CONVERSATIONS WITH SCIENTISTS

Krista J. Patriquin: Batty About Bats

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Krista J. Patriquin is a postdoctoral fellow in biology at the University of Toronto Mississauga (UTM) in Ontario, Canada. A Canadian native, Patriquin earned a bachelor's degree in biology from Mount Allison University in Sackville, New Brunswick in 1997, received a master's degree in ecology from the University of Calgary in Alberta in 2001, and completed a Ph.D. in biology at Dalhousie University in Halifax, Nova Scotia in 2012. Prior to joining UTM in 2015, Patriquin was an environmental consultant for the energy industry and a teaching assistant at Dalhousie and at Mount Saint Vincent University, also in Halifax.

Patriquin's research focuses on the behavioral ecology and conservation biology of bats. She is seeking "to understand why animals behave the way they do by examining how their behavior allows them to survive and reproduce and how changes in their environment affect their behavior." The topics she studies include "mating behavior, feeding behavior, social behavior, and genetic relatedness." Her goal is to apply her findings "to protect animal populations and their habitat" by using "a combination of field observations, experimental studies, genetic analyses, and quantitative analyses."

Below are Krista Patriquin's May 23, 2018 responses to questions posed to her by Today's Science*. Some of the questions deal with how she became interested in science and began her career in animal behavior, while others address particular issues raised by the research discussed in Bat-elicious: The Rewards of Spying.*

Q. When did you realize you wanted to become a scientist?

A. I have always loved animals and I especially loved watching nature shows. I knew since I was a young child that I wanted to somehow do things similar to what I saw on these shows. At that time, scientist wasn't a common career for women, so I was always encouraged to become a veterinarian. But I knew I wanted to work with wild animals, not people's pets. I went into university with plans to take biology, still unsure what I would do with that. It wasn't until I started my honor's research project on

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mating behavior in sticklebacks that I realized I could become a scientist and actually get paid to learn about animals and their behavior!!

Q. How did you choose your field?

A. When I entered university, I thought I wanted to specialize in zoology. But as I finished my various biology courses, I quickly realized my true passion is animal behavior and how different behaviors help animals survive and reproduce in different environments.

Q. Are there particular scientists, whether you know them in person or not, that you find inspiring?

A. [Charles] Darwin is someone who has been inspirational—his evolutionary theories form the very basis of all the work I, and many biologists, do today. I am also envious of the time he spent traveling and documenting the plants and animals he saw. I'm also very much interested in conservation, and so I am very inspired by the science communication and advocacy work that [Canadian broadcaster] David Suzuki has been doing.

Q. What do you think is the biggest misconception about your profession?

A. I think the biggest misconception is that science is for men (and that all scientists work in labs wearing lab coats). When I was younger and completed aptitude tests to figure out what I was best suited for, I always got "farmer" because it was the only acceptable career for a girl who liked nature. This perception is gradually changing, but I think it still prevents girls from going into STEM [science, technology, engineering and math]. This perception isn't helped by the fact that as you go up the ranks, you see fewer and fewer women. This needs to change.

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As for my work studying bat ecology, behavior and conservation, I think most people assume I spend my time in caves, and that I worry about things like bats giving me rabies and getting caught in my hair. Although some tropical bats do live in caves and others hibernate in caves for the winter, most bats actually live in trees. As for rabies, sure some bats have rabies. But, in reality, the percentage of bats that have rabies in a population is actually much lower than what is seen in animals like raccoons and skunks. I think one of the reasons most people think rabies is so common in bats is the fact that most people aren't lucky enough to cross paths with healthy bats, so they don't realize there are millions out there that are not sick—they

only know about the sick ones they encounter. And the hair thing, well, I remind people that many bats can detect something the size of a mosquito with their "sonar" (echolocation) so I very much doubt they would get caught in your hair. I think this misconception comes from the fact that bats are attracted to insects that are swarming around our heads. Bats will come incredibly close, but in the 20 years I've spent trying very hard to catch them, I've never had one hit me or get caught in my hair. I always joke that, if this was possible, I'd have the biggest hair imaginable.

Q. Are fringe-lipped bats particularly good at learning, compared to other bats? Are there any reasons why this species should be able to learn from heterospecifics?

Merlin D. Tutle/Bat Conservation International

"I think that there are likely some bats that are better at learning from others and some that are better at figuring things out for themselves. It all boils down to what they eat, where they eat, how they find their food, and who they live with."

A. With more than 1,300 species of bats, and so few experiments on learning in bats, it's difficult to give a concrete answer to this question because so little is known. I'm actually working on a review paper right now addressing this very question. I think that there are likely some bats that are better at learning from others and some that are better at figuring things out for themselves. It all boils down to what they eat, where they eat, how they find their food, and who they live with. Fringe-lipped bats are truly amazing bats in many ways, but I don't believe they are "special" when it comes to learning, or to learning from other species. I think we just need to know the right ways to test this in other species.

Q. Learning seems related to culture. Are there any kinds of knowledge that certain populations of fringe-lipped bats pass down, in a way distinct from what might be considered instinctual?

A. Learning is absolutely related to culture! Without learning, there would be no culture. Culture in bats is something that hasn't been properly studied yet, and something I'm very much interested in. At this time, we don't know if different groups of fringe-lipped bats pass down knowledge to other group members. We (and by this I mean the greater scientific community) do know that in some other bat species, one social group sounds different from a neighboring group, just like people from different parts of Canada or the U.S., or abroad, sound different from each other. And we know that these differences are passed down from one bat to the next through learning, not through genetic inheritance. So I believe bats do have culture.

Q. Is there any way in which reliance on echolocation, as opposed to vision, might affect how or how well an animal learns?

A. I have to admit that I don't know the answer to this offhand. It would depend a lot on the animal you're talking about, as well as what they are learning. I could see how sound would be especially helpful for learning because it can travel over greater distances than visual cues. Although bats see quite well (despite the common myth that bats are blind), flying at night means sound is much more reliable. For predatory bats, when it comes to figuring out what food to eat, I would think it would be easier for a nearby observer to make a connection between what was just eaten and the sound it made before being caught, compared to what it looked like. But for fruit- and nectar-eating bats, I think smell would be far more important than sound. Of course, it's important to point out that there is an entire group of bats that cannot echolocate—these are commonly known as the flying foxes. It would be interesting to compare learning in bats using sound vs. vision.

Q. Are you particularly interested in bats? Where did the idea for this study come from?

A. I didn't start off being interested in bats—in fact I always wanted to study cats, which is why I joke that one day I'll work my way up the alphabet from bats to cats. It was a happy accident that I started working with bats—after I finished my Bachelor of Science degree, I wanted to go on to do my Master of Science. I knew I wanted to continue studying animal behavior, but I wanted my work to also have a conservation application. I started writing various professors at universities across Canada, and was accepted into the lab of Dr. Robert Barclay in Calgary to study the effects of forest harvesting on the feeding behavior of bats. Bats are very interesting animals to work with because they fly at night, most use echolocation, and they are poorly understood, and often incredibly misunderstood by the public. It's because of these reasons that I have now been studying bats for 20 years!

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The idea for this particular study on learning in bats came from a three-way conversation between my adviser at STRI [Smithsonian Tropical Research Institute], Dr. Rachel Page; my postdoc adviser at UTM, Dr. John Ratcliffe; and myself. The beauty of science is that "the more you know, the more you know you don't know." In other words, we knew from Rachel's earlier work, as well as from work done by others in her lab, that these bats could learn new tricks from each other. But what we didn't know, but thought was likely possible, is that they could also learn from a different species that feeds in the same area using the same feeding strategy.

Q. Where do you spend most of your workday? Who are the people you work with?

A. When I'm collecting data, my "workday" is mostly at night in forests, prairies or urban parks. Or, as in this most recent study, I spent my nights in a room doing experiments with bats. When data collection is done, I spend my workday at my desk, either in my office on campus, at home, or in a coffee shop.

Q. What do you find most rewarding about your job? What do you find most challenging about your job?

A. There are so many things that are rewarding about my job—I get to learn new things every day and I get to share these things with all sorts of people. To learn, I get to travel and I get to work outside to study bats. I also get to travel to conferences where I listen to talks from experts from all over the world. I share what I learn with friends and family, but also, as an instructor, I share the world of science with university students. As a science communicator, I share the world of bats, science, and conservation with people of all ages through visits to school classes, science centers, and nature centers. I also use social media, like Twitter, to share interesting science stories. And, of course, I have been talking to different news and science media about my latest work. I'm very grateful people have taken an interest in this work and hope it helps more people see that bats are truly amazing and shouldn't be feared but instead respected.

As for the most challenging aspect of my job, you have to be very self-motivated. This hasn't been much of a problem for me, thankfully. But for people who are very task-oriented, working as a scientist in a university would not be for them.

Q. What has been the most exciting development in your field in the last 20 years? What do you think will be the most exciting development in your field in the next 20 years?

A. There have been an amazing number of developments in my field. It was only in the 1970s that bat detectors were first developed, allowing us to study bats. Since then, they have gone from something that very few people could afford, and that were very large and cumbersome, to something most anyone can buy and plug into their phones! The most recent thing that I think is a real game changer is the development of on-board detectors and proximity sensors. These tags are mounted to bats and record all of the sounds they make while feeding, while interacting with others in their roosts, and so on. And the proximity tags monitor who comes into contact with whom while out feeding or in the roost. This will help us understand more about the social lives of bats, and how they perceive their world.

Q. How does the research in your field affect our daily lives?

A. Bats play a vital role in our ecosystem—some eat lots of insects, including crop pests; nectar-feeding bats are major pollinators of crops; and fruit-eating bats are important for seed dispersal. Unfortunately, a lot of the world's bats are in decline because of climate change, habitat loss, and persecution. So, understanding how they cope with change is important to helping them thrive.

Q. For young people interested in pursuing a career in science, what are some helpful things to do in school? What are some helpful things to do outside of school?

A. In school, obviously take all the science courses you can AND writing courses too. Writing is a BIG part of basically any job as a scientist. As for the science side, you may be surprised by what you might be good at and what you might find interesting, but you won't know until you try. And for the things you may not be good at right away, work hard to get better at them. You never know what science skills you may need down the road. For

example, I have always struggled with math and somehow thought I wouldn't need to do much math to study animal behavior. Was I wrong! In my view, animal behavior and ecology, the two things I love, are some of the most math-intensive areas of biology out there. To this day I wish I had paid better attention to my math courses. Even more, I wish I had asked for help. I thought that it was all up to me to figure it out, and if I couldn't, then I must be too stupid. It wasn't until the last year of my BSc that I realized many of the A students were getting help from their instructors, friends, and tutors. So, don't be afraid to ask for help! BUT–make sure you try to find the answers on your own first–the biggest skill you need as a scientist, and in life, is to be able to problem solve.

As for what to do out of school, join clubs or science centers, watch science shows, read interesting books, talk to scientists—you'd be surprised how many of us are excited to talk to you about what we do! Depending on your age, you could also look for volunteer or paid opportunities to help others do science. Be open to new opportunities and ask lots of questions—and try to find answers to these questions.