Getting Curious with Jonathan Van Ness & Dr. Jessica Ware

JVN [00:00:00] Welcome to Getting Curious. I'm Jonathan Van Ness and every week I sit down for a 40 minute conversation, but it's never 40 minutes anymore, and I can't help it, 'cause I've got so many questions, with a brilliant expert to learn all about something that makes me curious. This week, we are re-airing a very special episode, with one of my very favorite people in the world, Dr. Jessica Ware, where I ask her: Are cicadas partying like it's 2004?

Welcome to "Getting Curious," this is Jonathan Van Ness. I'm so excited for today's episode. There is a lot to digest and a lot to process in the world. And sometimes you just need to get into that science so you can just, like, keep learning. But just give yourself a bit of variety. So with that being said, welcome Dr. Jessica Ware. You are an entomologist, an evolutionary biologist. You're a curator of the Odonata and Non-holometabolous insect orders at the American Museum of Natural History in New York and professor at the Richard Gilder Graduate School.

And this is also I just think one of the most amazing things is you're the, also the V.P. elect of the Entomological Society of America. And the president of the Worldwide Dragonfly Association. You got credits on credits with a side of credits, all in caps lock. Like with some other pretty fonts too. So thank you so much for taking your time to come talk to us, Dr. Jessica Ware.

DR. JESSICA WARE [00:01:24] Thank you for having me. I got to say, if you call me and ask me to talk about dragonflies or insects, I will be there in five seconds because I think talking about insects is one of the best and most fun pastimes. So I'm ready. I'm excited.

JVN [00:01:38] Oh my God, I can't wait. So, OK. This is kind of where this episode started from, came from. This is why I wanted to have you on. So I think, you know, we were all in quarantine and then we started reading those articles about all the cicadas coming up in Virginia and, like, West Virginia. And then that made me think about this time in 1996 in Quincy, Illinois, like, where I'm from. And my family had moved out to this farm. And I remember, like, the second week we got there, there was like, there was two garages and this, like, the second garage, as we so called it, was, like, covered in cicadas. And there was like and they said that year was like, one of the like every 7 year ones but ever, but I lived there for, like, you know, another like what, 11 or what's? Whatever. A long time, I lived there for like another, like, however many years till 2004 from '96. So yeah, 8 years. And I never saw them again. So then I read about these ones and I, and I hear there's these 7

year ones and then there's a 17-. What, what gives with these cicadas? What even are they? And why are they doing this, like, hibernation adjacent cousin of hibernation?

DR. JESSICA WARE [00:02:46] I mean, in a way they are really amazing, right? Because they do have, either 13 years or 17 years. Maybe that's why you didn't see them, because it's 13 or 17.

JVN [00:02:58] So there's no 7.

DR. JESSICA WARE [00:03:00] There's no 7. But there are, so there's two kinds of cicadas. There's the periodical ones that come out in these batches. Right? Like you describe, they're everywhere, you put, you can shovel them up, you know? And then there are the annual ones, and there, annual ones come out every year. So people sometimes get confused, I think, about which ones that they have. But you can tell them apart because the periodical ones. So they all have beady eyes. So they're very beady eyed creatures. But the periodical ones have red beady eyes. And so that, and they're a little bit smaller. So maybe those. But those are probably the ones that you saw on your second garage. And it's a really good strategy for them because they can avoid.

So they live underground as nymphs and they suck on sap, on, you know, plant juices. They suck on roots and rootlets. And they molt five times to get larger until the soil temperature's around, you know, 64 degrees. It signals a cue and they all emerge at once. And they think that maybe the reason why they do this is so that that way they could just basically use satiation as a strategy. So they stuff the predators, birds or whatever. And hopefully most of your brothers and sisters get eaten and you don't. And you can mate, you know, do what you need to do to pass your genes on to the next generation. By coming out in such a huge number. Only some of you are going to get eaten because eventually the predators are full. Right? And then the rest of you can mate, lay eggs, and then you can crawl into the ground and do what they gotta do.

JVN [00:04:30] OK, wait. There's so much to unpack there. But wait, I think before, because, I we got to talk about cicadas more because I'm curious, but also you, like, because you're an entomologist, which I think we learn on "Getting Curious" before in our episode about how can we be less rude to bees, is that basically you're studying like insects, like, entomology is like all things insects. Right?

DR. JESSICA WARE [00:04:52] Yeah. So I like all insects. I mean, I'm mostly, my specialty are kind of dragonflies and damselflies and then termites and cockroaches. But, you know, I have a graduate student that works on hemiptera. So hemiptera are the true bugs. Only.

So all the bugs are insects, but not all insects are bugs. Right? So it's just this one order that are bugs, and I have a grad student that works on, on bugs. So this, you know, I think-.

JVN [00:05:14] Wait, what. What? Who? A what? All insects. Would-. Give that to me one more time.

DR. JESSICA WARE [00:05:20] So all, so there's 27 or so, 24, depending on who you talk to, orders of insects. They're kind of these, these boxes, these bins in which we tried to group like things with the, with other like things. And one of them is called hemiptera. And they're called the true bugs. And they're the only ones that are actually bugs. All the other things that are insects are dragonflies or, you know, a-.

JVN [00:05:48] Beetle.

DR. JESSICA WARE [00:05:49] Bees or beetles or, yeah, or ants or whatever.

JVN [00:05:52] That's fascinating.

DR. JESSICA WARE [00:05:53] They are part of the-, bees, ants, and wasps. But only the group that's hemiptera are the true bugs. So you can always impress an entomologist if you say, oh, do you study insects or bugs? And then they're like, "Oh, wow, that's a very good distinction. I can't believe that, you know, the difference between bugs and insects." It's a good, it's a good party trick.

JVN [00:06:12] So what are the distinctions? What, what makes one one and then the other?

DR. JESSICA WARE [00:06:16] Well, hemiptera all have their mouthparts that are designed for sucking. So most of them suck plant juices, xylem or phloem, but some of them actually are modified to suck blood, like, assassin bugs and things like that. But so they're mouthparts are like a little beak. It's called a rostrum and it looks like a little pointy straw and it kind of points down towards their belly and then they just kind of stick it up and poke it into the, to the plant material. Or in the case of things like bed bugs, they stick it into you, to get your, your blood.

JVN [00:06:50] So a hemiptera is a bug. And then insects are, and then insects are insects?

DR. JESSICA WARE [00:06:57] Yeah. So hemiptera are a kind of, hemiptera are a kind of insect.

JVN [00:07:02] But they're the only true bugs.

DR. JESSICA WARE [00:07:03] Yeah. The only true bugs. Yeah.

JVN [00:07:05] So in order to be a bug you have to like suck.

DR. JESSICA WARE [00:07:09] To be a bug, you got to suck. Yeah. No, you have to, you have these sucking mouthparts with a rostrum. It's a kind of beak with the straw that kind of points downwards towards your belly, your abdomen and, and you suck either, you know, they, they've evolved over time to suck lots of different things. But I think the ancestor, ancestral state is that they were drinking, you know, plant juices.

JVN [00:07:31] But your favorite, slash specialty, is dragonfly, damselflies, cockroaches and who?

DR. JESSICA WARE [00:07:38] And termites. So people for a long time thought termites and cockroaches were really different. But it turns out termites are just like a fancy version of cockroaches that are social. So they had kings and queens and workers and soldiers that work together in the colony. But they're really just cockroaches. They're just like a specialty version of a cockroach. So it kind of makes sense-.

JVN [00:07:59] So cockroaches aren't social?

DR. JESSICA WARE [00:08:01] No.

JVN [00:08:01] Like the classic New York City cockroach, like there's no sort of hierarchy there? They're just all on their own eatin' stuff.

DR. JESSICA WARE [00:08:06] Yeah, they're just living their life, you know, mating, eating, dispersing, but with one goal in mind, just passing on their genes. Whereas in, in colonies like in the, in things like termites, they have altruism. They have, you know, collective behavior and sharing and, you know, group effort for a common goal and stuff like that, which the average cockroach doesn't do.

JVN [00:08:28] This is the thing I realized after interviewing scientists for some time, to me, because I'm so not a scientist and for anyone listening, like, we're all just like, "Oh, my gosh, tell us everything." But then I feel like sometimes scientists are like, "Well, I really am, like, all about this." But then, like, to me, I'm like, "Well, honey, you can say all this stuff because, like, you're literally a doctor, like, so yeah." So that's just so fascinating. But then I'm remembering that I was curious about cicadas, but now I want to hear about, like,

all the things that you like, specialize, schmecialize in. But then I also know that, like, I'm a journalist-adjacent person, I'm trying to learn about cicadas, so I just have to focus. So basically, I'm just having rhetorical fireworks and I'm telling you about it. So, oh my god. So with cicadas. Now because you also are an evolutionary biologist, which means that, doesn't that mean you study like evolution?

DR. JESSICA WARE [00:09:12] Yeah. Like people who are entomologists really can approach it from different angles. And a lot of people who do entomology do it for pest control. You know, they want to protect our food storage. You know, we, we like food. Food taste good. And pests also like food. And they want to eat our crops. And so a lot of entomology is dedicated to, kind of, managing pests that would otherwise, you know, invade homes, invade crops and what have you. But those of us who are evolutionary biologists, we're kind of looking at insects from the different angle. We're not really trying to kill them necessarily. We're trying to, you know, study what's happened over the last 400 or so million years, which is about how long we think there's been flying insects. What happened? Like, what made them, what made there be so many different kinds of insects?

We think, you know, there's over a million species of insects that have been described, but there might be 10 million, 5 million, 30 million. A lot of people have suggested, you know, huge numbers of the potential number of insects that are out there. And so we kind of try and do like a little bit, you know, explorer stuff. You know, you travel around, try and describe new species, see what you can find. And then for the ones that we do know about, we try and reconstruct what happened over their evolutionary history. What happened over the last, you know, 200 million years or so? Why do we have some species here and other species, you know, in a different location? Why are some things in the tropics, not in the Arctic? Or why some things in the Arctic and not in the tropics? You know, things like that. It's pretty fun.

JVN [00:10:36] So with the-. Yes. Ok, but wait. So with the cicadas. So, like, and then, like, in the evolutionary sense, 'cause once cicadas, like, reach adulthood and they're, like, you know, out, you know, swarmin everything and eatin' all the crops and stuff, they fly. Right? Like, don't cicadas fly?

DR. JESSICA WARE [00:10:54] Yeah, so cicadas, cicadas fly. They have very rigid and stiff wings. And they're members of the, the group of insects that have wings. And there's 3,000 species or so of cicadas. There's a lot of different species.

JVN [00:11:11] What? How many are annual and how many are periodical?

DR. JESSICA WARE [00:11:14] So we actually. So there's 3,000 species globally. But we, the periodical ones are only in the United States, which is mindblowing.

JVN [00:11:21] What?

DR. JESSICA WARE [00:11:22] Right? They're only here in North America.

JVN [00:11:24] Are you sure? Are we sure? I mean, but it because. Because. Because, you know, how are a part of those people that found the, you found that one Chinese, you are the person who had to like, say like, "Oh, yeah. That's that one special beetle in 2013." I was reading that article.

DR. JESSICA WARE [00:11:39] Oh, the roach. Yeah. The roach one.

JVN [00:11:40] The roach.

DR. JESSICA WARE [00:11:40] Yeah.

JVN [00:11:41] So do you think that there's a chance that maybe, like, someday they'll find out that there are cicadas? Like maybe they were hiding out like in, like, Chernobyl or, like, some rural part of Mongolia that we just haven't been to yet? Or what about the Amazon?

DR. JESSICA WARE [00:11:57] Well, it's true. I mean, we do find new species all the time. I feel like something huge, like periodical cicadas where they come out in thousands and thousands. Some human would have noted and said like, "Hey, just so you know, there's thousands of cicadas here right now." I feel like we would have had some notes about it. But it's still like there's-.

JVN [00:12:14] So what are the things in Africa? Eating all the, all the things right now? Isn't there, like, something eating a bunch of crops?

DR. JESSICA WARE [00:12:20] Yeah. The locusts.

JVN [00:12:21] Oh those are locusts?

DR. JESSICA WARE [00:12:22] Yeah. They're close relatives to hemiptera. But they're not hemiptera, they're a different group called orthoptera, and those are, talk about cool. Those are really neat because they, they, they can either be swarming or they can not be swarming. And it depends on whether as juveniles, they're in crowded conditions or if they're in solitary conditions. So if they're just eating their grass and chilling and not

around a lot of other locusts, then they don't do this swarming behavior and they have green body coloration. But then if they are in, in large groups, if they're grown, you know, or raised or reared, there's someone who's done a lot of research on this, Hojun Song. If they're reared in large groups, where it's very, very dense, then there's, like, a switch that turns on. They have a black form and they are locusts, like, the ones that you hear about from the plagues that, like, swarm and, you know, consume everything, they have a voracious appetite and they're dispersing. And it's a real problem.

JVN [00:13:21] And there's one of those, one of those, like, events is going on right now in somewhere in Africa, I think, and it's, like, it's, like, really creating, like, a food threat, like, a food source. I don't know. I literally just was reading about that, like, accidentally, like, yesterday, completely unrelated to the prep for this interview. But do you know about that thing?

DR. JESSICA WARE [00:13:39] Yeah, it's actually really very serious because it not only, I mean, like I said, you know, we are kind of competing with them for food sources. But even, even just, like, that, that's the primary threat. But, of course, it's also just a giant nuisance. I mean, they're like swarming, they're all over people's houses. You open your mouth, they're kind of, you know, flying at your, you know-.

JVN [00:13:58] Why? How did they get like that? Like, from an evolutionary standpoint? Like, because it's, like, a natural disaster or whatever. Like, how did they start? Like how, and with the guy that studied it, like how, why do sometimes they get all together? How does that even happen? Is it kind of cicada-ish that, like, there's a concentration of a bunch of locust eggs?

DR. JESSICA WARE [00:14:18] Well, yeah, I think what happens is the population density just gets higher and higher and higher until it reaches the threshold. And then they do this swarming behavior. So if you think about it from the perspective of the locusts, it kind of makes sense. Right? Because if you're really, really densely packed, you kind of want to disperse so that you can spread out and you're not all going to be competing and eating the same resources, consuming all the same food, taking up all the same space. So over a long period of our evolutionary time, that may have been a good strategy that, you know, if your population gets really, really dense, that you could have a switch that triggers for you to kind of move on and disperse. I always try and think of it from the perspective of what could have driven an insect to do it. 'Cause we always think of insects doing these things to us. But of course, all of these things, all of these behaviors evolve, you know, hundreds of millions of years or at least, you know, tens of millions of years before we even got on the scene.

JVN [00:15:12] Oh, my God. That's so interesting to think about because we always think about how, what they're doing to us, but really, like, they're just trying to live. And, like, you know, live their best Darwin, like, growing expanding life probably. But the next question that I'm about to ask you will take like 30 minutes to answer. And I could literally talk to you forever, so we're just gonna jump off and take a really quick break and we'll be right back with more Dr. Jessica Ware after this. So how do you get through a locust infestation, plague or a cicada in-? Like, what's the life cycle that makes it end?

DR. JESSICA WARE [00:15:59] Well, I mean, with cicadas eventu-, I mean, there's kind of like a time, like they all kind of emerge. Most of them, you know, or many of them are eaten. Some of them don't get eaten. They mate, they lay eggs, that it-, kind of in the crevices of bark. And then the eggs hatch. The nymphs, you know, drop down to the ground and crawl under the ground. And then you don't see them again for either 13 or 17 years. And that's kind of how it ends. Right? It's kind of relatively predictable, although with climate change, it's becoming less predictable because some of them are emerging early and what have you.

But with locusts it really, I mean, the best thing you can do is, is manage them with, with integrated pest management, which could be a combination of biological control or insecticides or what have you, because you need to secure food for humans because without, it's actually like a crisis that can lead to famine. But otherwise, if left unchecked, eventually it will just die out on its own, because eventually their, many of them will die. The resources will be used up. And then the population numbers go down. When the population numbers are low, they don't do the swarming behavior because then there's a switch and it's, like, "Oh, actually, I've got lots of space. There's not really anybody around me." And then they're in this other form, the green form, the non-, the non-swarming form.

JVN [00:17:13] I didn't realize I was gonna, like, struggle so much with talking about cicadas specifically because I didn't know how curious I was about all the other bugs that there are and that you know about. So, with locusts, how or how long do locusts live generally? And how do long cicadas live generally? Like, what's their lifespan of, like, adulthood?

DR. JESSICA WARE [00:17:37] Oh, well, I mean, for most insects, the lifespan of adulthood can be weeks or months. They're, it's really not that, that long. Even for dragonflies, I mean, they have one hot summer to do all the jobs they have to do. Find a mate, you know, make babies and stuff like that. But in all of these cases, they can have a much longer juvenile stage. So they go through these, what insects do is they, every months or years, depending on the insect. They basically shed their skin and have a slightly larger version of themselves. At least for these insects that we're talking about. And so for

dragonflies, for example, they can be, you know, 6 weeks in the water or 5 years in the water. And then they emerge as an adult. For cicadas, especially the periodical ones. The periodical ones might be, you know, molting every 5 years for 17 years. And then they emerge and have one hot summer to do all the jobs they have to do, you know, mate, reproduce, you know, lay eggs, disperse. And the same with locusts. You know, locusts are kind of continually molting in the juvenile stages until the adult stage. And then the adult stages are usually, you know, one hot summer's length to kind of get all the jobs done then.

JVN [00:18:50] So all those bugs as we know them, like cicadas, locusts, dragonflies. They never live for like 2 years or, like, what-? There's not like some grandmommy or granddaddy or like maybe non-binary dragonfly that is, like, 3 years old? Or, like, a really old one?

DR. JESSICA WARE [00:19:10] Well, they are, they're multiple year old, they're multiple years old. But like, it's as if, you know, you were a teenager.

JVN [00:19:16] Well, no, I mean, as an adult, I mean, not the, not the cicadas, because I get that that the cicadas, like, when they're the little, little, whatever they are in the ground. I've got to ask about that later. I'm curious about what that is, literally. But, but there's never, like, an adult one the way that we know it, like, there's not, like, an adult dragonfly or, like, an adult cicada or like an adult grasshopper, like none of them in their adult forms ever last more for than a summer? Can I get a 6-month-old grasshopper? Can I get a 1-year-old cicada that's, like, been thriving out in the wild for a year as an adult? Or no? It's always the summer. That's just how it is.

DR. JESSICA WARE [00:19:49] Yeah, it's usually not, not more than a few months. I mean, there have been a few cases where they found, I know someone, Melissa [Sánchez-Herrera]. She found a damselfly with her colleagues in Colombia that had fungus growing on it, which means it probably was at least a few months old. But it's kind of, sometimes can be hard to guess how old they are. You can kind of look at how tattered their wings are because their wings kind of start getting shredded.

JVN [00:20:10] Oh-

DR. JESSICA WARE [00:20:11] Here in North America, I mean, they're not going to live more than, you know, at least until October or so, because in New Jersey, New York, it's going to get cold and then, you know, the temperature will get him.

JVN [00:20:24] So, oh my god, wait. Mold. What was I thinking about the mold growing wings? I'm really shocked by the wings getting tattered. That did not occur to me.

DR. JESSICA WARE [00:20:34] Yeah.

JVN [00:20:36] Oh, yeah. So I was reading this other article, when I was researching for this about, like, how I, I read so many articles. I can't remember which ones were about you and which ones were just about insects. But I was reading how the, there's evidence that, like, the damselflies and the dragonflies were the first things to fly like 406 million years ago.

DR. JESSICA WARE [00:20:56] Yeah, that's right.

JVN [00:20:57] So. But I didn't know what, what is a damselfly? So I guess they still exist because your colleague found one. I guess I never heard of one. Where are they? What are they?

DR. JESSICA WARE [00:21:06] Well, you probably have seen dragonflies and damselflies and just thought that maybe they were the same thing. So I have a prop actually to show you. So this is a dragonfly. Right? And it's kind of stocky, thick-bodied. And usually they hold their wings out to the side when they land on something. And damselflies, I'm not going to show you one because they're teeny tiny.

JVN [00:21:26] Oh.

DR. JESSICA WARE [00:21:27] They're not all teeny tiny. But they're very slender. They're very slender bodies, which is why they're called damselflies, because maybe sexism, maybe the patriarchy, I don't know, but they're very slender abdomens and they tend to hold their wings behind their back and not all of them are blue. But in North America, often the ones that you see are blue in color. These like little thin blue things by water, whereas dragonflies, they're kind of stocky, you know, meaty. They often fly. You know, some dragonflies can type really fast, like 30, 35 miles an hour. So, their, their thorax, which is this kind of chest part of their body. It's just all muscle, you know, it's just really, really powerful flight muscle for flying. So you probably see damselflies and dragonflies but maybe just thought they were the same thing. There's six thousand species of dragonflies and damselflies. 3,000 are damselflies and around 3,000 or so are dragonflies.

JVN [00:22:21] And we find those all over the world?

DR. JESSICA WARE [00:22:23] Yeah, they're found all over the world and we have over 370, 400, close to 400 species I think, in North America. So even New Jersey, which I'm not

from New Jersey. I'm from Canada. But I've grown to love New Jersey. But New Jersey is not necessarily known for being nature's paradise. Right? We have 188 species here. 188. That's a lot. I'm very impressed by New Jersey's dragonflies and damselflies.

JVN [00:22:50] I will say that I, when I was filming in Philadelphia for "Queer Eye," I drove through New Jersey, like, you know, twice a week, like, going from New York City to Philadelphia. Obviously, Philadelphia is in Pennsylvania, but you drive all the way through New Jersey. And it's a be-, absolutely beautiful state but I never really got to see very much of and, obviously, you're on the highway. But still, there's a lot of just, like, really beautiful, you know, nature-y, marshy views and stuff that you would imagine there'd be a lot of bugs so that's really interesting. Okay, so now the group like the why, why we came, so which I just I literally could talk to you for 17 hours about bugs, I'm so shook, but I want to talk about cicadas. So they're only in North America?

DR. JESSICA WARE [00:23:34] The periodical ones. So the-.

JVN [00:23:37] Yeah.

DR. JESSICA WARE [00:23:37] Annual ones, you know, worldwide. But yeah, the periodical ones are only in North America. And there's a woman named Chris Simon. She's at the University of Connecticut. She's done a lot of work, her whole lab focuses on this group. And she thinks that probably there was, like, one brood around 10,000 years or so ago, that just because of, at the end of the last glacial cycle, because, you know, as forests kind of changed in composition and humans have modified forests, you know, so we can create our cities and our towns and stuff, these, you know, populations got isolated into these 15 or so different broods that started, you know, because of timing, because of temperature kind of diverged to have these 17 year, which are mostly the ones that are in the northern part, in the mid-Atlantic states are the 17 year cicadas. And then there's the 13 year cicadas, which tend to be, you know, Alabama, like some of the southern, southern parts of their range.

JVN [00:24:32] So which ones do you think I exp-, because my hometown's kind of like right smack in the middle of Illinois, like North-South wise but then we're on like the very Western bit. So it's kind of, like, in the middle. Like, do you think it could have been either one?

DR. JESSICA WARE [00:24:47] Well, you know, I don't actually know which one it is that's in Illinois. But there is, there's a website called Magicicada. And you can look at the broods for your state and it will tell you the dates when they're going to be emerging. The years like predicted, 10 years out. Like when you can see these because it's actually like a hobby,

like for a lot of entomologists and non-entomologists, like, love to travel places to see these emergences. So they have these beautiful tables. They show exactly where in each state each of the broods are. So we could look it up.

JVN [00:25:20] Oh, my God. OK, so wait. So then we were talking earlier about, like, the life cycle. Like what's that whole thing? Like and the, the molting is just when they go from, like, one thing to the next. But like, I don't. What are the life cycles of them, like, like, baby, nymph, big nymph. What happens?

DR. JESSICA WARE [00:25:39] So it's so neat because insects have two different ways of doing it. Right? So you, when we think of things like the "Hungry Caterpillar." Right? That is what's called a holometabolous insect. It has complete metamorphosis. So it goes an egg and then a larva and then a pupa and then an adult. So in the pupa, everything gets rearranged. And then they emerge as a butterfly. And the butterfly looks totally different from the caterpillar. But the things that we've been talking about, like termites and cockroaches or cicadas or dragonflies, they don't have that type of complete metamorphosis. Instead, they have these, like you said, an egg, and then a nymph, and a nymph usually just looks like a small version of the adult.

And then they molt into a slightly larger skin, a certain number of times. Different insects, different numbers of times. Until eventually they're the adult size. And then that's the final molt and then after they become an adult, they don't molt again. So the life cycle is can be really funny. Like, if you have something that's aquatic as a baby like dragonflies and damselflies are aquatic when they're, when they're nymphs. So they swim around in the water and they look really different from the adult. But technically, they're still the same idea where it's an egg then a nymph. No pupa. And then an adult.

JVN [00:26:56] OK, so that's what I was, because that is what was confusing me about, because I was like, OK. Holometabolous, I remember that word. So basically the difference there is is that non-homo, non-holometabolous ones are ones that basically don't completely rearrange themselves. And holometabolous ones are ones like butterflies or like the caterpillars.

DR. JESSICA WARE [00:27:15] Or wasps.

JVN [00:27:16] Yes. But basically. But, even the non-holometabolous ones because that's, I don't. I've never seen a baby cicada. So basically the adult cicada, once it finds a mate and once the mom gets pregnant, it lays, or she lays the eggs in tree bark?

DR. JESSICA WARE [00:27:37] Yeah. So usually what happens is-, insects are fascinating. So they, females, in a lot of insects, they can store sperm. They can store it for a period of time. So usually what happens is males will transfer sperm to a female and then she'll do her magic. Right? She'll get the sperm into the egg as it passes down the little slide. That's her egg-laying device. And then she'll put the eggs into the bark and then they hang out there for a little while and then the eggs hatch and the nymphs kind of drop to the ground and then crawl into the earth. And some of them make sort of, for cicadas, some of them make sort of tunnels. Some of them make little burrows. They're mostly drinking. I mean, they're only drinking xylem, like, they're drinking fluid, right? Sap. So they're anal. This is I don't know how real we want to get here.

JVN [00:28:21] I want to get so fucking real.

DR. JESSICA WARE [00:28:23] OK. So they their anal secretions are just liquid. Right? Because they're on like a liquid diet, they're on a juice fast. So they're basically in these little, like, mud areas under the ground, just kind of being bathed in their anal secretion as they drink the sap. And that's their life for 13 or 17 years.

JVN [00:28:42] Really quick question, because this is what I'm curious about, because that's what I can't imagine. So the mom has the sperm in there and then her little baby ovules or whatever, like, pass through and then it gets, like it makes itself into a little egg and the egg goes in the bark. When the egg hatches and it's the nymph, the cicada nymph. Because an adult cicada looks like a: what?

DR. JESSICA WARE [00:29:03] Right. So that's a good, that's a very good point. So adults cicadas have wings and they have these little beady eyes. They have these long wings. And-.

JVN [00:29:13] They look kind of grasshopper-y?

DR. JESSICA WARE [00:29:14] Well, they aren't, their legs, I mean, they're, like, all insects have six legs. So they have six legs like a grasshopper. But they don't have a really big, grasshoppers have really big hind leg for jumping. And cicadas don't have that. So they just have, kind of, six spindly legs. But as juveniles, they do not look like that. So they do not have big wings. They don't have wings. So instead they actually are modified for their lifestyle. Right? Wouldn't make sense to have wings and then crawl around under the earth because your wings would get torn to-.

JVN [00:29:43] Yeah.

DR. JESSICA WARE [00:29:43] To shreds, right? So instead they have a very, very hard exoskeleton and they have their front legs are modified for digging. So they have these kind of claws that are spines that they use, can use to kind of dig into the ground. And then they're very smooth over their back really, because they're just underneath the earth. And then when they emerge in their last molt to the adult, that's when they, you see them with the wings. And you know, the cicada look that you know and love. That you, that you're used to seeing as an adult.

JVN [00:30:16] So did, so do they always fall off the tree bark into the ground? Or do that or do some crawl down and some fall down? Or is it kind of both?

DR. JESSICA WARE [00:30:24] I think it's kind of both. I mean, especially with the case, in the case of periodical cicadas, it's frenzy. Right? It's frenzied. And whatever works, I think, to get you into the soil so that you don't get eaten. Do it. You know, that probably is selective for whatever behavior gets you into the soil quickly after you emerge that you're not eaten by a predator, probably would be selected for natural selection.

JVN [00:30:51] How can you, can, is a, is a nymph cicada big enough like for us to see it? Like, can you see it come out of the bark and go down?

DR. JESSICA WARE [00:30:59] No. There. I mean, may, maybe other people could but they're very small. I have, don't have the best eye sight, so small, like, the first instar is, which, what we call the, the thing that emerges from the egg, first instars are usually very, very tiny. So they'll be, they'll be hard to see. I mean, I guess it's also just unlikely that you would notice them. But certainly you will for sure be able to see the final one. The one that crawls out of the ground that molts to the adult. You'll sometimes see them. They're kind of brown, they look like have a hunchback and they'll be attached to a tree bark or a shrub. And you can see them.

JVN [00:31:33] I've seen that.

DR. JESSICA WARE [00:31:34] Yeah.

JVN [00:31:34] Yes. I saw those, like, covering trees. And it's just, like, their last shell. And then they must be like flying around.

DR. JESSICA WARE [00:31:42] Yeah. And you can see the seam in the back where they, kind of rips open and they-.

JVN [00:31:47] Yeah.

DR. JESSICA WARE [00:31:48] Pull their body out. When they do that, basically like their entire gut lining and the lining of their trachea, which is with wi-, from which they breathe, it gets ripped out too. So sometimes when you see those little shells, you see these white stringy things sticking out of the back. And that's what it is. It's like the inner part of their breathing apparatus that's been ripped inside out as they kind of pull themselves out of this, this juvenile state into adulthood.

JVN [00:32:13] 'Cause then there's like a new breathing apparatus that got built on the inside that whole time so they just don't need that old one?

DR. JESSICA WARE [00:32:18] Yeah.

JVN [00:32:19] And it just gets, like, pushed out from the inside or something?

DR. JESSICA WARE [00:32:21] Yeah. It's just the lining of it. So the actual structure that, you know, the little tube is still there, but the lining of it is what gets ripped out. What a way to go.

JVN [00:32:31] I can't even, on that note, we're going to take a really quick break. We'll be right back with more Dr. Jessica Ware after this. Welcome back to "Getting Curious." This is Jonathan Van Ness. We have Dr. Jessica Ware, so, so, yes. So, the, I have seen a lot of those bug or a lot of the cicada, the last molt on trees. But would you also see those on the ground sometimes because they might emerge out of the ground, too? Like, would those be like on the top of the soil?

DR. JESSICA WARE [00:32:56] Yes. Sometimes you see them there because they've just, that's just where they've chosen to emerge. But also sometimes they just fall off of the bark or the shrub and then they land on the ground. I have kids and my kids see them all the time and are like, “Oh what's that?” So they're definitely noticeable around the bottom part of the base of the tree.

JVN [00:33:14] So then basically, once they hatch and there are adults, like, they're flying around cicadas, they just have to find a mate. Reproduce.

DR. JESSICA WARE [00:33:22] Yeah, that's their goal. They have, it's that one hot summer. They have to eat, disperse. Find a mate, most life has a goal of dispersal just so that you can kind of mixed genes and what have you. So eat. Disperse. Find a mate. Do the mating part and then lay eggs. And. And then you can die, you know, knowing that you've passed your genes onto the next generation. So they do this in, like, a kind of a neat way because

cicadas, how do you find a mate? Right? Like who? How do you find a mate? Like when you're, you're a new cicada, you've just emerged from the ground. Well, one of the ways that they do it is with, with noise.

So we, when we think of cicadas. I mean, people have been writing about cicadas since the "Iliad." Right? Since Homer or, or probably before, but that's what I remember reading in high school. People have been talking about the song, right? That you hear from cicadas. And that song is actually has nothing to do with, with us. The song is males singing to try and advertise their kind of sexual prowess, their, their genetic fitness to females, so that that way females, which can hear, they have a tympani that they can hear with, males and females can hear. But females don't make noise. Females can pick up the sound.

And if, if males are able to call, they, especially if they call really hot times of the day or for really long durations, the longer the call, the better. It's a sign. It's a sign of fitness, because doing that is really metabolically expensive. It's hard on your body. And it's hard to do that when it's really, really hot. Plus, you risk, you know, drawing attention to yourself from predators and what have you. So it's a risky game to do it. But if you can do it and if you can do it, well, hey, that might mean that if a female mates with you. Her sons will also be able to do that. And they will also get a lot of mates. So it's kind of like an advertisement, like, of how fit or how well the male is so that females can use that as their criterion to kind of figure out, they can find a mate because it can go towards the sound. But they can also figure out which mate to go for.

JVN [00:35:23] So then the, once they have had all the babies, we were talking a little bit about, like their strategy on, like, how many, like, the babies there are so that, like, you know, hopefully don't get eaten like your brothers and sisters. And I think I was so overwhelmed with, how, just all the buggery that I couldn't really talk about it yet. But now I'm just circling back. So what was that all about? So they're either in the bark or they're in the ground, but like birds and like other things would just want to come be like, "Mmm yummy cicadas," and they eat all, they eat, like, like, how deep do they bury? Like, could you just go by a tree and, like, scoop a shovel down in, like, Illinois or Minnesota or Missouri or like Arkansas. And there'd be like a big old fuckin' brood of, like, cicadas molting under there?

DR. JESSICA WARE [00:36:08] Well, they go pretty deep, but I mean they don't go deeper than the roots, right? Because they need to be able to be feeding on the rootlets. And so the roots of the trees or shrubs. But I mean, I think the things that are, I mean, certainly they, they can be infected by nematodes, also the things can happen to them when they're in the ground. But it's when we think of them as, as their strategy for predators, we're often thinking about them when they've emerged as adults. Because when they're an

adult, birds and, and other things will come and consume them, including humans. I mean, lots of people eat cicadas. They're tasty. If you fry them, they taste kind of nutty. So, I mean, they're at attract-, they're, like, a good food source or at least a tasty food source. I mean, I don't know how many you'd have to eat to get your recommended daily-, but.

JVN [00:36:53] Yeah.

DR. JESSICA WARE [00:36:54] Yeah. A tasty food source. So, so their strategy of just kind of, it's better to be in a buffet than be a single sandwich sitting out there. Right? Because they're more likely that people will pick other items and not you. I guess it's kind of the strategy that they're using. For the periodical.

JVN [00:37:11] And just like in numbers, like just because how much does like a mom? Like, how much, how much will, like, a brood be?

DR. JESSICA WARE [00:37:18] Well, so females lay around 400 eggs. So, but not all of them are going to survive to adulthood. But when it, when the broods emerge, I mean, there are thousands and thousands of individuals that come out like thousands and thousands. It's, I feel like I'm underestimating it. You know, it's, it's really, really huge numbers. And they tend to be rather localized. So even though, when you see them on the news or whatever, it seems remarkable. But like in the state of New Jersey, we have several, we have a couple of different broods. But when there's a brood in northern New Jersey that's emerged, I don't see them at my house near Princeton. Like, I have to drive to northern New Jersey to see them. So the thousands and thousands, because that's their kind of local range for that, that brood.

JVN [00:38:00] So what's the one that's like really popping off in the news that we were reading about like a month ago or something? I thought it was, like, West Virginia maybe?

DR. JESSICA WARE [00:38:08] Yeah, there's one, it goes in West Virginia, Virginia, North Carolina. There's three states that it's in this year. So I think normally what we would have done is we would have driven to see them, as, you know, bug lovers. Right? But because of the virus, you know, we, we figured it wouldn't be safe to do so. But those are the ones, I mean, we've had a couple of years recently where broods that weren't supposed to emerge, emerged early. So we have one that's going to be coming up in New Jersey in a few years. And I wonder what the timing is going to be like, because it's, it's, it's, like, a temperature threshold. So they have to molt to these five, periodical cicadas have these five molts, I think. And then when the temperature in their environment is I think it's 64, 65 degrees, I forget what the temperature is, then that's a cue to emerge. But as you know,

like with climate change in a warming world, that clock is probably gonna need to be recalibrated.

JVN [00:39:01] Do we know, like, what that cue is? Like, what is it in them that, and I would assume that, like, is that a similar cue that, like, butterflies get to, like, go into a cocoon or like a or like a dragonfly or a damselfly gets to like, what are those? Why do bugs know how to do that? Or insects know how to do that?

DR. JESSICA WARE [00:39:20] I think, I mean, some insects are using light as a cue, you know, in day length as a cue. Some insects are using temperature as a cue, for sure. Sometimes it's, you know, there's other cues in the environment or food resource availability, that also can be a cue. And some of it might be hardwired. You know, we're even in an abundance of, of food and and warm temperatures. You know, there's still going to, they're still going to die, you know, after a certain amount of time. So it can be a combination of things I think that they use. But I think it's a testament to how, you know, 400 million years of evolution has allowed insects to do a lot of very sophisticated things. Right? And telling time as well as they can, you know, give or take for, for years.

JVN [00:40:08] Yeah.

DR. JESSICA WARE [00:40:08] Telling time like that is actually very remarkable, considering that their brains are not really brains, they are not like our brains. They just have these kind of clusters of ganglia, clusters of nerves. But they're able to use this to actually do very, I think, very sophisticated things.

JVN [00:40:22] I mean, obviously you are an incredible scientist. You're so just incredibly brilliant in your field. And I guess I just would love to take some time at the end. I should have done this at the beginning. I don't know why I didn't. But just, like, I because I read a lot about, like, how you found this, or you got to, like, confirm the presence of this cockroach in New Jersey?

DR. JESSICA WARE [00:40:44] New York.

JVN [00:40:45] New York.

DR. JESSICA WARE [00:40:45] Well, yeah, it’s in New Jersey now.

JVN [00:40:47] So what are some of, like, what are just, I guess, like, if you wanted to talk about, like, the chronologic or the chronological-ness of your career and, like, kind of, just,

like, what are, like, some of the high points in the things that you've gotten to confirm or study? Or some of, like, your most exciting kind of stories from the job?

DR. JESSICA WARE [00:41:04] Oh, that's a good question. I kind of think, like, at the time when you're doing a project, it always seems like it's the most fun one. Like, I don't think there's ever been a project where I thought, "Gee, this one wasn't very fun. I won't do that again." Like, each one seems like it's the most fun one. So we've done a lot of work. So dragonflies, when I was first starting out, I can tell you this, Jonathan. I thought dragonflies were so pretty. They're so colorful. Like, you can get, you know, any, so many different kinds of them. I'm sure every single dragonfly fact has already been discovered. So, there's no sense in working on them, because it's probably everything's already known.

And then when I went to grad school, it turns out my advisor kind of set me straight and said, "Are you kidding? It's, nobody works on dragonflies, really, there's very few of us that work on dragonflies," rather, I should say. So pretty much. You know, the sky's the limit. Just do what you're interested in. So we've kind of slowly been working through the groups of dragonflies that are out there and trying to uncover their evolutionary history. And each time we do that, it's exciting because you get to figure out their morphology, or there's one dragonfly that disperses and has the whole world as its population, we found out that it migrates. We confirmed with genetics that it kind of migrates across the globe, and working on that was really exciting. But I kind of think, I mean, any of the projects have been, have been rewarding because it always-.

JVN [00:42:20] But how did you find out about that one? How did you find that they were all over the globe? Because, like, so the dragonflies fly over the ocean?

DR. JESSICA WARE [00:26:] Yeah. And salt water is death. Right? Salt water is death for insects in general, but dragonflies, you know, they have no tolerance to salt water. They're freshwater insects. So I, you know how I got interested in it? Because I was studying, you know, dragonflies, and I got to go on a couple of collecting trips. And every time I went somewhere, I caught this thing, right? So I am African American and I had never been to the continent of Africa before. And there was a worldwide Dragonfly Meeting there in Namibia. And I was like, so psyched, you know, for the culture to get to go and like, catch African dragonflies, my heritage, my people on this continent. And then the first thing that I caught was Pantala, this thing, this global wanderer that I could get in New Jersey, like, in my driveway. And I was, like, "Oh, my gosh. That's funny."

And then when I went to Australia, that was also the first dragonfly that I caught. And so then I just started making me think, "Why is this everywhere?" And because it's so common. People had overlooked it, I think, because things that are really common aren't

that exciting, maybe, to study. But actually, the fact that it's so common is because it kind of does this exciting thing. And people had talked about it in the past. You know, people had written about it in the mid 20th century. And, you know, people who lived in India and in the Maldives had, had noticed that huge swarms of them would kind of show up at certain periods of time in the year. But it was really fun to use genetics to try and confirm, you know, that because in order for the genes to be shared, naughty bits have to, kind of, interact. Right? Like, you have to share genetic information somehow, which means you have to be close enough to pass on that information.

JVN [00:44:03] Yeah, you're diddling, honey. Yes.

DR. JESSICA WARE [00:44:05] Yeah. We call it the ingredients. So to pass along the ingredients, they have to be really close together, which means that the genetics kind of confirmed that whether we got them in South America or in Japan or in West Africa or Australia, they all were kind of sharing the same genetic pattern.

JVN [00:44:24] And all of those Pantala dragonflies have the same genetic pattern?

DR. JESSICA WARE [00:44:29] Yeah. And we just, we just submitted a new, a new paper on this, but we actually collaborated with a, with a colleague in Canada where we looked at their, so the wings of dragonflies are formed while they're in the water, but they're all just kind of crumpled up in the, in the nymph, in the nymph skin. And then when they emerge, then the wings kind of stretch out and you see, like, a typical dragonfly wing. But you can look at the dragonfly wing and you can see where the origin was of that dragonfly, because the hydrogen that's in the wings is from the H2O in which they were a baby. You can see whether or not the dragonfly that you've got, whether it was born in that region or not, because the hydrogen actually weighs slightly different amounts, depending on which part of the world you're in. So anyways, we did this study and it turns out almost all the dragonflies we tested were born in a different location than where we caught them, which means they are moving. They're moving.

JVN [00:45:22] How do they do it on planes? Do they just literally fly over the ocean? Do they hitch a ride? What is it?

DR. JESSICA WARE [00:45:27] I think they, I mean, they are just really good at taking advantage of wind. So they're not like butterflies. You know, they're flapping constantly. They just kind of glide. You know, they're, they're very, they're very hip. They're just kind of glide on the air and just coast, you know, over, over the ocean from land mass to land mass. From rainy season to rainy season, which is, I think it's so neat.

JVN [00:45:53] OK. Wait. I think I interrupted you before, I didn't mean to. So what? So you were studying, so you're studying in and they're-. How did you start studying dragonflies when your advisor was, like, “Wait? No, no one studies this.” Like, where were you? Were you in college studying entomology or were you-?

DR. JESSICA WARE [00:46:08] Well, I wanted to do marine biology, but I went to the university and I got turned on to insects and I loved it. And then this woman, Diane Srivastava, she had a project in Costa Rica and she invited me to be her research assistant. So I went to Costa Rica and she worked on damselflies. And that was when I first sort of thought, “Oh, this would be so cool to work on, but it's probably already done,” you know. That was kind of what-, I had that attitude. And then I went to school to do bio control, like, to do crop management, pest management, because I thought, “Well, you know, we need to secure human's food crops. You know, we need that, everybody, it will be a human service, it would be great for society. And there's always jobs in, in integrated pest management. It's a great career to go into.” And so I had gone to university to, to grad school to do that. And then around that time, I was, like, “Oh, I just don't want to do this. This isn't fun for me. I'd rather work on dragonflies.” And luckily, I was able to find an advisor there who was, who worked on dragonflies. And he was really encouraging, Mike May. And he said, like, that's what, he was the one that was like, girl no, there's a ton of unanswered questions for dragonflies. So you should study them. And that's what I did.

JVN [00:47:18] So with your, because it's, like, cockroaches, damselflies, dragonflies. And then why can't I remember the fourth one.

DR. JESSICA WARE [00:47:26] Termites.

JVN [00:47:28] Termites. What, like? What are the ones that are like? Because some are like, cockroaches are typically not social. Bees, we learn on "How can we be less rude to bees," like, are super social? So then, like, hornets are, tho-, those seem social, those have a colony.

DR. JESSICA WARE [00:49:47] Yeah, there are-.

JVN [00:49:48] And then. So I guess just, like, of the ones that you study, like, which ones are social and which ones are, like, “Don't mess with me, I don't have any friends?”

DR. JESSICA WARE [00:48:55] Dragonflies are, don't mess with me. I'll actually eat your face, 'cause they'll cannibalize other dragonflies. Like they don't care at all. They will just eat anything. They're voracious. They're lions, the lions of the air. Then cockroaches are mostly, like, not social. But there is a group that is like a sub social roach that lives in wood.

It's called cretaceous. And it kind of has overlapping generations. But it's not really technically social. It's just sub social. And then there are the termites and those are the only ones I study that are truly social. So they have kings and queens and workers and soldiers.

But you guys learned about bees and they're social for a very different reason. So the reason why termites, we think, the reason why they're social is because they consume cellulose. They consume wood, wood products. But they can't digest it. So they have to have these endosymbiont that live in their hind gut that break down the cellulose for them. So they, it would be like eating and eating and eating and not being able to get any nutrition unless you have these little things living in your gut. But every time they molt, remember we talked about like it rips your gut lining out. So every time they molt, they lose that stuff in their gut that would digest their food for them. So they have to recolonize their gut with some way, but they don't have access to just random probiotic stores. Right?

So what they do is they go up to their nest mates and they drink anal secretions. It's called proctodeal trophallaxis. And they basically just imbibe this anal juice from a nest mate to re kind of colonize the flora and fauna that live in their gut. So that way they can digest their food. So it wouldn't work if that was your strategy, if you weren't close to another termite because you could molt and just be by yourself and then, "Oh, shit." Like, you can't get your gut, you know, you're not gonna be able to digest your food. So we think that that may be one of the reasons that has driven them to have social behavior is this kind of need to kind of recolonize their guts. I mean, there could be other reasons too. And also they tend to overlap with their inside of, you know, bark or whatever. But certainly their diet and that need to have their microbiome kind of sorted in order for them to get nutrition from their food, that's a big driver. So.

JVN [00:50:10] And then what are the damselflies? Are those? Will those kill a, kill a friend too? Or are those friendly with each other?

DR. JESSICA WARE [00:50:16] No, they'll kill, they. They. So as juveniles in the water, dragonflies and damselflies, actually eat vertebrates. They'll eat tadpoles. They'll eat fish. Small fish. They don't care. They will eat anything. As adults, you know, they eat all sorts of other insects, they eat each other. And there's even, like, a couple of photos where it shows some of the larger dragonflies that actually have taken down a hummingbird. I've never seen that myself. But some people say that those photos are real. So they, I mean, they're, they're good at catching things and they're, they're good at eating things. They have these mouthparts that are kind of chewing mouthparts. They just, "Rarr, rarr, rarr." You know, bring the food in and then poop it out the back, you know, at the end. That was actually my first job, was looking, the woman who I went to Costa Rica with. I was looking at poop. I look at the damselfly poop and tried to figure out what they were eating.

JVN [00:51:11] Where was the poop?

DR. JESSICA WARE [00:51:12] Well, Jonathan, sometimes you have damselfly poop. Don't you?

JVN [00:51:17] Is it on trees or something or do you just find out on the ground or?

DR. JESSICA WARE [00:51:22] Well, she worked on a specific kind that lives, where the juvenile stage lives in roumeliotis, which is like a type of plant, pineapple's are roumeliotis. So, you know, that little spikey thing at the top, for example.

JVN [00:51:32] Yeah.

DR. JESSICA WARE [00:51:33] Water collects in between those leaves, insects actually live in the water. And so she was collecting the water and the poop was in the water.

JVN [00:51:41] So what is the fucking nastiest fucking thing you have ever seen? Like studying bugs. Like what is like that? Have you just ever, but are you a scientist so you don't get grossed out? But if you weren't scientists like if you didn't have like your doctor, like, you know, like, like your pre doctor professionals, like, when has, like, your, like, your inner child been, like, "Ewwwwww, this is so fucking nasty." Or has that never happened?

DR. JESSICA WARE [00:52:05] No. I'd say it happens all the time. It happens all the time. So there's, you know, a group of us, I think out there who are entomologists and who carry a secret shame because we actually are disgusted by members of insects. And I'm one of them. So I, I appreciate bed bugs so much. I think they're fascinating. They have traumatic insemination. The males have a penis that's like a knife. They stab the female. It's very, very interesting. But whenever I have seen one, I feel like my skin is crawling and I feel itchy and I don't enjoy it. And I have friends who have colonies, like, Louis Sorkin has colonies and he feeds them on his arm. I'm so impressed by him. But for me, I just can't be around them.

JVN [00:52:50] He keeps them in his house?

DR. JESSICA WARE [00:52:51] Well, I mean, now because of Covid, yes. But normally he keeps them at the American Museum. And they're fine. And he is, you know, he does all this interesting work with their behavior. It's so cool. As a scientist, I appreciate it. But when I see them-.

JVN [00:53:04] Are they social?

DR. JESSICA WARE [00:53:05] I feel sick to my stomach.

JVN [00:53:07] Are bed bugs social?

DR. JESSICA WARE [00:53:07] No, they're not social.

JVN [00:53:08] Like, how you said.

DR. JESSICA WARE [00:53:09] They just end up-.

JVN [00:53:09] And the boys stab the girls? I can't even talk about it right now. I'll be, I'll talking to you about bed bugs for 18,000 hours. Ok, but so bedbugs are-. Have you ever seen something when you were like out in the field doing stuff that was like super gross or disgusting?

DR. JESSICA WARE [00:53:23] Well, I shouldn't say this because it's going to make it seem like I'm actually scared all the time but I do have another one. So, you know, for whatever reason, I kind of have a little bit of a bugaboo about scorpions. They're not my favorite. They're arachnids.

JVN [00:53:39] I can't imagine why.

DR. JESSICA WARE [00:53:39] They're not my favorite, they're arachnids. I know people who work on them and they're really, really cool. But one time, it was actually that first time I went to Costa Rica with, with Diane and we were cutting down a bromeliad that was up in a tree. So we were cutting it like this and it was above my head. And we had done this a bunch of times and we were always worried there might be a snake inside. So we kind of rattled it a little bit and no snake came out. If there's a snake, the snake usually comes out right away. So we're cutting this down with a saw above my head. And she was just standing, like, kind of behind me. And she goes, "Jessica, above you." And I'm, "Yeah. I'm looking, right?" But I don't see it. And she's like, "No, no, no. Like above you. There's scorpions." And I swear, there was like 13 or 14 scorpions that just came piling out of this bromeliad, falling all over me. And I got the bromeliad and I screamed and I thought, like, "This is it." I'm going to get stung a bunch of times. I don't know which scorpions these are. Maybe they're-, I don't know what kind they are. And I felt, I felt bad. I still felt bad about myself that I reacted that way. But honestly, because by the time I saw what they were and they were pouring out on top of me, like, your eyes are, like, focusing. You see these scorpions kind of falling on you. I don't know. My hair's curly, too. I was like, "Oh, they're gonna be all over me." You know? I didn't enjoy it.

JVN [00:55:55] What did you do? Did you have to pick any off? Did you get stung? Did they all just kind of bounce off you?

DR. JESSICA WARE [00:55:01] See, this is where I end up looking kind of foolish, right? Because, of course, it's not like I got stung. And I was fine, and I shook them off me. I think I had-, Diane helped me. We were just flicking them off me. I jumped up and down a bunch of times. I ran around in circles a bunch of times like a crazy person. And then. And then that was it. And I didn't get stung at all. So in the end, I guess maybe the message is that scorpions aren't that bad, but for some reason, even when I think about it. My stomach just goes in knots just thinking about that.

JVN [00:55:31] Well, yeah. I mean, I think that's just so human. I mean, there is like a psychology to, like all, do entomologists ever study like why is it that humans are just kind of naturally scared about bugs? Like, what is that creepy crawly thing that we get when we think about them?

DR. JESSICA WARE [00:55:44] Yeah. Well, there's a woman, Vanessa [LoBue]. She's at Rutgers and she has a whole, she's a psychologist. And she, she studies, she, like, brings babies in and she exposes them to scorpions or snakes or whatever to see, like, when it is. And it's, like, a learned behavior usually from, from childhood that you learn to be afraid of, of insects and you're not necessarily born with an inherent dislike of them. So-.

JVN [00:56:06] I don't know. My first, my first sentence was, my first full sentence was "I don't like nakes." Like, for snakes. Like, I was really scared of snakes.

DR. JESSICA WARE [00:56:16] Sara [Ruane] would be so disappointed.

JVN [00:56:18] I, well, I'm so-. So I guess I didn't realize that scientists get disappointed in themselves and other people who want to learn about things, when they get grossed out by scary animals. But I guess it's more of the psychology of, like, why do we think that's scary? And I guess I think that is a really interesting thing to think about. Like, why do we have certain? I just, that's not really a question. I guess it's just, you know, interesting. So this is Yogi recess. We finally made it. Also, I just have to say, like, you're really just so incredible and I hope that this makes anyone else listening that is inspired by insects or wants to learn more. And like chase their passions that you can have a really thriving career where you can do just that, really like, you know. And I think all, there's just so many fields that are just so cool and so full of knowledge to be had that we just don't even know about. So I just think that's so cool. But so.

DR. JESSICA WARE [00:57:13] Well, thank you.

JVN [00:57:14] So final question. It's your Yogini recess. Is there anything that we would be remiss to not mention about cicadas or insects or, or you or anything that you want to hit on that we didn't get to hit on? It's your, the floor is yours.

DR. JESSICA WARE [00:57:32] Oh, that's exciting. First of all, thank you for saying such nice things. I do think that, you know, we should make more room for, for different types of people in science. So I, I think it's really cool to get to, you know, I was, said to my kids, like, "Oh, I'm worried. What if I seem like I'm a real square? Like, I'm not a fun person and I do a bad rap for entomologists." And my kids were, like, "Who wouldn't think you're a square? You are, of course, a square. All entomologists are squares." Even my kids think that. So hopefully I can, I can, I did a good, good rep for entomology.

So the only other thing I think that's kind of cool about dragonflies and damselflies that we didn't talk about, that I feel like I would be remiss to not mention is that males have two penises. So unlike all of the other insects that we've talked about, you know, male dragonflies actually have a secondary set of genitalia at, kind of near where their navel would be if you're picturing them in the proportions of a human. And so they do indirect sperm transfer. Like, males basically have this, they ejaculate into the second penis and then they use that second penis to transfer the ingredients, the, the sperm to the female. And that's just so remarkable that they do that.

And they also, you know, females can store sperm. So she mates multiple times and then she can choose which sperm she uses. So males don't want that. Right? They want to make sure that their sperm is what she uses to fertilize her eggs. So this secondary penis is actually, like, a little spoon and it scrapes out the previous male's sperm and then they deliver their own sperm. So, I mean, when you think of dragonflies and damselflies, I think that's what got me so interested in working with them was this reproductive race. Right? Like, females evolved to store sperm so they could make a choice over which male sperm they use, but then males evolved this little spoon to scrape out the previous male's sperm. And so it's this kind of, like, long term fight over who gets to control, you know, the genes that are used for this, for mating.

JVN [00:59:27] So can the girls' conveyor belt of sperm, like, be scooped up one so that the boys' secondary penis can't scoop it out? Or can it always scoop out the previous person's sperm?

DR. JESSICA WARE [00:59:38] It can always scoop it out. And sometimes it looks like a little spoon. Sometimes it looks like a claw. Sometimes it looks like, like, like, a Spock hand

or something. And they, they do it for, like, 20 minutes. I mean, sometimes they're scraping for like a very, very long time. And then the actual, you know, ejaculation is, is much shorter. So but females still have, they don't always scrape out all of the sperm. Sometimes they also just displace the sperm. So they just, like, kind of push, like, with a ramming rod, kind of, like, push the sperm deep inside. So that way it's less likely that she'll use it.

But I think that, you know, some, some females are able to still, you know, make some type of choice over which sperm they use. They used to think it was last in, first out kind of model. But now they think that's not true, that they're still, you know, females are able to choose as their strategy, you know, which makes sense. Right? She should be able to use whatever sperm is going to make her offspring the most fit, that should be selected for by natural selection. So.

JVN [01:00:38] Dr. Jessica Ware, I am so grateful for your time. I feel like I learned so many things. I just thank you so much. This is the most amazing episode. Thank you so much.

DR. JESSICA WARE [01:00:48] Thank you for having me.

JVN [01:00:38] You've been listening to Getting Curious with me, Jonathan Van Ness. This week, we re-aired an episode from June 2020 with Dr. Jessica Ware.

We'll be back next week with an all new episode.

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