacDougall-Shackleton 3:54

Yeah, well, so you've alluded to one, that arms race between the parasite on the one hand and the host. Selection is always going to favour parasites that become better and better at infecting their host. But at the same time selection is always going to favour hosts that become better and better at defending against parasites. Now in that particular arms race, that's one that we as host organisms are almost always going to lose, because the generation time of the parasite is just so much faster than ours. And the population size of the parasite is so high they can have such high rates of mutation. So, the parasites really have a huge advantage in these evolutionary arms races.

Henry Standage 4:38

And some animals, it looks like parasites are going to be an inevitable part of their life. So, you look at songbirds and birds obviously attract a ton of parasites. Why is parasite infection so common with birds?

Beth MacDougall-Shackleton 4:50

Yeah, so I mean, we're very aware of the devastating effects that parasites have had on birds. You know, there's famous examples of the Native bird life in Hawaii of course. the 1820s was really devastated and in many cases wiped out, when mosquitoes and the parasites that they carry came over. So, birds are something that people care a lot about. And so, we notice the parasites that affect birds. But birds aren't, you know, particularly unique in being hard hit by parasites. The real reason why so many creatures are affected by parasites is simply that there are many more species of parasite than there are of non-parasites. Yeah, some people say that there's probably about 10 times as many parasitic species as non-parasitic, so we're just so vastly outnumbered by parasites that it's perhaps not surprising that parasites have had huge evolutionary effects on practically every multicellular thing there is.

Henry Standage 5:55

Maybe birds just get a bad rap because they carry it so far. In one of your papers, you say that exposure to parasites is one of the costs of group living. Could you just expand on that for me?

Beth MacDougall-Shackleton 6:08

Yeah, sure. So, when an individual is just living by themselves, then they probably have a low rate of picking up parasites just from the environment. The second you start coming into, you know, arm's length of another individual of the same species or large groups of individuals, then there becomes a huge increase in the risk of acquiring their parasites. I mean, this is a very timely issue now with all the students coming back to live in the dorms and the lecture halls and a lot of viruses and diseases. Yeah, they love these tight, close, close quarters and close contact.

Henry Standage 6:53

Have some breeds or species evolved to kind of live on their own to get away from this group manifestation of the parasite?

Beth MacDougall-Shackleton 7:00

Great question, there's no birds that are completely solitary for their whole lifecycle. And the reason for that is simply that, you know, birds have two sexes like humans have two sexes, if they want to produce baby birds, they have to interact with another individual, at least once in their lives. But there are a lot of bird species, including song sparrows, the birds that I work on, that are very, very territorial. They will allow their mate to live in the same general area that they're in and they'll interact with their offspring, their babies, while they need to take care of them. But beyond that, they'll keep other individuals out and perhaps some of that is a defence against infectious disease.

Henry Standage 7:49

That's a sad defence. A bit lonely.

Beth MacDougall-Shackleton 7:51

I suppose it is, there are other birds that are very, very sociable and they presumably have other ways of dealing with the risks of becoming sick. These birds that are social tend to be very, very good at detecting signs of disease in their group members. And so, they may exclude the sick individual from the huddle at least until they get better.

Henry Standage 8:17

I want to shift more to your work with the songbirds. So, what are you looking at in the lab?

Beth MacDougall-Shackleton 8:23

Sure, yeah. A lot of my work involves interactions between these migratory songbirds and avian malaria. And so, some things we've done, have included looking at birds that are infected with malaria and comparing their migration success, their migration speed, the timing of their migration, relative to individuals that are not infected. These kinds of issues are sort of important when we're trying to forecast how rapidly different diseases will spread. If birds that become infected, can't migrate, then that's sad for the individual, but at least we don't have to worry about the disease spreading from one part of the world to the other. But other work we do in the lab has more to do with sexual selection and mate choice. So, some of my students are very interested in birdsong. For example, why female birds like males that can sing 10 song types? And so why is singing three song types not enough? What extra information is in those additional fancy songs that a male sings? Why should a female care?

Henry Standage 9:28

I saw that you did some work on reading the complexity of these songs.

Beth MacDougall-Shackleton 9:32

Some birds can sing more song types than others. And so, we say the birds with, what we can think of as big vocabularies they have, like, more complex songs. I mean, it does come down to sort of their early environment. If you give a bird all the food that it wants in its early years and you prevent it from becoming sick, then it will be able to learn a lot more songs. People have always been interested in how bird's kind of convey to other birds, to these potential mates who, as you point out are sort of taking a risk by mating with them. How do you point out to a potential mate, look, I'm healthy and I'm awesome? For a long time, we've been really focusing on song, figuring that birds that can sing a lot, and many different songs, are probably the healthiest birds out there. That's true. But what we are also realising now from work in my lab done by one of my PhD students, is that birds also change the way they smell when they become infected. So, birds, that if we experimentally exposed to malaria, smell is the tell. So, they're paying attention, not just to how one another sounds but also to their odour and perhaps using that to avoid sick individuals.

Henry Standage 10:58

Of all the threats outside of our control, infectious disease is the number one menace to humanity's survival and evolutionary fitness. Understanding more about the transmission of parasitological diseases, and the early symptoms

of them, will lead to an earth flourishing with healthy entities. I'm Henry Standage, signing out. Thanks for listening.