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CONVERSATION

# Early-career researchers: an interview with Sharlene Santana

Sharlene Santana is an Associate Professor at the University of Washington, USA, where she studies the relationships between morphology, function, behaviour and ecology in bats and other mammals. She is also the Curator of Mammals at the Burke Museum of Natural History and Culture. She received her Licenciatura in Biology from the Universidad de Los Andes, Venezuela, in 2004 before completing her PhD in Organismic and Evolutionary Biology in 2010 at the University of Massachusetts, Amherst, USA, with Betsy Dumont. Santana then completed a postdoctoral fellowship with Michael Alfaro at the Institute for Society and Genetics, the University of California, Los Angeles, USA.

**Can you tell us about your childhood?**

I grew up in Venezuela, in South America, in a city located in the east of the country called Maturín. I was an only child and my parents divorced when I was very little, so I grew up with my mum's side of the family, including my grandma and a couple of aunts. Though we lived in the city, we had a large backyard with many fruit trees, and I spent a lot of my free time observing the wild animals that visited us. My mum was a pharmacist and I helped in her pharmacy during my childhood, learning the names of chemicals and drugs. Perhaps because of this, biology and other sciences were my favourite subjects in school. However, I didn't have a good grasp of what being a scientist was like, or what I had to do to become a scientist. Even though my mum went to college, I didn't have any scientist role models or friends to help me. In my last year of high school, I had to decide about going to college and the career that I wanted to pursue. Luckily, I had a really cool biology professor, Luis López, who helped me figure out that going into science was the right path to develop my interests.

**How much of an influence was your mum in your career choice?**

My family benefited tremendously from free higher education in Venezuela, so my mum and her siblings were able to attend public universities. That was a huge advantage for me, because I didn't have to struggle with the challenges of being a first-generation student. I think some people expected me to become a pharmacist, because my mum owned her own business, but I wasn't interested in pharmacology and she had a lot of managerial responsibilities that I didn't like. Also, when I was growing up, the economy in Venezuela began getting worse, so it became harder for people to keep their businesses. However, my mum always encouraged me to be independent and to pursue my interests, which really helped.

**How did you decide which university to go to?**

When I went to college, there were three leading options for studying biology in Venezuela. The top biology department was in the capital, Caracas. However, I didn't want to live there, because it's a very large and stressful city. So, I went to the other side of the country to the Universidad de Los Andes (ULA) in Mérida. Back then, Mérida was such a beautiful and vibrant city; it was once called 'a University with a city inside'. The Biology Department was excellent and the campus was surrounded by mountains covered in cloud forest. Attending ULA ended up being a great decision for my career.

**Can you tell us about your undergraduate education?**

Undergraduate education in Venezuela is quite different from that in the US. The degree is five years; you have to do a thesis that is around the level of a Master's thesis in the US and the curriculum is very structured. There were a lot of mandatory science classes and we didn't get to take non-science elective classes like undergraduates in the US. When I started college, I thought that I would focus on genetics for my research and spend all of my time inside a lab. However, taking an animal biology class during my third semester had a big impact on me, because it exposed me to comparisons of form and function across animals from an evolutionary perspective, which is a theme that defines my research now. Later on, I took plant ecology, which was my first field-intensive class. Every week we went to a different site – forest, desert, alpine tundra – and collected morphological and physiological measurements from plants. That class really transformed my career path, because I realized that I loved working in the field and studying live organisms in their environments.

Towards my final year, I was trying to figure out what I wanted to do my thesis on and eventually started hanging out in the lab of

Sharlene Santana works in the Biology Department, Life Sciences Building, Box 351800, Seattle, WA 98195-1800, USA.
E-mail: ssantana@uw.edu

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Jesús Molinari, one of my animal biology professors. His lab studies bat ecology and taxonomy, and training with him was transformative. The more I learned about bats by reading the literature and going to the field, the more I was blown away by how diverse they are and by how little is known about many important aspects of their behaviour, ecology and evolution. I ended up doing my undergraduate thesis in his lab, focusing on the feeding behaviour of a species of fruit bat. Having the opportunity to do my own independent research was another turning point in my education; it helped me identify a group of organisms that was really good for answering the type of research questions that I am interested in and it gave me the motivation to pursue a PhD.

## Undergraduate education in Venezuela is quite different from that in the US

**How did you decide where to go for your PhD?**

I was looking at several labs within the field of ecomorphology and my potential advisors were authors of papers that had been influential in my undergraduate research. I was especially interested in Betsy Dumont's lab at the University of Massachusetts, Amherst, USA. Betsy's lab was integrating information about bat feeding behaviour to understand the evolution of skull morphology and she was starting to use cutting-edge tools from engineering to do that. I contacted her with an extremely long description of the research I was doing – I now realize that it was a really long email. We established communication and discussed my interests before she gave me the green light to apply for the grad school programme in her lab. The application involved writing research and personal statements, and taking standard tests such as the Graduate Record Examination and the Test of English as a Foreign Language. After I got accepted into the programme, I had to apply for a student visa, which was pretty nerve-wracking and expensive. In hindsight, perhaps I didn't need to be so nervous, because the university provided forms that stated that I had funding for the duration of my PhD. However, the political situation in Venezuela was getting increasingly complicated and it was becoming harder to get US visas. I had to travel to the US embassy in Caracas and be there before 6 a.m. for the visa interview, because the lines were so long.

## I had to apply for a student visa, which was pretty nerve-wracking

**At what point did you begin to think about the next stage after your PhD?**

I knew from the beginning of my PhD that I wanted to continue in academia, but I was not sure where I would develop my career, partially because of the situation in Venezuela. When I started my PhD, I intended to go back and become a professor there, but two major things happened. First, the situation in Venezuela deteriorated drastically, so returning and being a successful scientist there was not a viable option. Second, I realized that it would not be possible to have the cutting-edge tools and research infrastructure that I had gotten used to during my training in the US; if I returned to Venezuela, I would have had to change my research programme drastically. I applied for several postdoctoral fellowships and positions in the US and other countries and I got a two-year fellowship from the Institute for Society and Genetics, in the University of California, Los Angeles (UCLA), USA, which gave me a lot of academic freedom. My sponsor was Michael Alfaro, whose lab works primarily on fish and phylogenetic comparative methods. This was a great fit for me because I wanted to learn more about quantitative tools and phylogenetic comparative analyses. I worked on the evolution of primate facial coloration during my postdoc, which falls under the theme of how anatomy evolves, but helped me expand the breadth of my research.

**When did you begin looking for faculty positions?**

At the end of my first year at UCLA, I started applying for other postdoctoral research jobs and faculty positions. I can't remember exactly how many faculty positions I applied for, but it was definitely dozens. The University of Washington (UW), USA, where I have my job right now, was at the top of my list. My husband, Joe, grew up in Washington State, so there was the draw of having family nearby and staying on the west coast. I interviewed at UW first and had an offer from them before I went out for other interviews, which was really wild. I still went to a couple more interviews, in part because I wanted to learn about institutions that were not primary research universities. I also got a lot of rejections and there were many places that I never heard back from. The move to Seattle also worked well for Joe. He was not interested in a faculty position; he's a fish ecologist, primarily interested in applied research. We were able to negotiate a research associate position for him in the School of Aquatic and Fisheries Sciences, which allowed him to expand his research, make professional connections and ultimately land the federal job that he wanted.

**How did you become the Curator of Mammals at the Burke Museum?**

During my interview, the Biology Department chair asked if I would be interested in curatorial work because the former curator had retired several years before. That meant that there was an opening to negotiate for the mammal curator position when I got my job offer from UW. I was thrilled to become a curator because my research relies heavily on museum collections and I am interested in connecting the public with scientific research. My position is split 50/50 between the Biology Department and the museum, which is typical for most curators. The museum is not only part of the University of Washington, but it's also the Washington State Natural History and Culture Museum. That means we have academic links and serve an important role for the whole state. The building is located in the north part of campus, and we have over 55,000 mammal specimens. Being a curator mostly involves overseeing and deciding on directions of growth for the collection, including what specimens we might take in, the preservation methods we might use, developing outreach activities and supervising personnel. I also decide how the collections can be used for research and education. We have public exhibitions and we just moved to a new building, so we have been working hard to develop new exhibitions for the museum.

## Being a curator mostly involves overseeing and deciding on directions of growth for the collection

**How does your role as a curator complement your research?**

My lab is interested in understanding the evolution of morphology and function. We collect anatomical data from museum specimens for much of our research, so having unlimited access to the Burke collection makes my lab's work easier and helps broaden its scope.

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We get a lot of ideas simply by looking at specimens in our collection. Additionally, having a say in how specimens are preserved for the collection is critical, because we are interested in studying soft tissues like the musculature of the jaw. These soft tissues are not traditionally preserved in mammal specimens: skin and skulls are the tissues that are most commonly preserved. When we get fresh samples, we have access to the soft tissues before they are discarded or otherwise lost during specimen preparation.

**What is it like working with bats in the field?**

Fun and exhausting. During the day, we identify the field sites where we are going to place our mist nets, keeping in mind which locations might be most productive and safe. Then we pack some food, our equipment and leave for the netting sites before dusk. We set up the mist nets on trails or in forest gaps while there is still some light and wait for nightfall. Once the nets are open, we check them for bats every few minutes and work as late as needed.

Bats vary a lot in size. In the New World tropics, you might get tiny bats that are about 6 g and bats that are over 100 g. They also vary a lot in personality; some tend to be calm, but most are pretty feisty because they get tangled in the nets and want to free themselves. You have to be patient and careful when untangling a bat, both for yourself – so you don't get bitten – and also for the bats, so you don't hurt them. Once we have the bat, we identify its species based on external characteristics and decide which data we need to collect. If we are studying feeding biomechanics, we use a bite force meter to measure the bat's maximum voluntary bite force. If we are doing behavioural comparisons, we transport the bats back to the field station and put them in a tent where we record their behavioural responses to different conditions. We may also collect tiny biopsy samples from their wings, for species identification or genetic studies, and faecal samples for diet studies. Then we release most of the bats, but if we need specimens for morphological analyses, we bring a few back.

**Have you been involved in any activities to increase minority participation in science?**

I am a member of the Society for Integrative and Comparative Biology (SICB), and was part of their broadening participation committee for several years. This committee's goal is to increase the participation of under-represented minorities in the society, for example by providing Travel Awards for students and junior scientists to attend the annual conference. We also discuss ways to improve inclusivity in the Society, and to make the annual conference more accessible.

In 2016, my colleague Paul Gignac and I obtained funding from the National Science Foundation to fund a symposium at the SICB annual meeting. As part of our broader impact, the grant gave us the opportunity to bring Native American undergraduates to participate in their first SICB meeting and to provide them with graduate student mentors to guide them throughout the conference and provide career advice. We were specifically interested in reaching out to Native American students because they are critically under-represented in science. We advertised the opportunity nationally through our universities and selected six outstanding students to participate in the programme. They attended talks, conference events and had meetings with scientists who could serve as career role models. I believe it was a really positive experience; the students seemed to have a productive time at the conference and a couple of them got involved in research with faculty they met there. The following year, colleagues obtained funding for a similar programme, which was also very successful.

**The grant gave us the opportunity to bring Native American undergraduates to participate in their first SICB meeting**

**Is Open Access publishing a benefit or a threat?**

I think it's a net benefit. When I was an undergraduate in Venezuela I had to ask authors to send reprints to me by mail and waited months for them to arrive. We could not access the articles that we wanted to read, because of paywalls. Open Access will certainly help scientists in developing countries gain access to new research. However, I'm concerned that Open Access fees are very high, so now the barrier is on the author's side and that could certainly lead to inequities. Also, I now get emails from predatory journals on a daily basis and sub-par articles are published in Open Access journals that do not have high standards. As in other areas of life, we are now faced with large amounts of information and have to be better at filtering which sources to trust. In that sense Open Access can be a double-edged sword.

**What are the main challenges of being a minority in science?**

I often find myself being the only one of my gender and ethnicity in academic situations, which can be stressful because I don't want to be perceived as the spokesperson for one or all facets of my identity. I have also experienced a disproportionate number of requests to be on committees and, while I really appreciate when my colleagues strive to be inclusive, it has been a challenge to balance a large amount of service roles with the rest of my work. I try to see being a member of a minority as an asset, however, and I strive to value and feel empowered by my unique background.

**I don't want to be perceived as the spokesperson for one or all facets of my identity.**

**If you could have dinner with anyone from the past, who would it be?**

On a professional level, I would say Darwin – of course – because he is one of the people who created our field. But on a personal level, I think of my great-grandmother, who I never met because she died one month after I was born. She was descended from slaves; her grandma was a slave in the Caribbean and she was born in Venezuela in a small fishing village. She experienced violence and was a mother in her early teens toward the end of the civil war in Venezuela, yet she was able to overcome this incredibly difficult situation. After she had my grandpa, she started working, saving money and pursuing very smart business ideas. She prioritized providing my grandpa with an education. She sent him to school in Trinidad, where he learned English and got a degree. This prepared him for a career working in the electrical company in Venezuela, which allowed him to send my mom and her siblings to college in turn. I believe that my great-grandma's determination to overcome adversity – and her understanding of the importance of education – created a positive cascade of events for my family, which ultimately allowed me to have the freedom to become a scientist. I think it would be really nice to be able to tell her that.

Sharlene Santana was interviewed by Kathryn Knight. The interview has been edited and condensed with the interviewee's approval.