# S2 E2 Tamra Mendelson

38:14

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**SPEAKERS**

Matthew Zipple, Tamra Mendelson, Zeke Rowe

**Matthew Zipple** 00:08

Hello and welcome to the Animal Behavior Podcast. I'm Matthew Zipple. My guest today is Dr. Tamra Mendelson, a professor in the Department of Biological Sciences at the University of Maryland, Baltimore County. The Mendelson lab studies the ecology and evolution of communication and the role of sexual selection in driving speciation. Today, we're going to focus on the evolution of visual displays. And I'll say after having read the papers we're about to discuss, I really feel like I understand evolution in a different way than I did before. And I hope by the time we get to the end of this episode, the same will be true for all of you. So Tamra, welcome to the podcast. Thanks for being here.

**Tamra Mendelson** 00:45

Thank you for having me.

**Matthew Zipple** 00:47

A note, so listeners, before we get started, we're going to be talking mostly about two papers today that we'll link in the show notes. A 2019 review in Proceedings B and a 2020 data paper in Nature Communications. And the work we're going to focus on today built on the concept of sensory drive as its starting point. And we had Mike Ryan on last season. But for anyone who missed that episode, or has forgotten. Can you summarize the concept of sensory drive for us and how it contributes to our understanding of signal evolution?

**Tamra Mendelson** 01:19

Sure, sensory drive, writ large is really just about how the environment shapes communication. So the environment is the medium through which signals are sent. And so clearly, it's going to have an effect on both the signal and the perception of that signal. That can happen a number of ways sensory drive could affect signal transmission itself. So the light environment through which visual signal is sent is going to affect the perception of that signal. Sensory drive can also refer to selection on brains, in contexts other than mating or other than communication, that can then exert selection on signals themselves or communication traits. So we kind of distinguish sensory drive from sensory bias, but sensory bias is, in my mind, part and parcel of sensory drive. Sensory drive being the larger framework of how the environment shapes the evolution of communication signals, and responses.

**Matthew Zipple** 02:17

And you've written that sensory drive and other what we'll call perception, first models of signal evolution, focus on efficacy. And we're going to spend a lot of time today talking about a related concept efficiency. So efficacy and efficiency, can you introduce those terms before we dig into applying them?

**Tamra Mendelson** 02:36

Sure. Efficacy is how effectively a piece of information is transferred. And often we think about this, the best example is detection. How well detected is a signal from its background. So contrast, increasing contrast as a way of increasing efficacy. It's like it's the actual information that's being sent. That efficiency is how easily it's processed, or how much it costs to process that information. And that might be very post peripheral. So signal is detected by the retina. But then how efficiently is that signal process to post-retinally?

**Matthew Zipple** 03:15

And efficiency in signal processing is important. Because it turns out that processing visual stimuli is shockingly expensive energetically.

**Tamra Mendelson** 03:23

Indeed, yes.

**Matthew Zipple** 03:25

In the paper, you said something like 3% of all energetic energy at resting state is being used to process visual stimuli, which just blows me away.

**Tamra Mendelson** 03:34

Right. It's a lot of work.

**Matthew Zipple** 03:36

And so the neurological mechanism for increased efficiency, right, is using as few neurons as possible to process a stimulus. Is that right? That it's, it's called sparseness?

**Tamra Mendelson** 03:47

Yeah, that's right. It's basically instead of having a neuron for every single spot in our visual scene, instead, we have neurons that can detect vertical lines, or horizontal lines, or lines at a particular angle, or shapes. So instead of trying to have a neuron that is spiking at every single spot, that would be a lot of neurons firing at the same time. Instead, there's a post peripheral neuron that's saying, oh, let's put that together. That is a vertical line, boom. And now you've got one neuron firing that says vertical line, as opposed to 1000 neurons firing that's a dot, dot, dot, dot, dot. That makes sense?

**Matthew Zipple** 04:23

Yeah. And then presumably, after that fact, right? If we even get farther post peripheral

**Tamra Mendelson** 04:28

Yeah, yeah

**Matthew Zipple** 04:29

There's some kind of processing that's easiest to do when the arrangement of neurons turning dots into lines are arranged in a certain way?

**Tamra Mendelson** 04:38

Right. And it's the idea is that there are certain predictability is about the environments that we evolve in. So some environments have a lot of vertical lines and brains that have neurons that are tuned to vertical lines will be selected, they will be more efficient. And our brains are thought to evolve to the particular redundancies or the particular patterns that repeat themselves over and over again in our environment, so that we can rely on a particular tuned neuron to do its job and to represent what we need it to represent.

**Matthew Zipple** 05:08

That makes sense. And so in reading your work, something that is kind of a subtle point, but really helped me understand these topics better, is that for me, and I think most people in animal behavior, when they think about evolution shaping displays, they're thinking about how selection is acting on the display itself, and the ways in which the producer and receiver of that display behave. But a central part of what you're arguing for is that a ton of natural selection is indirectly shaping the display that has nothing to do with the display itself. So animals have been selected to process information as efficiently as possible, right?

**Tamra Mendelson** 05:42

Yes.

**Matthew Zipple** 05:43

And a mechanism that you rely on to kind of reinforce that selection is eliciting positive emotional response. So animals, when they process, and humans right, when they process stimuli efficiently, they get this positive emotional response, because they're doing a good job processing information in that it gives them... you know? Listeners can call it pleasure, use anything else you want,

**Tamra Mendelson** 06:06

You could call it a reward.

**Matthew Zipple** 06:08

Great. So talk a bit about kind of that idea, the evolution of efficient processing being something that then influences perception of sexual displays.

**Tamra Mendelson** 06:19

Well, yeah, and you're really getting at the heart of what I think our processing bias hypothesis proposes. The question is, what role does this pleasure or reward play in mate selection? We don't know. What we do know, is from humans, when people are given visual images that we know are fluently processed and fluent is another psychological term for efficient when we know that they're efficiently processed, for various reasons, we know mathematically that they should be. They give people pleasure, people report that they like them. Now, what role does that play in mate choice? I think to some of us, it seems obvious, if stimulus is pleasing, we will be attracted to it, we will go towards it. And if we're in the mood for mating, that's what we'll do. And so all else being equal, if you have two signalers, and both of them are appealing enough to mate with, but one of them has a slightly more pleasant design, you're more likely to go to that one. And that's, that's the basics of it. But linking that pleasure, and sexual preference, I think is a place where we still want to keep exploring.

**Matthew Zipple** 07:32

Sure. And before we turn away from humans, I want to talk a little bit about the evidence that we have from humans that efficiently processed stimuli are attractive or pleasing. So we have evidence from art, we have evidence from physical attraction to other humans, what do we know, in a bit more detail about human perception of efficient stimuli?

**Tamra Mendelson** 07:54

Okay, so were we ready to get into some numbers?

**Matthew Zipple** 07:58

Let's do some numbers!

**Tamra Mendelson** 07:59

Okay. Well, I don't know how much of the numbers and will stay conceptual but the Fourier slope, the slope of the Fourier power spectrum is a way that we measure patterns, it's a very simple measure of a pattern in an image. And it measures the frequency distribution of contrast. An image that has big squares, a big checkerboard has a very steep slope, it's got very large, high contrast at big frequencies, whereas tiny, tiny checkerboards have high contrast at small frequencies.

**Matthew Zipple** 08:31

Okay. And if we apply this to kind of a natural environment?

**Tamra Mendelson** 08:34

So like a beach scene, where you've just got a clear blue sky, and a white sandy beach. That's got a really steep slope, because you basically have just one line of contrast. Whereas if you just looked at the sand, that's got a very shallow slope, because you've got these tiny, tiny, tiny little frequencies of contrast, all those little sand grains are making contrasts. And that's at high frequency. So this, for the slope of the Fourier power spectrum, is a way of condensing a complex pattern down into one number. And you think that would be so simple that it wouldn't tell us anything, but in fact, natural scenes of the natural terrestrial scenes have a characteristic slope of the Fourier power spectrum. And when abstract art or images of faces are shown to people, they are most attractive when they mimic the Fourier slope of a natural scene and beyond for a slope, then there's another way of measuring the sparseness or the efficiency of an image. That is when you take an artificial neural network, deep convolutional neural network and you train it on images, let's say you train it on landscapes or terrestrial images.

**Matthew Zipple** 09:45

Briefly, just briefly, for anyone who doesn't know. A deep neural network is a machine learning approach, right?

**Tamra Mendelson** 09:50

Yes, it's a computer. It's a computer model. And you are taking an image and trying to recreate that image using multiple layers of a network. And when you create a network that is trained on images of natural scenes, you've basically created a brain that has evolved to decode those natural scenes, like our brains, or like fish brains. And then you can give that brain, that artificial neural network, another image and say, how hard is it to decode this image for you? Basically, how many neurons do you need into your network to accurately represent this new image that I'm showing you? And what we've seen is that when we show images of female faces, say, to men. So there have been two studies on the attractiveness of female faces to men and women, the images that are considered most attractive are the ones that were most easily decoded by the neural network, meaning they are the sparsest, meaning they're the most efficiently processed faces.

**Matthew Zipple** 10:57

I mean, that's just an incredible thing to be true. That just seems absolutely mind boggling. So you take this computer, you evolve, its brain, for lack of a better term, it's series of neurons series of neurons to evolve based on scenes, comparable to what humans might experience and then ask it to look at female faces. And it says the most efficient are the most attractive as rated by humans.

**Tamra Mendelson** 11:19

Right. So the machine will tell us what the most efficient is, and people will tell us what the most attractive are. And it turns out that those two correspond. So I can tell you that when I first learned about this, I learned about it at an Animal Behavior Society meeting in 2015. In Alaska, it was Dr. Julien Renoult, who has been my collaborator since then, he gave this talk, and I just like you, it blew me away. I ran up to him after his talk was like "This is amazing". It is one of the first times I heard a really reasonable hypothesis for understanding signal design. I had been studying these darters, for a long time, they have these complex signals, I don't understand them, I don't understand where they came from, and why they look like they do. And this hypothesis was like, one of the first glimpses into understanding patterns moreso than just simple colors or simple features. And he was excited to because Julien loves thinking about the intersection of psychology and natural history and evolution. And so that's how our collaboration got started. So what are darters? And can you tell us a bit more about the natural history or what they look like? Darters are amazing, and beautiful. To people and probably to each other. They are small, North American freshwater fish. They live basically north in Canada to south to somewhere in Mexico. They're east of the Rocky Mountains. And they're mostly in mid elevation streams. And they are benthic, which means that they don't swim around very much. They don't have swim bladders. So they mostly just sit at the bottom of the stream, and then dart from one place to another, which is why they're called darters. And the thing that I didn't realize until I was in graduate school is they have so many different color patterns, there are over 200 named species of darters. And each species seems to have a unique suite of secondary sexual traits. For some species that's not color for some species. Its little fleshy knobs at the tips of their fins that mimic eggs. And it's so cool, because some species, those knobs are on the first dorsal fin. But for other species, those little fleshy knots are on the second dorsal fin. For some species, those fleshy knobs are on the pectoral fin. Like, you know, so there's diversity right there. It's not even in color. But then for about two thirds or more of the species, the males are elaborately colored. They're just little jewels. If someone were to show you one, you'd think it was a tropical reef fish. They're just such high contrast, brilliant colors.

**Matthew Zipple** 13:49

That's fascinating. So, so we started this conversation with the goal of understanding right, the diversity of displays. So let's turn back in that direction, what why should we expect preferences? Let's assume that this preference isn't just limited to humans, a result should be so, so, why should we expect preference for efficiently processed signals to lead to diversity in signal forms?

**Tamra Mendelson** 14:13

Well, I think it really gets back to this pleasure preference connection. So if it's rewarding to process a signal efficiently, and if that then causes you to increase your mate attraction to a signal that is efficiently processed. I mean, that's selection for the signal right there. It's almost too simple. And so that's, I think we need to understand whether the pleasure that animals may or may not experience from efficient information processing is sufficient to dictate their decisions, their mate choice decisions.

**Matthew Zipple** 14:53

And if we think about kind of different species, they're going to experience a lot of variation in the environment that they inhabit. A fish, for example, spiders, maybe, you know, different species may, may, in a very real sense experience, habitats with different spatial characteristics.

**Tamra Mendelson** 15:10

Absolutely. So the easiest way to think about it might be a fiddler crab that spends its entire life and so has its ancestors for a very long time on a beach. That is a very different spatial statistic than the harvestman, Daddy Long Legs that spends his life in the forest. Right. There is a question about where do these preferences come from? Or really is it developmental? Or is it evolutionary? So is this tuning that we're talking about? Is that something that happens in an organism’s lifetime? And or is it happening over an evolutionary timescale? It could be that we could raise different organisms in different habitats and affect their preferences just ontogenetically or it could be this is genetically programmed, and we need long periods of evolutionary time for selection to shape these brain differences.

**Matthew Zipple** 16:00

It's a fascinating idea. Yeah. Am I right, that the point of your hypothesis, the point of this processing bias hypothesis is that you would expect the sexual displays of those two species of crabs, the one that lives on the beach, and the one that lives in the forest to diverge?

**Tamra Mendelson** 16:18

Yes, the tuning of the brain than the neurons that are specialized on particular spatial statistics will be different than the spatial statistics that have been adapted to in the forest.

**Matthew Zipple** 16:31

Got it. And so choosing individuals are going to differ in terms of what kinds of stimulus they're going to be able to efficiently process.

**Tamra Mendelson** 16:39

Yes.

**Matthew Zipple** 16:40

And so I think that then that one prediction, right of this, this hypothesis, is that sexual displays should have similar spatial statistics to the environment in which that animal lives. Is that right?

**Tamra Mendelson** 16:53

Yes, that's, yep, that's the prediction.

**Matthew Zipple** 16:55

And so so it kind of spell out for us, like if we think about, take Fourier slopes as the example. It's something that's measuring the distribution of contrast at different frequencies in the environment. So how would you essentially articulate that that prediction?

**Tamra Mendelson** 17:09

So we know, for example, like let's talk about darters, and these, these fish that live in these different micro habitats, so some species live with big, big boulders. And then you got some species that live mostly in sand. And so their life is, is, full of like tiny little sand grains, right? So boulders, boulder scenes, and sand scenes have different Fourier slopes. The boulder scene has a very steep Fourier slope, and a sand scene has a shallower Fourier slope. And we can also measure the Fourier slope of the signals of the darters themselves. They have complex and interesting color patterns. And what we did find is that species that live in the big boulder habitats do have a steeper Fourier slope that their patterns do, as compared to the fish patterns that live in sand, so that there's a correlation between the value of their Fourier slope on the fish and the value of the Fourier slope in the habitat.

**Matthew Zipple** 18:12

Okay, so these darters experienced different environments, they've trained their neural models on particular spatial statistics that match their habitats. So their brains, in theory should be able to most efficiently encode stimuli that match those same spatial statistics as their habitats. And so what do you find?

**Tamra Mendelson** 18:31

Well, we haven't actually measured what their brains do, I should be right up, right up front with that. We have found a correlation between the patterns on the fish and the patterns of the habitat, which is what we predict from the processing bias. So we found that the Fourier slope of the male nuptial pattern is most similar to the Fourier slope of the habitat in which that species is mostly found. And, and we have five habitats that are sort of run the continuum between boulder and sand.

**Matthew Zipple** 19:07

And that's something you only see in the male darters. Right?

**Tamra Mendelson** 19:10

So far, that is what we've only seen in the males and not the females.

**Matthew Zipple** 19:16

My guess is that doesn't feel conclusive to you yet. So, so is that right? And what are the next steps to try to continue to test this hypothesis?

**Tamra Mendelson** 19:25

Yes, it's tantalizing. And we were excited to find it. But also it could be explained by camouflage. So they match their habitat, right? But we scratch our heads because but the females didn't. So if it's camouflage, why didn't the females match their habitat? Well, we have possibly, we measured these during the breeding season. And females during the breeding season, get real eggy. They get these swollen white bellies that are really high contrast, easy to see. Their lateral line, which is the line that goes down the long axis of the fish. It gets real dark. And right below that is this white shiny belly. And so it could be that during the breeding season, all bets are off in terms of camouflage, she just wants to find a mate, males want to find her. So being highly detectable and high contrast and standing out from your environment is fine. So what we do need to do next is measure females in the non breeding season, when they don't have these big white bellies to look at their patterns as they exist most of the time. Their breeding season is very short. It's about six weeks of the year. So what if it turns out that female patterns also match the Fourier slope of their scene? So that would actually be more evidence that this could be camouflage. But what we wonder is whether camouflage and sexual selection or mate attraction could actually work together, they could actually be aligned. So normally, we think that camouflage and mate attraction are working at opposite ends, where if you want to be attractive, you have to be really noticeable. But if you want to be camouflage, you have to be really unnoticeable. And so to be attractive, you really have to sacrifice and be noticeable to predators, too. But what if camouflage patterns are actually attractive, or if you can take a camouflage background pattern, and maybe put some bells and whistles on it, like color, and make yourself noticeable, but also have an easily decoded background pattern to that, then maybe that makes you ever that much more attractive than the other guy that you're competing with?

**Matthew Zipple** 21:28

Cool. So let's say that you're right, broadly, right? Let's say the choosing individuals look at their potential mates and they choose the one whose visual display is most efficiently processed. How much do you feel like that result would conflict with an adaptationist worldview? Because it seems like if you're right, then there's no need for visual display to actually indicate anything about an animal's quality.

**Tamra Mendelson** 21:55

So when you say adaptationist, you mean sort of the good genes, quality indicator kind of thing, right?

**Matthew Zipple** 22:00

Some kind of quality indicator, whether it be because they have good genes, because they developed in a good environment, but for whatever reason, they're a higher quality animal and there's, they're telling that to the choosing individual, right?

**Tamra Mendelson** 22:11

So there's a number of ways that they could work together. They're not mutually exclusive. I don't think. So one way that this could work is that yes, another mutation arises that makes an individual more efficiently processed, and lucky guy, you know, it's not that he's any better. It's not that he's any better at foraging, it's not that he's any fatter, it's not any better of a dad, he just happened to luck out on this mutation to be attractive, right. And so that's exploitative, that would not be beneficial, necessarily for a female, unless, you know, experiencing that pleasure has fitness consequences in and of itself. But let's say it doesn't, let's say it's just that she's duped into mating with this male that really won't give her any direct or indirect benefits. But over time, those can become linked, right? It could be that males that are attractive and have higher survival or any other sort of direct or indirect benefit for the female, are doubly successful. And their genes are increased in the next generation. So it could be that those become linked.

**Matthew Zipple** 23:17

And it would seem like a critical part of that linkage would be that the more efficiently processed stimuli would need to also, it would have to be more costly to produce an efficiently processed stimuli. Such that then you know, the males that have the most efficiently processed stimuli are also the most capable of bearing those costs. Does that seem likely to you?

**Tamra Mendelson** 23:39

Not necessarily, I guess, I, I could see how it makes sense. But I could also say that let's say this is free, let's say you've just got a free wrapper, that suddenly makes you more attractive. It, all else being equal, if it's free, then everyone can have it. So you still got to have something going for you that gives you higher mating success, either through direct or indirect benefits to the chooser. Right? So I don't know that necessarily has to be costly itself to become linked.

**Matthew Zipple** 24:11

Yeah, I think that if if it's free, or if population size is small enough effective population size, small enough that the cost is low enough that we can overcome it. And so this, is this what I've been struggling with, because, okay, because, because I think it's very possible that, that if what it really comes down to is efficient processing of stimuli, that in fact, there is no adaptive benefit for the chooser in the case of most signals that we see. Right, that there's no, there's no quality information, it's not necessary at least. And so then it's just not obvious that the efficiency of a signal is gonna predict the cost paid by the producer.

**Tamra Mendelson** 24:50

Right.

**Matthew Zipple** 24:51

And so when that, when you get that breakdown between attractiveness and costs, I think kind of the, what I'll call the adaptationist worldview. Sexual signals, I think at least has to take a backseat to the kind of updated sensory drive model that you're advocating for.

**Tamra Mendelson** 25:09

I'm comfortable with that. I'm comfortable with the adaptationist really taking a backseat. I, I really would like to think about how processing biases might play more of a role than quality indicators. I'm very comfortable exploring that.

**Matthew Zipple** 25:26

Great, cool, cool, cool. Me too. And you know, so like, it's, it's super different from where I started, you know, grad school like, because like, I think that an adaptationist worldview, assuming that if something is the way it is, it's because there's been selection on that particular trait to be that way, because it benefits somebody.

**Tamra Mendelson** 25:43

Right?

**Matthew Zipple** 25:44

I think that's so intuitive, right. But people have tried to warn us for decades, that's not always true. And it's easy to just brush it off. But I think that this has been, I mean, exploring this literature that you've written has really, I think, pushed me to reconsider whether something that seems like it must be adaptive really is.

**Tamra Mendelson** 26:02

Right. So that's when you get into what do we mean by adaptive? So I still think that there's a role for selection, because selection has shaped the brain, it just hasn't shaped the brain specifically, to respond to that signal. I mean, that signal has coopted the brain that has evolved for another reason. It's not that this is a selection free argument, say, selection is acting on the brain and changing brain properties. And then the indirect outcome of that is a preference for particular patterns.

**Matthew Zipple** 26:35

Right? So it's a very, it's a brain first view of the world.

**Tamra Mendelson** 26:39

Very much. So yes,

**Matthew Zipple** 26:40

Gotcha.

**Tamra Mendelson** 26:40

Yeah. Yeah.

**Matthew Zipple** 26:42

Is there any reason to think that the bias towards efficiently processed stimuli is limited to visual displays? Or? Or can we assume that if we look, the same framework will readily transfer to auditory or chemical stimuli?

**Tamra Mendelson** 26:54

Well, we have been thinking about that. And in principle, there's no reason I mean, at the, at the algorithmic level, this is just about information transfer, right. So it doesn't matter how you implement that. This is information that's being sent and received. But I've talked to acoustic biologists, I've talked to people who study olfaction, and to translate what we've been developing to these different modalities will take some work, I think, but in principle, there's no reason that it shouldn't transfer, that it shouldn't apply.

**Matthew Zipple** 27:25

Cool. I think let's leave it there for now. And we're gonna take a quick break, and then we'll shift gears to talk a bit about what drew you to animal behavior as well as a unique training program that you're working to implement at UMBC. But first, here's a two minute takeaway.

**Zeke Rowe** 27:40

Imagine for a moment that you've misplaced your keys in your bedroom and you're trying to find them. How easy this task will be will depend on how visually complex your room is. With an untidy and messy room making the keys a lot harder to find. Previous research has shown that such visual complexity can not only impede human search, but also the search of a range of non human animals. This leads to an interesting question, how does this affect alter the behavior and evolution of animals which wants to remain hidden? Hi, I'm Zeke Roe, and I'm a PhD student at the Vrije Universiteit Amsterdam. My goals as a researcher are to better understand how animals use coloration to remain concealed and to untangle the behavioral and evolutionary impacts this has on both predators and prey. The work I conducted for my Masters whilst I was at the University of Bristol attempted to look into visual complexity, and specifically how a greater complexity can aid camouflaged individuals to remain hidden. To do this, we designed artificial moths which varied in their camouflage efficiency, and placed over 2400 of these onto oak trees around the local woodland. We then monitored the daily bird predation levels, and compared this target mortality to the complexity of their immediate background using feature congestion. This is a metric based on the features from the early stages of visual processing, namely variation in luminance color and edge orientation. We saw from the target mortalities that just like you searching for your keys, birds struggled to find targets which had the greater background complexity as long as there was some background matching occurring between the target moth and the oak bark. We therefore concluded that complexity can mitigate less than perfect camouflage. This suggests that habitat choice with respect to complexity could be an effective means of changing the balance between salience for signaling and crypsis for remaining concealed. Additionally, perhaps visual complexity can play an important role in the evolution of camouflage in heterogeneous environments for the potential for a greater level of imperfect comfort large and complex scenes. If you're interested in following my research, you'll find me on Twitter @Zeke_Rowe_

**Matthew Zipple** 29:53

So now we're back. You're now a Professor at UMBC. And UMBC is a Minority Serving Institution. Can you tell us what a Minority Serving Institution is for anyone who's not familiar? And then, and then a bit about how that part of the University's mission influences the way that you do your work.

**Tamra Mendelson** 30:12

A Minority Serving Institution is an institution basically is designated based strictly on the numbers of different racial and ethnic groups represented by the student population. And so if you have a certain number, a certain percentage of underrepresented groups, then you are a Minority Serving Institution. And it is very much part and parcel of our mission, our mission is inclusive excellence. And I like to think a lot about making sure that our lab is inclusive and welcoming, and honors different backgrounds so that not everybody is going to think the same, not everybody's going to have the same questions. Not everybody's going to have the same goals. We're all valued.

**Matthew Zipple** 30:51

Cool. You're the lead PI on an NSF training grant that funds a program at UMBC, called ICARE. Tell us a bit about the mission of ICARE and what it is.

**Tamra Mendelson** 31:01

Yeah, so ICARE stands for the Interdisciplinary Consortium for Applied Research in the Environment. And it really started as a way for evolutionary biologists and ecologists at UMBC to spend more time together. And then we got this RRT. This NSF research training grant, which is a graduate training grant. The mission of that grant specifically, is to diversify the environmental workforce through community engaged research. So our model is that each trainee, these are Master students, are mentored by a UMBC faculty member, and a what we call a partner mentor, which is a professional scientist or engineer. And as part of that research team, then we also ask them to find a stakeholder a community stakeholder. So we work on that part of the Chesapeake Bay that is the Baltimore Harbor and the land surrounding that. And the stakeholder is involved in designing that research, potentially implementing that research so that the research that the students do really has impact, and they can see that impact. And then part of that model is nice, because then it networks, all our trainees with all different workforce sectors. Our mentors are taking inclusive mentoring training, to make sure that we are creating a space in which diverse voices and diverse backgrounds are welcomed, and accepted and feel, feel a sense of belonging.

**Matthew Zipple** 32:26

And has the program advanced or is the first cohort advanced to a point yet where there's an example of a student project that that you can share with us.

**Tamra Mendelson** 32:33

Sure. My own student, Darryl Acker-Carter is working on aquaculture in the, sort of the middle branch of the Baltimore Harbor. So he's doing work on figuring out whether this new solar powered oyster platform is a better way of farming oysters, oysters clean up the bay, they provide potential jobs, they provide things to eat. So he's helping work on the data necessary to determine whether this solar powered platform is going to be successful, and what ways to tweak it to make it better. Yeah.

**Matthew Zipple** 33:07

Super cool. So what, what made you decide to pour all this effort into building an applied science training program?

**Tamra Mendelson** 33:15

I don't really know. It just it almost feels like a calling. And the benefits, if we really succeed are so great, that it's so motivating that it just keeps me going. But then in the back of my mind, I'm like, But wait, I'm an evolutionary fish psychologist. What am I doing? What am I doing trying to solve environmental problems in Baltimore Harbor, but it feels good. So that's why I'm doing it.

**Matthew Zipple** 33:40

Well, I think for so many people that it would feel like an impossible barrier to get past. It's like, well, I'm an evolutionary fish psychologist, what do I know? But like, I think it's I think it's a real testament to kind of the way in which scientific training prepares us to do a lot of things, right. And like, we can really do things that we think are going to make the world a better place, if that's how we decide to allocate our time.

**Tamra Mendelson** 34:03

I think you're right, I think going through a PhD or going through a rigorous scientific training program does give you a lot of confidence, like I can solve problems. I, I'm resourceful. I'll figure this out.

**Matthew Zipple** 34:15

Well, I think the ICARE program that sounds really exciting, can't wait to see the research that comes out of it. I think it's just such a terrific innovation really, and an effort. So congratulations, and congratulations to all of the, all of the students. I'm sure it'll do a great job.

**Tamra Mendelson** 34:30

I'm sure they will do.

**Matthew Zipple** 34:31

Cool. Very cool. Yeah. And what are you what are you most excited about in the next five years in terms of your research or, or the field of animal behavior more broadly?

**Tamra Mendelson** 34:43

In terms of my research program that I have been traveling along, I'm very excited about thinking about how camouflage and sexual signaling work together. That's a, that's an open question to me that I'm very interested in. The other one I alluded to already where I'm interested in the difference between wanting and liking, taking more of a psychological approach to what I've been doing, and asking whether this idea of liking which is more related to aesthetics, perhaps, how that influences our wanting, which in what I say our I mean animals in general, wanting which would be more related to sexual attraction or sexual decision. So those I'm excited about. And then the third part of my research program is very much um, you know, we've had this, this female choice paradigm for a while. And you know, Darwin had a hard time introducing this female choice paradigm back in the late 1800s. Like, surely females don't care about anything. And if they did, it doesn't matter. So we had a hard time pushing that agenda. But we have embraced that agenda. And I'm wondering if maybe we've embraced that agenda, to the exclusion of trying to figure out what males want, and also pleiotropic traits between males and females in terms of their preferences. So I'm also very interested in how male brains and female brains differ and how they are the same in terms of a mating decision.

**Matthew Zipple** 36:09

All right, terrific. Tamra Mendelssohn. Thanks so much for taking the time.

**Tamra Mendelson** 36:14

Thank you.

**Matthew Zipple** 36:18

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.