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Faculty Spotlight

An interview with

Dr. Princehouse

by Christopher Carr

Dr. Patricia Princehouse is a Senior Research Associate at Case Western Reserve University. She is currently the Director of the Evolutionary Biology Program, as well as a co-founder and current Outreach Director of the Institute for the Science of Origins, which runs and manages the Origins Science major at CWRU. Dr. Princehouse received her PhD from Harvard University under famed evolutionary biologist Dr. Stephen Jay Gould, and has been an important voice in the evolutionary biology field as well as in the world of science outreach and science education. In this interview, she details the story of how she entered her field of interest, and the work she has done advancing scientific inquiry in both the academic and public sphere.

Q: When did you decide you wanted to go into evolutionary biology?

A: It's hard to say exactly when I decided to go into evolutionary biology, but from the time I could even talk, even before that, I was so curious about animals. Dogs, horses, anything I could come across. By the time I was four, I was taking classes at the natural history museum, because they had some for kids. Between the time I was four and, like, fourteen, I took virtually every course that the natural history museum offered. And of course you end up being exposed to some theory - I mean, I even did taxidermy. And this is in Dayton, Ohio, where I grew up. They had an important Native American excavation affordation site they were doing, which we called the Incinerator site. Now, I believe it's called something like Sun Valley, but it was on the site of an old incinerator, so we called it the Incinerator site. I was doing fieldwork when I was nine years old, and I actually didn't associate it with universities, because my experience had been in the museum. Even Richard Leakey came through and gave a talk when I was in high school, and I was very impressed because a friend of mine asked him a question, you know, a great man, right, but it was at the museum, so I didn't associate it. When I went to college, I thought that I would be a veterinarian, because of the interest in animals, but in the meantime, I'm collecting fossils and doing school projects on evolution-related stuff;

Photograph by Chandana Pandurangi

I just didn't associate it with that. After some of the in and out of a couple of different colleges, I finally found that anthropology is something that is offered at universities, and I took a course on finite behavior, and I took a course on, human evolution, a course on human diversity and variation, ancient Near East archaeology, stuff like that, and that was kind of my way in. It was like, on the one hand, I had invertebrate fossils because it's the Ordivician down there, right, and on the other hand, anthropology, paleoanthropology, physical anthropology. And so at some point, it just kind of converged on evolutionary biology as a major field.

Q: During your time at Harvard, you had the opportunity to work alongside Dr. Stephen Jay Gould, who was a real titan in the field of evolution. What was it like working alongside him?

A: So he was my doctoral advisor, and it's funny because when people would go to his talks, he was a bit brusque and he gave this feeling to a lot of people that he was unapproachable, which is the exact opposite of what he was actually like, and it, it's a funny thing. Um, he was one of the few Harvard professors - at Harvard, when you have some of these major professors and they offer a Monday, Wednesday, Friday course, they don't teach the Friday course, because you also have a recitation section, right, that you have with a graduate student or somebody. So the number of contact hours, as it's called, is met if you don't teach the Friday course. He taught the Friday class. He also held two-hour office hours every week when he was in town. He would often be out giving lectures, but if he was in town, there

was a two-hour office hours. And he taught all three lectures, for the course, and then he had a second course as well that he taught about half of the lectures on that was co-taught with Richard Lewington, who's a famous geneticist, and I was a teaching assistant for both of those courses with him. So, I got to know him very well. He was terrific - smart, interested in everything. He was one of the best people I've ever met at articulating ethics - why he does things in particular ways, why he does or doesn't put in grants, why he is doing a particular thing. It was very important to him to think through moral questions, as well as scientific questions. And of course, his work famously addresses not just science, but also, ethics and society, and the sorts of interactions that there have been between science and other areas of human interest.

Q: After your time at Harvard, how did you find your way to Case?

A: So, before I was at Harvard, I was at Yale - I have a Master's from Yale. And my lab partners for gross anatomy, one of my best friends who was also at Yale, her husband was a Shakespeare expert, was a graduate student in English, and he got hired here at Case. And as I'm from Ohio, and my parents had actually relocated to just outside Cleveland, I would see them when I was back. And then after I finished, I was out of school for a while, I didn't go immediately for my PhD, and so I would see them fairly often and got to know more people at Case. Eventually, I met my husband, who is a professor here. The chair of Philosophy offered me a job - said, "you should just come here." So even before I had my dissertation, I was teaching here, and it just kind of happened. But Case is a great place, for just the sorts of things that I'm interested in, right - it couldn't have been just anywhere. I mean, the legacy here of science in evolutionary biology and particularly human evolution - Davidson Black from a hundred years ago, the Peking fossils. And of course, the Hamann- Todd collection, which are at the Cleveland Museum of Natural History, the largest collection of human bones, of human skeletons, for research collection, and also the largest collection of chimpanzee skeletons and some other non-human primates. So great resources here and a lot of really cool people. And so when I was started here, I got to know Cynthia Beall and we started the Evolutionary Biology major here - it's an interdisciplinary major, right? And then that led on eventually to me becoming involved in this newer enterprise - Origins, with Glenn Starkman. We developed the Origins major and a bunch of outreach stuff, and it just kind of came together. So that's how I ended up here.

Q: What particular parts of evolutionary biology have your most interest today?

A: Evolutionary biology encompasses a great many things. I have an interest in modern species of animals, domestication of our domesticated animals, particularly dogs. I breed dogs as a hobby. I also had horses for years too. There's that whole part, and there's also the fossil part. I've always loved fossils and paleontology. Since the time I was old enough to pick up a rock, I was looking for trilobites. Where those two things come together, and along with human evolution, is fossil apes. When I went to Yale for grad school, I was particularly interested in fossil apes. Everyone's drawn to the bipedal ones, the humans, the protohumans, or whatever. To me, well that's fine. Once you're upright, you get some brain expansion, and it's pretty much us. How did you get there? There's this huge proliferation of ape species in the Miocene between 25 and 5 million years ago that until very recently, virtually no one cared about. Except for when I was in grad school, my friend Isaiah Nengo and I both cared about apes. He came from a very different background, he's Kenyan, he grew up in Kenya, he was a protege of Richard Leakey. He decided that this guy needs to go study in the states. I met Isaiah at a conference, and I said that you need to go talk to Gould. You've read Gould's stuff. He's like, this is great. he also ended up, different timing, being a TA for Gould's courses. Anyway I digress, this is an issue of what's often called an evolutionary radiation. You had a radiation of apes in the Miocene. You had an evolutionary radiation of bipedal hominins in the Pliocene. You'll see this in Darwin's finches, famously as a radiation of different forms on different islands. To me, this issue of what causes new traits to arise, then kind of find a whole new radiation of things, or evolutionary novelties, are part of what's often called macro-evolution. To

me, macroevolution is extremely interesting. How do you get trends in the fossil record? You'll have this radiation of giraffes or elephants, this sort of thing. Those kinds of trends. It's not enough to say that variation arose, and selection acted on it. This led me also to my more humanities interest, which is history of the philosophy of science, the history of evolutionary thought and my dissertation was

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on controversies in the past 150 years in macro-evolutionary theory. I got to be pretty familiar with Darwin.

You hear a whole lot of people saying a lot of things about Darwin and what he thought, and unless you've really read his books, letters, and all kinds of things, It's very hard to interpret what's he's saying if you're just exposed to it here or there. If you don't understand the whole continuity of his thought, because he was a prolific writer. Darwin had a whole range of different mechanisms. People say it was all natural selection, but it was not all natural selection. Darwin himself said, in his own lifetime, you're getting me wrong and this is not everything. He says that great is the power of steady misrepresentation. There's one thing you can internalize, it's absolutely true. Not just for Darwin.

Darwin was very interested in how different parts of different animals grew at different rates, so if you have an evolutionary radiation, the larger ones might have longer necks than to smaller ones that get larger disproportionately or legs that get longer disproportionately. This is called allometric correlations. He called them correlation of growth, or allometry. Another thing that I fine very interesting in Darwin's thought and in certain things I've been looking at are called polyspecific associations, or associations involving more than one species. If you think about the savannah, you've got those big herds out there, you have wildebeests and zebras, and some giraffes, and sometimes some rhinos. You have different species living together and cooperating. You'll often hear Darwin represented as being a 'nature red in tooth and claw.' Darwin did talk about a struggle for existence, but he says that in a two canine animals, and in a time of drought, some will struggle who will need struggle and survive, but equally much, the plants at the end of desert struggle just as much. When you are talking about struggle for survival, it's on so many different levels. Polyspecific associations form when it's advantageous for individuals to cooperate. It's one thing to cooperate among members of your own species, but you can get other benefits from polyspecific associations because you will be using different aspects of the ecology at the same time, so you're not going to

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strip away their resources. If you have a bunch of monkeys and they all eat the same kind of fruit, you can't have that many monkeys in the trees, but if some eat from another kind of tree, if some eat leaves, and some are looking at bark, sap, bugs, and things like that, then you have a certain division of labor and everyone benefits from the larger group size because somebody's going to see predators. There're all kinds of advantages. Humans and dogs are a polyspecific association. If you look over time, it's coming out more and more in the past few thousands of years as humans started to leave Africa, or at least a small subset of humans left Africa, and gave rise to the rest of

the people around the world. If you look at Europe and Asia, this was an ice age climate they were traveling in to. If you ask, people say that dogs came domesticated because they followed our camps and ate our garbage. We were the ones who came into their areas. They were well-adapted to the environment, so we probably came in and ate their garbage. We learned to cooperatively hunt with them, and cooperate in other ways. They can eat stuff we can't, vice-versa. We can get to some things they can't get to really well. That's probably how that came about. It's a very interesting thing. This leads to a whole host of issues that I'm interested in. Another area we haven't talked about is digital organisms, or artificial life, but I'll leave that for another time.

Q: You've devoted a lot of your time to scientific outreach. Why is it so important for scientists to go beyond just their research and actually try to speak up?

A: I think that science has a lot to offer humanity. It has been responsible for most if not all the breakthroughs that have greatly improved things like survivability, lack of seriously damaging hard work, the sorts of things that basically produce the kind of freedom we have today. We use it for all sorts of silly things, but also, these kinds of breakthroughs that come from science have benefited all of humanity at a level that no other human enterprise has produced. It's all been done even as scientists have been fairly distant in many ways from the public. Science outreach is sometimes seen as scientists sharing a little bit of what they do, and that it's nice for them to do that. I think people who are outside science should be demanding that scientists explain this to them because it's self-defense. They need to know how to be making decisions about scientific issues and because scientists are often wrong about things. That's the art of science. It's the art of being wrong in useful and fruitful ways, and then correcting it. When you think about what makes science different from other ways of knowing, people say the scientific method. There's no scientific method. There's not one scientific method. It's a whole concatenation of different processes. As you're working through them, it's the democratic element of science, having a lot of people involved so that they correct each other's mistakes, that is important. You may have seen recently the big study that came out in Nature about the oceans absorbing heat faster than expected. Somebody on a blog caught an error in that, brought it up, and they issued a correction to the article, saying that it's still bad, but the error bars are larger than expected. That's democracy. Science is one of the best demonstrations of democracy because if you have enough people working, they do correct those things. It's still bad, but there's a little bit more respite.

Just as an example, what you really need is a whole lot of different people. The more people that understand science, the better science is going to be and the better society is going to be. The sorts of things that we've done, like outreach to alums of the university that come and enjoy our programs. We enjoy talking to them, and I like challenging our scientists to be able to talk to people not in their field. We do a lot of things that get folks of different fields to interact in the university, mainly with faculty, but also in the outreach. Beyond that, we have talks in bars. We have talks at libraries. We'd send a speaker just about anywhere.

Outside of my work at Case, I've also been involved with some science things. For example, I was Chair for the March For Science for the past 2 years in Cleveland. This is where you get some people who are really demanding science. I encourage that, and I'd like to see more of that. Folks need to press us on that. I've also been involved with the National Center for Science Education, and the Ohio Citizens for Science, which tried to counter some of the attacks on the integrity of science from folks that are particularly anti-evolutionist, which are often the strongest, but they don't stop at evolution. The Big Bang comes under scrutiny, climate change, stem cell usage. There are people who are either confused about science or object to some of the things about it, especially for religious reasons, but also you get people who want to attack science, or particularly evolution, as a sort of hook to convert people to their religious views. If you say, well science says it's like this and not like that, you should believe in my view of the world, which is not illegal except for when you're doing it to other people's children in public schools where

they are required to attend by the government. It's illegal to try to use the science classroom to convert other people's children to your religion. That's the issue a lot of things have centered.

When I first got involved, I just wanted to do the science. I don't want to have anything to do with these other parts, but then, when they were introducing the anti-evolutionism in the science standards of the state of Ohio, I ended up going to Columbus. I have no background in government stuff, and I said that I'm just here to talk about the science. This is wrong, this is a misrepresentation, this is simply factually wrong, whatever, and the politicians on the boards said they don't care, it's what our constituents want. I was unprepared for this. Blatant lying was okay if that is what the constituents want, which most are wrong about by the way. People, when push comes to shove, when it does become an issue in any political campaign, people want real science. They want their kids to become doctors. If this stuff is fake, they don't want it. This is part of why, even on the constitutional grounds, the pro-science side always wins when it goes to court. Before it gets to court, the politicians usually get voted out of office. So I'm like, it's wrong and it's also unconstitutional, and we got some legal experts to explain this to them. They say they don't care because they're going to be out of office before this goes to court, and whatever locality loses a lot of money. This is wanted happened in the Dover Pennsylvania trial, which is often called a "Dover Trap" now. You get some of these big organizations like the Discovery Institute and come and seed this stuff like intelligent design, or just general anti-evolutionism stuff. Somebody latches on to it, and that community ends up paying the $2 million in legal fees and not the Discovery Institute. That's why it is called a Dover Trap.

Finally, it came to the ream of politics. This is so far away from me, having anything to do with academics or my involvement with Ohio Citizens for Science or National Center for Science Education. Some friends of mine and I thought that we got to run candidates. Then I ended up running political campaigns for people, and we won every single one. We raised more money than what has ever been raised for a candidate for state board because people do care about these issues. They do want real science, and we won on every single one. People said to me, you're going to run for office now right, and I said no. I'm a one-issue person. Every now and then, something will come up, and there will be a little delegation saying, "why are you here." It's hard, and I ended up going to a lot of churches. I'm Catholic, so my background is quite different than the Protestant megachurches you run into this stuff in. Getting to know people in those setting is very interesting, and we got some rapport. Several ministers apologize on behalf of their flocks for their behavior.

One other thing I'll tell you about for science outreach is a fairly new project. Bringing it back to my friend Isaiah, he works in the Turkana Basin, part of the Turkana Basin Institute. A year and a half ago, Kenya has started new universities. They have seven, and recently decided to have one in every county, which there are 36. There's a new one is Turkana county, which is completely desert. 80 percent of them are pastoralists, still living with the camels, goats, in these gorgeous huts. There's a new university there that has 12 faculty and 300

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students, and no funding. They need to expand in the next 20 years to have 20,000 students. They asked Isaiah if he had any friends that could help them with new projects, and we're looking for starting a center for evoluFthat's tionary medicine and global nursing. The nursing school and public health people would much rather have things here, and so they ditched him into doing fieldwork, where we're going to be doing some public health stuff and some straight up science outreach. I have written a one-day curriculum that we have printed on the back of a t-shirt, and hand out to the nomads. There's more to it than that, but I'm hoping this will go viral. Oil has just been discovered south of the lake, and they're about to be entrenched with outsiders in the next

two years, so we'd love for all the young girls in Turkana to become nurses. We're going to work on that, but in two years, we aren't going to achieve that, but hopefully, we can give them some insight into scientific thinking. I have some specific ways I won't go into, but we have this curriculum which we hope will become viral. I'm taking students there on spring break, and we're going to look for fossils on Isaiah's sites. We're going to implement a one-day model curriculum as a pilot study.

A Selection of Dr. Princehouse's Work

Princehouse, P. (2009). Punctuated equilibria and speciation: What does it mean to be a Darwinian. *The Paleobiological Revolution*, 149-75.

Princehouse, P. M. (2003). 'Mutant Phoenix: Macroevolution in Twentieth-Century Debates over Synthesis and Punctuated Evolution. *Harvard University Doctoral Dissertation.*