Title: Bat Science Stories, More Than Dark Nights with Dr. Cylita Guy

Nerdin' About Podcast Transcript, Season 3 Episode 1

Michael
Hey everyone welcome to Nerdin About. I'm Space Michael, and with me as always to kick off Season 3 of this here podcast. That is Dr. Kaylee Byers. Can you believe we're in season 3? We're podcasters now Kaylee.

Kaylee
Indeed, I can because I have edited both of the previous seasons. So, I believe that we're here. I love that we're here. How are you feeling about the season 3 commencing?

Michael
I think now that we've actually reached this plateau if you want to call it that, season 3 feels like we are now in something, we should be learning something, this is now the third act. You know, something new is going to happen. We're going to have some revelations. I'm excited to find out what they are, because I don't know what they are yet.

Kaylee
Well, you know what, we are going to start strong for season 3 and we're going to set ourselves up for tons of revelations because today we are talking with Dr. Cylita Guy, and Dr. Guy is an ecologist, data scientist and science communicator who studies bats. Her first children's book, "Chasing Bats and Tracking Rats: Urban Ecology, Community Science and How We Share Our Cities" comes out this fall. Hi, Cylita, how are you doing?

Cylita
I'm doing great. How are both y'all?

Kaylee
Good I think, Michael, how are you doing?

Michael
Yeah, I'm doing great. I'm super stoked to learn about these flying creatures, which I did see some on my camping trip that I was just on last week. So excited to learn more.

Cylita
I always get so excited when I see bats in the wild. I remember three summers ago, I was hiking on the West Coast Trail, and I was so excited because there was a species of bat that lives in BC, their echolocation calls are low enough that you can hear them. I went on a trip without seeing them, and then the last night I was standing out looking over the ocean on the West Coast Trail, and this one long little bat flies across the water, and I'm like I wonder if it's a spotted bat, and then I hear its call and I freaked out! The entire campsite was like what's going on? I'm always down with people seeing bats in the wild.

Kaylee
Now that's very exciting. So just recently, I was out listening for bats at a local spot. We've been doing a bat study and we had one of those little echo locator sound meters.

Cylita
Acoustic detectors as we like to call them.

Kaylee
It was excellent. Is that what you had to listen to the spotted bat to know that it was a spotted bat?

Cylita
Well, I hypothesized it was a spotted bat, they're special in that they echolocate at high frequencies. Very similar to other species of bats that echolocate, but some of their calls do come into the human range, they echolocate this slightly lower frequency sometimes. It's a very distinct call, and I had prepared myself by listening to that ahead of time. That lower frequency is what I was hearing, and picking up on and getting excited about. Maybe it was all in my head. Maybe I was just tired from four days of hiking. I don't care, I choose to believe that it was a spotted bat, and it was the best day of my trip.

Kaylee
It was undoubtedly a spotted bat. I love so much that you prepared to go out to hear this by listening to their call in advance. That's like my whole birding experience, because I'm not very good at actually physically seeing birds, but the calls are something that I try to listen to in the city. Speaking of cities, you are an urban ecologist, you do urban ecology. Can you tell us a little bit about what urban ecology is?

Cylita
Yeah, I mean, urban ecology is really interesting, right? When we think of scientists who study nature, ecologists like myself, or, you know, like yourself, Dr. Byers, right? We often think of people going out into the wilderness to study wildlife in their natural habitat. But we forget over half of the world's population lives in a city. Cities take up a substantial part of our land area, and they're not devoid of nature, right? So, there's all this nature sitting here, and so urban ecology is the study of the nature that lives and thrives and sometimes doesn't thrive, alongside humans in our cities, in our sprawling urban landscapes, kind of that urban to farmland or rural divide.

Kaylee
I'd really love to know how you became interested in urban ecology, because for me coming to study rats was really that I was interested in understanding how humans' interface with wildlife, and what the consequences are for health, and cities because of what you just said, are a great place to study that, and rats are a great study organism. So how did you begin to be interested in urban ecology work?

Cylita
I feel like rats, studying bats lends itself to working at a human wildlife interface because lots of bats live in cities, and they're particularly good - what we would call pests. I don't like to think of them as pests, they're just trying to live their best life and make a home, but they do often get into people's houses. So, a lot of the time we think of them as pests and are trying to get them out. That being said, I didn't come to this world of urban ecology by choice, it was actually kind of by happenstance. I was in my PhD, and I really wanted to do a lot of theoretical work, a lot of machine learning, a lot of coding, and a lot of working with other people's data. One of my advisors at the time was like, "Well, I think that's bullshit. If you want to study bats, no person in

my lab will study bats without at least - You need to hold the bat, you need to understand them, and you need to work with them in the wild". So, he paired me up with a postdoc, and she developed all these questions around how urban bats used parks, and how we could use parks as a way to study their social structure. As science often goes, that project didn't work out, and so we pivoted it, we turned it into these more fundamental questions: How do bats in the city use this big, beautiful park or this big piece of green space? Are they using green spaces in the way that we think that they should be using green spaces? One thing led to another and next thing, you know, I'm spending two summers studying bats in Toronto's Hyde Park.

Kaylee
Well, that's the dream, you just accidentally come to being able to go out and wrangle bats.

Cylita
Well, I mean, it's the dream I didn't know I had.

Michael
So Cylita, I'm curious, because you talk about bats in cities, and when we talk about urban ecology and thinking of bats that live in cities, but I saw some bats out there in the deep of the woods. So, when you're studying bats that live in the cities, are you just specifically studying that particular type of species? Or are they connected? Are the bats that live in the deep forest connected to the ones that live in the cities?

Cylita
I mean, that's a great question. So, we were really focused on this urban population of bats that resided in this one particular public park. So, we were studying the big brown focused on one type of species of bat. We also went out and pulled data from across North America from other researchers who study bats in their native range. Now, big brown bats are a little funny in that they are almost so good at living alongside humans that we very rarely find them out in the wild in the middle of nowhere. They're definitely there, and they do use that space, but if there is a building available, they will be in that building, because it's nice, warm and dry. We actually found data from other researchers across North America to compare how things like body condition, weight, size, how many babies they're having, how that varies across this heavily urbanized landscape to more natural spaces. That being said there's also a connection in that the species of bats that we study, while they're kind of in the city for part of the year, they hibernate - well, we're not sure where they hibernate, but they likely hibernate outside the city in the forest out in the Scarborough regions, because they have very specific requirements for hibernating. They like caves at a specific temperature, and a specific humidity and so they actually will leave the city, all of our bats would disappear. You know, come September, we weren't catching anything, because they were off ready to have their fall swarming season, getting ready to move into their case for hibernation.

Michael
Could you get into how you actually work with the bats? Like when Kaylee gets in there, she's crawling around in the alleys of our city. When you're working with bats are you also getting into attics or, you know, scaling trees? Like how exactly are you working with bats?

Cylita
Yeah, so we did most of our catching using mist nets, which are these super fine fishing-like nets. We would set them up between two poles at night out in open spaces where we know

bats would probably be feeding. So, we were mostly working with them in open spaces. I will tell you I much rather would have gone into an attic and pulled them off of the walls, because it would have been so much faster, so much easier. There were lots of nights where we would sit in the dark set up like these massive nets and then be like, "Oh, well, I guess we caught another moth." Take that out for four hours and sit and twiddle my thumbs for the rest of the night, which is no fun. But when you do catch them, it is really exciting. Bats that we caught out in the park while they were out flying, feeding, you know, doing their bat thing, we put these tiny little radio transmitters on them. These radio transmitters, we can follow the signal in the landscape, and we would track them during the day to figure out where they go to sleep or where they were roosting. We were fortunate enough to find a very large roost in the chimney of an old house. My partner Dr. Krista Patriquin and I got up on the roof and we had this makeshift contraption called a roost trap, which she hung over the entrance to the roost, and as the bats would exit at night, they hit this trap and fell into a nice, beautiful pillowcase at the end. So that was another way that we caught them. We never actually had to get into a building, but that's another common way that scientists do it. You go into a cave, you go into a building, and you just pull them off the walls with a gloved hand.

Kaylee
What does a big roost look like? I've been going into some roost areas lately, and I don't really have a good sense. I mean, I know one of them is much bigger than the others. But what would you consider to be a large roost?

Cylita
So, I mean, this roost had, as my talented research assistant Joshua Hines estimated who stood underneath that roof several nights in a row, and counted how many bats he saw emerge.

Kaylee
Bless.

Cylita
I know, right? Got to give it to those research assistants. We estimated to be 75 to 80 individuals, which to me is a substantial roost. I mean, I have limited experience with bats in the field, but it can vary for species across the world. There roosts of some free-tail bats that can be millions of individuals like some of the densest mammalian aggregations on this planet. But then we also have some species of bats which are solitary. So, for most of the year, they hang out by themselves, and so there you have a roost of one. For some of our big browns, especially the males, we had a much harder time finding those roosts for those males, but when we did find them, it was one, maybe two coming out of that one structure versus this colony, with females and their pups worth, like 75 individuals.

Kaylee
Very cool. What a range. I mean, they're an incredibly diverse group of mammals.

Cylita
Over 1400 species, the second most species rich group of mammals. They live everywhere, except the High Arctic in the Antarctic. With that much geography covered, and that many species this is just such an amazing amount of diversity. It just is exciting. I love the little guys, little things.

Michael
So, 1400 different species of bats. I'm curious about how similar they all are and how different they all are? Because there's this preconceived notion that you're as blind as a bat. Is that true? Are bats actually blind? What are some of those things that we do know about bats, and some of the mysteries of bats that we don't know?

Cylita
Oh, get ready. We're going to debunk some serious bat myths here. So there definitely is similarity between species. I won't lie, here in North America, I catch a lot of bats, and I'm like, small brown bat, but not a little brown maybe an eastern myotis. Look, you have a tiny projection on the back of your foot, you're a small foot, and many of these species do look fairly similar. They have a similar ecological niche, or a kind of similar overlap in how they live their lives. But that being said, there can be a lot of diversity. There's a lot of difference in the group, especially as we get down into the tropical species, there's some wild variations there in physical form and function. Coming back to this idea, are bats blind? It's like the old saying "you're blind as a bat", not true. I think that old adage comes from the fact that a lot of species of bats echolocate, they're using these high frequency sounds to navigate their nocturnal environments, but the bats that echolocate can still see. Now I say that like with a little asterisk because there are some species that are my favorite species, the rhinolophids, the horseshoe bats. They've got these very large nose leaves. So, these like huge folds of skin on their face. They've got these tiny little eyes tucked behind these folds of skin. They can see, but probably not that well. Then you have our pteropodids, or our flying foxes. These are species of bats that have these large, brilliant, stunning eyes, and they actually don't have the ability to echolocate, they've never had it. These species rely only on their eyesight and their sense of smell to get around in the dark. So, there's a lot of differences in how bats navigate how they find their food, what they eat, a lot eat insects, some eat meat, some feed on nectar, some feed on fruit, there's a huge diversity in their diets as well.

Kaylee
Yeah, it's super awesome. Some are navigating caves, some are not. They're perched up in trees, so much variety.

Cylita
There's one species of bat that is known to excavate termite mounds, so sometimes active, often abandoned, they'll find a little hole, dig it out a bit more, and they'll roost up inside that termite mound. They also can make their own structures. There are tent roosting species of bats and they'll find these large leaves in the tropics. They'll chew along the centerpiece of the leaf so it folds over, makes a little tent, and then they'll have the roost up inside that tent for a couple of nights. Once it starts to wilt, they'll move on to the next leaf that they can find.

Kaylee
That is the cutest thing I've ever heard.

Cylita
The most adorable.

Kaylee
Are there any big questions that you're still really excited about when it comes to bats? I feel like with all that diversity, we must still be discovering things about them.

Cylita
Yeah, I mean, we're still discovering new species. There are over 1400 the last time I checked, to me, that's really exciting that we're still discovering new species. I think the piece that I often don't think about, or maybe I forget, is just because we found a new species doesn't mean that we know things about it. So, there's all this fundamental natural history, like what does it eat? Where does it live? What does it need to survive? How does it live its life? So many open questions about so many species of bats like that. As you can imagine that information is really important for their conservation and their protection. I just think there's so much awesome natural history work being done, and to be done. I also get really excited about the work that is done around their social systems. So, a lot of species have the same social dynamic that humans have. They get together in groups, they'll have some associations with some individuals, and then they'll go away, they'll associate with other individuals, or come back together. They'll do things like share food, and they've shown that they can transmit information. One individual can teach another individual of the same species, and of different species, information to access food and other resources in their environment. So, I think we have a lot to learn about their sociality and their social dynamics.

Kaylee
Oh, I never want to stop talking about bats. But, I would also like to talk a little bit about another aspect of your work, as you mentioned you got into bats, because you were interested in this aspect of data science, machine learning, and dealing with data. So, I'm really curious about how that work with bats, and that PhD work intersects with the work you're doing now, as a data scientist?

Cylita
I'm going to take that question all the way back to before I started my PhD. I was in my undergrad, I was wondering what I was going to do with my life, and I knew that I really liked doing research. I really like studying wildlife and ecology. As I thought about careers in ecology that I knew of at the time, which I won't lie, I didn't know very much. I was like, I don't really see myself doing something like this forever. So, my goal was really to acquire a set of skills that I could transfer, and so when I decided I was going to study bats, I wanted to study bats with a heavy math component. I want to use methods that rely on things like machine learning, and statistics and leverage big data where I get to learn how to code and maybe I get to do some heavy mathematical modeling. I think the thing that helped me transition into data science were a lot of the methods that I used in my PhD, the statistical analysis. I also did a chapter where I was using machine learning to predict which species of bats were likely to be undetected carriers of diseases that could jump into humans. We're kind of currently in the throes of COVID-19.

Kaylee
Oh, are we?

Cylita
Why we all at are home talking remotely? (Laughs) I was really focused on these zoonotic viruses emerging from bats, so I applied machine learning as an approach to try to help us develop more targeted surveillance. It was very hard for me to say "okay I'm going to take a break from ecology, and see if I can apply these skills somewhere else." But I will say it has been incredibly rewarding, because I realized at the end of the day, data is what gets me excited. If you give me an interesting question, it's a puzzle. That's how I think about data. Good

data collection is one thing, but if you're given this mass of data, which a lot of businesses have from their consumers, from people that they're trying to help give a service, to cities trying to plan. They're these masses of data that have stories in them, if analyzed properly, and appropriately. To me, it's a super fun challenge. Working in industry has just been so great, because I've taken some of those methods I've applied in my PhD, and I've just really gotten to accelerate my skill set. I've gotten to learn a lot more. I mean, it's funny, I would talk about how I looked at "big data" in my PhD and it's a tiny fraction of what I use today at my job. It's a completely different scale, a completely different set of questions, but I still get to be a scientist. I still get to ask questions. I get to come up with solutions to problems, and the thing that I think I was really missing in my grad school, and in my PhD, is I get to build, I work with software engineers, I work machine learning engineers, and we build a system that people in the business use. So having that ownership and that kind ability to architect and create is has been really, really exciting.

Michael
So Cylita you have just written your first children's book, it hasn't come out yet. You can pre-order it. We're going to get into that, we're going to give away the book at the end of the episode on social media, but tell us about this book. What inspired you to write it?

Cylita
I feel like as many budding science communicators, which I was during grad school, I really like the science, I want more people to like science, and I would really love to write a kid's book about it. But where do you start? How do you do that? I was very fortunate in year three of my PhD, I participated in this podcast called the Story Collider, some of your audience may or may not be familiar, where I got up on stage and told one of my favorite stories from the field. It got a lot of commendation and a lot of people enjoyed my story, and the way that I tell stories about science, and someone passed my name along to the publishers at Annick Press, and they were very much in need of people to write science stories. They really wanted to have books about science, nonfiction books about science for kids written by scientists themselves. So, we got together, we pitched a couple ideas, I proposed a book, and we ended up taking it in this totally different direction. Of course, the first book I proposed to them was all about bats. It was really focused on not so much cool facts about bats, which definitely exists in kids' books, it was more focused on how we scientists study bats in the urban landscape. The editors and the rest of the folks at Annick as they're reading this proposal said "this is really cool. But you can't be the only person who studies stuff in cities, right? This is what's really exciting. We want more of this." So, I went off, and I rejigged this proposal, and I did a bit more research and I realized that there was this gap where kids don't think about nature and their cities. A lot of people, a lot of adults don't think about nature in their cities. I thought this is the book that I want to write. I want children and parents and you know, people without kids who just happened to see it on the shelves. I want people to care about their urban nature enough to be invested in it, to learn its names and to notice it. For me, writing this book is one of the ways that I hope to accomplish that goal.

Michael
Yeah, so we should say, the books entitled "Chasing Bats and Tracking Rats: Urban Ecology, Community Science and How We Share Our Cities". Kaylee's already pre-ordered a bunch of them, and you can too. What are some of the stories that kids can read about in this book?

Cylita
Kids will get to hear from eight different scientists from across North America. I'm one, I talk about my most dangerous night in the field where somebody almost fell off a roof. We had our run-in with the police, all while studying bats. You also get to hear from Dr. Byers herself.

Kaylee
Wow, who would have guessed? (Laughs)

Cylita
Who knew!? They'll read all about urban rat trapping, and how that goes down, we'll hear about Harold, the first rat Kaylee ever caught and his sneaky evasive maneuvers. We also have a scientist who studies urban trees using a bicycle to collect information on them. So, we'll hear about some really innovative ways about the way that scientists collect data in the city. There's a researcher who studies coyotes, there's a story about him in there. There are bears, there's one woman who was studying bears in Northern Ontario. For a lot of people, when we think of cities, we think of places like Toronto, Vancouver, Los Angeles, New York. But we also have a researcher from Sudbury who was there at the time studying black bears, and how that is a very large type of wildlife that most people don't think about being in a city environment, but they live in a city. So, we've got a little bit of something for everyone. We also have one scientist who studies invertebrates in the middle of the winter in Toronto lakes and streams, which is pretty intense. You'll hear about a story where she almost falls into a raging river. So, there's lots of tension and drama, but also so much science, which is the most important part.

Michael
We should also mention that it's illustrated by Cornelia Li. So, it's got some really cool illustrations, cover looks amazing.

Cylita
I just want to give a shout out to Cornelia's work it's just so stunning. It's so brilliant. So, when I heard that she would be the one illustrating this book, it was amazing. She brings the scientists' stories to life in a way that I could never write them and so each chapter has a full-page illustration of each scientist in their natural habitat with their study organism. We're so close to being able to share some of this art on Twitter, and through some of the book readings that I'm about to do. She also illustrates a lot of the scientific equipment that each scientist is using. For me, that was really exciting, because I feel like a lot of children's STEM books are really good at giving the endpoints of knowledge. So here's all the stuff we know about the way the world works. But we don't always do a really great job as communicators helping people understand how scientists figure these things out. I think I'm really excited about this book, because it takes people through the process, it shows them some of the tools that scientists use. To me that's a really exciting piece of that learning as well.

Michael
Hold up. Are you saying that there's a picture of Kaylee in this book?

Cylita
Yes! In fact, if you take a look at the cover, Kaylee is on the cover with Harold in hand.

Kaylee
Most importantly, the rat van, forever, will live on the front of a book, the first time I saw that cover, I actually cried. I had so many emotions. It was like this little snippet of this life that I have lived and this work that I have done. Within the context of so many other stories, you have so many different scientists in here. They work on different systems. But you've also chosen to tell a diversity of stories. So how did you pick what stories to tell? Because of course, one scientist doesn't just have one story either, right? There are many stories as part of field work.

Cylita
Yeah, it was really hard. It was hard to narrow it down to a handful of scientists to include, so much so that I have to shine spotlights on other scientists across the world, like shout out to this person and this person, and this person, because there's just so many of you and your work is so cool. So, as I was choosing the main feature scientists, I was really focusing on trying to highlight diversity in all its forms. So, in types of study organisms, not just focusing on mammals and birds, which everybody loves, but don't worry, there are mammals and birds. Really focusing on species that are perceived as pests to shine them in this more positive light and help people understand that, yeah, sometimes it sucks when the trash panda tipped over your garbage can. But they're really important for ecosystems, this is part of city living. I also tried to include researchers whose perspectives go beyond what we consider to fall within the purview of Western science. So, one of the researchers in the book is Indigenous, and she talks about the way that she combines her traditional teachings that she's learned as part of her upbringing with the work that she does, as a scientist. We also have two scientists in the book who talk about how their work, and how the distribution of species in cities, how that has been influenced by racist practices, like redlining, literally drawing red boxes around to say, "Hey, if you're a person of colour, if you're Black, you're Brown, you can live here, but nowhere else." Those practices have shaped communities, and they shaped who has access to communities, and that's simply not right, it's not fair. That bias manifests in many ways, right? I also chose to include folks who use community data. So, what is traditionally known as citizen science, although this is a name that I'm glad that we're moving away from now referring to it as community science, to highlight for folks that you don't have to get a PhD to be a scientist, you don’t have to have an advanced degree, and that protection and ownership over our communities, and our local nature is something that we can all have the power to do, we can all contribute to that data collection, we can all ask our own questions, and then go out and pair with scientists to collect that data collected on our own is part of our community. So, I really want people who read this book to recognize how humans and wildlife are not separate, especially in cities and also feel that they are empowered to learn about that and change where they see and where they don't see nature in their cities.

Kaylee
I think this is why I'm so excited about this book. In science, we often see it as something that is independent of your identity, right? It's this objective thing that you do, it is unbiased. And science is such a part of your identity. It's how you create your questions. It's how you engage with the science. It's who you involve in the science as well. That's what I love so much about this book, because it tells you the science and it tells you the process of science and it integrates identity, and the importance of it and I think that I'm just really excited for kiddos and non-kiddos because I'll be giving this book to many non-kiddos, you included Michael.

Michael

One last question Cylita, what do you call a collection of bats?

Kaylee
A colony?

Michael
A colony? Do you know what you call a collection of nerds?

Kaylee
The nerd herd!

Michael
All right if you want to get in on the nerd herd, we post questions on our social media @NerdNiteYVR Twitter, Instagram and Facebook. Our first one comes in from Sandra who asks “Are bat scientists pissed off with the stigmatization with Dracula, or perhaps COVID?”

Cylita
Yeah, all the time. You know, when you really love someone, and they just start talking about these misconceptions. I feel it deep in my soul when people are like "bats are bad because they get stuck in your hair". No, they don't. "They're bad because they suck blood." Well, actually, only three species of bats do, and this is really unique. It's actually super cool if you think about the fact that they can get all of their nutrients just from blood. The association between bats and COVID I find frustrating to combat. In general, during my PhD I studied bats as carriers of sometimes species jumping viruses, and they get a really bad rap. When in reality, lots of other mammals, lots of birds, lots of our farm and domestic animals are capable of sharing infectious diseases with us, it's not just bats. Vilifying them as the primary source I don't think helps the problem because it often leads to these counterintuitive actions where people go into roosts and try to eliminate them. At the same time. I don't want to downplay the significance and the burden of bat borne diseases. I mean, in South America, rabies from vampire bats costs us non trivial amounts in livestock, and in treating humans who are potentially bitten by bats. The way that I view this problem is, we are infringing on the natural habitat of these animals. We need to do our best at these places where we're coming into conflict, to really use sound reasoning to promote the existence of these bats in their healthy existence, but also to minimize our impact on the landscape to make these transmission events less likely. Now, I want to say, I don't actually think I'm pissed off about the association with Dracula, because I think that's a really cool cultural association. When you look at old vampire legends, the component of transforming into a bat is not something that you see, that was actually an addition by Bram Stoker when he wrote Dracula, and it's since been co-opted into many different vampire legends and myths. So, to me that's a really cool and interesting connection. I also really liked Van Helsing, I'm a sucker for Hugh Jackman, one of my favorite movies of all time.

Michael
The brand new Castlevania show that’s on Netflix too, three seasons, amazing. If you haven't seen it, I played the video game a lot when I was a kid, but the animation is very cool.

Cylita
Great, I'll put that on our watch list.

Kaylee

I like that you highlighted something in there too about the bats as carriers for disease and then our interest in killing them. Because that's something that I deal with rats all the time. It's like just kill all the rats because they're disease causing. There are studies in rats that we've done, and there are studies in bats that show that if you go in and you just start killing bats, it actually increases disease in people. In some cases, you disrupt them, right? Again, you're just disrupting them some more.

Cylita
You're also stressing them, right? We've worked to show that when we stress out animals, they have a weakened immune response. So, it makes it more likely that if they are carrying infection, it can emerge with resurgence, and it's more likely that it be transmitted, it's more likely that they infect another individual in the colony. These things that we think is going to fix the problem has these knock-on consequences that can actually make it much worse.

Kaylee
Yeah, totally. So, let's maybe move away from this super culling mentality. Second question. We have one more question from the nerd herd. This one's from Kyle who asks “Did bats always have echolocation?”

Cylita
This is such an interesting question. I actually had to read up on it, because I feel like throughout my PhD it changed, it changed with kind of each piece of information that was added. So, there are two hypotheses out there, there was this kind of ancestral species of bat from which all bats are progenitors and the thought was this kind of ancestral species evolved the ability to echolocate, and then our pteropodids are species of bats that don't echolocate lost it at some point. So that's kind of one line of thinking. The other line of thinking is that when bats first started, they didn't have this ability, and then as they evolved and diverged, some of the groups independently evolved the ability to echolocate, and these pteropodids just never had it, they actually had the ancestral form. The latest paper on all of this suggests that it is that second hypothesis that the groups that can echolocate evolved independently, and the pteropodids matched that ancestral form, and have not had that ability to echolocate. So, I think to answer the question, no they've not always had the ability, some of them gained it at a later time.

Michael
Sweet. Should we nerd out some more?

Kaylee
Oh, yes, please.

Michael
If you want to get in on the nerd outs, you can tweet at us. You can Instagram us. You can Facebook us @NerdNiteYVR on all of those platforms. Our first one comes in from Erin who is nerding out about volcanoes. Cylita do bats congregate around volcanoes or do they avoid those types of hot places?

Cylita
Bats and volcanoes, y'all really put me on the spot here? Both volcanoes and bats are found in tropical equatorial regions. One spews fire and brimstone, as far as I know, there are no species

of bats that breathe fire, and although I think it would be really rad if they did. A tenuous connection at best, but it is a connection.

Michael
Wonderful. Cylita I'm really curious to learn about what you are nerding out about?

Cylita
Yes. So, cicadas, but there's a little bit of a backstory here. So, my partner has a three almost four-year-old son, and he is obsessed with insects, right? Like most kids, they go through that dinosaur phase. He was like dinosaurs, they're extinct. Give me the insects. We've recently been very fortunate to move to a house here in Toronto that has a wonderful yard. So, he's been digging up all sorts of things. His favorite thing are earthworms, but while we were cleaning out weeds in the early spring, a couple times we unearthed these cicada larvae. Still underground in its tiny little burrow, feeding on the fluids from tree roots. We buried them, and so he's been waiting all spring and all summer to see one of these things. We showed him pictures but it's not really registering, he's like “okay, you're telling me this thing is going to become this other thing”. Now here in Ontario, the dog-day cicada is the species that we have here, and those larvae are starting to crawl up or actually I should say those nymphs. This is a learning process, I studied mammals, and I know nothing about insects. These nymphs are now emerging from the ground, they're digging out. They're crawling up trees, and they're undergoing their final molt, where they emerge as the adult with those wings, the males then quickly go off to mate as quickly as they can, and then they'll die. The females will hang around for a little bit longer, enough time to lay their eggs, which I learned that they lay their eggs in a tree canopy, and then the eggs will hatch and fall down, and those larvae will burry into the ground, find a tree root where they'll go through this process of developing again. This is the regular species that we have here in Ontario, but cicadas have been in the news very recently because all across eastern North America, primarily in the United States, we had the emergence of Brood X, this periodic 17 years spent developing and then emerges in this huge flurry of cicadas, they recently underwent their emergence, which I think is pretty cool. So, I'm still nerding out about cicadas because I will confess, he asks a lot of really good questions, and I'm like "Buddy, that's a great question. I don't know what they eat, I think they eat leaves," and I was like, "Oh crap, they don't eat leaves." They feed on sap from tree roots, mind blown. It's like, what are these appendages? He's very fascinated with their butts?

Kaylee
Why wouldn't you be? (Laughs)

Cylita
So now we are on this mission to find a freshly emerged cicada for him to see. The reason that we have all these questions is our property is now littered with cicada exoskeletons from that final molt stage. So, we haven't seen a live adult, we've heard them. The male's make that distinct, loud noise that we often associate with summer, that heavy buzzing. We found lots of these exoskeletons and he's actually collected them from the front yard and they're now in a Tupperware, and he is very set on finding them all. It's like Pokémon, but only with one species, and it's only cicadas.

Kaylee
Real life Pokémon way better.

Cylita

We're down with it. This is not a bad thing.

Kaylee
I love this for you so much. Oh, that's great. Michael, what about you? Have you noticed any insect exoskeletons? Do you collect them? Do you do real life Pokémon? What's up for you? What do you been nerding about?

Michael
Well, interesting enough. I'm not really familiar with cicadas, I'm a West Coast kid. Like I mentioned last season nerding out about Neon Genesis Evangelion. If anyone's watched that anime from the 90s the soundtrack has this cicada sound. I didn't know what it was until somebody told me from the East Coast that's the cicadas. That's just what all summer sounds like. It's very eerie for anyone that knows that show, very ominous. So, I think I'm maybe a little bit afraid of cicadas now. But I am nerding out about something that I have some conflicting emotions about, and that's billionaires in space. Okay, so we're recording this in July 2021, where we saw Richard Branson, Jeff Bezos, both physically take their tourist trips into space. Now I got called recently to be on CBC to be part of their live coverage of Virgin Galactic taking Branson on a sub orbital flight, and here is where the conflicting emotions come in. So, I'm stoked to be able to give my perspective on space travel on national television, but a billionaire doing a flight that NASA astronauts have done hundreds of times back in the 60s. Like, who cares? Why is this news? So, I'm doing research on the flight, and the one thing that I actually am interested in is this little fight that Branson and Bezos have, because they don't like each other, and that's how high you have to go until you are officially in space. So Virgin is going 80 kilometers up, but Blue Origin is going over 100 kilometers, which is where this artificial traditional border of space is, it's called the Karman Line. When it comes to where space is, once the orbital dynamics of the Earth take over with aerodynamics. So essentially, you're a spaceship, rather than a plane using air to float. But if you can see the curvature of the earth, I'm pretty sure you can say that you're in space. So, if you're taking a Virgin flight, and worried about not being in space, don't worry you'll be in space. The main balancing act that I've been going through recently is through these interviews is that I still have to be enthusiastic for the future of space travel, which is going to allow regular people eventually to go into space, even for a short trip.

Cylita
Do people with copious amounts of money to spend only on a trip to space qualify as regular?

Michael
Well, when I say eventually, I mean, not in our lifetime, but you know, like maybe like 50 to 100 years, we can say, people can maybe do this on a vacation. Yes, regular people in quotation marks, and right now being excited for billionaires to do this seems wrong, you know, during a pandemic, and it's exposing all of the inequities of the world, but we live in this capitalist society, which is not going to go anywhere, anytime soon. So as a space science communicator, I'm grappling with how to communicate this. I'm thinking could billionaires seeing the Earth from space eventually help in some way? Could "regular people", maybe 100 years from now see Earth from space, could that lead to a greater universal look at our planet as a unique world to protect? I don't know, it's something that I need to think deeper on, because space science communication, which is what I do, is no longer just coming from government space agencies. Those are places that are typically neutral, they're bipartisan groups, generally around the world, but private, huge corporations that are in the space game, and that means I have to talk about them. So maybe it's an opportunity to also raise questions of humans in space, and

perhaps not only thinking about what we're doing there, but what we're doing here on Earth. So, lots of conflicting emotions on my nerd out. Kaylee, what are you nerding about?

Kaylee
I've actually been nerding out about, well, right now I'm taking a French course through Explore Canada. So, if you're within one year of school, you can apply to the Explorer program. I think you can still apply if you're outside of school, I was right within the one year out of the PhD deadline. In years past you would go and do a French immersion experience. You'd stay with a family; you'd go do five weeks of coursework. In this version, it's virtual and it was great opportunity for me. I work a full-time job and I am specifically in a course that's in Quebec and I'm learning about some history of Quebec. I'm in a special group on learning about legends of Quebec all very religious, or at least the older ones very religious, but I've been really enjoying it, I'm learning so much. For example, I texted this to Cylita the other day, because I learned that the French term for bat is “chauve souris”. Cylita what is the exact definition of chauve souris?

Cylita
I think it's like flying mouse or flying mouse with wings.

Kaylee
It's very close. It is bald mouse, and what I love about that so much, is one, not mice, not related, very distant. That's a huge misconception, right? Not the same. Also, not bald, like I actually don't know of any species that are bald. I'm very excited to be corrected.

Cylita
So actually, I want to jump in there really quick because there is at least one species of hairless bat that it's almost completely naked. So, it's the naked Bulldog bat found in certain parts of Southeast Asia, like Malaysia and Borneo.

Kaylee
I love this so much. So out there, there is one species of bat that we could call chauve souris, the rest of them not accurate. I've really enjoyed it. I've been learning about how to conjugate my verbs and recognizing that holy smokes, I don't even know really how to do that in English. So, it's been a great learning experience. I've really been enjoying it, and I look forward to maybe getting to an intermediate level at some point. So that's what I've been nerding out about.

Michael
Well, thank you so much Cylita for joining us on our first episode of season three. If people want to learn more about you and preorder the book, which once again is titled “Chasing Bats, Tracking Rats: Urban Ecology, Community Science and How We Share Our Cities”. When can people do that?

Cylita
You can hit me up on social media, I'm on Twitter and Instagram @CylitaGuy. I also have this lovely website that I built for myself, www.cylitaguy.com that contains a link where you can preorder my book, but while you can go to Amazon or you can go to Indigo, or you can go directly to Annick to order it. Please support your local bookstore, find a local bookstore. Be like Kaylee, ask them to order that book in for you, and keep your local folks some business too.

Michael

Yeah, Bezos doesn't need the money. He's going to space.

Cylita
Yeah, exactly. That's the one thing I took from your nerd out.

Kaylee
Thank you so much Cylita for being here. This was so much fun. I learned so much about bats.

Cylita
Thank you for having me here and letting me just spew facts about bats.

Kaylee
Our absolute pleasure. We hope that you listening had a great time learning a lot about bats, too. If you want to hear more from us, you can follow us on our socials @NerdNiteYVR on Twitter, Instagram, and Facebook. We'll be back in a couple of weeks. But until we meet again, keep your eyes on the skies to spot your local bat friends.

Transcribed in part by otter.ai