

Diplopodology with Dr. Derek Hennen

Ologies Podcast

August 30, 2022

Oh hey, it's the room-temperature bubbly water that you're sipping like foam, Alie Ward. We are back and your relationship with millipedes is about to change because I know you and... you don't think about millipedes enough. So get ready for a new you! One that stops on hikes to sniff worm-looking things that were some of the first terrestrial animals. There are 12,000 species of these but there might be five times that lurking in leaf litter around the world, and you will love them, and you will love this guest.

So, if you liked the vibe of the Dendrology episode with Casey Clapp, get ready for a ride with this Diplopodologist who studied biology for undergrad in Ohio, got a master's in entomology at the University of Arkansas, and his PhD in millipedes at Virginia Polytechnic Institute and State University. You may have noticed; he's lived in the South. When he says the word "color" it sounds like "collar" and if you hear it and it delights you, feel free to take a tiny sip of the nearest beverage in celebration of him. He has been on my list for years to interview, and just this weekend we got a chance to connect and talk legs.

But before we get into it, just a quick thank you to everyone who supports the show at Patreon.com/Ologies and sent in such wonderfully astute questions. Thank you to everyone who recommends the show to your friends and your enemies alike, and to everyone who makes sure they're subscribed for fresh episodes, and leaves reviews, which I honestly, tearfully read every one of them... I'm not crying every time I read one, but I do read all of them. I pull a new one each week to prove it. This week's is from RGrabman who wrote:

Come for the interviews, stay for the asides. Alie Ward is the human embodiment of a footnote, and that is the highest form of compliment.

And I will take that. Also, get well Ella. So, thank you for your reviews, I read them all.

Okay, onto the episode in which you will upgrade your brain with trivia such as, where you will not find a millipede, if they have toenails, the difference between a centipede and a millipede (big question), which species has the most legs, glow-in-the-dark wormy bugs, if Taylor Swift is on another astral plane with 300 legs, sniffing these animals to impress others, free field guides, and why entomologists get to name critters after weird stuff with millipede enthusiast, absolute human gem, and top-notch diplopodologist, Dr. Derek Hennen.

Alie: You have been on my list. I've had an index card with the word "millipedes" and your email on it, sitting on my desk for like two years.

Derek: Well, I'm glad we were finally able to work it out. My name is Derek Hennen and I use he/him pronouns.

Alie: And how long have you been, is it a... wait, help me out, a decapodologist?

Derek: Diplopodologist.

Alie: Dipopodologist.

Aside: I said it wrong again; it's diplopodologist.

Alie: I don't even know what a decapod is.

Derek: I think that's shrimps and crabs? Some crustacean.

Alie: Clearly the note card just said 'millipedes'. [both laugh]

Derek: That's all you need.

Alie: Do you know, what is the etymology of the ology? Do you have any idea?

Derek: Yeah, so *diplo* coming from Greek for "two," and then *podo*, foot. So, two-foot because they have two pairs of legs on each segment, so a Diplopoda.

Alie: Now, do most arthropods have just one coming off of a segment?

Derek: Yeah, mostly it's just that one segment gives you one pair of legs. Millipedes are interesting because somewhere in their evolution they've undergone this fusion of multiple segments into one. So, we call that the diplosegment. Not all of the millipede segments and diplosegments. There are some that don't have any legs and there are a couple near the front of the body that only have one pair of legs on them. But most of the rest are going to be diplosegments.

Alie: So, are some arms and some legs?

Derek: They're all legs. [Alie laughs] Humans, we're kind of weird because we do have arms and legs, but when we get down to the majority of animals, you're just talking... they're all legs.

Alie: I've long, long argued that toads have arms. I feel like there's definitely little hand and fingey situations happening. But what about, okay... Millipede, though, comes from the word for 1,000, right? And then centipede for 100?

Derek: Yup!

Alie: Is there any veracity to either of those names?

Derek: Well, there didn't used to be, but only a couple months ago my former PhD advisor, Paul Merek, he worked with some Australian scientists who had found this weird millipede deep underground from a borehole; I think it was found during some mining exploration or environmental assessment of some place they wanted to mine. So, they had this very, very deep tunnel to put a borehole down there and collect whatever critters were down there. I forget exactly how deep it was.

Aside: I looked up the paper and it was about 60 meters deep, or nearly 20 stories below the earth.

Derek: The point of it is that they brought up this weird millipede and it's actually the first millipede that we know of that has 1,000 legs. So, the thousand-leg-nomer was a misnomer until very recently and now we know, yes, there are millipedes with 1,000 legs.

So, most millipedes, they'll have anywhere from... oh, maybe like, a dozen or so leg pairs to one or two hundred, but we had not found one with 1,000 before. Previous to this, the millipede with the highest number of legs was from California [*"Righteous."*] and it was around 700 legs.

Alie: That's still a shit-ton of legs. I mean, let's be honest.

Derek: Oh yeah, it's so many.

Alie: If you round up, it's like, it's almost 1,000... [mumbles]

Derek: You know, if you're sitting down looking at one of these millipedes and like, "Oh man, that's a bunch of legs. Do I want to spend all this time counting them up or it's like, "Nhh, 1,2, 3, 1,000... there we go, 1,000 legs." [*Alie laughs*]

Alie: What was it like in the millipede community when that leg number was counted, and it was over 1,000? What was happening? Did people go out that night? Were there cakes?

Derek: Oh yeah, we were celebrating because finally... you know, we get that question a lot and we'd be like, "Well, technically no," and we sound like a bunch of nerds. But now we can be like, "Yeah, they got 1,000 legs. You know it!" [*Alie laughs*] So, it was nice to finally be like, yes, this is a true name for this animal, we finally found it, it took us a little while but we got there.

Alie: Does that specimen have a genus and species name yet?

Derek: Yes! So, that is *Eumillipes* is the genus, so that means 'true millipede' and then *persephone* which is a... I'm not that up to date on my Greek mythology but I think Persephone was the one who went down to Hades for... reasons?

Aside: Just a side note, so in Greek mythology, Persephone was the daughter of Demeter and Zeus. One afternoon, Persephone is just trying to have a chill day, picking flowers in a field, minding her goddamn beeswax and then Hades, the king of the Underworld, rips a fissure in the earth and takes her to hell to be his bride. Her mom's pissed, especially since Zeus gave permission for all this bullshit. And also, Hades is Zeus' brother, so do the math... she now lives in hell with her sexual predator uncle as her husband; so many flavors of gross happening here. So, she's like, "Get me out!" But Hades feeds her a pomegranate seed so now she can never escape because them's the rules. So, the family strikes a deal, she has to be bicoastal between Hell and Earth, and while she's in the Underworld with her gross, naked uncle, it's winter up here on Earth.

So anyway, this millipede that looks kind of like a noodle, with a previously mythical number of over 1,000 legs (1,306 to be exact), lives 200 feet below the surface and is named *Eumillipes Persephone*, goth as hell.

Derek: So, you know, it's a true deep millipede.

Alie: Oh man, what a find. Did your PhD advisor get to classify and name it?

Derek: Yeah, so he was on that paper. One of my former lab mates, Jackson Means, he was also on that paper. So, they got it shipped from Australia, and my advisor, Paul Merek, he counted up the legs, took a good photo of it, and put a dot every 5 legs or so, so he could count them more easily. Jackson did the genetic stuff for it to see where it falls out on the evolutionary tree of millipedes. It took them a while, but they were able to put that together, work with some other scientists, and really produce a really nice paper that got some great coverage in the media which... we're always happy to see when millipedes are mentioned [*Alie laughs*] anywhere in the media. We were all happy to see this thing finally come to fruition and get out there.

Alie: Are millipedes mentioned in the media enough? Are there any pop-cultural references to millipedes? When do you tend to see them? When does your Google alert for millipedes go off?

Derek: Actually, in the past decade or so, we're seeing more coverage of millipedes in the media which is nice. When we find these supernumerary millipedes, they'll get covered.

Aside: Supernumerary meaning: hella legs.

Derek: I recently had described a bunch of millipedes stemming from my PhD work and I named one of those after Taylor Swift [*Alie laughs*] so, that was a lot of media coverage. I was kind of thinking, “Either people will notice it, or no one’s going to see it or care.” But it just kind of exploded so I was happy to see that. But a lot of coverage in the media about millipedes stems from either, “How many legs *do* these things actually have?” Because you know, people make lists of superlative animals; which has the most legs, which has the fewest? Snakes and millipedes, I guess.

Aside: So appreciative of Ms. Swift’s songs that Derek named the Tennessee millipede species, *Nannaria swiftae*, or the Swift twisted-claw millipede, and it does have twisted claws just like the most bonkers nails you’ve ever seen. So, I went to fact-check all of this and one of the top related Google inquiries was, “Why is Taylor Swift a millipede?” And while that is a question for an alternate and perhaps a superior multiverse, the reason she is a millipede in this one is because of the chestnut hue of this 300-legged, dirt-eating, tiny beast.

So, who else gets a millipede named after them? Thanks for asking. Derek’s wife, Marian, got a millipede honor too. For more on this kind of flavor of cuteness, you can listen to the recent Dipterology episode with Dr. Bryan Lessard who has named flies after Beyoncé and RuPaul, among others.

Derek: Versus other people, typically invertebrate biologists, we have a lot of things to name because there are *so* many undescribed invertebrates out there and they’re the majority of animal species. So, we have all these names to give to these critters and if I named all these millipedes after some morphological feature, they’d probably be some pretty boring names because their body really looks the same except for their sexual structures [*“Well, hello there.”*] and I feel kind of strange just naming them after the sexual structures. [*Alie laughs*] So, I like to include some more cultural names or other stories behind the names.

For example, I took some botany courses during my undergrad career, and I really enjoyed those, so I like to know what the forest composition is like as I’m going through and finding these species. So, I named probably four or five after just the tree species I was seeing so there’s *Nannaria rhododenra*, *tsuga*, which is hemlock, *liriodendra* which is after tulip tree, which has one of the best scientific names I’ve ever read, *Liriodendron tulipifera*... just, it’s gorgeous, [*Alie laughs*] just rolls off your tongue like honey.

Okay, there was this one millipede where I found it in northern Georgia and I was on my own, I was collecting all by myself, I pulled up to this national forest site and it’s got these beautiful hemlocks and rhododendron trees, beautiful stream just flowing through it. I’m like, “Ah, this is beautiful, this is perfect for twisted-claw millipedes.” So, I sat down, had a nice lunch thinking about how easy it’s going to be to find these millipedes. Then I collected for about two hours, did not find *any*, and I was like, “This makes no sense, this is the perfect habitat for these things. Where are they going to be?”

So, I got really angry and frustrated so I just started... I use a garden claw to dig up these millipedes because they’re under the soil, under the leaf litter. So, I just got so frustrated I was just hitting the ground with that and digging a hole, and low and behold, I just saw one of these things pop up from the soil, like, “I finally found it!” It just took two hours of frustration to finally find it and I named it *Nannaria spalax*, which means “mole” in Greek because it’s just kind of digging under the soil.

Alie: Now, is that what fieldwork looks like for you? You have a garden spade, maybe a sandwich, and probably a hat and sunscreen, and you are just turning over leaf litter to see what you find?

Derek: Yeah, pretty much. I feel like I'm very lucky because, for my fieldwork, I got to go to all these beautiful forests, state parks, national forests, whatever other places I could get into. Whereas I have some other friends who, for their scientific work, they'd be out in the middle of a cornfield or something in the blazing hot sun and just toiling. Whereas I'm, you know, having a nice sandwich by the stream in a forest. It really is just getting into these places that have a good amount of leaf litter, flipping logs and rocks, turning over a bunch of leaves, maybe digging into the soil a little bit, and that's how I would find my millipedes.

Sometimes I would collect a bunch of leaf litter and put it through something called a Berlese funnel. It's essentially a bucket with a funnel in it; you put all this dirt and soil, and leaf litter into that and put a light above it and then you put a cup of alcohol below the funnel. [*"Can I get you a drink?"*] And then that'll drive all the millipedes and other bugs down into that cup of alcohol and then you sort through it later. It's a great way to get these tiny little bugs you would never see otherwise. You see the coolest things in the leaf litter. I've been doing this for about a decade or so now and I'm still finding species I've never seen before. They're just all under your feet as you're walking through the woods, and you'd just never know otherwise unless you stopped and looked.

So, I loved the fieldwork I got to do. A lot of the time it was with my lab mate Jackson, so we had a good time just driving throughout the eastern US, listening to podcasts, stopping at whatever little pull-off we could if we saw some good trees. We just had a blast going through the forests and finding these little bugs.

Alie: What were you like as a kid? How did you know that you were destined to become a dipodipodologist? Mmm.

Derek: Diplopodologist.

Alie: Diplopodologist. How did you figure out that's where your legs were taking you?

Derek: I mean it's random. If you talk to a lot of entomologists, you'll get these stories like, "Oh I've been sticking bugs into my pocket since I was 4 years old." I was not one of those kids. I was inside playing Pokémon all the time, my dad used to get angry at me, "Just go outside! You're always in your room playing video games." [*Alie laughs*] And it wasn't until college that I really started to get more interested in biology and I had some professors who were entomologists. So, if we had a lab, we'd go out into the woods and look for bugs and do all this other stuff.

Originally, I'd started college wanting to go into marine biology, but I also went to college in Ohio, and we don't have much ocean out there. But what we do have, particularly in southeast Ohio, where I was, is a lot of forest. So, once I discovered bugs it was like, "Wow, I can just go anywhere and find these cool bugs," and so it just kind of snowballed from there.

Getting into millipedes was completely random. I had the opportunity to go to this millipede and centipede identification workshop at a little biological station when I was still in undergrad. They let me go for free, I learned about millipedes and centipedes and that just kick-started it. It was and remains a pretty wide-open field, there's a lot of work to still be done.

If you think about butterflies or dragonflies, these are groups that are pretty well studied because they're these big insects that are very charismatic; people like them, they're very pretty to look at. But with millipedes and centipedes, there's only been at any one time, in North America at least, maybe half a dozen people working on them. So, there's still a lot of species to be described, a lot of behavior to look at and just figure out the basic stuff. You go to your local bookstore, you can probably find a great butterfly guide that tells you all the stuff you need to know for your area, and that just doesn't exist for millipedes and centipedes.

Alie: Yeah! No one cares enough about them, it's not fair.

Derek: Exactly! So, we need to make them care. [*Alie laughs*] And they're so cool! And there are so many beautiful ones too. I got into these things, and I was like, "Maybe we'll see if I like them or not," and they just continue to blow my mind. They're so cool.

Alie: What type of color variation and leg variation? I'm used to seeing the ones that look kind of like a dark brown hot dog [*Derek laughs*] with a million legs, those are the ones that sometimes make their way into the garage and you're like, "Oh, what are you doing here?" And they're like, "Nothing, nothing." What other types are out there?

Derek: Yeah, so the one that most people are probably familiar with is kind of like you, they've come into your garage or your basement or something, they're kind of brown, they've got a bunch of legs. Typically, the ones we see in our homes are introduced species. There's one species called the greenhouse millipede, it's native to east Asia, and it has since spread to every continent except Antarctica.

Alie: Oh woah!

Derek: And honestly, I wouldn't be surprised if they find it in McMurdo sometime. [*Alie laughs*] It is the most successful millipede in the world; it's not very interesting to look at, but you've got to respect the drive it has.

Aside: If there's anyone down at McMurdo, the US research station on Antarctica listening to this, please holler at Derek if you see what looks to be a tiny, deep brownish, cuckoo-y nut necklace but with like, 60 yellowish legs, just scooting around being like, "Hey I made it."

Derek: But millipedes as a whole, they come in every color under the rainbow. There are green millipedes, blue millipedes. I've seen these, just, mind-numbingly beautiful, violet-purple millipedes; this is a species near Knoxville, Tennessee. And it's this really interesting slate gray, purple, blue color to it, it's just gorgeous. I'm based in Virginia, and in the Appalachians, we're just blessed to have a plethora of gorgeous millipedes. Their base color is black, and they can have spots and stripes of yellow, red, orange, bright, colorful coloration. And you know, you show someone one of those millipedes and that starts to kind of turn the gears in their heads like, "Oh, maybe I was wrong about these guys." So, they are just... augh, they're so cool.

Some of them will fluoresce under UV light, so that's how I really fell in love with them. I learned about that, and I was like, "I need to see this for myself," so I got a cheapo UV light on the internet, went out at night on a little night hike, and was shining it on the ground, and I saw a couple dozen of these little millipedes, they were maybe an inch long, and they were just glowing this ethereal blueish green color. It was like all these little shining stars going under and out of the leaves, it was amazing. Once you've seen that, it's hard to not

appreciate them, they're so... Augh, just amazing. That's what really made it all click for me and I was like, "Yeah, this is what I'm going to do for the rest of my life."

Alie: Oh, I love that! Do the six of you millipede scientists in the continental US have any idea why they might fluoresce under that UV light?

Derek: Yeah, it's a good question. We know it's a chemical in their exoskeleton that causes that fluorescence, but we don't know an exact reason for it. It might just be that it's a random byproduct of that chemical in the exoskeleton. But interestingly enough, out in California, there are true bioluminescent millipedes, so kind of like lightning bugs, they'll produce their own light.

Alie: Nooo. What?!

Derek: Yeah, and that has been found to be sort of a warning to predators. So, their main predators are these little rodents, some type of mouse out there. So, by glowing, producing that light, that's their aposematism, their warning coloration. At night, it's dark, their colors can't be shown with this, "Don't eat me" reds and yellows on black, that type of color. So, at night if they can at least advertise to these rodents, "I'm glowing this color. Maybe think twice before you eat me because you'll either die or throw up and that helps neither of us." That's what bioluminescence is thought to be for, but the UV fluorescence, we don't really know if there even is a reason for that.

Alie: In terms of the bioluminescent ones, where are those found in California?

Derek: Yeah, so those are in the Sierra Nevadas; I think Sequoia National Park has some. It's this really cool genus called *Motyxia*. They're in the Sierra Nevadas of California, and there's also one other bioluminescent millipede, I believe it's in Japan in the southern Ryukyu Islands. So, those are the only ones worldwide. Alie, you're in California, so if you're lucky, if you go out at 3 AM up in the Sierra Nevadas, you might be able to find some.

Aside: For more on bioluminescent bugs, you can see the Sparklebuttology episode about lightning bugs with the world's finest firefly expert and a self-proclaimed sparklebuttologist, that is her word, Dr. Sara Lewis, in which I learned that California has pink glow worms. So Californians, crush a can of Monster and stay up until dawn looking for glowing bugs because there are worse ways to destroy your sleep cycle and I've done them.

Also, what is a millipede versus a centipede? Is it like how all cacti are succulents, but not all succulents and cacti? Or like how all tortoises are turtles, but not all turtles are tortoises? Nope. It's not like that at all.

Derek: But you also see a lot of people have trouble keeping in their heads, "what's a millipede versus what's a centipede." They just think, "Oh, it's a little bug with a lot of legs, it's one of these things." So, a lot of time I'll be talking to people about millipedes, and you know, I'm thinking, "Go on, I'm telling them all this good stuff, they're really into it." And then they'll be like, "So, with these centipedes..." and it's like, oh man. [*Alie laughs*] Which, you know, you just try to meet people where they are. Before I started studying these things, I didn't know the difference, maybe I didn't even know there was a difference, so you know, I don't try to focus on that, but I do try to... Essentially, centipedes are carnivores, they have fewer legs, millipedes are vegetarians, they have more legs. So, that's kind of a good way to split them apart in your head.

Alie: Well, you know, curious about what the millipedes are eating versus what the centipedes are eating. And also, do you study centipedes at all? Or how is your time split between centipedes and millipedes?

Derek: Yeah. So, let's see. Between millipedes and centipedes, for my PhD work I was focused on millipedes; I might grab some centipedes when I was out. But since I finished that I've been getting a little more into centipedes. There's this group of centipedes called the stone centipedes, and they are not very well studied in North America. There are scientists in other parts of the world that do study them but here in North America, there's only one guy studying them for like, 50 years. He was kind of a jerk and some of his taxonomy is pretty bad, so I don't feel bad for shaming him now. *[Alie laughs]*

To give another tangent, this guy, I think he died in the '50s or the '60s, and one of his former students, when he learned of his death said, "Ahh, his meanness must finally have gotten to him."

Alie: Sounds like a dick.

Derek: Yeah. So, for the longest time it was him, there've been a couple other American scientists that have worked on this group of centipedes but not too many, so there's still a lot of work to be done. I've been trying to get into this group of centipedes more and figure out where we are and try to pull together some identification resources for them so that we can get more people interested in them and working on them because there's so much work that still needs to be done.

Aside: You hear that, budding entomologists? The world needs centi-people, and though they have tons of legs and kind of bitey jaws, they're not as big of dicks as their human researchers so, get in there.

Derek: They're cool little centipedes. If you get bitten by one, it's not really going to be a problem. These ones in North America, they only get to be about an inch long, so it might be kind of like a wasp or a bee sting. I've never been bitten by one so far so, you know, if that happens, I'll update you. But a lot of them are pretty small. I do a lot of leaf litter sampling and then I'll see them in the little cups of alcohol after they come through the Berlese funnel.

Some of them have really cool modifications to their legs, especially the last two pairs of legs on their body. There's one species around here in southwest Virginia that I find pretty often, and the males will have this weird, like, brush of hairs on one of their leg segments, which is weirdly enlarged and kind of bulbous and we don't really know what those hairs are for. Are they secreting chemicals to attract a female? Or secreting pheromones to calm her down so they can mate or something? We just don't know. It's a cool morphological feature but we don't know about the behavior of them.

So, I've been trying to get a little bit more into centipedes and get a baseline of, "what's occurring around me?" That type of thing. Hopefully, in the coming decades we'll get more and more information about these centipedes. And there are more people getting interested in them. I tell people, right now is a great time to get into millipedes or centipedes because there's so much more information, you can actually find good photographs of them online, which wasn't really the case when I started.

Alie: Well, do centipedes, because they're carnivorous, do they have venom glands kind of like arachnids, is that what's going on? Versus millipedes, are millipedes out eating dead leaf litter and dead organic material?

Derek: Yeah, that's an excellent way of thinking about it, actually. So, when we're talking about centipedes and their poison glands and their jaws, a really cool thing about centipedes is that their actual mouthparts are pretty tiny, they're not very large. They have this really weird head morphology. What you see if you were looking at the underside of a centipede, those venom jaws or forcipules, those are actually modified legs. And if you sort of dissect the head of the centipede, it becomes really apparent, like, these are just beefy venom legs, essentially. If you get it under a really good microscope, you can actually look through the cuticle, the exoskeleton of those venom legs, and see the poison gland within that. It goes up to the very tip of the forcipule there; it's very sharp, kind of like if you've ever seen an up-close image of a scorpion sting or something like that, there's a little core at the tip and that's where they secrete the venom into whatever critter they've caught and are currently terrifying.

It's kind of like spiders, how they'll also grab something in their jaws, inject that venom. Spiders, they'll kind of suck out the juices, they don't really have the mouthparts to tear things apart. Centipedes do; they're small mouthparts but after they've subdued something, killed it with their venom, they're just sort of, I don't know... You know if you're eating a really frozen popsicle and you're just kind of gnawing on it trying to get the stuff off? That's how they're eating their prey. They just kind of have to gnaw at it and get these chunks ripped off.

Alie: What are they eating, by the way?

Derek: They're really eating whatever they can get their hands on... well, their legs on I suppose. [Alie laughs] So, they're eating these small arthropods that are down in the leaf litter. Most of the time when you find centipedes, they're either going to be in the soil, or under logs, under the leaves. So, depending on their size, they're going after small bugs like springtails, maybe juvenile insects that they're finding, really anything like that.

As they get larger, they'll feed on larger prey. I think it was *Planet Earth* or one of these BBC documentaries, maybe a decade ago now, it's been a while since I've seen it, but they've got this amazing footage of this bat cave somewhere in southeast Asia, I think it was. And they got these huge tropical centipedes that can get up to a foot long and they will hang from these ceilings to catch the bats as they fly out. [David Attenborough narrates, "Holding on with its hind legs, it reaches out into their flight path and almost immediately... It has one. An injection of venom from its fangs kills the bat almost instantaneously. It will take it an hour or so, but it will eat all the bat's flesh.]"

Alie: Oh, shut up. [squirms]

Derek: Yeah. And as an invertebrate scientist, whenever we see these stories of invertebrates eating vertebrates, we're like, "Yeah! Finally! Here's how it feels." Because usually it's the vertebrates feeding on the invertebrates, [Alie laughs] so you know, we get some pride from that.

There is a recent paper looking at the ecology of this island, somewhere in the Pacific, I think it was. It was looking at these nesting birds and what the predators of them were. And it turns out that there are these large tropical centipedes on the island, and they are the number one cause of mortality for these bird chicks.

Aside: Looked this up and this was on Phillip Island, which is about 900 miles east of Australia, where nearly 4,000 black-winged petrel chicks a year get gobbled by foot-long centipedes. There have been days where you are absentmindedly scrolling Twitter on the

toilet at work, and somewhere, on a quiet island, a centipede is eating a fucking bird. [*“Oh my goodness, he ate a bird? Michael, he ate a bird!”*]

Derek: You know, when you get a large enough centipede, they will start going after vertebrates. They’ll eat, again, whatever they can subdue and get their legs around.

Alie: Oh my god, the idea of a bug eating a bird is so... mind-blowing, like so backwards, and weird, and cool.

Derek: It gives you pause. And you know, while we’re on that topic, I just want to... blanket statement: centipedes are not trying to attack humans. Typically, you’re not going to have to worry. If you’re around some of these larger tropical centipedes, which that’s what the entire group of those centipedes is called but we do have them in temperate regions as well... You know, just don’t grab these centipedes and you’re probably going to be okay. They’re not particularly aggressive toward us because we’re just a lot bigger and they can’t really eat us so they’re going to leave us alone.

Alie: Are there any species that can send you to the hospital like a black widow or something?

Derek: Yeah, if you’re coming up against one of these foot-long centipedes and it bites you, and if you’re immunocompromised or something like that, then it could probably send you to the hospital. It would at least be pretty painful so you might go there just for that. But typically, you’re not going to have to worry about any that are really serious.

Alie: Can I ask you questions from listeners?

Derek: Yes, please.

Alie: They have some good questions and I saved some of their good questions because I know it’s on all of our minds.

Aside: But before your questions, let’s toss some money like leaf litter at a cause of the ologist’s choosing, and this week, Derek asks that it go to the Lower Muskingum Conservancy, which is a land trust in the Muskingum River Watershed in southeast Ohio, and it is for conservation purposes. He said, “I spent a lot of time on their lands collecting millipedes when I was in college and they exemplify why caring about your local nature matters.” You can visit MuskingumRiver.org which is linked in the show notes in case I am saying that wrong. Thank you to sponsors for making that donation possible.

[*Ad Break*]

Okay, your 1,000 questions including this one which was also asked by Justine Doll, Jenna Catalano, Lauren Legg, Megan Ramirez, Ayshia Yaeger, Elijah, and first-time question-askers, Anna Frazier, and Leila Laco, and...

Alie: Mia Manzer wrote in this question: Fucking why? [*Derek laughs*] That was the whole question. But Hannah Nuest, Erik K, Hailey, Mo Casey, a lot of people want to know: Why, why so many legs?

Derek: Well, why not?

Alie: I mean, don’t get me wrong, I would like 700-1,000 legs also, I mean, more the better. But from an evolutionary standpoint, why so many legs?

Derek: You know that’s a good question that often comes up. Essentially, the body plan of a millipede, you’ve got head, and then you’ve got trunk. Trunk is just all the other segments

after the head. And so, they have a segment right after the head called a column and it's larger, usually kind of quadrate...

Aside: Quadrate just means square, side note. So, their quadrate column is just a big, square-ass neck.

Derek: Think of it sort of like a bulldozer or something; they have this plate that they can push against stuff. In their daily lives, what they're mostly doing is burrowing around and moving stuff, so having all those legs and that plate right at the front of their bodies, all those extra legs gives them a lot of power. So, that helps them push away soil particles, pieces of wood, things like that, and helps them be able to burrow and tunnel around.

So, probably why they have all those legs is that it gives them a lot more power to be able to really push through or wedge themselves into tight spaces. Some of these millipedes with many, many legs like *Eumillipes Persephone*, that true 1,000-leg millipede, it's probably also using all those legs because it's living deep down underground in the soil. Maybe that kind of helps them grab onto soil particles and be able to move around a lot.

When you get that many legs, it gets a little bit tricky to even walk on the top of the ground. Typically, when you see a lot of legs on a millipede, they're going to be down in the soil and able to move around, grabbing the soil particles and move their bodies around that way. I've seen some of these millipedes on a countertop or out of that very tight soil crevice space, and they're not very good at moving, they're sort of looking for stuff they can wrap their legs around to really propel them and move around with. So, if you have all these legs and that pushing plate, that gives you power to burrow around or just to grab onto soil particles so you can actually move through the substratum.

Alie: So, it makes much more sense to watch them walk through dirt than it does on your garage floor?

Derek: Yeah, pretty much. If you ever see them on your garage floor, they might slip, or they will sort of start to climb a wall and then fall over, it's kind of cute actually. Sometimes I keep them in these little cups when I'm working with them, and they'll go around the edge and try to go as high up as they can and then they kind of fall over and they're kind of embarrassed and try to righten themselves. But if they're just in the soil, or under a log or something, that's where they like to be, that's where they can really move around and show off how good they are at moving and living.

Alie: That makes me feel so much better for them. Because yes, I think we're used to seeing them looking awkward but they're like, "Yeah, I'm just out of my element, dude." I also love that for people that only have one to two legs, maybe tops, that just the idea of like, "How could you possibly need those?" But if you were walking through a bunch of rocks and pebbles, you would want, obviously, more limbs to get them out of the way, you know? How badass.

Derek: One of the coolest things too, you can find this pretty easily online, but if you look up just, like, a slow-motion video of a millipede walking, it's weirdly beautiful. They have what's called a metachronal gait, that's different from a tripod gait of most insects where they're moving three legs at once. Millipedes, when they're moving... this is another cool thing about their diplosegments that we talked about earlier, how most of their segments are fused together. Within each of those diplosegments they have two ganglia, so two tiny brains in their bodies. And as they're moving, their brain sends a signal, "Okay, let's move forward." That signal cascades down the body, through each of these tiny brains, which then tells those legs to move.

Aside: Brains in its legs, like a chain reaction of leg brains. For more on why people are horny about this, you can see articles like the recent *Science* piece titled, “Centipedes, the ‘envy of engineers,’ inspire a new generation of robots.” Leg brains, hundreds of leg brains.

Derek: So, as it’s moving, you see this wave motion of the legs moving together and it is super cool to see. If you ever find a millipede out and about, if you just watch it and stop... maybe if you think, “That millipede has too many legs, I’m freaked out,” maybe just kind of, deep breaths, calm down. Just walk it walk and it’s strangely beautiful and hypnotizing.

Alie: Do you find that people don’t quite understand the work you do because we have a fear of so many legs? But then again, people are freaked out by snakes because they don’t have any legs. Have you, in the ten years that you’ve been doing this, seen patterns to what people are squicked out by?

Derek: Yeah, it’s definitely if there are more legs that are longer, then the freaked-out factor is higher. *[Alie laughs]* So, if you take something like a house centipede, which people are familiar with, these are an introduced species in North America and they’re often found in basements or bathrooms, they like to hang out in your tub or your sink. People don’t like to see that at 2 AM. Number one, “Here’s something that shouldn’t be here. Oh no, it has a lot of legs. Oh no, they’re very long, I’m outta here.” If you get that, people are more scared of it, they don’t really like to see that. But with these smaller millipedes that have, maybe their legs aren’t so long even if they do have a lot of them, if they’re just not as apparent, it doesn’t freak people out as much, which is good.

What I tell people if they’re scared or they don’t like these millipedes and centipedes, you know, maybe look up a couple photos of some of the prettier ones. If you just search for the family *Xystodesmidae*, the cherry millipedes, that’s a great way in to overcome your fear because these are beautiful, these are the Ferraris of the millipede world. *[Alie laughs]* They are gorgeous, they’re the ones that have the black-on-yellow coloration, oranges and reds. There’s a species here around Blacksburg, where I’m based, and it just looks like the most beautiful paint was just dripped down its body. It is gorgeous. You see one of those, you see it fluorescing under a UV light; how can you not love that? They’re just the best. they can compete with any butterfly that’s out there, easily.

It’s sort of like this exposure therapy. If you’re freaked out or scared of these things, little by little, if you look at the ones that are easiest to appreciate, that’ll help you overcome that fear, so that’s what I try to suggest to people.

Aside: You know what, let’s try and mend a fence here.

Alie: When it comes to house centipedes, do you have any advice for people who do see them, say in the sink or on a wall? Because I feel like house centipedes are the bug that gets texted to me the most by friends who are terrified being like, “What is this? I think I found a new species. Maybe aliens have landed,” or something of that nature. Do you have any advice for people who encounter a house centipede? Because they do look feathery with legs. It looks like an eyelash strip, two eyelash strips fused with a worm in the middle. You know?

Derek: *[laughs]* Oh, that’s amazing. Yeah, you know, so the first thing I would say, which I recognize is not very helpful, but have you thought about just accepting the new roommate? *[Alie laughs]* Because they play an important role in your house which is, if you’re seeing these house centipedes, what you’re not seeing are all the bugs that they’re eating because they are voracious predators, they’re... oh my gosh, their venom jaws are

terrifying. They have all these spikes and spines on them, they can catch prey very well and they are so fast; you look at them, you blink, and they're gone. So, they are great at eating all the other bugs that you don't want in your home. Typically, they stay out of the way but sometimes your paths cross, but that is how they pay rent. *[Alie laughs]*

The other thing I would tell people, if they've got enough roommates or they live with roommates for long enough, you can take a Tupperware container or a large cup or something, if you can very carefully put that over the centipede, slide a piece of paper under there, and then you can just take it outside and throw it out and then you don't have to worry about it anymore. But you know, I am so excited whenever I find one of those in my home. "Oh yes, finally!" I've only found maybe one or two and I lived in the same place for, you know, seven years at this point. So, I want more. Send me your house centipedes, I will take them.

Alie: Or at least take a picture and post it online and let others know, "These eat baby cockroaches, they eat the things that you don't maybe want in your house." So, they're doing good work, they deserve to be there just as much as you do.

We had a lot of listeners, Victoria Oetting, HBG, Chris Curious, first-time question-asker, Lila Mankad wanted to know about the smell. Chris asked: Why do they smell weird when you pick them up? Lila asked: I heard they don't sting but produce hydrogen cyanide. Victoria wants to know: Does a millipede have to be crushed to release its smelly toxin, or do they just fart it out when they're scared? *[Derek laughs]* So, what is it?

Derek: Yeah. I'm sorry if you're hearing a crunching noise, my cat is chewing on plastic for some reason. *[Alie laughs]* Hopefully that doesn't come through. *[to cat, "Chloe, stop it."]* Anyway. I'm surprised that it's taken us so long to get to the smell, yes. They are just a flower field of varying smells. You do not need to crush them to get them to emit their smell. It is kind of like they're farting because they're scared. You know, "Don't hug me, I'm scared." *[big, deep fart followed by small child's voice, "Excuse me, I had to fart."]* That's what the millipedes are telling you. And they have a wide variety of which millipedes smell and don't smell. Not all millipedes smell, some of them don't have chemical defenses, so their main defense is going to be to run away or just not be seen in the first place. So, you know, we don't have to worry about those right now.

Aside: So, to answer your question about self-defense Brooke Williams, they bolt, or they stink.

Derek: The ones that do smell, they're some, I call them ChapStick millipedes, the common name is slug millipedes because they kind of look like a little slug. Their legs are kind of hidden under their body, so if you're freaked out by legs, you won't be freaked out by this one. To elicit any millipede to really release its chemical defenses, you just have to pick it up and gently move it around in your hand and then smell. And these ones, they smell like camphor or ChapStick, or something weirdly chemical, it's super cool. If you uncover these, you can actually smell them before you see them sometimes. That is my cue when I'm in the field, I'll be like, "Oh, there's a smell, where's the millipede?"

There are others that smell just like, just the worst. There's this group called the crested millipedes and they look really cool when they secrete their chemical defenses because typically, they're going to be this nice chocolate brown color, like, "Oh hey, that's a pretty cool millipede, check that out." And the chemicals come out in these little liquid droplets and they kind of look like these little milky latex droplets all along the sides of the body,

“Oh cool, it’s chocolate milk millipede.” But then you smell it and it’s just, like, spoiled milk over a decaying carcass. [Alie laughs] It is weird that it smells so bad. I try my best not to ever pick these up because then you just don’t want to eat anything for, like, a day, because anytime you bring anything close to your face, you get that smell, it’s awful. It sucks so much.

Alie: Oh god, oh nooo.

Derek: Yeah, but you know, that’s what you want when you’re trying to deter predators. All these chemical defenses are to make sure that any predators will smell that and then maybe stop before they try to eat you. Because the smell, that tells them they’re poisonous so it’s like, “Hey, just so you know before you try to bite me, I will taste bad.” And they’re like, “Whatever, I don’t believe you.” And then the predator bites them and like, “Oh wow, you were poisonous.” And then they either throw up or die. So, it’s in the best interest of the millipede to make sure that the predator knows before it even gets that far, “Hey, I don’t taste good, I’m poisonous, leave me alone.” And then the predator can tell, “Okay, I respect your distance, that’s cool.”

Alie: I respect your distance. That’s a good thing to say in general just whenever anyone... “I respect your distance.”

Derek: Yes. I think that all the time when I come across anything mildly wild.

Alie: Yeah.

Aside: Do any smell good?

Derek: The best smell that you can ever get with millipedes, one of the listeners asked about hydrogen cyanide and yes, some millipedes do release hydrogen cyanide. This is only in the group called the flat-backed millipedes, the *Polydesmidae*, this is the most diverse group of millipedes worldwide. And they release a couple chemicals. So, they have benzaldehyde and hydrogen cyanide. So, that hydrogen cyanide, it’s a very potent poison, you don’t want any cyanide going into your body. The benzaldehyde makes it smell like cherries or almonds. That’s why one particular group, the *Xystodesmidae*, gets their common name of the cherry millipedes from that smell.

If you see a relatively-large-for-a-millipede, maybe an inch, inch and a half, or so and it’s black with these great yellow or orange spots, that’s probably a cherry millipede. If you pick that up and shake it around and then smell your hands, it smells like cherries. I can’t really eat many cherry-flavored things anymore because it just reminds me of the millipedes now. [Alie laughs] But it is amazing.

If you see that and you’re on a hike with your friends, pick that up and show them and they will think you’re the coolest... well, they won’t think you’re the coolest, but they’ll think it’s interesting. I love to do that, especially if I’m on a hike with a bunch of kids and it’s like “Hey, smell this bug,” and they’re like, “Woah, woah it smells like candy!” It’s like, “Yes, don’t eat it.” Because you don’t want to ingest that hydrogen cyanide. There have been some studies done where the typical... one of the most common of this is the Virginia cherry millipede, it’s black with yellow stripes, typically, and it has enough hydrogen cyanide in its body to kill 18 pigeon-sized birds.

Alie: Oh wow. That’s specific, also.

Derek: Yeah, if a human were to eat one of these, I don't think it would have major harm to you; you might throw up or something. You don't want to eat these things. You'll probably be okay because we're much more massive than even 18 pigeon-sized birds.

Aside: You want more info? You can saunter over on your sad amount of legs to the 2009 study, "A Müllerian mimicry ring in Appalachian millipedes." So first off, Müllerian mimicry is when different species have a similar warning signal, and both will kick your ass. So, the bright colors of different millipedes, which don't even have eyes to see each other, but have evolved to have similar coloring and warning systems for their sighted enemies. Now, there's also Batesian mimicry which is when a species evolves to be a knock-off of another's warning colors but it's actually just a harmless dupe. Can you believe it? But the millipedes in Appalachia that look alike, squirt this noxious stuff from an opening called an ozopore. So go on, git!

Alie: Stephanie Leské, as long as we're talking about the output of millipedes, wants to know: What's their poop like? Is it long like them?

Derek: [laughs] That's such a specific question. oftentimes it's liquidy and gritty because they're mostly feeding on leaf litter. The way they do that, they're not very picky so they just sort of go through the dirt and the leaf litter and just have their mouths open and they're just gnawing at whatever. So, their guts are typically filled with a lot of soil, leaf particles, dead leaf particles. So, I've picked up enough millipedes, I've been pooped on by a lot of millipedes at this point [Alie laughs] and usually it's kind of liquidy and brown and you'll clean it off and wipe it off and it just leaves some mud because of all that dirt they've ingested. So, typically you know, it's pretty dirty and liquidy.

But there are some millipedes, the best example, which here in North America is *Narceus americanus*, the giant American millipede or the iron worm. It's one of our largest millipedes, at least here in the eastern US; it can grow to be about four, five inches long so, you know, pretty big sucker. And the mother, she is a great mother. What she does, she will lay her eggs... Typically, we're used to something like a bird, "Oh it lays its egg out near where its butt is." With millipedes, their reproductive organs are actually closer to their neck, they're progoneates. So, that's a lot different than we're used to, so that took me a while to get used to, too.

So, what they'll do... The mother *Narceus* millipede, she will take an egg out from by her neck, fertilize it as it exists her oviduct, and then she'll take that egg, pass it all the way down her body, and she's got like probably around 150 pairs of legs so it's like an assembly line passing it all the way down. She will then take that egg and take it a little bit up her butt to then encase it in her poop and really squeeze that to get any excess water out, and then place that in this nice little poop ball. So, if you were to open up one of those poop balls, it has a nice little egg in it. And that poop ball protects the egg from desiccation, other elements, something coming up to eat it.

And then, when that tiny little baby millipede hatches, will eat its way out of that fecal pellet, as it does it ingest some of that fecal matter and it gets some of the microorganisms from its mother so that it can then digest those dead leaves. ["Thanks Mom."] So, it is just a perfect example of a loving mother doing everything she can to set her children up to have a successful life. You'll sometimes come across these little piles of poop and if you open them up you can find these little eggs.

Alie: Imagine just getting smeared, like a mud mask, “Bye-bye baby!” And then you just leave them, you leave a batch of your babies and keep walking.

Derek: And she will lay, you know, multiple batches. She’ll lay over 200 eggs, maybe even more at different points in her life.

Alie: I’m glad we’re addressing this because Leah E. Anderson and Morgan both want to know about congregations of them. Leah says: This summer I was at a state park in Wisconsin and during a hike I came upon thousands of millipedes on the ground, crawling up trees and rocks and even in the creek. Morgan says: I went camping last weekend and found many millipede friends in the bathrooms. Why are they congregating in a relatively clean building? Do they all hatch at once?

Derek: I am so jealous of these people. [*Alie laughs*] I don’t know if they hatch exactly at once, but they do hatch pretty close to one another and so you know, if you come across a hatch of millipedes, maybe you’ll see a bunch of them. Though, they are very tiny and they only hatch with three pairs of legs, which is kind of cool, they add more legs as they grow. [*Alie gasps*]

But when we’re talking about these congregations of millipedes, especially if people are seeing them roaming across the landscape... I still have never seen that; I’ve never seen this mass of millipedes migrating. We still don’t have a good idea of exactly why this is happening. It seems to happen oftentimes when it’s drier in the summer, so maybe part of these migrating masses of millipedes, they’ve been reported to be thousands of individuals at once. Typically, they’re juveniles, maybe a couple of adults with them. But it might be that they’re all moving to find places with better resources. Maybe where they’ve been, it’s too dry, so during the summer that makes sense.

But millipedes... it’s dangerous for them to be in very dry areas because, unlike insects which have a nice waxy coating on their exoskeleton to protect them from drying out, millipedes typically don’t have that. So, they need to be able to be in these moist, humid habitats so that they don’t just dry up into a husk and die. So, it might be when there’s a big mass of them, they’re just trying to find a better place to hang out and eat some dirt and leaves.

But we don’t have a great idea of exactly why it happens, but you’ll see it just pop up on iNaturalist or social media where people are freaked out by why all these millipedes are here. Sometimes they’ll come into people’s basements; I had a friend send me a photo of her parents’ basement, they were removing buckets of millipedes, the greenhouse millipede. They like these humid weather areas, so they like to really go to these places that have a lot of water available for them.

Alie: [*deep, concerned voice*] Buckets of millipedes, that sounds like a genre film, just like a horror film.

Aside: Also, I think that you should know that according to the 2020 paper titled, “Genital morphology and the mechanics of copulation in the millipede genus *Pseudopolydesmus*” published by researchers at the Field Museum, when engaged in lovemaking, male millipedes will jizz behind their second set of legs and then they’ll goop it up on their own legs, sending it down the line to the seventh set of legs before they hand it off to a female’s neck vagina.

And all of this business really just makes our sci-fi aliens seem boring. And I was sitting there poring through the studies, CT images of boning millipedes and these electron-

scanning arthropod genitals and it just became apparent that we are the aliens abducting creatures to study their junk. It's us.

Alie: First-time question-asker Amy Zucker Morgenstern wants to know: They grow by adding segments, right? So, how does that work? If you look closely at an adolescent millipede, will you see a lot of partly formed segments or segments that haven't let their legs down yet, or what? And Greg Walloch wants to know: Do millipedes actually keep growing if they get cut in half or lose limbs? Does that happen?

Derek: Oh, so if a millipede loses some limbs, generally it will be fine. If you cut a millipede in half, it's going to die. So, avoid doing that, you don't want to do that.

Alie: Don't do that, okay.

Derek: Yeah. But they do add more segments throughout their life. And so, if you look at a baby millipede, it's got 6 legs, cool. It's going to have a couple of segments at the end of the body that are legless, and so as it molts it will add legs to those legless segments and when those legs get added, it adds a couple more rings without legs. So, it'll keep doing that, and that's how it adds the legs, slow growth. During each molt, they'll be able to add more legs to 'em. Some millipedes, they will keep doing this throughout their life until they die, just adding more and more legs. Most other millipedes though, they'll reach a certain point and then be like, "Okay, that's enough," and that's where they'll end with their legs. A lot of the millipedes like the flat-backed millipedes that we talked about before, those will have about 20 pairs of legs and then they're like, "Okay, that's good enough for me." But some of these longer, cylindrical millipedes, they'll keep adding for a little while. You're not going to see these half-formed legs jutting out, but you will see these legless segments at the end of the body. It almost looks like it has a weird tail there, you're like, "Oh, why are there no legs here? Is it injured?" No, it's still just growing; it's adding them as it goes along.

Alie: It's just awkward. Just an awkward teenager.

Derek: Little bit more of a sluglike look.

Alie: Cuuute.

Derek: [*sleepy voice*] I'm just waiting for my legs to come in, it's fine.

Alie: Ann Hanlin is a first-time question-asker and said, they asked their grandma if she had any questions about millipedes and her grandma asked: Do they have toenails?

Derek: Do they have toenails? ... Kinda, I guess. They have little claws, so if you looked very closely at the end of a millipede's legs, they got these various leg segments called podomeres, and they'll get all the way to the end where they've got a tarsus, and then attached to that last tarsus, they have a little claw jutting out... So, you know, I'd consider that a toenail.

Alie: Augh, that's amazing.

Derek: Yeah, so they'll have that main claw. One of the groups of millipedes that I studied were the twisted-claw millipedes and they're called that because the males, on some of their anterior legs, they have these really weird, they're twisted and kind of spatulate claws. We don't know what exactly they use them for, maybe it's to hold onto the females during mating but the females don't have them, only the males have those twisted claws, they're super cool to see. If you google, "Twisted-claw millipede," you'll be able to see what that looks like. So yeah, they do have toenails.

Alie: That's so good to know. I would have thought that was a definite no, and now... we know.

Derek: If you let them walk on your hand, like if you see one of those giant American millipedes, put it on your hand and as it's walking along it almost feels like little Velcro kind of moving along and that's the little claws going into your skin and trying to get a hold on. It kind of tickles, it's fun.

Alie: Megan Duffy, first-time question-asker, wants to know if you've seen the *Charlie the Unicorn* episode with the giant space millipede.

Derek: *[laughs]* Of course, yes, I saw that when it came out. *[music plays, millipede sings, "I am a millipede, I am amaaazing. I command you to gaze upon my face."]* Sometimes that song gets stuck in my head, for sure.

Alie: Finally, Will Clark, first-time question-asker, wants to know: Do they make good pets? Or better left outside munching poop and stuff? What do you think?

Derek: Personally, I think they're better left outside. They can be relatively easy to keep as pets. In the pet trade, you might see, like, the desert millipede or the American giant millipede; those are often kept in captivity. I kept one of those giant American millipedes for like, a year and a half or so, and they're fine, you just need to give them some leaves, maybe some lettuce, spray the container so that it stays nice and moist for them.

They just don't really do a lot. It's kind of nice to have them around to show people what a big millipede looks like, but you're not going to get too much back and forth with it like you would with a cat or a dog. So, I prefer my cat. Generally, millipedes are pretty easy to keep though some groups are more difficult than others. But these big cylindrical ones, if you're kind of interested and just want to keep one for a while, yeah that's a fine thing to do.

Alie: Imagine if Chloe had 720 legs though. What about the worst thing about millipedes? There's got to be something that sucks, or about the job. There's got to be something you don't like about millipedes.

Derek: Yeah, I think the worst thing is just I'll be out sometimes looking for some of these millipedes, and it'll be beautiful habitat, and you're not finding anything, it'll be hot and humid. I sometimes tell people that looking for millipedes extracts a blood tax because the best millipedes like to be around poison ivy, or stinging nettle, or ticks, and mosquitoes. So, whenever it's warm outside during the season, I just get more bug bites and weird scabs and stuff and it's like, "Well, that's nature for ya." You need to give something, equivalent exchange. So, I don't enjoy that part so much. But you know, there's a lot to like about millipedes so I can't really complain too much.

Alie: What's your favorite? I always have to end on what your favorite thing about them is. I can't even imagine! How are you even going to pick one?

Derek: Yeah, my favorite thing is just... Before I got really into millipedes, I wasn't really into nature so much and really appreciative of the local nature and ecology around me. But with millipedes, there's a lot of endemic species, which means that there are some that only occur in a small area and nowhere else in the world. Some of these ranges we have for millipedes is less than a square meter because the species has only been found once. And particularly here in North America and here in the Appalachians where I am, we have so many endemic millipede species that don't occur anywhere else, they're rarely found because people aren't looking for them.

So, as I've gotten more into millipedes, and finding these different species, and learning more about them, it just really makes me appreciate the nature all around me and that local

connection to this random patch of woods near where you live. And I think that's a really powerful connection because you'll see nature documentaries, and they're deep in the jungles of Borneo, or off the coast of Brazil, these very far-flung places from where we are, in the United States at least. And by really getting into my local bugs and millipedes, it's really made me appreciate where I live. It gives you perspective and I think it's a really powerful way to connect with the nature all around you and not just kind of... to make sure you care and think about, "Okay, here's a patch of trees. Should we make it a parking lot, or leave it as a natural area?" I hope that, even if you look at a millipede or a bug or any part of nature, that you can find that way to really connect with the place where you live and not just think, "All the cool stuff is far away so why does this even matter?" And that perspective, I've really enjoyed learning more about my local nature and especially millipedes.

There's always something new. These millipedes and centipedes... and we didn't even talk about these other related myriapods called pauropods, they look like little Twinkie potatoes that are maybe 2 millimeters long and I go crazy whenever I find one; they're so cool. They're so neat. And no one knows about them! The world expert on this was a guy who lived in Sweden, I believe, and he was in his 90s, he died a couple years ago. So, there's no one really working on these things anymore. So, we need ambassadors for these little bugs. It doesn't have to be millipedes or pauropods, though I hope it is. You can contact me, and I'll talk to you about them. Whatever nature is around you, I think it's important to be an ambassador for these cool parts of nature that you might not think about otherwise.

Alie: Well, keep up the amazing work. It's really wonderful to follow you on social media because I feel like if ever there's going to be any millipede news, you're going to be the one breaking it and disseminating that information, so I get very excited.

Derek: Well, thank you.

Alie: Where can people find you and more of your work?

Derek: Yeah, you can follow me on Twitter, I'm @DerekHennen. If you just want the millipede and centipede news and nothing else, you can follow my millipede-specific account which is, @DearMillipede. So, you know, if you have a question about millipedes or centipedes or want to send me some or just a cool photo of one, you can send them to me on Twitter. You can find my email, it's out there, but yeah, Twitter is probably the best way to contact me.

Alie: What about books? Any future books?

Derek: Oh! Yeah, oh gosh! I completely forgot. But I finally did do something that I've been wanting to do for a decade now, since right when I got into millipedes. So, I grew up in Ohio, that's where I learned millipedes, and as I was trying to pull together just a basic, "What millipedes are around me?" It was very difficult to do because there weren't any field guides for millipedes in North America, so I fixed that.

I worked with my colleague Jeff Brown and people at the Ohio Division of Wildlife, and we put out a free guide to Ohio's millipedes. It's got beautiful photos, mostly from other people who very graciously let me use their photographs but if you just google, "Ohio millipede guide" you can find a PDF of it online, for free. It's very specific to Ohio but you can use it to get an idea of what groups of millipedes might be around you, wherever you are in the US and Canada. You can also get a printed copy if you contact the Ohio Division of Wildlife and it's gorgeous. I got mine a couple of months ago and I was just... Augh, it was so nice to see it.

And so hopefully, now, when people are like, “I’d like to know more about millipedes,” they have something they can take with them on a hike and get down to maybe the species or if not the species, then the order or family of millipede they might be seeing. I’m so excited for that.

Alie: Congratulations! That’s a big deal! That’s so cool. I will link the PDF in the show notes so people can click on it and just peruse and see these different types of millipedes and get their eyeballs around them, you know, wrap their brain and eyes around ‘em.

Derek: Yeah, we need more eyeballs on millipedes. And I also want to say that the flat-backed millipedes and many other millipedes don’t have any eyes at all, so it’s our job to appreciate their beauty because they just can’t do it. So, we need to make sure that they are affirmed that they are doing great, they are beautiful, and magnificent. So, please join me in doing that.

Alie: Thank you, Dr. Millipede, this has been amazing.

Derek: Thank you for having me, I had a lot of fun.

So, ask millipede people, millions of questions because honestly, they want you to know! And Derek’s social media handles are linked in the show notes, follow him, and so is the PDF field guide to millipedes and the charity that we donated to. More links will be up at AlieWard.com/Ologies/Diplopodology, which is linked in the show notes, so you don’t have to spell it.

I’m @AlieWard on [Instagram](https://www.instagram.com/AlieWard) and [Twitter](https://twitter.com/AlieWard) and we’re @Ologies on [both](https://www.youtube.com/channel/UC...). *Ologies* merch is available at OlogiesMerch.com in case you need a shirt, or a hat, or a tote, or a gift, or a bathing suit to put on your body. Thank you to Susan Hale for taking care of merch and so much, so much else for the show. Thank you, Noel Dilworth, who does the scheduling and is driving me to the airport at 6 AM tomorrow to see family in Montana. Thank you to Erin Talbert, Shannon Feltus, and Boni Dutch who admin the *Ologies* Podcast [Facebook group](https://www.facebook.com/OlogiesPodcast). The Wordary makes professional transcripts and Caleb Patton bleeps them, those are up for free at AlieWard.com/Ologies/Extras. Thank you, Kelly R. Dwyer, who does the website.

We also have short episodes called *Smologies* that are condensed, they have no swears in them; those are in our feed, you can scroll through, or you can find them all at AlieWard.com/Smologies, that’s linked in the show notes. Mercedes Maitland and Zeke Rodrigues Thomas of Mindjam Media make those with assist from Steven Ray Morris. And the man who I would name a millipede for, hands down, legs down, Jarrett Sleeper, lead editor and puts this all together every week. And Nick Thorburn wrote the theme music.

If you stick around ‘til the end of the week I tell you a secret and this week I would like you to know that I got Invisalign in October 2018 and I was supposed to be done March 2019... [*whispers*] I think... Is that right? [*deep breath*] Eugh. Okay, yeah. But because of the pandemic and the fact that I can only seem to remember to wear them at night, it will be four years of my having Invisalign, it was supposed to be six months. I can’t even begin to process that. And I think that my orthodontist wonders how I’m a member of regular society. I think he’s concerned for me. Anyway. Whatever you’re doing, you’re doing great. All right, berbye.

Transcribed by Aveline Malek at TheWordary.com

Links to things we discussed:

A donation was made to [Lower Muskingum Conservancy](#)

Dr. Derek Hennen's [website](#)

Follow Dr. Derek Hennen on [Instagram](#) and [Twitter](#)

Follow @DearMillipede on [Twitter](#)

[Ohio's guide to millipedes, written by Derek!](#)

[Dr. Paul Marek – one of the scientists who described the true millipede](#)

[Millipede with 1000 legs!](#)

[“The first true millipede—1306 legs long,” 2021 paper on *Eumillipes persephone*](#)

[Taylor Swift inspired an entomologist to name a new millipede species after the megastar](#)

[Xystocheir bistipita: Discovery of a glowing millipede in California and the gradual evolution of bioluminescence in Diplopoda](#)

[Bioluminescent aposematism in millipedes](#)

[DIY Berlese funnel](#)

[BBC's “Life in the Undergrowth” series](#)

[Giant bird-eating centipedes exist — and they're surprisingly important for their ecosystem](#)

[“Michael it ate a BIRD.”](#)

[House centipede: don't panic](#)

[Centipedes, the ‘envy of engineers,’ inspire a new generation of robots](#)

[Genital morphology and the mechanics of copulation in the millipede genus *Pseudopolydesmus* \(Diplopoda: Polydesmida: Polydesmidae\)](#)

[Batesian vs. Mullierian mimicry](#)

[I Am a Millipede \(Song from Charlie the Unicorn 4\)](#)