S2 E3 Swanne Gordon

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Matthew Zipple 00:08

Hello, and welcome to the Animal Behavior Podcast, Matthew Zipple. This week I'm talking with Dr. Swanne Gordon, Assistant Professor of Biology at Washington University in St. Louis. This week's episode is largely about diversity, in nature and in the biological sciences. We talk about a puzzling polymorphism in tiger moths and the series of elegant experiments that Swanne and her colleagues performed to understand the evolutionary dynamics involved. Then after the break, we talk about racial and ethnic diversity among evolutionary biologists, or rather the lack thereof, and where Swanne sees challenges and opportunities for improving diversity in our field in the coming years. And we'll close with the discussion of expanding our set of model organisms that we study in animal behavior research to include a more diverse range of taxa. I hope you enjoy. Here's my conversation with Swanne Gordon. Swanne Gordon, welcome to the show. Thanks for being here today.

Swanne Gordon 01:06

Thanks for having me. Before I begin, I want to pay acknowledgement to the stolen lands upon which so many of us inhabit and work on and to the stolen people who have built or helped build those lands. I also want to acknowledge that, as we're kind of talking here, you know, you and I in the studio, that our world is bleeding from, you know, things like climate change and a pandemic, to people suffering through war. And it's okay to acknowledge that it's not okay. Right.

Matthew Zipple 01:41

Yeah, thank you for acknowledging those things that's really important. So in several episodes this season we're pushing into relatively complex evolutionary concepts, and I'm eager to keep pushing that effort forward today. So you've been investigating a fascinating evolutionary puzzle in wood tiger moths. So let's start with the description of the wood tiger moth natural history, what is the life of wood tiger moth like?

Swanne Gordon 02:08

So wood tiger moths, in nature at the moment, go through around one generation per year. And so they come out of their eggs as larvae. And they'll go through around seven molts before they pupate, and they'll spend around two weeks or so in the pupa. Before then they eclose as adults. As adults, they'll probably fly for around two weeks, where the female will try to fertilize all of her eggs, at which point she will lay them. And then they will hatch out into larvae. The larvae are cryptically colored when they're born. So they're just brown little light things that will kind of balloon or fly away as they hatch out of their eggs. But then at around the two week mark, they start to develop their coloration. And so they'll typically have a warning signal of an orange band over an otherwise black colorful body. And they will then stay this way as they grow for again, around five or so molts. They do overwinter as larvae. And so they'll kind of go to sleep and wake up in the spring, and then continue eating until they hatch out into adults, at which point they're capital breeders. So they do not need to eat, they do all of their eating as larvae. And then their main goal is just to kind of fly around and find a mate and then leave, of course, their genetic material to the next generation. So they're an interesting system in terms of their life history. But where I'm concerned with them is that they're an interesting system of polymorphism. And so the adults as well as the juvenile stage display widespread diversity of their warning signal, which are in adults, these colored hind wings, and so we can have white, yellow, red or black male morphs across the globe. And so they're very widespread. The females, instead of having these discrete color patterns, they have this beautiful continuous coloration in their hind wing variation from yellow all the way to red. And then if we look at their distribution around the world, you can see places where one particular morph has gone to fixation, or where they actually coexist with more than one morph, we can see places where males and females are sexually monomorphic versus other places where they're sexually dimorphic. So it's an interesting system not only for its natural history, but also for its distribution in terms of answering a variety of questions.

Matthew Zipple 04:54

And it's that polymorphism that kind of creates this puzzle, right so the purpose of this coloration is, among other things, a predator defense. Right? And so take us back to evolutionary basics here. Why is polymorphism an unusual thing to observe?

Swanne Gordon 05:10

Yes, it's not necessarily unusual, we can see polymorphism in a variety of systems, you know, across nature, we expect that, in whatever system we're looking at, that if one form or eco morph has any sort of an advantage over another, and this could be due to predation, like you mentioned, or sexual selection, whatever it is some sort of an advantage, then we would expect over time for that morph to go to fixation. But of course, nature is more complicated than that, right? And so many times we have, you know, non neutral other sorts of mechanisms or, or interactive forces that then maintain diversity, instead of having a particular form go to fixation.

Matthew Zipple 06:07

Right.

Swanne Gordon 06:08

So polymorphism, in aposematic systems is problematic for two main reasons. The first is its origin. Right? Because, I mean, one can imagine that educating naive predators that hey, don't eat me, I'm bad for you. Right? Must have been initially tough to become established, because they had to have been at a low frequency. So how did that learning that predator learning take place before it was wiped out? Right. And then it's also problematic in terms of its maintenance, because theory supposes just like for other organisms, but particularly for aposematic systems, that aposematism should lead to mono morphism, or fixation of the locally common or locally advantageous form. And this is because positive frequency dependent selection should drive conspicuous coloration, right, to confer a protection advantage to toxic prey dependent on the high frequency of individuals sort of displaying that signal.

Matthew Zipple 07:24

So I think let's just pause then and explain what frequency dependent selection is gonna mean, if we can break that down.

Swanne Gordon 07:31

Yeah. So positive frequency dependent selection is this idea that common morphs or common traits forms whatever, should have an advantage over less common ones. And that's kind of opposite to negative frequency dependent selection, which is that rare forms should have some sort of an advantage. When we think about things that can maintain polymorphism in nature, for instance, negative frequency dependent selection is one of those things, because even if you know their survival selection against, say, rare morphs, there's something that is allowing these rare morphs to flourish and to coexist. Yeah, so we expect mono morphism in these aposematic systems. But despite all of these predictions, we still find many examples of polymorphism in aposematic systems, which I think is forcing many of us now to wonder about the paradox and to wonder, right? How uncommon, it really should be seen.

Matthew Zipple 08:43

Right. And so the, the wood tiger moths, like you mentioned, have at least four male morphs. Let's focus here on on the two that occur in in the area in Finland, where you were studying them, which are white and yellow, the approach to understand how it is that this polymorphism is maintained, is to try to measure natural selection, and sexual selection and their density dependence, and then ask whether those results are capable of explaining the observed phenomenon.

Swanne Gordon 09:12

Yeah. So what you're getting on is the kind of forms of balance selection that can maintain polymorphism. Right. Many of us in biology know about things like heterozygote advantage. But what I was concerned, what we're concerned that especially in this paper that we're going to talk about, I think a lot, is that interplay between natural and sexual selection that might actually help kind of maintain polymorphism. When we think about the white and the yellow morph in Finland, one of my ideas of something that could potentially counter predation selection, because before we did this study, we had done a couple where we just looked at baseline predation against the yellow and the white morph. And then we showed that in central Finland, the yellow morph seems to have some sort of an advantage against predators. Such that we don't know if it was due to the toxicity level, or the conspicuous coloration, right? That there's some kind of innate... "Oh, you're bright and colorful, so I'm not going to touch you", right? Or behavioral differences between the whites in the yellow or whatever it was, we found that idea. And then there was another study that looked at mating in the wood tiger moth. And then it showed that the white morph seem to have a mating advantage. And so maybe this interplay between natural and sexual selection could help maintain polymorphism in the system. But then when I came along, just pulling kind of inspiration from my guppy work. I thought, that's fantastic. But what if we thought about it under a frequency component? So looking specifically at the fact that as an aposematic system, we expect not just survival selection, but positive frequency dependent selection (FDS), right survival selection, and then maybe in a counter this positive FDS right on one side in terms of predators, maybe negative frequency dependent selection could actually counter it, reproductive selection, could actually counter it, and explain a little bit better than just like the initial experiments, looking baseline at white versus yellow, and then linking a little bit more to the widespread distribution of polymorphism that we see in the system.

Matthew Zipple 11:48

So at this point, I just want to make sure I understand at this point, what you all have found is yellow morphs have a survival advantage. White morphs appear to have a reproductive advantage, at least under some contacts. And so if that's what's happening, then you could imagine this kind of trade off leading to the maintenance of the polymorphism. But that, does that rely on negative density dependence for the sexual selection?

Swanne Gordon 12:14

Yeah, so what we initially found what, what you said, you're right. So predation advantage to yellow mating advantage to white, but that experiment was done under balanced ratios of white versus yellow. In both of those experiments, right. But then when we look at the distribution across nature, we find areas where it's not just balanced, right, there's not just equal numbers of white and yellow. So what we wanted to do is expand that study a little bit, so that we could include variations and frequency to see if there was a signal of the effect of frequency on those findings. I fully anticipated. And I think so did my colleagues, that what we would have found was, you know, survival selection, positive frequency dependent selection, like we expect in an aposematic system. But we fully anticipated that we would have found negative frequency dependent selection on the other side, right? That would sort of give

evidence to explain the maintenance of polymorphism. Because just highlighting variation between whites and yellows at equal ratios, is not a mechanism that can maintain polymorphism in the system.

Matthew Zipple 12:26

Okay. Got it. Yeah, that makes perfect sense. So you have this expectation going in. And we're gonna get to the results shortly. But I think that I want to step us through kind of the arena that you're talking about the behavioral experiments. So you do this sexual selection experiment, this reproductive success experiment, under these predator free but otherwise, semi natural conditions. Walk us through what that looks like and how you did that for a moth, how you create a somewhat natural trackable system.

Swanne Gordon 13:58

Yeah, I'm gonna have to, you know, pull up my memory hat here. So we built an outdoor enclosure, and it was really big outdoor cage that we split into around six different arenas. So we could run experiments one after the other. And the enclosure itself, the wide cage was big, I think was like 20 by 30 meters. So it was a huge base. We built it over natural foliage, where we knew we had found wood tiger moths before and we put it up and we left it there, you know, we before the season started, and then we tracked that there were no individuals in the particular arena before we started the experiment. The cage was all meshed in because you know, to keep them inside. But the top and two of the sides were completely open so that they could have you know, airflow coming in. They could have pheromones coming in from individuals around the area, right They could hear predators, they could hear bird predators. So trying to simulate as much as possible, the natural setting, compared to just doing it in indoor aviaries, as we have done in some of our experiments as well. And so, in this enclosure, we decided to test whether negative frequency dependent selection in the context again, if sexual selection could balance those morph ratios, and then allow those rare morphs to flourish. And then again, we did this in central Finland. So again, this is a white biased population, a stable white bias population. And I think it's around 60% white individuals every year to around 40% Yellow individuals every year. And this was the same population, that we had found that under equal frequencies, that whites somehow have a mating advantage, and then the yellows have a survival advantage. And so in this large cage, we had three different treatments, we had a balanced morph treatment. And so we had equal numbers of whites versus yellow. So kind of simulating what we expected to find based on what we did before for mating, but now in a big arena, rather than an individual little box. And then we had a white bias treatment, so much more white individuals than yellow individuals. And then we had a yellow bias treatment, so much more yellow individuals than white individuals. And then we had females in there, because of course, the females are reproductive baits. And so what we did is we glued a string to the back of the female. And then we tethered them in these styrofoam boxes in each of the large cages. So the female could fly... fly around, right, but we knew at least where each of the females were. And then the females could call their pheromones, right. And they get to track the males within each of the treatment enclosures to them. And we could track you know, the data of who exactly is going around the females from the marked males, or who is eventually successful in mating with the females. And then at the end of the experiment, we could easily recapture all of the females and then be able to bring

them back to the lab. So it was a really, really interesting setup where we tried to make it as close to natural settings. But of course, you know, it's not the real thing.

Matthew Zipple 17:38

Yep, I think it's wonderful. I think it's a really elegant effort. And so you have this, you know, clear prediction, you're expecting negative frequency dependent reproductive success. So to spell that out, that means that in the in the yellow bias treatment, you would expect the white morphs to do better. And the white bias treatment, you'd expect the yellow morphs to do better.

Swanne Gordon 18:00

Exactly, no difference in the balance treatment where they have equal ratios, or potentially an advantage to the white morph.

Matthew Zipple 18:10

And so what did you find?

Swanne Gordon 18:13

Yeah so... to our confusion, instead, we found positive frequency dependent selection, reproductive selection, in that just looking at individual relative fitness, which is the number of offspring to one male compared to other males in that enclosure, we found that in the balanced treatment, there was no difference between yellow and white male fathers, which was great. We were like, yeah, hey. And then when we looked at the white bias treatment, we found that the whites actually had the higher reproductive success. Likewise, in the yellow bias treatments, the yellows had the highest reproductive success. And this was striking, right? It wasn't close. It was a striking difference. And so we were extremely confused. Because now not only do we have one mode of positive frequency dependent selection of the a survival selection, but now we have a second one, right? Via reproductive selection. Each of them proposes supposing by theory, to drive a particular morph to fixation by artifact of the fact that you will win rates via predation or mating, every single event.

Matthew Zipple 19:37

So we're in a situation now and looking at these results where you've got positive frequency dependent selection on predator avoidance, and positive frequency dependent selection reproductive success, which like is a classic recipe for a single morph, right, but there's two more, so the puzzle remains. And so you built a model to try to understand how these different parameters could work together to lead to the maintenance of polymorphism So what's the answer? How do you think that this paradoxical outcome comes to be?

Swanne Gordon 20:05

Yeah. So, I mean, when we first got the to positive modes, and I was just like... Okay, I mean, how am I gonna write this paper? I'm just gonna put it in the drawer with my other millions of papers that I have to write and just don't know how to complete the story. I think I like building all of my research projects as a story, you know, like a story to tell to kind of answer that question. And when there are gaps where I just can't explain it, then I don't know, for me, it's so much better to just sit on it and maybe do another experiment or, or think a little bit more than to just write what I have right away, which probably isn't great for being a successful scientist over time. But I kind of sat on it. And I thought about it. And I read a couple more papers and talked with colleagues. And then I found a paper that explained that positive frequency dependent selection or survival selection, can still maintain polymorphism. If you think about it under a spatial context, that in some environments, there might be advantages to one particular morph. But in another environment, maybe there's advantages to the opposite morph. And then with a little bit of dispersal between them, as long as you expand your view of the spatial arena, then you could maintain overall diversity in the system. And so then, I had a conversation with, you know, Hanna Kokko and Johanna Mappes about whether or not this could be a reason, right, even with two now, positive modes of frequency dependent selection, that we maybe can show that we can maintain polymorphism, as well. And so we integrated our data from the mating experiment that we had done with some known estimates of predation against a morphs where we had 60 different predation transects, differing bird communities, and then in each different environment, we had survival advantage, either the whites or the yellow dependent on the actual predator community in that local patch. And so then we integrated both of those two forms of data in a simple spatial model, to kind of see if, you know, under this varying predation pressure and advantages to one morph or another, combined within that same type of generation mating advantage dependent on the frequency of the individuals, and then we ran the model for around 1000 generations and included those different levels of dispersal, which is what we need for to work in that spatial component. And we were able to show yes, mathematically, that polymorphism can be maintained under two modes of positive frequency dependent selection, of course, for the first time, as long as again, it's considered under the spatial component, and with some aspects or levels of dispersal, so that it's not a panmictic or, or population that does not move around.

Matthew Zipple 23:22

Yeah, I think that's such a fabulous result, because I think it speaks to the kind of the ideal synergy between empirical data and modeling is that for a model to be useful, you have to have really good data. But when you build a model, it can reveal things that intuition just would not, for the most part, come upon.

Swanne Gordon 23:43

I know, I think it was, you know, a brilliant effort by all of our co authors. Exactly for the things that you said, and yes, it's a simple model, right? We're really simplifying what's happening in nature and some of the parameters that we know about this system. But even in its simplified form, it can inform so much in terms of what to test next, right? Because one of the things we found was that yeah, we need

dispersal, but maybe not too much dispersal, right? Because then it's just going to throw everything off. And so we did a follow up experiment looking at do these move? We never really knew that, we anticipated it, because you can see them around the globe. So they must have moved right. But on the on a smaller scale, temporal and spatially do they move. And we were able to show with an intense mark recapture over a couple of seasons that yes, they actually move and they move a lot. And so this model, right, pointed to that. Here's your next step. This is where you go, this is where you want to focus on.

Matthew Zipple 24:52

Wonderful. We're going to take a quick break now. And when we come back, we're going to talk about diversity in animal behavior, both in terms of the science tests doing the work as well as the systems that they choose to study. But first, here's a two minute takeaway

Dishari Dasgupta 25:11

Hello, everyone, my name is Dishari Dasgupta and I am currently pursuing my PhD from IISER Kolkata, India, under Dr. Anindita Bhadra and Dr. Manabi Paul. We are currently studying the urban adapted behavior in non human primates. Specifically on free ranging gray langurs, Semnopithecus entellus. Now, urbanization has a significant contribution in causing habitat loss worldwide. Now this habitat loss has forced some species like Semnopithecus entellus to live in and around human settlements. In our study, which we carried out on free ranging langurs in West Bengal, in India, we observed that the diet of langurs residing in an urban area mostly consisted of processed food items such as bun, biscuits, and processed peanuts, whereas longurs residing in semi urban and rural area, mostly fed on unprocessed food items such as leaves, fruits and berries. Now noting this difference in food choice. Within the same species, we carried out a food choice experiment, we gave them an option to choose from two processed and two unprocessed food items, and found out that despite being more akin to unprocessed food items, they chose to consume processed food items. Now such behavioral plasticity among free ranging langurs in response to unbearable environmental stress, such as availability of natural foliage was first reported by us. However, the underlying cause for this behavioral plasticity hasn't been explored yet. It is highly likely that epigenetic alterations might play a pivotal role, but we are not sure of it yet. Thank you.

Matthew Zipple 27:15

Welcome back, I'm talking today with Swanne Gordon, Assistant Professor of Biology at Washington University in St. Louis. In a Q&A with Nature, Ecology and Evolution, you said quote, before you know who I am, as a scientist, you need to know who I am as a person. So tell us who you are as a person and a bit about your, your kind of academic and scientific journey to this point.

Swanne Gordon 27:37

Yeah, um, I grew up in Montreal, Canada, but my family is originally Jamaican. And when our families split, it kind of split into a third, a third of them went to Canada, a third of them went to the UK, mainly

London. And then a third of them went to the US, mainly Florida, New York, and then kind of spreading around from that. So I was of the third that moved to Canada, mainly Montreal. And so I got to grow up under this rich cultural influence. But then in a location, where, in general, at least in my education, and academic background, I didn't really have this. Instead, I was one of only in a space that was actually quite homogeneous. And so I think I was able to in diversifying, where I went across my academic career, bring in who I was right, as a person into my studies of diversity, and polymorphism, and how it is maintained, cross all of these different settings.

Matthew Zipple 28:52

Yeah, and I'm really intrigued by kind of the sentiment behind that statement. How should we view the relationship between someone's identity and her science?

Swanne Gordon 29:03

I mean, who I am as a person informs the type of science that I do, and therefore who I am as a person is important to acknowledge at the same time as my science. I think for too long in academia, and specifically in our field of animal behavior, or even evolutionary ecology as a whole, we have wanted to separate those two things, right? The times that the science was done, and who these individuals were as people from the wonderful and influential science that they have managed to accomplish. And there are those of us that do not have the ability to separate ourselves that way, right. And do not have the ability to get over the fact or not acknowledge that there are people that may have been for more underrepresented groups that may have been the ones to have performed some of this influential science but did not get the opportunity. And I think it's time for us as a field in animal behavior, but also, again, broader biology in general, to talk about these things, because for many of us, it is triggering that we do not mention them at all.

Matthew Zipple 30:28

Was there a time when you were aware of some aspect of your identity, actively shaping a question that you asked or an approach that you took?

Swanne Gordon 30:39

I think just my whole passion behind trying to understand and just wanting to understand how organisms or different eco morphs can coexist and thrive in nature. It all stemmed from me being a child, looking at some of the historical things I was learning in school, but also being privy to some of my, you know, maybe horrible racial, or whatever experiences or gender or experiences growing up in my lifetime, and trying to understand how can we better coexist? How can we learn from studying diversity in nature?

Matthew Zipple 31:23

Right. So let's talk now about racial and ethnic diversity or lack thereof, in evolutionary biology and animal behavior. And I think it's useful to ground this in some numbers to start. So according to a 2017 NSF survey of the full time biological workforce in America, only 3% of biological scientists are black, and 5% are Hispanic or Latino, despite those groups making up 12 and 19% of the US population, respectively. And Joseph Graves and others have argued that black scientists are even more excluded from evolutionary biology, perhaps representing as little as .3% of the field. And in 2019, only eight PhD recipients in the whole field of evolutionary biology were black. And it's just that it's a shocking, state of affairs, right? It's one that when you hear the numbers, it's impossible to reach a conclusion other than exclusionary injustice is occurring.

Swanne Gordon 32:23

Yeah. So I mean, that data is shocking to many people that I sometimes say, say it to or show it to. But to someone like me, it really isn't right. Because in my field, attending, you know, behavioral conferences, or even in my collaborative networks, which, you know, I've been fortunate to have a quite broad one, you know, based on the groups that I've been in, that I've always seen this, right. I don't think people understand sometimes what it's like to be the only until they're put in a situation like that, and they turn around and they're like. Oh, my goodness, I'm the only... this. That makes me uncomfortable. But they don't understand that there is a lot of us that this is just a baseline kind of experience for us. And that, that that is powerful in and of itself. So when I started my Professorship at Washington University in St. Louis, I was speaking to the assistant provost. And then she was mentioning... Swanne, you know, I think you are our first and you know, only and I'm still only, black tenure track professor in I think the hard sciences at Wash U. So that kind of struck me. And over the past three years now that I've been here, and I've started really talking about these things in public now that I've been given this platform, and I feel the responsibility to do it. Not much has changed, right? I think what has changed is the conversations that we're having, yes, that has increased. But when it comes to the action, right, the actual behavioral shifts, that we're going to need to change our culture such that we can value diversity enough to make safe spaces for it to thrive, has not right. And so there's a disconnect, in that people are like. Yes, but what we need is more evidence, and it's like, no, we don't. I could pull up papers upon papers upon papers, showing what is important or needed to diversify our workforce. We can pull up research and research that shows the benefits of diversity in nature, right? And in academia. But it's not going to matter if we don't decide to make our words count for more than just words and make our words count towards our actions, right, of actually changing things of actually calling out toxicity and bullying in each of our departments or institutions, the type of bullying and, and prejudice that can keep people from reaching higher and higher echelons of higher academia. So it's not a leaky pipeline. It's a broken pipeline. It's a broken pipeline that needs to be fixed, right, that needs to be redone, because it is too far gone now.

Matthew Zipple 35:46

Right? So over the last 18 months, there's been this really visible energy among people in our field. And I can just feel it being wasted. Like, there's no question in my mind that the political capital

necessary to make real progress is a scarce resource that needs to be spent effectively. So what efforts have you seen expenditures of political capital that you think have been the most valuable, and that you think might be the most effective and that we should prioritize going forward?

Swanne Gordon 36:21

Yeah, so the financial obligation behind all of these things is, of course, important, right. But the financial side alone cannot work. Right. So there's been programs such as the Athena SWAN, in in the UK, that is to decrease gender bias, and to increase gender representation in UK sites that they put a lot of money into and behind. So it had a broad scale, benefit over time, right, it made a difference. But what was maybe not as strongly pushed was focusing also on the cultural change, the cultural change, so that when the money goes away, that the cultural shift and change that happened via these financial means will actually be maintained long term. And so I think that is what was missing in these past two, three years, especially after the whole George Floyd. Tragedy. To use one example, there was a real push towards financially and also physically trying to support black academics in the sciences. But what was lacking was the cultural adjustment of we need to first before we bring anybody in, before we use money in hiring, that we need to figure out whether or not we can retain people that we need to figure out whether or not we can shift our culture to not make the spaces that are students or faculty from underrepresented groups will come in and not have a safe and inclusive and comfortable environment. Right. And because we didn't do that what we're starting to see now or what I'm starting to experience is kind of a backlash to that, right? We've done that we did that for two years, we've had this conversation, we put money in here, hasn't the problem been fixed? Or can we now stop talking about that and go back to regular things? Or should we be alarmed that maybe we're losing jobs? Or maybe we're putting in people that, you know, don't deserve these opportunities or don't want, like, we're starting to see this sort of sentiment come in? What's with all this woke culture? That's changing things and shifting things? Right. But because we didn't try to address the toxicity, because we didn't try to address what were the initial things that led to us being in the position that we're in right now? And how does even shifting or putting money over here change things? If the prevailing factors are still there, right? We're just going to be wasting that money and no change will happen.

Matthew Zipple 39:18

Right. And, you know, I've struggled to understand that... what's the right word, resistance to cultural change that has existed in animal behavior and an evolutionary biology. And I think that the, the imbalance, the racial imbalance is so striking in this field, in particular, because of the relative success that the field has had in reducing gender discrepancies. So you know, 40 to 45% of faculty are women, depending on what stage you look at. And that's obviously not parity, not going to pretend we've eliminated systemic gender biases in the field. As compared to other natural sciences, right, that's a much higher rate of performance. And I'm struck by the resistance to that cultural shift that exists. And when I talked with Susan Albert's last year about steps to increase gender parity in the field, she talked about the huge importance of having a critical mass of highly visible women, early in animal behavior promoting that, that success. So how important do you think the absence of that critical mass is for would be scientists from historically excluded groups?

Swanne Gordon 40:36

Yeah, I think it's wonderful that you bring up, you know, the gender bias, and how we've managed to, to have those hard conversations, you know, a decade or a couple of decades ago, and how much how far we have managed to come. The problem that I'm noticing now in terms of gender bias and expanding it to other instances of underrepresented groups, is that I think a lot of people that were loud vocal proponents of making sure that we achieve gender parity as much as possible, are for the most part inexplicably silent when it comes to further expanding, right, this this fight for diversity for a variety of other underrepresented groups. And I think that's a shame, because the battle is won together, right. And when conditions improve, for one group, it improves for everyone, right, including members of the majority, even though they might not recognize it in the beginning, right. So in nature, my research as we talked about today, right, but and also that of many, many others, have shown that frequency is important in establishing and maintaining diverse communities. Likewise, in academia, what you're basically saying that you is that representation matters, right? Having a critical mass of researchers from underrepresented groups is important for long term maintenance and establishment of diversity. And I'm hoping that we will eventually get there, and hopefully not in decades.

Matthew Zipple 42:34

Absolutely. Thank you for, for sharing those thoughts and for your sharing your experiences.

Swanne Gordon 42:42

Thank you.

Matthew Zipple 42:44

So I want to spend the last part of our conversation talking about a different related type of diversity in our field, which is diversity in model systems. And in a paper that you co authored with Meghan Duffy and colleagues, you all argue that fields of ecology, evolution and behavior would benefit from having more diverse model systems. So before we get to that argument, what do I mean by a model system?

Swanne Gordon 43:09

Yeah, so a model system is one which has been used for either like a long term capacity to answer certain pointed questions in biology, and has been used and reused by numerous researchers over time. That paper, we wanted to highlight the bias, or the disparity in the types of model systems that we use, and hence, the types of financial resources that are available for one system that people want to work on versus another. And in highlighting only a few model systems, what you do is you highlight only a few types of researchers, you only highlight a few types of research done in particular places in the globe, or in particular institutions. Right. So by expanding your idea of what a model system is, like we tried to do in that paper, then what we're hoping is that it will expand the idea of who are the researchers behind these model systems? Where is that research being done? And what are the types of questions that we can ask that can be more generalizable across taxa that is not just in mammals

that is not just in plants, that is not just in birds or other types of animals, right. But we can kind of expand our viewpoint and start questioning ourselves into why is this a particular model system for this topic? What if it's not the best system to ask this sort of question? But what if there's something else out there?

Matthew Zipple 45:02

I'm gonna play devil's advocate if that's okay, for defending model systems, and I'll be eager to hear your response. The opposing argument relies, I think heavily on the fact that resources in terms of financial and human capital are both limited. Dozens of people can study just one population of a single species for their entire career, and not be anywhere close to knowing everything about that species. Which is really all to say that there's this trade off, right, between breadth of the kind of set of study systems and our depth of knowledge within that system.

Swanne Gordon 45:37

And you have some valid points, right, not only about the importance of long term datasets, but also the importance of multiple people approaching a question or a system from a variety of different angles, sub disciplines, and whatever, to answer that question. But to answer it from a variety of different ways. The only way that we can, of course know enough of whether the system is generalizable is if we know enough about the system, right. But the idea that we try to give in this paper is that that side is right, we still need some of these big, broader model systems. But what we're saying is that now we have enough people and we have enough resources to now expand our idea of those systems, right? We expand the boundaries of the types of systems that we use, we expand the model scientists, the people behind those systems, right, who's studying those systems that brings in of course, diversity of thoughts and ideas behind what can potentially be happening, right that innovation, that new way of looking at things and then the the suppose it or the traditional view that will allow us to potentially go beyond our scope of discovery in each of these different topics.

Matthew Zipple 47:09

I think that that is the perfect place to leave things. Dr. Swanne Gordon, thank you so much for joining us today.

Swanne Gordon 47:15

Oh, well, it was wonderful to be here.

Matthew Zipple 47:19

The Animal Behavior Podcast is created by a great team of animal behavior researchers and science communication professionals. Amy Strauss and I prepare and conduct the interviews. Our content editing team is Naomi Person, a longtime radio producer, Poppy Lambert, a PhD student studying tool innovation in cockatoos and children at the University of Veterinary Medicine, Vienna, and Niko

Hensley, an NSF postdoctoral fellow studying the evolution of neuro sensory systems and their implications for animal communication at Cornell University. Our communications director is Casey Patmore, a PhD student at the University of Edinburgh studying the behavior of burying beetles. You can follow us on Twitter @AnimalBehavPod, or find us at our website animalbehaviorpod.com. And you can always get in touch by email at animalbehaviorpod@gmail.com. We'll be rolling out our website throughout the season, including new educational resources that will accompany select episodes. Those materials are being developed by our new education team. Emily McLean, assistant professor of biology at Oxford college at Emory University, and Georgia Lambert, a PhD candidate studying parental cooperation in burying beetles at the University of Edinburgh. Our sound directors Brian Leavell, a PhD candidate studying the evolution of acoustic signals at Ximena Bernal's lab at Purdue University. This season I'll be recording my side of most conversations in the Cornell Broadcast Studios with engineering support from Bert Odom-Reed. Our art is all produced by animal behavior researchers. Our logo was designed by Adeline Durand-Monteil our theme music is by Sally Street and transitions are by André Gonçalves. We receive financial support from the Animal Behavior Society. Finally, if you'd like the show, then you probably know other people that would like the show to but don't know it yet. Do them and us a favor and tell them about us. Thanks for listening and see you next time