Myrmecology with Terry McGlynn
Ologies Podcast
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Oh hey. It's your grandma's new boyfriend, who just wants to show you some magic tricks! Alie Ward, back with another episode of Ologies. It's Tuesday, man, let's learn about some ants! They're tiny, they're mighty, they're harmless—sometimes not—and they're more organized than all of the clowns on your Slack thread. But you know what? Maybe you don't want to see thousands of tiny ladies having an all-night rave in your cereal pantry, but to quote common parlance, "Can a bitch live?" Let's learn about these little creatures and more importantly, let's suck some self-help and organizational strategies out of them with a myrmecologist, which is a word you only know about if you're a myrmecologist.

But first, per usual, you know the drill. I say thank you to people who let me keep the podcast going: all the patrons at Patreon.com/Ologies who pay a buck or more a month, all the folks who put OlogiesMerch.com things on their bodies—including a ton of very, dare I say, delicious fall designs, like vintagey-looking college sweatshirts and bird-print mugs and train shirts, brand new enamel pins for epidemiology. And as always, thank you to the folks who say, "You know what—this pod is worth mashing the star button on iTunes app and maybe leaving a review for Dad Ward to creep in the night when she feels lonesome, and then read aloud to you to prove that I read them." This week's fresh review is fresh in from someone calling themselves Don'tKnowYet. They say,

> *My only problem with this podcast is that every episode makes me want to go do ALL OF THE THINGS, and I don't have time in my day to do all of it. Like hike the railroad lines, scale a volcano, conserve the ocean, redefine beauty standards… Ahh! I freakin' love this podcast. Have shared it with everyone I know. Currently writing this in my Ologies shirt. That is all.*

Don'tKnowYet, one thing I know—you seem cool. Thanks for listening. Thank you for the reviews. Dad Ward loved it.

Ooookaaaay myyyrrrrrmecologyyyyy… I said that all strung out like a line of ants. Did you like it? Good. Okay, I'm writing this before looking up the etymology. I'm just going to say, I wrote this before I looked it up. I took a wild guess that it was Greek for ant. Hold on, I Googled it. Damnit, I'm right. But it wasn't coined until 1906 when naturalist William Morton Wheeler was like, "Dangit, I love ants! I need a title that sounds like a wizard!" He took 'myrme' and put on 'cologist'. There you go. Myrmecologist. Done.

Now this Ologist I had followed on Twitter for months and months and months and months, and our schedules never quite aligned to do an episode. Finally, he was back from the rainforest on a sunny Sunday afternoon and I was so excited to sit down and chat. He spends part of his time in the rainforest of Costa Rica studying tropical ants and is also a biology professor at Cal State University, Dominguez Hills, which has over 10,000 students, 70% of whom are first-generation college students. I think that is awesome.

The result of this is a whole nest of facts about invasive species and colony communications and the bizarre genetics of queen ants and why army ants are your new squad and what it rrrreallllly, really, really feels like, like for real, to get stung by a bullet ant. Is it that bad? And what we can learn about our own strength and work ethic from these lovely ladies—and some dudes—we call ants.

So get ready, make a beeline, make an ant line, for this chat with myrmecologist Dr. Terry McGLynn.

Alie Ward: Did I say it right?

Dr. Terry McGlynn: Myrmecologist.

Alie: Myrmecologist.

Terry: I think. Well, like all these words, there's no proper way of saying it. It's just the ones that are socially acceptable among people who do. So you can't say a word wrong, you just say it different than other people say.

Alie: Okay. That makes sense! How long have you been a myrmecologist?

Terry: I started working on ants in 1994 when I started grad school.

Alie: So, a minute!

Terry: Yeah. That's a couple of decades, right?

Alie: A couple decades… of ants not literally under your belt, in your pants, but just in your life. What was it about ants?

Terry: I realized this is the one question that I knew you're going to ask: Why did you work on ants? When I was in college, I started out as a psychology/philosophy double major. Then I ended up being pre-med. I even interviewed at med school, took the MCAT, the whole thing, I have no idea why. But then I had this epiphany when I was flying home from my first med school interview and I'm like, "This is not what I want to do. These people are not my people. I don't want to do that for a living." The whole time in college I was taking all these courses about organismal biology, ecology, evolution, conservation. I was auditing a class in insect biology and I was like, "Well, that's what I think is really cool, actually."

Aside: Before getting his PhD in Colorado, Terry majored in Biology for undergrad at Occidental College—Obama's alma mater here in LA—and when he was thinking about grad school, he was considering Europe, and he ended up interviewing with a Swiss professor who studied ants. He even flew out to interview—the first time he'd ever left the country. In the end, he didn't study at that lab, but the experience of emailing back and forth with this Swiss dude unveiled the tiny, wonderful world of myrmecology.

Terry: It seemed really, really, really cool! After that I decided, "Wow, I want to work on the evolution of social behavior in insects, and ants are social insects. Ants have this colonial lifestyle.

Alie: Now let's unpack this really quick. Do you think having an interest in social science and philosophy, plus a little biology interest, that those were married perfectly in a social insect?

Terry: Maybe. I think my interest originally, like the angsty teenager that just went to college, was interested in, well what makes us human? I was wondering, and I still wonder, how is it that we are what we are; that we think, we feel, we love, we perceive, but we are just mere meat? Somehow this tissue of our brain *is* what we are. I mean that's just amazing to me, that everything we experienced is that meat. And it still is amazing to me! I think I wanted to study that, and I realized I don't think neurobiology was there or is there yet to do that.

Aside: At first I thought he was saying 'mere me', as in 'merely myself', but I think he's saying 'mere meat', [*wet squish*], that we're meat, which is so much more metal. What a metal way to look at our delicate existence! I approve.

Terry: I think what fascinates me about ants is, if you just look at it a different level of organization. What is an organism, what is a superorganism, what is an ant colony? How do you have something which is so well organized out of small pieces that are really, really dumb?

Aside: [*classical music playing in the background*] So many ants right now are sipping oatmilk cortados over the *Economist,* just being like, "Wow. Wooooow. Really???"

Terry: Ants are really stupid, but colonies often do complex tasks really well. I mean they have small little brains.

Alie: Walk me through it, a little bit of a colony. We had an episode on Melittology, bees, and we've covered some social insects, but what are the similarities between bees and ants? Are they all mostly women? Are they all driven by pheromones or behavior or vision? What's going on down there?

Terry: Yeah. All kinds of bees are complex just like all kinds of ants are complex. The way the honeybees organize the division of labor so that thing where you do one task, then you get promoted to another task, to get promoted to another task… That's called temporal polyethism.

Aside: That means at different times you do different things. Like your chores as a kid may have gone from feeding the cat, to doing the laundry, to driving your siblings to school. If your kids don't think you're enough of a douche, tell them it's imperative that they engage in temporal polyethism to acquire their weekly stipend. That way they can talk about you to a therapist later in life.

Terry: However, some ants might be more inclined to perform some tasks rather than others. Some ants are more generalist, some are highly specialized.

Alie: Whoa! There's engineer ants and architect ants and ones that are like, “You know what guys? I'm pretty good at finding seeds, so I'm just going to do that,”?

Terry: Sorta. But if you were to remove some ants from the colony or add some ants in the colony, they might change their tasks. Some ants have broad variety in body sizes. For instance, in leaf-cutter ants, you have these huge, huge ones with these big heads that are used for chopping stems and defending the colony for when vertebrates attack, and you have these tiny, tiny, little ants that might tend to fungal garden and ride on the leaves.

The way that the polymorphic ants divide labor and the way that monomorphic ants divide labor is different.

Alie: It's a little different.

Terry: Yeah.

Alie: Now what is your work like day to day? Here's what I picture. Tell me if I'm wrong. I picture that you work in a lab and it's full of aquariums that are just big writhing balls of ants. You also have a clipboard and maybe a lab coat, and then sometimes you're in the field with a magnifying glass. Is any of that correct?

Terry: Nnnno.

Alie: Okay. Just checking. [*Terry laughs*]

Terry: I think my average workday is probably not that different from yours, which is I'm sitting in front of a laptop.

Alie: Okay.

Terry: Or I'm standing at my desk or whatever. In the lab I have a bunch of ants, a ton of ants, but they're all dead.

Alie: Oh my god! Okay. Are they organized into, like, little tiny pins or are they just in shoe boxes?

Terry: I have them in vials and these vials would be packaged in racks and these racks are on shelves. Visiting a museum there's all these ants that are mounted in collections, on pins. When we mount ants in museum collections, you glue them onto the tip of a little point and put the pin through that so you can look at them because if you put the pin through the ant, then it messes them up.

Alie: That'd be like, “Oh, we just put a missile through Alie.” You can't do that to an ant, they're too teeny-tiny!

Terry: Yeah, even the really, really big chunky ants that you could kind of do that to, by convention, we don't.

Alie: Okay.

Terry: I keep most of mine just sitting in alcohol from the way I collected them. Most of the ants that I've collected are whole colonies.

Alie: Oooooohhhh.

Terry: These whole colonies are really, really, tiny ones. They would easily fit inside a thimble. They would occupy a two-milliliter tube with tons of space available.

Alie: You mean a whole colony is 200 bros or ladies?

Terry: It depends. I mean, some colonies will just have 10 or 20 or 30 ants, and then some might have hundreds. But even for these tiny little ones that I work with on the leaf litter of the rainforest floor, the ants themselves are so tiny that a colony of a couple hundred ants will still fit into a tiny little tube.

Alie: That's crazy!

Terry: These are unspeakably tiny.

Alie: How did you get involved with the tiniest ants? Were you like, "I have great vision, ergo I will work with the tiny ants." No?

Terry: No, actually. I just started wearing like the progressive lenses.

Alie: Heeeyy!

Terry: When I'm out in the field with students, they're seeing things that I literally cannot see.

Alie: Microscopic micro machines!

Aside: [*commercial clip excerpt: "Micromachines, they're micromachine pocket play sets. Sold separately from Galoob. The smaller they are, the better they are."*]

For his dissertation Terry worked with *Wasmannia auropunctata*. I don't know if I am saying that right, so let's just call them little fire ants, 'cause that's their name, unless you're from Down Undah.

Terry: Although in Australia they call it the electric ant. These ants are like a couple millimeters long and so really, really tiny. If they sting you it feels like a little pin prick. Which is amazing something that small can hurt actually hurt you.

Alie: I know!

Terry: Most ants are really tiny. A lot of them are just that small.

Aside: [*high pitch*] I'm so little!

Alie: Smaller than the ones that we see trying to eat a watermelon rind on the countertop.

Terry: Right. Yeah. Here in LA, the ones that you have, I don't know if you get them in your place, but the Argentine ants, people think that's a common invasive species found in Mediterranean climates or whatnot. The one that was taking over my kitchen last week.

Alie: Oh no. Oh my god! What did you do? You're a godfather to them. Did you commit mass anticide?

Terry: I wiped off the ones off the counter…

Aside: [*high pitch*] Noooo! How dare you?

Terry: **...** but then I just blocked the entrance off. I wasn't trying to kill them all off, I just kept them from getting in. I have the caulk gun ready to go and I keep finding a new space where they... It's like the evolutionary arms race is them finding new ways to get in and me caulking that spot.

Alie: That is one thing you can do if you don't want to just send in a poisoned cake and kill off your whole colony. That's a nice thing to do.

Aside: As a college sophomore, I lived in my first house with friends. Everyone was pretty goth and got along, but one of my roommates was very, very, stoney-baloney… like a lot, which was so endearing. We had an ant infestation and he told me all about these things called Grants Ant Sticks, these baits that you soak in hot water and then you set out and he explained it to me like this:

> [*lower pitch*] Like alright, okay, like if you were so hungry, right, and you found like 20 pizzas and you took them to your friends and were like, "Shit you guys, pizzas! This rules!" Everyone's like, "Whut! This is the best!" But then the pizzas, like, poisoned everyone. It's like, so tight.

I have never forgotten this tutorial and I'll be honest, I have used these ant baits every time I've had an infestation and I've felt so bad about it—like I am the villain in their action movie—but it does work for a while. [*lower pitch*] "Tiiight…"

Terry: Yeah. But that's only going to be a short-term solution anyway. Even if you get the toxic bait that they'll take and bring back, which could be effective, that's going to kill them off for a while, but eventually there's gonna be some that are just moving back because you can't eliminate ants from the entire neighborhood. It's essentially one big super-colony all throughout the LA area.

Alie: Nnnnoooo!!!

Terry: Yeah.

Alie: Wait a minute. Okay. These Argentinian ants, which are invasive and they're the tiny, not tiny, but they're this small little black ones that invade your kitchen. I know that they, kind of, have outpaced harvester ants, which are the bigger, kind of like amber-y color ones that live in the hills, right?

Terry: Yeah, which people call red ants? Yeah, the harvester ants.

Alie: It just kind of spans one big colony under the city?

Terry: For the most part. Or occupying the whole city.

Aside: This blew my mind. If your friend moves 10 miles away in LA you will never see each other again. Burbank to WeHo, that is a forever goodbye, just move on. But for ants, they're all essentially roommates. The Argentine ants—the little ones that are invasive species but have pretty lax dietary tastes, they'll eat almost anything—they have a California colony that stretches 560 miles, which is nothing compared to one colony in Southern Europe—3700 miles big! Billions of sisters. It's no wonder the harvester ants—with their picky diet of [*exaggerated Southern Californian accent*] locally harvested seeds—are getting smoked by their Argentine relatives.

Terry: I know there's one big super colony. If we were to get ants in one part of LA and move them to another part of LA, they'll be like "Hey sister, how's it going?" And accept them just like the members of the same colony.

Alie: Wwwwhhhaaaa!! That's so weird!

Terry: If you were to grab ants and put them in a vial and then go 100 miles, 200 miles, either they'll get along or they don't. If they don't, that means that you've hit a new super colony and you can tell where the border between the super colonies is because there's a line of dead ants on the ground where they just go to war.

Alie: No. Are you kidding me? [*clip from Game of Thrones: Robb Stark, "Call the banners."*]

Terry: They were just constantly fighting. But there's one large super colony that has taken over most of LA.

Alie: They're all in the same family. Now even if they're the same species, they'll have a battle ground? there'll be like a line of death?

Terry: Well yeah. In general for ants, their biggest enemy is another colony of the same species.

Alie: Oh. It's like humans!

Terry: Yeah, exactly.

Alie: Is that like a lot of social animals? They operate as such one massive super-organism that, like, their biggest predator really is their own species?

Terry: I wouldn't say the biggest predator, but their biggest competitor. If the species has a niche and they're nesting in a particular environment and they're consuming the same kind of food and they need the same environmental requirements, then of course if there's another colony that's just like you, that has the same environment or requirements, then they're your biggest competition.

Alie: Oh, how many species of ants are there?

Terry: I think, described, we might be up to 12,000-ish. I think the estimates people say there's probably about 20,000, but maybe about half of them aren't described, we haven't put names to them yet.

Aside: If you want to be a myrmecologist, just know that 8,000 species of ants are like, "Notice me, please, I am right here." They are begging you to be an ant scientist, but they probably don't know the part about putting some of their friends in jars. Even though it's to identify and save ant-kind, it seems like a difficult task for ant lovers. I love you, I kill you, but I love you, but I kill you.

Alie: Do you have a favorite species of ant? Be honest.

Terry: Oh, that's hard. I mean, I guess one of my favorites are the bulldog ants in Australia. The Myrmecia, if I had to say.

Alie: What are they?

Terry: Well, they're really big. They have these bulging eyes, but they're one of the few ants that… they almost act like a vertebrate. Most ants, if you mess with their hill—even like the big bullet ants that I've worked with and whatnot—they sort of just run around and get upset. Like, "Oh, I might sting you, oh look, I'm fierce," or they'll freak out or run away. But the bulldog ants, they'll just send a few ants up out of their nest. They'll look at you and just open their mandibles and be like, "I see you." They just stand up and it's like an intimidation thing. Also, they have a really painful sting. So they're actually honestly advertising how badass they are.

Aside: So Bulldog ants actually... mad dog. [*bulldog growl*]

Alie: Okay. Explain to me a little bit about the social behavior because I think that's one thing that people are just like mesmerized by ants because they have this social behavior, they have these tiny little brains. How do they do it? Is it all through pheromones? Like is it just innate? What is even happening here?

Terry: Clearly ants communicate with chemicals a lot. Chemicals are a huge, big part of their communication. I mean visual inputs for the most part… There are some blind ants, ones that live underground usually don't have eyes or don't use them or whatever. We're still working out in detail which chemicals are used in what circumstances. Some will have a very discrete signal. For example, in a famous circumstance, if you put this one chemical on an ant that communicates to other ants that they're dead, they'll pick it up and drag them into the waste pile.

Alie: Even if they're kicking and screaming, being like, "What's up? Hey assholes, I'm fully alive!" They're like, "Sorry, you smell like a corpse. You're out."

Terry: Yeah, that's totally the story Wilson did. That was like was the comical thing. He would paint live ants with a chemical that says that they're dead ants and then ants would be dragged—living—over to the dead pile.

Alie: So rough.

Terry: The concept is that the way that colonies divide labor… Essentially some ants will do some things, other ants will do other things, and we're not even close to understanding the details of how one species does things differently from another species and why. For instance, if you take a colony of ants and you put them in an area—there's dirt—and you give them a chance to excavate a nest, different species will have different nest architectures. So you can look at the structure of a nest, or the structure of a nest entrance, or you could do a casting of the nest and be like, "Oh, I think I know what species it is, just on the shape of the nests that they dig."

How is it that a species is socially organized to do something like that repetitively? I mean there's still so much to learn, but in general it's thought that the way that colonies organize complex behavior is based on interactions with one another. If you interact with an individual, then that communicates different kinds of information depending on what chemicals you share, what body posture you have, like in honeybees for example, what orientation your body is. From all of these small, little pieces of behavior, then we have a complex colony emerge.

Aside: A lot of small, simple computers can make a big, complex computer. And yes, of course this is being studied by the military. Imagine a million tiny robot soldiers. Or maybe don't.

Alie: Do you get optimistic about solving future problems with maybe some themes or things we've learned from ant behavior? Or are you like, "Oh shit, we're gonna learn from ants and we're all going to kill each other?"

Terry: I'm terrified of the concept that we could use learning, education, and technology to do bad things regardless.

Alie: Right.

Terry: I think if we study how social insects work, there's a lot of power and understanding of how the world works. I think by studying insects, we can tap into lots of new knowledge, and then it's up to us to use that wisely.

Alie: Now, can you give me some hot goss'? Can you spill the tea on some of ants' crazy behaviors? What kind of *Real Housewives* shit happens in those colonies? Also, are they mostly ladies?

Terry: Oh yeah. Just like in almost all social insects, except for social cockroaches formerly known as termites.

Alie: Oooohhhh! Wait, what??

Terry: Yeah, yeah.

Alie: Termites are now called social cockroaches? When did that happen???

Terry: Well, it happened 10 years ago, but now people are getting their heads around this.

Aside: So, another detail to get your head around? I'll say this fast because: a) it's unrelated to ants, and b) it's disgusting.

Termites eat wood, and cockroaches are coprophages, which means they're feces eaters. Scientists think that being friendly and eating each other's snacky waste could have set the stage for good gut biomes that's able to digest wood. That's how cockroaches turned into termites. Thank you. I'm sorry. Let's get back to ants. Specifically, the dames.

Alie: Ants and bees. We're looking at a bunch of ladies.

Terry: Yeah. Yeah. All workers are female. In pretty much almost all colonies, if you're seeing an ant that has no wings, then it's going to be a female worker.

Alie: Do boy ants have wings?

Terry: Yeah. Almost all the time the boy ants will have wings, and their job is to have sex and then die and that's it.

Aside: Boy ant to-do list is: be born, have wings, have a nuptial flight, mate, and then die. You're done. P.S. the male ants—who are not called uncles but rather drones—and the queens will usually mate when it's humid out, or after it rains, so she can get laaaid then rip off her own wings—casually—and pump her babies into a hole in the earth, thus starting one big, happy, kind of overworked family. And remember: the family that sniffs and rubs their bodily secretions on each other together, stays together.

Alie: What kind of actions and behaviors do they have in terms of communicating with each other?

Terry: 'They' meaning the ants?

Alie: The ants, yeah.

Terry: Sometimes they'll actually perform physical movements on one another to communicate things, but it's pretty much all chemical for the most part.

Alie: Do they say things like, "Hey, there's a fruit loop over there," or "Hey, watch out, there's a weird anteater lurching about,"? What are they chatting about?

Terry: There are big categories that you can put pheromones into. There are recruitment pheromones, which is like, "Hey, the food's over there," then there are trail pheromones saying, "Well this is the trail." There are different kinds of trail pheromones. Some are long-term trail pheromones that will last for a long time saying, "This is our big long-term trail." Sometimes you'll have trail pheromones that evaporate really quickly or that are short-term trail pheromones.

Alie: Whoa! Pardon this question, is this just coming out of their butt? Where's it coming from?

Terry: They have different glands and different parts of their bodies. Some of the glands, like for instance, the alarm pheromones are in the mandibles, the mandibular glands. Once

in a long while we're still discovering new glands, but there's a few key glands in the head or in the middle part of the butt, yeah.

Alie: They're like, “Nyah, this is just a short-term trail. We're not going to hang here for too long.” They're just gonna squirt some stuff out of their thorax and then that evaporates. The alarm ones near their mandibles are really interesting.

Terry: Yeah. Which means like, “Attack what's near there.” There's also the Argentine ants and their super-colonies. One of the things that we find is the reason the ants will accept or reject someone into the colony is the pheromones. The ants have to physically rub up against one another to smell these. Once you touch, then you would come in contact with this pheromone, which is a long chain carbon, which is not volatile. If that matches their own, then they recognize them as colony mates. If those compounds are different enough, they recognize them as different. If you were to coat ants with these chemicals, then they'll recognize one another as colony mates.

Alie: Oh my god. You can almost trick them into being like, “No, no, no! You guys are cool,” because you just coated them with the same kind of perfume.

Terry: Yeah, to some extent. But also, if you were to take a colony and then split it apart and give them different kinds of food that have different kinds of chemicals, then they'll stop getting along with one another.

Aside: I had a boyfriend years ago who ate one bowl of epically pungent garlic soup, one fateful day, and I thought maybe we were going to break up. I thought that was the end. I considered it. I just did not know how to cope politely.

Alie: How do you approach invasive species? Clearly you marvel at ants. Are you like, “Ah, I'm pissed off at you guys because you are outpacing native species,” or do you just say, “Let nature be nature,”?

Terry: I studied invasive species for my dissertation. I've gotten past that. I'm doing other things now. It's a problem. It's a problem because, especially in ants, it seems for at least 50 to 100 years after they arrive, they really reduce the abundance of other native ants. Also, pragmatically speaking, it's an economic problem because most of these invasive species cause problems that disrupt trade, could be human health problems, or cause problems for endangered species. With red imported fire ants, they'll eat ground nesting birds.

Alie: What??? They'll eat a bird?

Terry: They'll eat the little baby birds. I think they have trouble getting into the eggs, but as soon as they hatch, they'll swarm over the nest.

Alie: Oh my god!!

Terry: Ground nesting birds in the Southeastern US are really at risk because of this invasive species.

Alie: Why do some ants want to eat an apple core, and others are like, [*very low voice*] "I need flesh."

Terry: Species are different. All different kinds of ants have all different kinds of diet. Some ants primarily eat other ants, like army ants.

Alie: Army ants eat other ants??

Terry: Most army ant species are specialists on other social insects, other ant colonies and wasp colonies and termites.

Alie: Oh, I didn't know that. There are some species of ants that have reputations: fire ants, army ants, bullet ants. What is it about those species that are more ferocious or more threatening to people? And should we be marveling at that instead of being like, "Hey ants, knock it off."

Terry: Oh, I think we totally should be marvelized! Ants… they're amazing, yeah. Army ants aren't really a threat. I guess if you were to put a baby in a bassinet [*baby coo*] and let it sit there as army ants went through, that probably would not be good news because they would get stung a lot, right? Otherwise army ants are great. If they come through your house, you step outside for a couple of hours, you come back and they've cleaned out all the insect pests.

Alie: Have they really? They've just marched through and been like, "I ate a cockroach. I ate a moth."

Terry: Yeah. Seriously. So it's normal. I think there's this notion that they're incredibly efficient, but I've looked through places where army ants had just roamed through. There's still bugs in the litter. They didn't get everybody.

Alie: They didn't get everything. A little sloppy. What about bullet ants and fire ants? Why are they called those things?

Terry: Bullet ants are just called bullet ants because it really, really hurts when they sting you.

Alie: Why does it hurt so bad?

Terry: Why does it hurt so bad? Could be an approximate answer like, "It's a structure of this poneratoxin and the alpha poneratoxin and beta poneratoxin causes a lot of pain." The real question is why is it they evolved the toxin, which is so much more painful than everyone else? My pet concept behind that is, bullet ants are huge and they also have pretty big colonies considering their size. The colonies can have a few thousand individuals when they get to be big. The larvae and the pupae are really big and chunky. It's like a really, really, good meal. I can imagine a coati or a peccary or someone digging up the ground and would love eating all of those.

Aside: This just in: A coati is a very cute, long-faced, raccoon-looking idiot and a peccary appears to be a spindle-legged forest piggy with frothy Texas hair. They would probably love to eat soft squishy bullet ant babies like Swedish fish.

Terry: Because they offer such a massive nutritional reward to someone who attacks the colony, they probably have to deter vertebrates really well. No vertebrate in its right mind is gonna mess with a bullet ant colony. So their colonies… you could probably dig and access them within several seconds if you had a shovel or good digging claws, but you'd just be crazy too because they sting so badly. Whereas, so many other ants, if they have a lot of nutritious prey available to them, then they're probably deep in a piece of wood. Carpenter ants get to be almost as big as bullet ants, but they don't even have a sting and they bite you, but it's not the worst thing in the world. It's just that they're nesting in wood, you're not going to rip open a whole tree to eat a carpenter ant colony. Bullet ant colonies are really vulnerable if they're just in soil at the base of a tree.

Alie: That's a great answer.

Aside: So lesson: hide your shit or be prepared to defend it.

Alie: How do you feel when you see people, say in science programs or You Tube, that are like, "I put my hands in a fire ant colony!" or "I let a bullet ant sting me to see how it would feel!" [*cartoon slip sound effect*] Are you just shaking your damn head on the side?

Terry: I think with a fire ant, that's just kind of dumb. I think gosh, it's gotta hurt! People with fire ants—if fire ants sting you, you get all these welts and the blisters and it's horrible, it's painful. You know what's going to happen. I think with bullet ants what happens is you get stung and it looks like nothing. Initially you might swell up or whatever, but then you see people reacting in extraordinary pain and it's a matter of curiosity, right? I've had several students intentionally get themselves stung by bullet ants because they wanted to know what it felt like.

Alie: And? And???

Terry: And it really hurt! [*laughs*]

Alie: What did they do, what kind of reactions happen?

Terry: They just scream their heads off and then use all kinds of cursing [*clip from movie A Christmas Story: Ralphie,* "*You dort'n, no good, damn nipple bang, gunk stinkin' crisp!!*"]

I've worked with bullet ants. I published a few papers on them and I've only been stung by them once, and that was in the lab when I was being dumb. It's possible to work with them and not get stung if you just treat them with respect and understand how they behave.

Alie: Well, hello, what happened? What happened?? Tell me everything. You were in the lab. You got stung by a bullet ant? Where?!? How?!?

Terry: I was in the lab and I needed to weigh this ant because we're doing experiments with microbes in their guts. To weigh the ant, I needed to put it in a container and weigh the ant in the container, then you subtract the weight of the container. I realized that when I weighed the cup, it didn't have a lid on it. I was like, "Oh, I need to weigh a cup with a

lid." But I wasn't thinking that the cup that had the lid on it was the one that had the ant I was weighing in it.

Alie: Oh no!

Terry: I just wasn't thinking. So the moment I got the lid off…

Aside: P.S. If you haven't already, now would be a good time to cover the ears of your children or my mom.

Terry: …you know, it just got me right on the tip of my finger and I was like, [*gradually deepens and slows to a stop*] "fuck, fuck, fuck, fuck, fuck, fuck, fuck!" and I flung the ant somewhere in the balance room and it was roaming around. [*Alie laughs*] Meanwhile, I have this sophomore in college, I'm showing her how to do this experiment for the rest of the summer, then she sees this. I was like, "Oh my god," it was so bad. It was really, really bad.

Alie: Did you ever find the flung ant?

Terry: Oh yeah. Yeah. They're huge. How do you not find them?

Aside: Okay, I looked these things up, and they are meaty as hell. They're about as big as a wingless wasp, but with a sting some experts say is 30 times more painful than a bee's. Worse than childbirth and being burned.

P.S. How do we know that? One Cornell University study in the 1940s was trying to measure comparative pains using something that's still called a dolorimeter. Dolor, by the way, is straight up a noun meaning "great sorrow or distress". They used this dolorimeter and during childbirth the team of scientists: James D. Hardy, Harold G. Wolff and Helen Goodell... um… heated? I guess burned women? To ask which feels worse. The answer must have been a consistent "fuck off" enough that they stopped using this method. For Terry, who has a child, but no experience shoving one out an orifice, how would he describe it?

Alie: Oh my god, what did it feel like??

Terry: The way I explain it… I've seen multiple people get stung, right? Or at least see the aftereffects, and so it affects different people differently. It's not to say that everyone else will have this response, but for me it was like if you put your finger on a countertop and I were to give you a hammer and ask you hit it as hard as you can. That's what it felt like. [*Alie shrieking in the background*] Yeah.

Alie: How long does it last?

Terry: One common name that people have for them is Hormiga Veinticuatro, the 24-hour-ant. Mine did not last 24 hours, but it *reeeally* hurt! I took a full dose of ibuprofen and Benadryl because my hand started to get really puffy. It was throbbing enough where I just couldn't focus on anything. It was like my day was done.

Alie: Yeah, ya think??

Terry: Then I had lost muscular strength in the hand. I couldn't hold a coffee cup in this hand. I just couldn't squeeze enough to hold it. It was weird. That evening, the whole hand was numb. I would poke it and I couldn't feel it.

Alie: Oh my god! Here's a question. If you could do your whole life over and you had a chance to not have that happen to you, would you erase that from your experience? Or are you in some way glad that you know what it's like?

Terry: I guess enough people have asked me what it feels like…

Aside: [*several recordings layered over each other*] "What did it feel like?"

Terry: …that it's better to have that experience than to be that smug dude who's like, "Well, I'm so careful I never get stung." [*laughs*]

Alie: I have heard also Phil Torres, the lepidopterologist that I interviewed about butterflies, he says that entomologists have a rite of passage, everyone wants to get a botfly larva stuck in them. Do ant researchers say, "I kinda wanna see what this is like"?

Terry: No, I think among the ant people I know, at least, ant men I know, they would be more into… I think a botfly would still be a bigger rite of passage than a bullet ant sting.

Alie: Than a bullet ant? Oh my god! What's the craziest thing that you've seen in the field, or the craziest behavior you've ever witnessed?

Terry: Wow. I would say probably the coolest thing I've seen are kidnapper ants.

Alie: What the hell??

Terry: People used to call these slave-making ants, but I don't think it really describes their behavior well. What kidnapper ants are—this I just saw in Arizona—they are colonies that go on seasonal raids where they find the colonies of other ants and steal their brood and bring them back to their own nest and raise them up. Then those ants live there. They're kidnapping baby ants from another colony. If you were to look at a kidnapper ant colony, there's two kinds of workers. There's the kidnapper ants themselves, which are big and bright orange. Then the ants that they stole, who are working alongside them thinking they belonged there, but they were actually kidnapped.

Alie: Is that a matter of pheromones? Do they rub their pheromone on it where they're like, "You can't tell that we are not your real family,"?

Terry: Yeah. The thing is, if you're raised in that environment, then you'll basically be having the odors that come from that environment. We know that kidnapper ants will use pheromones to disrupt the communication of the colonies. These ants that get raided by kidnapper ants, they kind of know it's coming. I mean, it's evolved over probably millions of years. So they've evolved some kind of defense, but obviously the defenses aren't quite good enough.

Alie: Does that mean that the kidnapper ant queen is kind of like a cult leader? She's a David Koresh of like a Jonestown? She's like, "You belong here and you love it. Keep working."

Terry: You totally can imagine that. Yeah.

Alie: Now what are ant queens like? I should've asked this earlier, but what are ant queens like? Are they just pumping out babies all the time? Do they get killed and eaten by someone when they're ready to go?

Terry: The popular conception is that queens run the colony. For the most part, queens are not in charge. It's the workers that are running the colony. The queen, if anything, is the captive of the ants because the queen is doing reproductive labor for the colony and the ants are doing all the other labor. If a queen has only mated once, then because of bizarre genetics that we could get into, the workers are more related to their sisters, the queen's daughters, than the queen is to her own daughters.

Alie: Weird!

Terry: You could argue that the queen is actually doing the reproductive work for her daughters who are in the colony.

Alie: Ooh, that's some *Handmaid's Tale* shit right there

Terry: Yeah, totally.

Alie: What does your research right now deal with? What's your bread and butter research?

Terry: The way a friend of mine described what I do, he's like, "I really like when you do that experimental, natural history." I'm like, "Oh, that's a good word for it." What I do is I find… There's so many curious, weird phenomena that we don't understand out there. I'm like, "I think I'm going to try to do experiments to try to figure out what's going on." I have a few different things I'm working on. One thing is, I'm understanding—and this is what a lot of people are working on for good reason—the thermal biology of ants and how they are adapting to hotter temperatures.

Alie: Oh, god!

Terry: The way I've been looking at this is looking at variation within a colony and how that might evolve and how colonies use behavioral flexibility to respond to changing temperature. A lot of people are looking at differences among species to think about how things will change, but I think ant colonies might evolve behaviorally to adapt to higher temperatures.

Alie: Oh wow, that's crazy. Do you think that they'll store more water or seek higher ground or lower ground or…?

Terry: Yeah, they might nest deeper. They might forage at different times of day or nest in deeper leaf litter. But it looks like that they're more adaptable than people thought. It's one thing I'm working on.

There's this other group of ants I'm working on that moved their nest all the time. Well, many ants… People think of ants as like, "Here's a hole in the ground where the ant colony lives." But it turns out that the majority of species moved their nests on a regular

basis, like every few weeks, every few months, once a year. So I've been working to show people that this is actually kind of the way the ants are. They're not like miniature plants rooted in the ground, but just like our invasive Argentine ants move all over the city. Even if you don't look at invasive species, if you're just looking at natural areas, ants moving their nest is a pretty common thing. I've been trying to figure out how and why that happens in a couple of species.

Alie: Why does it happen, do you think?

Terry: Well, it's very different depending upon the species you're looking at, about what the advantage is. There are some that do it because they're trying to find a sunnier patch. If the structure of the forest changes so they end up in a place that's shadier, they need to move to a place that's more sunny.

Alie: Oh my god, they do the skedaddle!

Aside: [*high pitched*] Go on! Git!

Terry: Yeah, totally.

Alie: Now, how do you feel when you see people pouring molten aluminum into an ant colony?

Aside: For a visual, imagine a small, squat, shiny, metal Christmas tree that a robot might put up, or shimmering silver coral, or maybe a bush Dr. Suess would dream up for the future. If you Google "anthill art", you can see products and some art displays and also the process. In so doing, you will, again, realize that we are the villains in an ant's action film. For sure.

Alie: Because I know that they can then dig it up and it's this beautiful branching structure. But I'm also like, "Duuuude! The aaants!"

Terry: I just see it as a gorgeous work of art. I mean, I estimated on the back of an envelope the number of ants that I killed and, on the low end—very low end—it's like a quarter million, half million. Maybe there's little "Wanted" posters of me inside the ant colony. [*Alie laughs*] Unlike a lot of other people who study insects, I actually work really hard to avoid collecting. I think biological collections are very important and we should continue to build to maintain collections. But I think we need to think hard about the ethics of how we do this.

There's a lot of data to be acquired from those too. I know people are now doing that as an art piece. Also, a lot of what we've learned about nest architecture has come from that kind of casting. The guy who pioneered this technique, Walter Tschinkel, has done all this amazing work on the architecture of nest colonies. Before doing the metal casting, people would cast colonies with dental plaster because you need something that goes down the fine, little holes the ants crawl through if you're going to cast the whole colony. Dental plaster is fine enough that you can penetrate the colony really well. Then digging up the colony is so difficult because it doesn't come up in one piece. Then you have to reconstruct it.

Aside: A metal casting of the colony stays intact but the plaster cast has to be reconstructed like a jigsaw because it breaks apart. However, molten metal—surprise! —destroys all the ants, while the plaster can be washed away later, and scientists can figure out which ants were kickin' it in which part of their house.

Terry: You can be like, "Oh, these ants were in this chamber, those ants were this chamber."

Alie: Oh wow. You can't do that with metal.

Terry: Exactly.

Alie: Can you imagine if a wall of molten metal came out like a flash flood?

Terry: Out of nowhere.

Alie: Yeah, you're just like, "Weeee oooouut!" Oh my god! Are you ready for rapid fire round?

Terry: Oh, sure.

Alie: Okay. Patreon questions. I got like 80 questions, but we're not going to do all of them because some people ask the same questions. We're going to run through as many as we can. Are you ready?

Terry: Okay.

Alie: Sarah Michelle wants to know: Why do bullet ants scream when they attack? Is it an intimidation tactic?

Terry: Some people think so. I think it could be, yeah. Bullet ants make this *ssst ssst ssst ssst* when you disturb a nest and the odor is a little garlicky when they do that.

Alie: [*high pitched*] Whaaat??

Terry: I jump back when I hear it, and so I imagine that other vertebrates do too, because that way it's a warning sign. My guess is yes, but it hasn't been shown experimentally.

Alie: Sure. If you hear that, I mean, why do you think rattlesnakes have rattles?

Terry: Right.

Alie: They're like, "Don't make me use this venom!"

Terry: Exactly.

Alie: They're like, "You know what's coming."

Aside: It's like the ice cream truck, [*ice cream truck music, then record scratch*] but, with pain and death.

Alie: Todd McLaren wants to know: What's the deepest ant hole recorded? Any idea?

Terry: I know if you were look at leaf-cutter ant colonies, they can go maybe 10, 20 meters deep, I think. There are probably some that go deeper that we haven't collected. I know

people that have tried to excavate colonies where… There's these volcano ants in Australia where they make these tiny little mounds of soil that looked like volcanoes. You try to dig them up, and the hole just goes deep and deep and deep [*very low voice*] and deep. I know people have gone down many meters and not found them.

Alie: Damn! That's some spelunking right there! For reals!

Jessica Chamberlain wants to know: If you're mean, like my husband, and squish a scout ant that you see on its own in your house. Will the colony send another scout to look for it, or will they just abandon their fallen comrade?

Terry: I'm just speaking from experience. If it's in your house and you have one ant roaming around, if it's the very, very first ant, in theory, maybe? In practice, probably not.

Alie: Oh really? Okay.

Terry: They would probably send more.

Alie: Alright. They're just like, "Hey, where's Heidi?" And then like, "I don't know. Go find her! Maybe she found good stuff!"

Terry: Yeah, I think they probably forget that… I mean, it's better to do that than not, if you don't want them to come back. But I think it's probably futile. I think I'd look for the caulk gun instead or follow her and see where she goes.

Alie: So if you keep following her and she's on her way home, she's doing her home commute, you can find where the entrance is?

Terry: Totally. Which is about like how I spend most of my time in the forest. If you want to find an ant colony, give them food, then they'll walk back to their home. Actually, if you're trying to get rid of that scout ant, what you do is feed her, then see what crack she's going to go into, then kill her and cover up the crack.

Alie: [*sharp intake of breath*] That's really calculated! That's not… That's definitely premeditated, first degree, instead of just a crime of opportunity or passion. That's amazing! You're like, "Oh, want a crumb?" and she's like, [*fast, higher pitch*] "Oh my god! Thank you so much! I'm gonna have to take this home," and you're like, "No, you won't, bitch."

Alie: Several people wanted to know: How are ants so strong? How can they lift 10 times their own a weight?

Radha, Evan, McKenna, all wanted to know: How much weight can ant carry? Why are they so strong?

Terry: I think the answer is they can carry like maybe 100, 200 times their mass or something like that. The answer is that ants are not particularly strong. It's just a matter of scaling for body size. In other words, if you were to shrink your own body down to the size of an ant, then you would be as strong as an ant that size. It's scaling. The way that muscles work is their power… it's a function of the cross-sectional area of the muscle essentially.

If you shrink down, then you're just that much more powerful. Just like if you were to take an ant and to scale them up to our size, then they'd only be as strong as us.

Alie: They could barely do a push up and they're like, [*nasal, vocal fry*] "Ehhh… my luggage is too heavy. Will, someone put it in the overhead for me?"

I had no idea. I thought they got so much props. I thought they were just mystically strong.

Terry: Yeah, totally.

Alie: Who knew? Physics! Scaling!

Cody Whoppencamp [phonetic] and Dave Miller both pretty much wanted to know: Someone once told me that based on estimates, ants outnumber humans. Am I gullible or is that fact true? And is it true that the weight of all the ants in the world exceeds the weight of humans? So, let's debunk some flimflam. Numbers and weights of ants versus human.

Terry: Oh, there's way, way, way more ants than people. There has to be. Any back-of-the-envelope calculation. I would say every other thing that people say about ants dates back to an off-the-cuff thing that E. O. Wilson said 20 years ago.

Aside: For context, 89-year-old American biologist and author E. O. Wilson is said to be the world's foremost expert on ants, and he postulated in a 1994 book, "When combined, all ants in the world taken together weigh about as much as all human beings." All myrmecologists know this quote.

Terry: That's the thing about the mass of ants being equivalent to the mass of people. Getting more myrmecologists using more back-of-envelope calculations, we're like, "Yeah, that sounds fine."

Alie: Okay. So ants outnumber human beings, definitely numerically, and also by weight.

Terry: Yeah. Or maybe about the same, but ballpark, it could be within an order of magnitude, the same as more or less.

Alie: Woo! Okay. Then that's not even flimflam that we needed to debunk. That's some real shit.

Kendall Thorston, Christopher Barley, and Eva all want to ask about ant farming: Do they farm aphids? You mentioned something about a fungus farm. How did they get so good at farming? Does that make them smarter than early humans?

Terry: Well, that makes them more social. I mean, the question is what is smart, right?

Alie: This is your philosophy background! [*Terry laughs*]

Terry: The party line is that ants evolved agriculture 60 million years ago with fungus-growing ants.

Alie: Oh my god.

Terry: They collected bits of animal poop or whatnot. Famously now, leaf-cutter ants will cut leaves and they'll grow a big a garden.

Aside: So remember, there are the leaf-cutter ants that take leaf pieces and grow fungus on them; meanwhile me, an alive human, who can drive a car and Skype France, has killed three cacti in the last year.

Terry: They carefully tend to this garden and they used the same kind of integrated pest management that we use in our crops.

Alie: Oh my god, that's crazy.

Terry: There's weeds that grow in there and they've evolved relationships with bacteria that attack those weeds. Every single day there's someone in a few labs that's discovering a new partner in this co-evolved complex situation of how ants do this. I would say the analogy for farming would be with fungus growing ants, whereas the analogy for ranching, I would say, would be with aphids.

Alie: Oh my god!

Terry: Ants will occasionally grow aphids and they will milk the aphids to get their honeydew, which is basically the leftover sugary stuff that the aphids don't consume when they're feeding on plants. There's also caterpillars that will do this with the ants too.

Alie: This is essentially just like nectar pee, right?

Terry: Yeah, exactly. Also, analogously, in addition to milking cows, occasionally we will kill them and eat them. The same thing with the ants and the aphids. They might eat an aphid once in a while.

Alie: Are they managing the herd?

Terry: Oh, carefully, yes. They will transport them around, and adaptively manage it. Sometimes, they'll kill off a plant by using too many of them. Oftentimes, they use ranching management techniques.

Alie: That's so wild west. That's insane. So cowboy.

Okay. So Kristen McAdams and Lilly Hill both want to know: Why do fire ants hate me? They both asked in particular: Why do fire ants hate me? So Lily and Kristin, at least know it's not just you!

Mark wants to know: How can they act as both a solid and a liquid? So fire ants. What's their beef about? Also, are they solid or liquid?

Terry: Fire ants are so mad! Ants will defend their nests. If you take an individual fire ant, it could walk on you and it's not going to sting you right away. If you disrupt a mound, then it's going to get really mad at you. Most other ants, you can't destroy their mounds so easily because they're underground or something, whereas fire ants have this big soil

mound above the surface. If you kick that soil mound, then they're just going to get really pissed because it's like you just took apart their home. I think they seem to be more angry because the structure of their home is a lot more likely to be disturbed. They also have a potent sting that goes with it.

Aside: Lesson: insecurity makes us bitches.

Terry: The whole solid/liquid thing, and how they can float and raft when it floods, it's cool. Fire ants evolved in these seasonal floodplains in South America. When it floods, the colonies can just pick up and then raft along and then land when the waters recede. The ants' bodies will cling together. If you have a whole bunch of ants clinging together, then they will pour these physical properties. Actually, they act as a liquid, but the ants themselves also can be a solid. I don't think I can offer a solid answer [*ba-dum-TSH!!*] with respect to physics how they do that, but it's super cool.

Aside: I floated this idea by Google, and it turns out that the little hairs on their tiny lady legs trap enough air to keep them all afloat. So congratulations, there is another reason to avoid shaving your legs today.

Alie: Olivia Roofs—great question—says: "As soon as I saw this post, it reminded me of the infection that turns ants into zombies. What is it and what's the lifecycle?" This is cordyceps?

Terry: Yeah, the common name, cordyceps, like Ophiocordyceps, is... The zombie ant fungus is super cool. There's a number of people working to figure this critter out. It takes over the brain of the animal. It tells them to perch somewhere, and then that results in… It kills the animal and the spore gets spread that will infect another animal. Super cool!

Alie: It kind of turns them into these zombies though, where some ants will crawl up a plant stem, perch out on the leaf, and then wait until the cordyceps explodes from their head and infects all of their family members?

Terry: Yeah, I think that usually the explosion happens after the answer already dead and perched. But yeah, they will go to a location that helps the dispersal of the fungal spores. It turns out that—and there's a recent paper that came out showing that—the way that ants bite onto the tissue corresponds to the environment that they are in to help it spread more effectively.

Alie: Does this stuff ever just completely boggle you? Do you start thinking… Do you get galaxy brain where you're like, "What is anything? Is this all a simulation? Does dark matter teach ants what to do?" Do you ever get stoner-y about this stuff?

Terry: I used to, but for every single thing that I read about that's weird, I know people have already figured out even weirder things. I think it's like, "Wow, that's super cool!" I mean, yeah, that's amazing, but then there are these flukes that we'll have, like three or four different hosts, for example. They'll infect a bird and they'll infect the snail and an alien, and has this complex life cycle and it affects the behavior of every single one. Cordyceps seems kind of straightforward compared to some of these other crazy host-

altering ones. Does the toxoplasmosis actually cause people to not have fear or so on? I don't know.

Aside: This isn't even college roommate, bong-ripper philosophy, this is just the wild world of brain parasites. Speaking of peril…

Alie: Kellen Freeman and Ray Casha both want to know how the death spiral works. What is happening in an ant death spiral?

Terry: For the uninitiated, the death spiral is this thing where… Army ants forage in these big raids and all follow one another. If you were to take a bunch of army ants and somehow separate them from the rest of their colony, you can trick them, or they might accidentally march in a big circle. They just follow one another. They basically create a single pheromonal trail and it's a death spiral so keep marching and marching until they're all dead.

Alie: [*sharp intake of breath*] Why????

Terry: They all follow one another in big trails. Individual ant colonies can solve complex problems and do big things, but ant workers are dumb and they follow simple rules.

Aside: Terry explains how this is kind of like computer code.

Terry: If you have an army ant colony that's a quarter million ants. Every ant is following a simple program, and when you have all these simple bits of code together, then they function. If you were to take some of these individual ants and separate them from the other ants, then they're just kind of screwed. They'll just wander around. If you take an ant and bring her away from her colony, far enough away that she'll never get back, she's not like that dog that's going to cross the whole country and find its way home.

Aside: [*clip from Homeward Bound*]

Shadow: Peter!

Peter: Shadow!

Shadow: Oh Peter! I worried about you so!

Yeah no, it's not like 1993's *Homeward Bound*.

Terry: It's going to be like, "Oh, I don't know where to go." Then wander around aimlessly until it tries to find some signal about where it's home might be and then it won't. And then it'll just die. [*clip from The Big Lebowski: The Dude, "Bummer." Mr. Lebowski, "Huh?" The Dude, "This is a bummer, man."*]

Alie: Tracy Benhemou wants to know: I have to know, will ants added to a camping sauté add a little flavor like lemon juice due to the acetic acid in their heads? Have you eaten ants?

Terry: Yes, some ants. Yeah, I try not to. I'm vegetarian so I extend that to insects, but I've tried some inadvertently. I mean, we all eat insects when we don't try. There are some that taste absolutely horrible, but for instance, in this part of the world, we have what we call

citronella ants. They live underground, the genus Lasius, and they actually have a citronella-y odor to them. The weaver ants in Southeast Asia and in the Australian wet tropics, they have a lemony flavor to their butts. Some people call them lemon ants. I don't think they have that much acetic acid. I mean there's formic acid, butyric acid, so acetic acid is straight up vinegar.

Aside: Lemon ants, by the way, release this citrusy smell when attacked, to warn others. And they also use formic acid as an herbicide and that creates clearings in the forest where nothing really grows. This is called a Devil's Garden, which is definitely a venue that my existential metal band, Mere Meat, would love to play.

Terry: But ants, what might add other flavors? I mean, people will roast queens of leaf-cutter ants. People, once a year, will collect the brood of weaver ants and collect them in large numbers. You can get them an ethnic food stores in jars here.

Alie: Wow. I hear that they might be a little spicy too. Some ants.

Terry: Oh, some of them, yeah, have a little bit of spice.

Alie: [*very high pitched*] Crazy!! I think I've eaten ants. I think I had ants on a cookie on purpose.

Let's see. Elliot Inio [ph.] wants to know: Do it fart? Do ants fart?

Terry: Oh my god, I haven't gotten to that page in the book yet!

Aside: Terry is referencing the bestselling book *Does It Fart*. Now I don't have a copy of the book, but I do have evidence that Antman might, taken from this Screen Junkies interview with Paul Rudd. [*clip from Screen Junkies interview with Paul Rudd, "Paul Rudd's tooting!"*] He has either a very squeaky chair or problematic intestines.

Alie: Ant farms, yes or no?

Terry: Ant farms… the ones that you buy out of the box at Uncle Milton? No, because they're all going to die because they don't send you a queen. They just die. They're these *Onion* articles about how getting an ant farm is a lesson in toiling until you die. That's what that is. But if you were to build your own ant farm and collect your own ant colony, there are many amateur ant enthusiasts who really know their biology and are super cool, and there's ant chat rooms, they're willing to help. If you want your own ant colonies, then doing it that way, yes.

Alie: Ooo! So as long as you get the queen, and you set it up right, and you do it respectfully.

Terry: Yeah, exactly.

Alie: That's cool. I didn't know that.

Terry: Yeah, super cool. There's a whole community of people who do that.

Alie: You know what? I can't have a dog in this apartment, but maybe I could adopt like a couple thousand ants.

Terry: You can totally have an ant colony in here, yeah!

Alie: Right? I just found my summer project! [*laughs*]

A few different people like Craig Monomy and Sarah Sparrow want to know if there are plants or natural remedies or other insects that you could use in your house to deter ants?

Terry: Probably not. There's a lot of discussion about what chemicals could you use. Could you spray powder or chalk or cayenne pepper or whatever? Pretty much, those don't work.

Alie: Okay. Cinnamon? No?

Terry: No.

Alie: Just checking. Okay. So the answer iiiis… no. The answer is get a caulk gun!

Terry: Caulk gun. Yeah. Or a general answer would be to kill your lawn.

Alie: Wwwhhaaattt???

Terry: Right, because I've killed my lawn and I still have trouble with ants. At least, if you're in a dry place, like in California, where you have all these Argentine ants, they are fed by moisture. If it's dry, you don't have them. We were doing a cleanup in Compton Creek up on a dry spot and you had harvester ants right there in the middle of urban whatever.

Alie: Oh wow.

Aside: Harvester ants? Just on the look-out for that quality, organic, free range, gluten free seed to eat. Whereas Argentine ants are munching on pizza crust under a dead possum. And loving it.

Terry: Often the invasive species will be following water or following human disturbance. So if you get all your neighbors together and have more native landscaping, then you'll have fewer of these invasive ants that would be taking over your house. But I think the key is to keep from letting them in.

Alie: Okay. So just gently follow them home. Like an absolute creep.

Terry: Right. Yeah.

Alie: Annah Thompson wants to know: Are there loner or introvert ants who are not down with the social thing?

Terry: The only nonsocial ants we have are colonies that produce what we call social parasites. Actually, they're not colonies, they are nonsocial ants. They only produce queens and males. What they do is, the queens will fly off and live inside the colony of other ants and take their food and lay their own eggs and sneak them in with the rest of the colony.

Aside: The fact that ants don't have long running reality show franchises is an artistic failing of our culture.

Terry: Then she'll just make queens and males to make new colonies. So they're socially parasitic, and they evolved after ants originally evolved.

Alie: Oh wow! They're kind of like sociopaths. They just come in like freeloaders.

Terry: They're total free loaders, yeah.

Alie: Total narcissists!

Terry: All other ants are social.

Alie: Oh, I didn't know that.

Danny Kaye wants to know: Have you ever spelled your name out in ant pheromones? à la E. L. Williams?

Terry: I have not spelled my name out in ant pheromones.

Alie: Okay. Just checking.

Zach Tarbo wants to know: I heard that ants are great at predicting weather, is there any truth to this?

Terry: The one example I can think of if they're great at predicting weather is if they know if it's really going to rain. For instance, in dry areas like in the southwestern US, they reproduce after a rainstorm and often, if you're going to have a lot of rain there's mating flights. Sometimes they'll start flying before the rains hit so, often people studying them who are trying to collect them can look at the weather reports and be like, "Oh, I bet they're going to fly tonight."

Alie: You said queens. Do some colonies have multiple queens or no?

Terry: Yeah. Many kinds of ants will have more than one queen per colony.

Alie: Oh, okay. Oh, I didn't know that.

Sean and Josh Grandinetti want to know: What's the most amazing ant behavior you've seen, and do they have self-awareness?

Terry: I don't think they have... If we talk about self-awareness as in cognition where they recognize themselves in the mirror, I don't think so. The most amazing behavior I've seen deals with the army ants that roam across the ground and eat all the other ants that they find. There's this colony of ants, which we now call Cappadocian ants.

Aside: I looked this up, and this is a region in Turkey that known, in part, for its elaborate network—ready for this?—of underground cities. Hidden tunnels that could house possibly up to 20,000 people, the entrance of which could be concealed by boulders. Full underground cities we just discovered a few years ago! If you are an archaeologist working on this with any kind of hookup, please do holler. I am hereby begging you. Okay. But back to ants.

Terry: There are these Cappadocian ants that are really tiny but routinely are subjected to attack by army ants. Outside their nest entrance, they have a little pebble sitting outside, and when an in an aggressive ant comes to that ant colony and they smell them, an ant will come out and drag that pebble and plug the nest shut. You can stimulate this behavior by getting any kind of really aggressive, smelly ant, like an army ant, and wave it in front of the ant entrance, and they'll come out and they'll grab that little pebble and close it shut.

Alie: Damn! They're like, "Nothing to see here! You're not getting in here!" That's amazing. Like in horror movies when you see someone block the door with a chair, you're like, "That'll keep them out!" [*Terry laughs*] That's so smart.

I love this question so much. Jade wants to know, and I ask this definitely from a lot of ologists, but Jade wants to know: Which is more accurate scientifically, *A Bug's Life* or *Ants*?

Terry: Hmm… [*Jeopardy music*] *A Bug's Life*.

Alie: Really? Do you have a preference between both ant movies?

Terry: Gosh, well I've only seen each of them once. I just found the *Ants* one annoying. When Woody Allen has a good movie, he's good. But otherwise it's like, "Uuugghh," you know. Then there's all these other issues with Woody Allen. I think *A Bug's Life*, in general, the whole concept about the colony having a seasonal nature and working together and storing food… In general, in terms of the life history of the ant, I think it's far better than the *Ants* movie. *Antman*, I thought, was wonderful with ant biology. I thought a lot of stuff was spot on. Dare I say, in some ways it was realistic.

Alie: Wwwwhhoooaahh! When you go to your next myrmecology conference, will you guys talk about that and be like, "Hey, who did the consulting on that? Because that was a pretty good job."

Terry: Well, we all know the dude who's consulting on that.

Alie: Oh, really? [*laughs*]

Terry: The last ant meeting, I was talking to the grad student who worked on it, and he did a great job. He's like, "Oh, the one thing I'm really annoyed about," he was telling me, "was that they didn't do the all ants being female."

Alie: That was my next question. How do you feel when you watched *A Bug's Life* and it's protagonist is a little male, are you like, "Wha…ahh…."

Terry: If you're going to explain why all ants are female, that's not an easy discussion. I think 'old me' and other more pedantic people would be like, "Oh my gosh, are you kidding? How can you let them get that wrong? That's the most basic thing ever!" 'Recent me' is like, "Well you know, actually, since it's not an easy thing to explain and it's rather obscure and it doesn't, in the grand scheme of things, make that much difference, then maybe we should just say, 'Well yeah, sure, fine, whatever. Let's not talk about gender.'"

Aside: Terry says that there's one character named Antony [*snippet from song "I Need to Know" by Mark Anthony: "I need to know!"*] that is clearly, morphologically, physically a queen, but it's a male… which was noted by the consultants but the studio was like, "Naaaah its fine."

Terry: Because there's all these other things they had absolutely right about all the other ants, all these, "Oh well carpenter ants are like this and they do this," you know, "and bullet ants are like this." They had all that stuff right! They looked like them, and they behaved like them. It was like amazing! So I think they made some decision at the home office, like, "Okay, we know the consultant told us about this but screw it, we're just not going to do that."

Alie: I do feel like a lot of people know that social insects tend to be primarily female. Do you know what I mean? I feel like a lot of people… You don't have to be like a super, super, obscure myrmecology groupie to know that. Can you describe in a nutshell why they are female? I know you said it's obscure and complex.

Terry: Okay. In ants, bees, and wasps the males have a single copy of the genes. They are haploid. Females have two copies of the genes, meaning they're diploid. That's a thing in this group. That's just the way they are. That means when males are making sperm, there's no meiosis, there's no sorting of genes. So in other words, all male sperm is identical.

Alie: Oh wow!

Terry: Their sperm is an exact copy of them.

Alie: Oh, weird.

Terry: That results in weirdness, these asymmetries in relatedness. For the most part, like most of the social animals that are truly social that way, they have that genetic thing going on.

Alie: How do they know that the eggs are just going to be female?

Terry: Essentially, there is a competition or a war in the colony where a queen will lay an egg, and she can choose to make it a male or a female, depending on whether or not she squirts sperm on it. In insects, the females have something called a spermatheca that store sperm, so males die after they have sex for the most part. But worse for females is that they just don't have sex again, they just store the sperm for the rest of their life.

Alie: Oh man. You get one super-lay and then you're like, "I guess I'm celibate!"

Terry: Or, maybe a bunch, and then you have sperm from a bunch of males, but then that's it. Then she lays an egg. She can make it a male by not putting any sperm on it, or she can make it a female by fertilizing it.

Alie: Oooohhhh!

Terry: When she makes a male, that's 100% her genes.

Alie: Oh, wow! Okay, that's kind of crazy!

Terry: Genetically, it's in the female's interest to make males because the males are more closely related to her than her daughters, who are only 50% related to her. If a queen is essentially being selfish, then she's making too many males. But then the workers will get pissed off because the workers want them to lay sisters because the workers are more closely related to the sisters.

Alie: Oh my god! That is like *Game of Thrones*!

Terry: Yeah. It's totally *Game of Thrones*. There's all these conflicts of interest and it's a total mess.

Aside: For a long time, scientists were very firm in thinking that the relatedness caused the evolution of social behavior. But...

Terry: There's a new generation of scientists that didn't live through these wars, but anyone who's my generation or older, we're talking it's fighting words.

Alie: Really??

Terry: Yeah.

Alie: So drama in the colony; drama outside of the colony looking at the colony!

Terry: Yeah, totally.

Alie: Who knew that ant life was such a roiling soap opera? Okay. So last questions. What do you haaaate about your job, other than getting stung by bullet ants?

Terry: [*Jeopardy theme*] Oh gosh. I guess… Well, I guess I don't. [*record scratch*] This is a hard thing to say because it's so awesome! But as a myrmecologist, what do I hate about being a myrmecologist? I guess it's because being in southern California, the ants are relatively boring compared to so many other parts of the world.

Alie: Oh! We don't have quite as much trapdoor ants and fungus ants and we've got a couple of big species battling it out.

Terry: Right. You have Argentine ants, which is like, "Ugh. It's an invasive species of blah blah, blah blah…" Then some of the native ants, eeehh… they're kind of cool, but once you get tropical then you see all these amazing things. So I see them when I go elsewhere, but not when I'm here.

Alie: So I guess it keeps you thirsty for field research?

Terry: Yeah, exactly.

Alie: Are you ever at a picnic in LA or at someone's house and you get distracted by ants and you're like, "Ooh, I gotta go look at that."

Terry: Yeah, once in a while. And people chortle. It'll be like, “Oooh!” you know. I should have a vial my pocket at all times, but I don't. Some people I know they don't go anywhere without a vial.

Alie: Do you have friends who call you Antman?

Terry: Yeah, there's a few.

Alie: Then what do you love the most about being a myrmecologist?

Terry: There's still so much mystery. It's a whole frontier. As Corrie Moreau recently pointed out, “There's a few hundred people in the world that have labs that are focusing on studying ants and there's so many things that we don't know.” Especially in the tropics, wherever you go, there are ants and they are doing things that are running the world. So it's hard to not discover cool things if you choose to look.

Alie: If you had to glean some self-help information from ants, is there anything that ants have inspired you to do differently with your life or could inspire us to do?

Terry: Within ant colonies there's a lot of conflict and despite the reputation for having their act together and working really hard, there's a lot of lazy ants that are waiting for other ants to do their job. [*Alie laughs*] So I would think if you were to look at an ant colony, most ants aren't doing anything.

Alie: Really??

Terry: For every ant that you see above ground doing something, there's 10 ants sitting on their ass doing nothing underground.

Alie: Oh my god!! [*laughs*]

Terry: I think that's a good counterexample for me. Ants, instead of being, “Go to the ants thou sluggard, they work really hard, blah blah blah.” No, ants are waiting for other ants to do their job before they can do theirs. They're the opposite of being hardworking, entrepreneurial, whatever. They're a counterexample. That's how I learned from ants.

Alie: Does that make you work harder or chill more?

Terry: No, I think I should learn from them that I probably should choose my own path and do my own thing rather than just try to perform the role that I think I'm supposed to be doing. Like for instance, if my house is messy, it's because, well, my wife's waiting for me to do the dishes and I'm waiting for her to do the dishes so they don't get done. That's the kind of thing that I could kind of see happening in an ant colony where they follow the rules. If the individual washing dishes isn't there at the moment, then it's not going to happen.

Alie: That's so funny to think about lazy ants making you take initiative. Which, by the way, I have a sink full of dirty dishes and I live alone. This is the saddest thing. No one to blame but myself. I'm my own lazy ant. [*Alie and Terry laugh*] This was so informative! I love

this. I don't think I'm ever going to look at ants the same. I mean I already loved them, but I'm definitely going to be more prone to just seeing where they're headed.

Terry: Yeah, you just watch them. I mean, so the thing is, if your kitchen is overrun with ants, you don't have to freak out and wipe them all away because if you wait five more minutes, it's not going to get worse. Might as well just watch them. Right? Then you nuke them.

Alie: Thank you so much for being here! This was dope. I loved it.

Terry: Thank you so much.

Ask smart people stupid questions all you want. Even if they seem like small inquiries, the answers can be mighty.

To find Terry McGlynn on Twitter, he's @Hormiga or he's at LeafLitter.org. He is great.

Ologies is @Ologies on Twitter and Instagram. I'm @AlieWard, on Twitter and Instagram. Do say hello. Come and follow.

For Ologies Merch, go to OlogiesMerch.com. There's a bunch of new fall pins and mugs and shirts, and sweatshirts. Thank you Boni Dutch and Shannon Feltus for helping with all of that. If you post yourself in merch, tag it #ologiesmerch so I can find you and repost you on my Instagram. Thank you very much. I like to look at you wearing the things.

You can support the show for as low as a dollar a month at Patreon.com/Ologies. Twenty-five cents an episode! The Ologies Facebook group is a party full of fine human beings, thanks to admins Hannah Lippow and Erin Talbert. Thank you to Steven Ray Morris, host of *The Purrcast* and *See Jurassic Right* for all the edits you do to put the show together. Special thanks to Dr. Teagan Wall for saying that male ants are called uncles, a joke for which she gave me permission to include. Theme song is by Nick Thorburn.

If you stick around to the very end, you know that I tell you a secret. I will tell you right now that I am recording this from an Airbnb in Seattle. My friend is getting married, Ologies lepidopterologist Phil Torres. Everyone in the house is asleep so I'm whisper-asiding downstairs, hoping I am not going to wake anyone up.

PS., Phil's fiancé, Silja, bought him the Gucci loafers with the bugs on them [*gasp!*] we talked about at the end of his episode. I'm so happy. Happily ever after! It does exist! I will also tell you that there is a bonus episode coming up soon that is an anniversary episode. Steven Ray Morris asked me your questions that you submitted, and I guess my secret this week is that I hope you like it! That sounded so desperate. I don't think it's a laugh-riot, I think I was so sentimental talking about the anniversary of Ologies that it's like how much it means to means to me. Just so you know, is it heartfelt? Very, very, yes. That bonus episode will be out soon.

Thank you as always for listening! High-five an ant if you see one, but gently, though, ok? Alright.

Berbye!

Transcribed by Azalia Worden

Some links which may be of use to you:

Wheeler going around naming stuff

Ant super colonies/megaparties

Electric ants aka little fire ants

Micromachines: remember these? No?

Leafcutting + fungus growing is their jam

Anthill art

Childbirth vs other pains in the literal and figurative ass

Termites are like "lol we're roaches"

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