

Behavioral Ecology with Dr. Amy Worthington

Ologies Podcast

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Oh heeey, it's that guy in third period who's always drawing in a notepad but never lets anyone see it, Alie Ward, back with another episode of *Ologies*. So, behavioral ecology, [*chipmunk voice*] what the ding-dang heck is it? Well, it's why animals such as worms, and bugs, and your cousin, do what they do. And what's a better window into this world than the steamy porthole of cricket boning? Before we get to that sexiness though, a few thank-yous.

First of all, thank you to Patrons at [Patreon.com/Ologies](https://patreon.com/Ologies) for all the support to make the podcast since day one. You allowed me to take a trip through the Midwest in April, gathering episodes as I went. So this would not exist without your donations, this very episode. Donations start at 25 cents an episode if you want to join in on that party.

Also, thank you to everyone who has subscribed, who's rated, or especially who's reviewed the podcast. Y'all know I read your reviews on dark and stormy nights, and then I pluck a fresh one out in gratitude. Such as, for example, *LugubriousDisposition* says:

Bob Saget! Used here as an expletive. Alie Ward will crawl into your sweet little ear canal and before she leaves, prepare you a veritable feast of fascinating material on your eardrum-table. Don't resist, let her make brain dinner in your head.

Thank you, *LugubriousDisposition*, for that. I hope you're uncomfortably bloated with information.

Okay, so behavioral ecology, let's get into it. The word 'behavioral' comes from a root for possession. And ecology is the science of the relationship of living things to their environment, and it comes from the Greek *oikos*, meaning 'house' or 'dwelling'. So, being possessed with behavior in relation to your environment; why we do what we do, where we do it.

This episode was such a lucky fluke; it was just a gift from space and time. I was driving through the Midwest, and I had a cancellation in an interview, so I had one extra hour in Omaha. So I tweeted: [*old-fashioned radio voice*] "Okay, so I happen to have the day open in Omaha. Any ologists out there? Or should I just go to the Omaha Zoo and lurk around with my equipment?" And this ologist tweeted back: [*old-fashioned radio voice*] "Or you could just come lurk around Creighton University, visit my lab, and learn all about cricket sex and the nasty little horsehair worms that manipulate their host's behavior and physiology." My response? "I'll be there in 15 minutes!"

I think she had to postpone a tenure review for this, which is endearing and very punk-rock, but I ran into her building. [*Alie walking around campus whispering under her breath, "Okay, Hixson-Lied Science Building. Aaaaaah!"*] I dashed into her office, and we had a breakneck fast interview about her amazing work.

We sat down at her desk, and had just a scintillating chat about what puts crickets in the mood; what kind of people behavioral ecologists are; why she likes converting premeds to cricket folks; some nightmarish parasites; inbreeding that puts *Game of Thrones* to shame; and why crickets and other animals, such as humans, might delay making babies in favor of more pressing concerns.

So put your stubby wings together and make some noise for Assistant Professor at Creighton University and Behavioral Ecologist, Dr. Amy Worthington.

Dr. Amy Worthington: Amy Worthington.

Alie Ward: Okay, there we go. Dr. Worthington, of course. So here we are, we're in Omaha. I have just completely bulldozed into your workday. So sorry!

Amy: In all the right ways.

Alie: Thank you so much for being on Twitter and available for me to just bust into your university.

Amy: Well, thanks for being responsive to my fan-tweeting you and trying to bully you into coming to Creighton instead of the Omaha Zoo.

Alie: Well, I am very obviously familiar with what you do because your Twitter banner is two crickets, um, in a tender, intimate moment.

Amy: They are having sex, yes.

Alie: So you study cricket sex, but in a wider outlook it's reproductive physiology? Behavioral ecology? Tell me about what you do.

Amy: Yeah, so a lot of the research that we do in my lab is we focus on the concept that there are, what we call, life history tradeoffs.

Aside: Again, life history tradeoffs. Everyone from crickets, to squirrels, to you, has to make tradeoffs.

Amy: Every organism has a limited amount of resources, in terms of energy, that they can allocate towards different physiological processes. And if you overinvest in one, it means that one of those other physiological processes doesn't have the energy needed to fuel it.

Our big tradeoff that we look at is the tradeoff between the immune response and reproduction. These are two of the most energetically costly processes of any individuals.

Aside: So, for some individual animals it comes down to remaining alive or having shorties.

Alie: But sometimes, I guess, animals can't decide, "Should I mate and die, should I literally fuck off and die, or..."

Amy: *[laughs]* Live fast, die hard!

Alie: Yeah! Or, "Should I stay alive and maybe not reproduce as much?"

Amy: Yeah, and postpone reproduction until you're healthy and you've recovered from some type of illness or parasite, absolutely.

Aside: Or like, finishing school. I don't know. Speaking of which, Amy got a Bachelor's and a Master's in biology at the University of South Dakota, and a PhD in Ecology and Evolutionary Biology from Iowa State University. And she says she grew up obsessed with Bill Nye – heeey! – and her dad always set up science projects like rockets, and paper lanterns, and chemistry experiments.

She says as a kid she would hole up in her room, sometimes taking notes on organisms in her animal encyclopedia, which is such adorable dorkiness! I want a time machine; I wanna go back and babysit her.

She said she wanted to be a science educator but didn't realize she was going to be a researcher until after getting her master's, so she moved on to her PhD.

Alie: So, now you're doing this under the model of crickets. Did you always like crickets, or are they really fast-reproducing... like, a good species to study?

Amy: Yes to all of the above!

Alie: Okay!

Amy: So, crickets... I didn't grow up loving insects. I was like most people, terrified of them. I worked in a pet store for a long time and crickets were my first insect that I had an intimate relationship with because people would come in to get them to feed their animals.

So, I became really familiar with them then, and when I started my PhD there was a project in a lab at Iowa State working on crickets, and they're just fabulous organisms. There's a surprisingly large research group that focuses on researching crickets, especially in the context of evolution, and mating, and reproduction, and immune response.

They're perfect, they reproduce really quickly, you could have a lab population of them so you kind of always have access to them, and they're easy to handle. They're easy to rear, they're cheap to feed, they eat *Special Kitty* cat food from Wal-Mart.

Alie: They do?

Amy: Yes!

Alie: I didn't know that!

Amy: They're just fabulous organisms to work with.

Aside: And each lady cricket can have over 200 children, which *smokes* the birth rate of both of my Catholic grandmas. I asked Amy if her lab subjects ever serenade her.

Amy: The males sing, yes. The males rub their wings together, not their legs, which is a common misconception.

Alie: Yeah, that's some flimflam right there.

Amy: Yeah, so the males rub their wings together, and it's a mechanism to attract females. So they have several different calls, both ones that attract females from a long ways away, and then when females get close, they change into a different type of song that essentially displays how sexy they are. [*"You are so friggin' sexy right now!"*]

Alie: At what point did you start to really embrace the cricket and get excited about doing research with them?

Amy: When I first started my PhD. My first year of my PhD, I went out in the field and collected these crickets and one of the things that will always stick with me is, collecting these crickets in the wild is insane.

Because you're out at night in a field, and you're trying to collect these crickets and find them. And half the time when you think you find a cricket, you get close, and you see one, and about two inches away there is a spider or a scorpion, some type of predator that's just about ready to eat it.

Alie: [*small voice*] Oh no!

Amy: And so you start realizing that there are a lot of issues at play in terms of these males that are calling. They're drawing attention to themselves because they're sending out this large auditory cue to the environment, so predators can find them easily.

And on the flipside, you've got these females that are out wandering aimlessly trying to find these males. They have to travel fairly long distances to find males and in the process they're encountering predators themselves, and parasites, and all sorts of different pathogens. It just is amazing that they can be as numerous as they are when they have so many challenges that are hindering their ability to reproduce.

Alie: What are the biggest challenges that you have encountered? Or how do you study that in a lab? Because I'm going to guess that your lab doesn't have scorpions and spiders everywhere like an obstacle course. Like a Halloween horror house for the crickets.

Amy: No, no. [*Homer Simpson scream*] That would be fabulous, but we actually study the effects of this long-lived parasite called a horsehair worm. They are fairly large parasites that infect crickets as one of their hosts. They also infect cockroaches, and praying mantids, and things like that.

Aside: All right, so one of the factors of immunity is, "Do y'all got parasites?" And we're just gonna put our blinkety-blinker on, we're gonna merge real quick onto a side street about horsehair worms, because they are bananas, and they're more nightmarish than any sci-fi CGI, and crickets have to contend with them! But first off: how rare are these things?

Amy: The number of people I've had come up to me and be like, "Okay, I have a question. I stepped on a cricket the other day..." And then I say, "... and a giant worm came out?" And they're like, "Yyyeeesss!"

Alie: Oh god!

Amy: My yoga teacher did that to me and she was surprised that I knew what was coming because she thought it was the most bizarre thing and I wasn't gonna believe that it happened. And I'm like, "Well, that's what I study."

Alie: Oh my god!

Amy: They're actually fairly common. I mean, they're in those streams that you're driving over and that you're kind of ignoring. They're everywhere.

Alie: I had no idea. I thought they were super rare because it's disgusting and weird. So I thought, "This has gotta be one in a million," like finding a pearl in an oyster or something.

Aside: So how are crickets getting these? Have they been cursed by a witch? Did they anger a magic troll?

Amy: But they essentially get eaten in a cyst form by the crickets. And then these cysts develop inside of these hosts for a month, sometimes more. And when they emerge, they can be twenty times longer than the length of their host.

Alie: Oh, barf!

Amy: So, it's actually pretty impressive. I brought one in just so you can see what these horsehair worms look like.

Alie: She just produced a vial from her blazer pocket and in it is just this *ga-nar!* [as in gnarly] This is amazing. This looks like my hair all over car seats and in the shower, but it's like thick, wiry... How long is this thing?

Amy: My guess is that one's probably about 9-12 inches long. It came out of a one-inch cricket.

Alie: How does it happen? This looks like something that if you found it in your omelet you would definitely sue the diner. This is ga-narly! How do they grow so much bigger? And what's the difference in mass?

Amy: This is what's kind of crazy: these parasites grow from something that you have to basically see under a microscope into a worm this large. They do it over about the course of a month, which is a significant portion of a cricket's life, right? Crickets generally live for maybe two to three months in the wild, and that's it.

So, for half to a third of a cricket's life, they have this terrible parasite that's growing like crazy inside them. And the only thing that these parasites can rely on for their own growth is, essentially, eating up the fat reserves of their host.

Alie: [*sad groan*] Nawh.

Aside: So, quick aside: not only that, but certain species can zombify the host's brain, making them seek water, fling themselves in, and drown so that the horsehair worm can make a graceful exit out of its dead anus to go make more babies in the water.

And just as I was relishing in the comfort of not being a cricket, I did stumble upon a paper in a scientific journal about a few people in Japan who have been infected with horsehair worms, and now I have to bleach my eyeballs.

Anyway, behavioral ecology: life history tradeoffs.

Amy: So, getting back into what I generally study in terms of these life history tradeoffs, obviously in this case, the host cricket potentially would like to have an immune response and mount an immune response against these parasites to kill them off. And we've been trying to figure out how it is that the parasites actually avoid being detected by the immune response of the cricket.

And then, on top of that, it looks like the crickets aren't necessarily able to mount a response against them, but one of the drawbacks to that is that these parasites now actively eat and take up all of the fat reserves of the cricket, which otherwise these crickets are trying to build up for their own reproductive purposes.

They're using that fat in order to grow larger; they're investing that fat and those energy resources into creating very large testes. You may not know this, but crickets have some of the largest testes per body size of any animal in the animal kingdom.

Alie: What?! Really?

Amy: They're giant. [*Very... large...*]

Alie: Whyyyy?

Amy: And it's because they have a lot of sex.

Alie: Oh my god, they do?!

Amy: So much sex. On average, some recent studies have shown, that individuals mate up to seven or eight times per night.

Alie: Oh boy! With the same cricket, or just like...?

Amy: Usually it can be the same, and they also will go out and actively find other partners to mate with.

Alie: Why are they so horny? So horny!!

Amy: They get a lot of benefit out of it. So, obviously for males the more they mate the more tickets in the lottery, so to speak, they have for providing sperm to fertilize a female's eggs. And for females, some of my PhD work actually showed that females that mate early and often actually have higher fecundity, so they're able to lay more eggs and have more offspring themselves.

Alie: Like a 'use it or lose it' kind of thing?

Amy: Yeah, so both males and females mate at high rates and they get fitness benefits from doing so.

Alie: Oh my god! So then, is this also like, "We're gonna need more baby crickets out there if we're gonna have scorpions trying to hunt us when we're out doing our songs." Is this also just strength in numbers?

Amy: Yeah, it's a bit of that. Animals in the wild, their main goal is to produce the maximum amount of offspring as possible. And individuals that can produce more offspring than other individuals of their same species have higher fitness, they pass on more of their genes, and in terms of evolutionary time periods they have a bigger effect in terms of which genes are a part of that pool.

Aside: So, provided they have the resources themselves to survive, animals are typically wired to pass along more of themselves. But even Charles Darwin was like, "Why tho?!" He wrote in 1862, [*old-fashioned radio voice with old-fashioned background music*]

We do not even in the least know the final cause of sexuality Why new beings should be produced by the union of two sexual elements. The whole subject is as yet hidden in darkness.

A study published in *Nature* in 2015 shone a light on it, and it dealt with flower beetles and essentially inbred them for several generations, kind of like royalty, until they could no longer go on and survive. And the study found that it was pretty key for the males to compete for reproduction and females to choose. The authors wrote, "Our findings reveal that sexual selection improves population viability in the face of genetic stress."

So, I suppose, just know: the choosier you are today, the better off our entire species tomorrow. So keep swipin'.

Alie: With your research are you looking at how often the crickets are mating, what resources they need? What have you been able to determine from that? And does it apply to any other bugs or any other species?

Amy: Oh, yes. We've got some pretty crazy evidence from my PhD and this is actually one of the coolest things that I came across, and why I am now so unbelievably passionate about crickets, is that during my PhD we were trying to look at: what benefits do females get from mating? [*"She's ready."*]

We know that if they mate more, they lay more eggs and they have more offspring, but males don't provide anything. They give, like, this teeny tiny little spermatophore, which is just a capsule containing sperm and some seminal fluids, and then they're off. There's no parental care, they don't give anything to the females. In fact, sometimes they can injure the females because they're kind of jerks. [*"Yooooooooou're out!"*]

But females are having more babies when they mate more, so we started looking at what exactly is in that spermatophore aside from sperm. And one trend that had been building –

not only in crickets, but across a variety of different taxa – are that females that mate more, or that have mated, have stronger immune systems.

Alie: Oh my god!

Amy: Which there's a lot of explanations for that, but when you get down to these crickets that are basically just passing seminal fluid and that's it, we don't really know why they would have a stronger immune response and essentially have increased survival.

So, for my work I ended up looking into that and found that there are particular chemicals that are passed on in that seminal fluid that are both major modulators of female reproduction.

Aside: So, something in the sperm capsule. What is in the sperm capsule? Is it pixie dust? Is it a dewdrop of Red Bull?

Amy: So as males provide... They're called prostaglandins. As males provide prostaglandins it helps females produce more eggs and it stimulates them to lay more eggs. But this chemical's also one of the major modulators of the immune response.

Alie: Ooooh! So, if you are out there, you're getting more cricket tail, and you're a lady, does that mean that you're less likely to get a horsehair worm?

Amy: Potentially. It definitely seems like you're less likely to die from some of the other diseases, such as like bacterial infections. You might also be able to fight off ectoparasites more.

Alie: Ooh!

Amy: Yeah. So there's all these things that go together. As individuals mate they gain fitness, and they can lay more eggs, and have more offspring. But also, we generally think if you over-invest in reproduction, you don't have as much energy to invest in immune response.

Aside: Which would make sense, because making other beings is expensive. And more so when you're not a cricket, and you can't just bury a hundred of your babies in loose soil and be like, "Berbye. Good luck. I'm gonna find some new dads." But how does it affect crickets?

Amy: And yet here we are, finding females that are having increased fitness and laying more babies and *also* having a stronger immune response. It goes against the ideas of these tradeoffs that we innately think exist.

Alie: What about the males? Do they lose anything by mating more? Are they gaining anything other than better chances of having more babies? But are they gaining anything from an immune standpoint at all?

Amy: No, and that's one of the things that I was trying to look at, and I never quite got to answer this question, yet. But if males are providing this prostaglandin to help females lay eggs and to help them survive better, potentially until they lay their eggs, is that taking away prostaglandin that males need to modulate their immune response and help regulate that? So that's something that is a current question that we have, and that we're still interested in looking into.

Aside: So not only do males compete to be like, "I'm the best! Trust me, look how hard I will sing for you! I will fight a scorpion!" but also, female crickets can be choosy. Not just at the time of the bonking.

During mating, males insert this spermatophore into a female's reproductive tract and it drains into her for the next 40 or so minutes. But there's also something called fertilization

bias, or directional post-mating female mate-choice. This is also called 'cryptic' because it's like, "Oooh, what's going on in there?"

And in some species, certain sperm may not be stored. So she's like, [*sarcastic*] "Thanks, it was so fun. Nah." And this can protect the species from inbreeding. Now, in a study titled "Female Crickets Assess Relatedness During Mate-Guarding and Bias Storage of Sperm Toward Unrelated Males," this boiling hot tea was spilled:

It says that while sperm are being transferred from the spermatophore to the female's reproductive tract, the mated male remains with and guards the female, because females often attempt to leave unattractive males and go remove the spermatophores before the sperm drips in and has been transferred. And then the guarding males try to prevent the females from doing so.

So the guarding can represent a period of sexual conflict over insemination. Males attempt to subvert the female mate-choice decision. Dudes are like, "No, keep mine. Keep it. Keep it." And the female's like, "I don't even like you that much."

Interesting!

Alie: Do you ever apply any of your cricket knowledge to your own love life or your friends' love life?

Amy: [*laughs*] In terms of this, when I give this research talk, I do make it clear that prostaglandin is a component of seminal fluids across all animals, and it was originally given its name because it was found in the human prostate.

Alie: Ooooooh!

Amy: So prostaglandin mediates reproductive physiology in humans and immune-physiology in humans as well. So, it has conserved functions from crickets all the way up to humans.

Alie: And is it easier to study it in a model with crickets than... Perhaps going up the food chain it'll be looked at in a different way because of what you can kind of prove or detect in crickets?

Amy: Yeah, absolutely. What we learn in crickets is, crickets are a very basic model but they're super easy and incredibly cheap to work with. We can learn a lot about them and we can do a lot of manipulations experimentally that are essentially unethical when you get to higher order animals.

The second something has a backbone, all of a sudden it's more likely to feel pain, especially more intensely, and so there's a lot more restrictions there in terms of not only what you can do, but what you feel comfortable doing as well.

Alie: Yeah. What do your experiments look like? Are there cages of different crickets and they're checking each other out? How do you sex a cricket? What does lab work look like?

Amy: When we're doing mating type trials, which is something we'll be doing a lot of this summer, to look at the effects of these ridiculous horsehair worms and whether they make males unsexy to females.

Aside: Can you imagine watching *The Bachelorette* and a dude is eliminated for having a giant 18-foot-long worm coming out of his ass? I can. I can imagine it, and it's riveting.

Amy: We essentially go into this very warm, humid, dark room and we turn on the red lights, [*clip from "Roxanne" by The Police: "You don't have to put on the red light,"*] and we pair crickets together and watch them have sex.

Alie: [*gasps*] What kind of notes do you have to make on a clipboard? Like how long it lasts, how many partners?

Amy: Yeah, how long it took females to mount their males, how long it took...

Alie: Wait, ladies mount the guys?

Amy: Yeah, that's another really cool thing about crickets. A lot of animals, you find that males get a lot out of mating. They have a really high reproductive capacity, so the more females they mate with, the higher their fitness. And that's generally not the rule with females; females can mate with lots of males, but they generally can't ever obtain as high a fitness as males, because they have a limited number of eggs.

A lot of male animals will coerce females into mating. Essentially that's the non-anthropomorphic way to say that they rape them.

Aside: Science: sometimes pretty awful. And by science, I mean life.

Amy: And male crickets can't do that. So males have to call to females, [*"Is she ready?!"*] and females have to accept them as a mate, and females have to mount them in order for males to transfer their ejaculate. [*"She ready."*]

So, that gets to why are females mating so frequently if they don't necessarily have to? There's nothing forcing them to do it, so there's obviously some benefit for that.

Alie: Do you think that there's anything innately that they can sense themselves getting stronger because of their immune response?

Amy: Yeah, so there's definitely going to be different propensities to re-mate. And that might be dependent on previous mate experiences. If you've mated before and your previous mate was kind of low-quality [*clip from "No Scrubs" by TLC: "Nooooh / No scrubs / No scrubs,"*] you probably have a higher propensity to mate again.

Also, condition. So depending on if you have a lot of resources and a lot of eggs available, you're probably likely to mate to make sure you have enough sperm to fertilize them. Whereas, if you're kind of in the process of producing eggs and there's nothing to lay, you might avoid it, because mating is pretty costly. Females frequently get injured, they lose eggs, they get sexually transmitted diseases.

Aside: Making babies: pretty costly, in so many ways. [*ka-ching*]

Amy: So, one of the more common ones are these little nematodes that essentially get passed around. They kind of hide up by the genitalia and they can get passed from one cricket to the next.

Alie: Ugh, geni-worms are the worst. [*Amy laughs*] Just the worst. I wonder if their Tinder bios have to be like, "P.S. I have geni-worms, it's not a big deal."

When you're watching them, how do you know which female is which? Are they wearing different colored vests?

Amy: Oh if we have multiple females that we're watching? We just use little paint markers. So we can mark their pronotums and they can have different little colors associated with them, or

we keep 'em in different deli cups. Those things that you bring all your leftovers home from the restaurant, that's what we do our cricket matings in.

Alie: Do you put one-on-one together at a time, or do you put several together and just see what happens?

Amy: Yeah, usually if we're trying to actually do behavioral assays, we will put one male and one female in together.

Aside: So heteronormative, poor crickets. Just another reason to be glad you're not a cricket, and you can be who you wanna be, love who you wanna love, you get to eat snow cones, and ride in fast trains staring at the horizon, and your life span is longer than three months.

Alie: And then how do you know if that couple mates and then they are like, "Okay, I'm on to the next one. [*clip from "On to the Next One" by Jay-Z: "On to the / On / On to the"*] I'm ready to... [*clicks tongue*]"

Amy: Oh, it's actually really easy. So if you, say, look away and write a note and they quick do it, you can check. Because males, when they transfer their spermatophore, it's retained externally. It kind of gets glued on, it gets threaded into the female's genital tract, and then they glue it on. So it sticks out and you can see this tiny little hardened white capsule sticking out of the rear end of the female.

Aside: Yup. I looked this up, and it's like a big ole white butt glob. Kind of like if you were wearing a clear fanny pack full of mayonnaise. [*splat*]

Alie: And then does she absorb that?

Amy: Yeah. She'll essentially pump her abdomen, so she'll use her muscles to start sucking that out and move that seminal fluid and sperm from the spermatophore into her spermatheca, which is her sperm storage organ.

Alie: And then how long does she store that?

Amy: She can store it for quite a long time. I haven't done tests to see exactly how long it stays in there, but there's evidence that she can use the sperm contained in the spermatheca for at least two weeks, potentially a little longer. [*"Give me a fortnight."*]

Alie: Does she get to choose, like, "Okay this is Harold's, this is Jeffrey's..." Does she know whose is whose?

Amy: We don't really have evidence of that in crickets, because their spermatheca is like one large balloon. All the sperm goes into this one large area and then it kind of gets mixed. So, it's more who has more sperm there, they get to fertilize that proportion of the eggs.

But things like dung flies have a variety of different sperm storage organs and they can store sperm in different compartments.

Alie: Oh my gosh!

Aside: So yes, in crickets, once it's in her lady balloon, perhaps it's fair game, but she may get to pop it out first, like spitting some grisly meat into a napkin at dinner. But other insects have internal dad pockets and they can mix and match depending on who they dig the most. What a beautiful thing!

Now, speaking of beautiful things, each week we donate to a charity of the ologist's choosing, and this week Dr. Worthington chose Fontenelle Forest. It's one of Nebraska's oldest conservation organizations and one of the largest private nature centers in the nation.

They say it's a place where people can experience and enjoy the quiet wild of nature, and it's located in Bellevue, Nebraska, just south of Omaha. So, thank you, Amy, for choosing that and there will be a link in the show notes to find out more about them. And thank you to the sponsors this week for making this donation possible. Now a few kind words about those sponsors.

[Ad Break]

Okay, we're back.

Alie: Oh, I need to ask you Patreon questions! Here we go: Connie Snow wants to know: What's the best way to get rid of crickets that come into your house?

Amy: Well, it's to not leave cat food out. [laughs]

Alie: Okay.

Amy: Yeah, that's hard. Because I try so hard to attract them, that I generally don't try and get rid of them. Yeah, I don't have a good answer for that.

Aside: Okay. I looked this up, and apparently crickets love molasses. Who knew? So you can set out a bowl with a few teaspoons of molasses, covered in a cup of two of water, and they'll be like, "Mm! Is that molasses?" And they'll come and hop in, and I'm guessing that they die in bliss. I don't know what you'd do about the ant infestation you might get afterward. Maybe you like ants more than crickets, I don't know.

You could also make sure to seal all your windows and doors with caulking, or you could adopt a free-range gecko that lives in your house and eats them. But don't let the gecko out, or else people will be asking me how to control their gecko populations.

Another option is just to love the crickets and consider them tiny roommates who only get to live for a few months. Amy understands your plight.

Amy: I also have them keep me up at night. More so for me because when I hear them calling it reminds me of all the research I have to do.

Alie: Oh god! Do you ever take some home on your backpack and be like, "Huh? How'd you get out?!"

Amy: I frequently have empty deli cups that I carry around in case I come across crickets in the wild that I need to catch, and then when we're doing collections out in the field I frequently will accidentally have crickets that somehow were in the deli cup and they got stuck in the bottom of my backpack. And then I'll come across them a couple days later and they're just hungry. It's very surprising when that happens.

Alie: You're like, "Oh hello buddy!" Is there a particular species that you tend to do your research with?

Amy: Yeah, I mostly work with species from the southern half of the United States. Currently we're working on *Gryllus firmus*, which is a sand cricket. But I've also worked on the field cricket, which is the Texas field cricket, so *Gryllus texensis*.

Alie: I want to ask how you feel about eating them, but someone may have asked that already.

Amy: They're fabulous! I actually have some suckers up there with crickets in there if you'd like one.

Aside: For more on this, see the Entomophagy Anthropology episode, which is aaaaall about bug eating as a sustainable protein source. [*slow-motion*] Chirp, gulp, burp, repeat.

Alie: Mariko Shinn wants to know: I'm really interested in getting into behavioral ecology, what should I expect with school and jobs in the next few years?

Amy: Yeah, actually there's a lot of opportunities in terms of the field of behavioral ecology, and it's really just about finding your interest. So going out there, reading papers, figuring out what really piques your interest, and then digging in and contacting those labs.

If you really love behavioral ecology, the more you get into it the more passionate you become, and so everything just generally falls into place, I feel. On top of that, the field of behavioral ecology, the people who are a part of this field, are awesome. There's a really strong community, and people are very accepting, and they're very friendly, they're very laid back.

So the conferences you'd go to as a behavioral ecologist, rather than everybody dressing up in these suits and ties, you've got Keens with socks underneath, and everybody's wearing a Hawaiian print shirt. It's a very friendly field, I think.

Alie: Aaw! So yes to behavioral ecology.

Amy: Oh, it's fabulous.

Alie: Oh yay!

Aside: P.S. behavioral ecologists can study all kinds of things. From why birds fly in formation, to why meerkats pop up all cute, to parental care in penguins, to frog calls, so much more. It's a study of "Why do you do that? And how does it help?" And it's rad.

Now, less rad to some people, is the appearance of a certain type of cricket. Long, wispy legs like if Slenderman had been turned into a bug. Let's unpack it.

Alie: Sydney Brown wants to know: Why are cave crickets so frightening to so many people?

Amy: [*laughs*] Yeah, they're a bizarre shape, I think? They're pretty spindly, so I think that that does a lot. I think anything unfamiliar is hard for people, especially when it comes to insects, the more spindly an insect is, the more fear and creepy-crawlies it instills.

Alie: Yeah, but the Jerusalem cricket is this roly-poly-boob-di-doop, and people haaaaate theeeeem!

Amy: I know! Oh, but they're huge, and they're bulbous, and they're larger than people want to look at.

Alie: Yeah, I know. I love them! Sydney Brown also asks: What's the most common parasite of crickets?

Amy: Oh, I would say that that's probably, I imagine... Most crickets, there's a lot of different types of parasites depending on what species of cricket you're looking at. Ectoparasites are very common, so there's these large red parasites that kind of stick on to the soft parts of the outside of crickets. But then also nematodes are fairly common.

Aside: PS, a nematode is how you formally address a roundworm, like, "Ms. Nematode?" "No, please, call me Roundy-Dubs."

Amy: Gregarines are another type of intestinal parasite; those are incredibly common as well. We're currently finding out that hairworms are more and more common.

Alie: Chris Brewer wants to know: Do crickets have a mating chirp? And obviously that's a yes, the males do, and it's different species to species?

Amy: Yeah, in a lot of cases there's kind of overlapping species nearby, and they are able to identify their mates using their particular calls.

Alie: Oh wow!

Amy: Yeah, they're very species-specific and it helps prevent hybridization in closely related species that overlap in geographic area.

Alie: Can you tell the difference of different chirps, or is that a completely different field?

Amy: I have not spent a lot of time comparing one species to the next. I can definitely tell the difference between the species like the ground crickets that we have in the area versus my field crickets that I work on. They have very different calls, they're different pitches, and they're kind of different frequencies.

The ones nearby go really kind of fast and high. [*sound of a ground cricket, fast and high pitch*] They also are calling during the day a lot, and my crickets generally are calling either immediately after dusk or right before dawn. [*sound of a field cricket, slower and lower pitch*]

Alie: Oh, so they're crepuscular?

Amy: Yes!

Alie: Ooh! And is that when they are out just feeding in general, or is that more their mating time?

Amy: That's generally when they're trying to attract mates.

Alie: Is that because it's a safer time for them?

Amy: In part, yeah. There's not as many birds out and about, which are major predators, although they're definitely starting to get up and moving as well. Because they rely on acoustic calls, they don't have to have light available in order to attract mates, so that makes it a little easier for them to make use of those nighttime hours.

Alie: Oh, that's so smart!

Aside: This next question is one that's on all of our minds. Probably all the time.

Alie: Jen Athanas wants to know: What behavioral ecology principles are as true with humans as animals?

Amy: Oh, goodness. I will say that, like, in terms of what I study, I study these life history tradeoffs, and my lab gets together and we read all these papers together and look through them. And at the beginning of this semester we read a paper about these life history tradeoffs in humans and how there's tradeoffs between the immune response, and these different reproductive hormones, and other processes of the body. So we have those same principles that are at play with us. The idea that you only have a limited amount of resources.

We generally think that, well, most of us are well-off enough to be able to go out and buy more food if we need it. But the problem is that there's still constraints within our own bodies. We still have a limited amount of proteins that are able to shuttle different nutrients around our body, and therefore in a lot of cases, we still are seeing the same exact types of

trade-offs between the immune system, and growth, and health, and reproduction as any other animal that lives out there.

Aside: Birth rates in the US, side note, had a little peak in 2007 just before the recession hit. And they've been dropping for ten years, which is maybe not a co-winky-dink.

Alie: And do you notice trends, maybe, with people waiting to have kids until they're older, until they have more money to pay for the kid's college? Or is there anything trend-wise that you look at where you see millennials aren't having as many children and you're like, "Hmmm, the economy, or..." Does that ever happen with you?

Amy: Yeah, absolutely! I mean, you think about the amount of debt that millennials have nowadays, in terms of college, or trying to buy a house, or pretty much anything, and earning potential's way down. So yeah, there's just fewer resources. So I think that cultural changes have allowed for there to be a shift away from this immediate, kind of, push to reproduce early and fast, and so that has contributed to this.

But there's also resource tradeoffs, and as humans one of those resources is money. It's not just the amount of fat that we have available or the amount of food that we have available. And so yeah, absolutely, we just have to kind of extend these principles into that monetary realm to understand some of the things that we're seeing that are occurring today in society.

Alie: And what about with second- and third-wave feminism, perhaps with women being like, "No, I'd like to have a job and not just make babies." Is that behavioral ecology as well?

Amy: Yes, in a respect, right? Behavioral ecology is the study of individuals and how they interact with their environments, and so yeah, there's going to be different pushes in terms of when to reproduce and how much to reproduce. But it gets a little tricky, it's not as easy to directly relate everything to humans, at least not as easy as we'd want it to be.

Alie: Yeah, exactly. But it is a good thing to start talking about if an Aunt or a Grandma asks you when you're going to start having children, you can just go into a whole big reproductive physiology behavioral ecology rant and just bore her. Bore her into not asking.

Are there any movies about crickets, any characters that you're... Or do you see things like Jiminy Cricket, and you're like, "Stop rubbing your legs together, number one. Jiminy Cricket!" If you see a cricket cartoon calling, essentially that's a cricket with a boner being like, "Anyone out there"?

Amy: *[laughing]* Yes! I will have to say, Disney does a fabulous job of getting the biology right in a lot of respects, and a lot of those other animated films... So I'm still completely in love with *A Bug's Life*. *[Manny from A Bug's Life says: "That, my friends, is the sound of applause!"]* You know, all the things that those individuals do are just awesome.

I love seeing real science in films, especially for young kids. Especially now that I have a two-year-old daughter at home, and just watching her learn and pick up on these things from movies makes me realize how important it is to have everything right, because kids learn from there. They're picking it up.

Alie: I mean, stop with the male bees, you know what I mean?

Amy: Oh my gosh, the *Bee Movie* just kills me. I can't do it!

Alie: I know. I know! How dare they? And even in *Ant-Man* it was a male ant, I think. And you're like, "This is basic. This is such an easy get."

Aside: Just a side-note, y'all could've named her Antonia! So easy. My god! As long as I'm pissed, let's just stay negative for a second.

Alie: What is the shittiest thing about crickets or about your job? What's the suckiest thing?

Amy: Well, dead crickets smell worse than rotten potatoes.

Alie: *[laughs]* Oh no! I don't have any metric for rotten potatoes.

Amy: Don't ever forget one in the bottom of your pantry. No, dead crickets are terrible, and they're juicy, and they're just disgusting. So that's the worst, when you're cleaning out cricket bins and you accidentally touch one that just explodes in your hand. But other than that they're great. They rarely bite, so you don't have to really worry about that.

Alie: But they do bite?

Amy: They can bite, yeah. They can draw blood. Normally you have to be doing something to deserve it. Like, you're trying to knock them out and give them an injection, or tear out their testes, or something like that. They'll bite you.

Alie: You're like, "Well played."

Amy: Yes, yeah, you're like, "I deserved it; it's fine."

Alie: What about the best thing about your job or about crickets?

Amy: I would say the best thing about my job is I get to do work with a bunch of undergraduate researchers. And the vast majority of them come into my lab saying they want to go into pre-health professions. So, they want to go into dentistry, or to become a medical doctor.

Then they're doing research on crickets, which they obviously don't have interest in. And getting to watch their love for these insects grow, watching them the first time they interact with a cricket and how kind of jumpy they are and tentative, and then by the time my students leave the lab, they're very proud that they worked with crickets. It's a bit of a badge of honor that they can pick them up and just throw them in whatever bins they need to. They're not using gloves, they're fine using their hands now; it's really fun.

And then watching them explain their research in, like, the most engaging and amazing way. I should say this, because one of my current students is giving her first oral presentation on her research over the horsehair worm in crickets, her name is Emily Harders, and she would kill me if I didn't mention her on here, because she is your biggest fan.

Aside: Heeey! Shout-out to @EmilyHarders on Twitter. You can follow her for more ghastly information on horsehair worms. It's really a sight to behold.

Amy: We still scream in glee when we allow the horsehair worms to emerge from the crickets. You just watch as, like, three or four of these emerge from a single cricket, and it is still like you're in the movie *Alien*.

Alie: Yeah, I can't believe that it's real.

Amy: It's amazing.

Alie: *[spooky sound]* It's like, "Watch out Dr. Pimple Popper," because that's pretty cathartic, I'm sure.

Amy: Oh, this is so much better! Yes!

Alie: This has been so informative. I'm never going to hear a cricket song quite the same. It's just essentially them being like, "Anyone wanna have sex with meeeee?"

Amy: That is absolutely my goal.

Alie: Thank you so much.

Amy: Yes, thank you.

Alie: I loved this.

So to follow Dr. Amy Worthington, find her on Twitter [@WorthingtonLab](#), or you can check out her blog: [AmyMWorthington.wordpress.com](#).

To find *Ologies*, we're @Ologies on [Twitter](#) and [Instagram](#), come say hello. I'm @AlieWard on both.

And to submit questions via [Patreon](#), join up for as little as one dollar a month; my heart is very cheap. And usually I get to ask waaaay more questions and say way more names, but this was so rushed, just sayin'.

Okay, for *Ologies* merch go to [OlogiesMerch.com](#), and you can tag your pictures #OlogiesMerch on Instagram so I can post you on Merch Mondays. Thank you Shannon Feltus and Boni Dutch for managing all that.

And thank you Erin Talbert and Hannah Lipow for adminning the [Facebook Ologies Podcast Group](#), which is a great place for curious non-jerks.

Assistant editing was done by Jarrett Sleeping of Mindjam Media, who hosts two podcasts: *Fight Stuff*, about combat sports, so funny, and *My Good Bad Brain* about mental health. And thank you, as always, to Steven Ray Morris, for stitching these episodes together. And for more on him you can listen to his podcast *The Purrrrcast*, about kitties, or *See Jurassic Right*, which is about dinosaurs. The theme song was written and performed by Nick Thorburn of the band *Islands*.

Now if you stick around 'til the end of the episode, you know I tell a secret. And this week's secret is that I sobbed so hard this week in a Wal-Mart after losing my wallet, and it's still missing. Let's just say it's been a rough week, kiddos, but I have cancelled my cards, and I have blocked off a date in the next few weeks to go to the desert and just stare into space, so maybe that'll fix me.

Anyway, do what you want to do, keep singing and hopping around.

Berbye.

Transcribed by Janou, cat mom and everything enthusiast. Dordrecht, The Netherlands

Final touches by Kaydee Coast who reminds you; don't lick toads, check your crevices, milk your thumbs, and never apologize for asking questions. How else are you going to learn about the size of cricket bits? Kthxbi

Some links which may be of interest:

A donation was made to: [fontenelleforest.org](#)

[Look at this gross horsehair worm](#)

[Horsehair worms in humans](#)

[Four beetle incest anyone?](#)

[How to get rid of crickets](#)

[Is the meaning of life to make babies?](#)

[Ovarian fluid and cryptic mate selection](#)

[Mate guarding bias in crickets](#)

[The night time is the right time](#)

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