Transcript

Speaker 1: You're tuned in to 90.7 FM, k a l x Berkeley. My name is Tesla Munson and this is the graduates, the interview talk show where we speak with UC Berkeley graduate students about their work here on campus and around the world today I have the pleasure of being joined by vertebrate paleontologist, Jesse Aderholt from the Department of integrative biology. You're a phd candidate but not much longer soon you're going to be a doctor, right? That is correct. I only have a couple more weeks here before I finished and so we were especially happy that you could fit us into [00:00:30] your busy schedule as you finish things up here. So thank you for having me Tesla. No problem. Do you, what does it feel like to be finishing for those of us who have a while before we can look forward to that. It's the best feeling in the world.

Speaker 2: Okay. Graduate School was rewarding but very, very high stress I think. And it's something for me, getting my phd has been a goal actually since I was a little girl. So to finally be here is just absolutely amazing. Like standing on the top

Speaker 1: the hill and looking [00:01:00] out, seeing all the things in front of you. Yes. Yeah. You, so you have been interested in paleontology since you were a little girl since you were nine? I hear,

Speaker 2: yes. Like almost every paleontologist I know I was one of those little kids who love dinosaurs and fossils and uh, I had the good fortune to go on a family camping trip to Anza Borrego desert state park when I was around eight probably. And I found out that they had a volunteer paleontology program. So I wrote a letter to them and asked if I could join or if I [00:01:30] could at least visit for a day. And the State Park Paleontologist, George Jefferson ultimately invited my mother and I to become volunteer paleontologists. Um, so I joined when I was nine and I was a volunteer there until I graduated high school when I was 18. Uh, so it was a pretty amazing experience and my mother was a phenomenal person who at least until I could drive myself, uh, would drive me all the way there, which is about three hours each way. Once a month for [00:02:00] like 10 years. She did that. Wow. Okay. So it must, it must be a California state park then, right? Yeah, it's a California state park. Yes. Awesome. Southeastern California. I near the solvency. And did you have [inaudible]

Speaker 1: like a bunch of experience? Are they as a nine year old? Are they just uh, they just take volunteers? They just, just

Speaker 2: take volunteers. The program is actually a really amazing way to get into paleontology for anybody who is in the area and doesn't have training but wants to get some experience. They mostly have, um, retired people in their program, [00:02:30] but it's for anyone who's interested and they actually train you. So you do a three hour lecture once

or twice a month. Over the course of the program you get trained in methods of fossil identification. You learn the basics of geology. You learn about anatomy of the animals or studying, they teach you how to do field work. They teach you how to fossil prep. So almost all the volunteers I think go in with no prior experience, but there is an actual training program and you even get to take little test at the [00:03:00] end and get your official certification. Awesome. So it's almost as good as like a field course.

Speaker 2: It is kind of in a way. Yeah. I think in some ways perhaps not quite as rigorous, but it really was kind of my 10 year long field course experience. Yeah, that's great. And then you went to college and you did not get a degree in paleontology though, right? No. When you are an undergraduate, it's very rare to find a program that actually will issue a degree in paleontology itself. So I majored in geology and then I did a concentration [00:03:30] in Paleo biology. And you had to, I saw near a CVU at a couple of minors in there. Yeah. I, I really love variety of fields. I studied French throughout high school. I love the language. I pursued that as a minor. Um, and then I've also really been interested in women's studies historically. So I minored in a women's studies or gender studies as well.

Speaker 2: Well that brings us to the, you know, the question about geology. We, you know, we always talk about diversity in the sciences and [00:04:00] people say that geology is the most restricted department in terms of diversity. Did you experience that or what was your experience like? My experience is actually, it depends on what group of people you look at within the department. At my undergraduate institution, I was in the Department of Geology, but it was actually called Earth and environmental sciences. So I think because of the environmental sciences part, there were actually quite a few undergraduate females there. And actually when I think back on [00:04:30] my cohort of undergraduate students in the department, we were like 10 females and two males or something like that. Awesome. But if you look at the faculty in contrast in that department, definitely I would say the majority were male. So I think it's partly due to changing trend in the times and a partly because it was environmental and geology.

Speaker 2: And you did research as an Undergrad too, right? Yeah. Um, I actually, when I was applying to colleges [00:05:00] and still in, uh, high school, I kind of did what I also did for graduate school. I didn't just pick a school that looked good. I actually reached out to professors who I'd be interested in working with and let them know who I was and talked about my interest in paleontology and told them I was looking for sort of a mentor in Paleontology as an undergraduate. And one of the professors I got in contact with during that period of my senior year of high school was Dr. Peter Dodson [00:05:30] at the University of Pennsylvania. And he is a world renowned for a paleontologist. He's especially known for his work on how orange dinosaurs like triceratops. And he was very responsive and very supportive when I first contacted him. So he was really part of the reason I chose to go to Penn. And throughout my entire four years there he supported me in many, many ways, including getting me an introduction to some research. So at the time I was an undergraduate, he had [00:06:00] recently had some graduate

students of his who were doing work in China. So Peter twice took me to China with him where I got to do a little bit of field work and also a study, some really, really gorgeous bird fossils. So my senior thesis as an undergraduate was actually the description of a new species of bird.

Speaker 1: Wow. That's pretty a pretty high level for an Undergrad.

Speaker 2: It was really cool too because um, we named it Chania graff and I, so Chili Anya was our regional Chinese [00:06:30] name, but then graph and I was, the species name was actually for Greg [inaudible] who is the lead

Speaker 1: singer of bad religion because he actually studied paleontology for a while before he became a rockstar. Wow. Published a paper or two. So did you let him know that he got this fossil named after him? He knows. Yeah. That's pretty cool. I didn't tell him personally, but through the grapevine, I know that he knows. So you don't, you don't get like backstage passes and, no, not yet. Next next species though. Hopefully. So we, [00:07:00] you said you did some field work and you also looked at fossils. How were those two things different?

Speaker 2: Well, as a paleontologist you sometimes get to go out and do a lot of field work looking for them and you know, walking around outside or sitting in a place and digging. But tons of specimens are already in museums and haven't been studied yet and some people tend to specialize more on the field work and some people tend to specialize more in museum work. So in my case there were literally hundreds of bird fossils that were at this institution in China [00:07:30] when I went. So we got to do a few days of field work kind of just for fun almost to get a feel for the site, how the fossils are found, try our hand at finding a few. But there were so many that were already discovered and prepared that we didn't really, we could kind of skip that step of doing field work in this particular case.

Speaker 1: So I, I should have asked a, you said bird fossils, so how old are we talking here?

Speaker 2: This site, they are roughly 120 million years old. So that's in the early Cretaceous period.

Speaker 1: That's pretty old. Uh, how, [00:08:00] how long have bird's been around?

Speaker 2: It really depends on how you define bird, which can be a little bit tricky and controversial. So if we stick to a very, very strict definition and just call the group of modern birds, birds and everything else, we term a stem group, bird, then birds would originate somewhere, perhaps more in the mid or later cretaceous, maybe 80 million years ago roughly. So what I was looking at aren't considered [00:08:30] birds in a very strict sense. But if you do want to extend that definition to include anything that is relatively small and has flight feathers, then perhaps by the early cretaceous or even before then. So it's kind of a great

Speaker 1: area. So what sort of a morphological differences are there between the, these stem group birds and the modern group birds? The that I work in

Speaker 2: on in particular is called the Indian tea ornithine, which means opposite [00:09:00] bird. And they have a number of striking differences from modern birds. And superficially they actually look a lot like maybe a little song bird that you would see perched in your tree in your backyard. There are a lot of them are small. They have little recurved claws on their feet, just like you see in a lot of modern birds. We know that they have long feathers and they were active fliers. But then if you look in their mouth, for example, they still have teeth. If you look at the tips of their fingers on their wings, [00:09:30] they still have a little tiny claws. If you look at the sternum or the breastbone, um, it often is a bit smaller and has a much lower, uh, big Keel. The part that hangs down than in modern birds.

Speaker 2: So in a variety of subtler ways, they're actually quite different. So no birds have teeth today. Uh, no, no. It's pretty crazy to think about, but run around with teeth. Some of them do have claws today on their, their [00:10:00] fingers, right? They all have claws on their toes, but baby Hoatzin, which is a special bird that lives in South America, they have claws on their hands still. And they as a defense mechanism when a Predator comes to their nest and the tree, they'd jump at a tree and land on the ground just to kind of escape and then they can use their claws to climb back up and get in the nest. And if you look at the fingers of ostriches, even as adults, they have claws on their fingers. So they're really [00:10:30] tiny and not probably used for anything, but they still do have those claws. Cool.

Speaker 1: Well if you're just tuning in, you are tuned in to 90.7 FM, k a l ex Berkeley. And this is the graduates. My name's Tesla Munson. Today I'm speaking with vertebrate paleontologist, Jesse Aderhold about her work in paleontology and looking at birds and bird fossils. And so I know that for your dissertation you work with both fossils as well, but also this like they weren't alive but a bunch of modern birds, right?

Speaker 2: Yeah. I [00:11:00] actually, two thirds of my dissertation is devoted to work on modern birds instead of fossil birds. And part of the reason for that is that when I came here and I thought I would just be setting fossil birds, um, I began my work and I was especially interested in understanding the development and the growth strategies of extinct birds. And I started getting frustrated with how little we know about the way that modern birds grow, especially when it comes to post needle development. So [00:11:30] how the bird grows from the time it hatches to the time it becomes an adult. There's not a huge amount of research that's been done on that period of bird lives. And as a paleontologist, that's a particular interest to me because finding fossil embryos and eggs is extremely rare. So the fossil record doesn't preserve a lot of developmental stages, period.

Speaker 2: And what we do have is mostly postnatal. So I then took an interest in studying postnatal [00:12:00] development in modern birds, uh, in an effort to better understand the fossil record. But also I think it gives insight into the evolution of modern birds themselves. So when you say growth, do you mean just like how quickly they get big or were you looking at a particular kind of growth? I was looking at a lot of multiple facets of growth, not so much growth rates kind of shape change through growth. We know that many animals grow Allah metrically, so that means that their bodies [00:12:30] change shape as they get older. So definitely this occurs in humans. If you look at the shape of a baby overall, it's way different than an adult, right? The head is much larger relative to the rest of its body. Almost all babies tend to have really large eyes relative to their face.

Speaker 2: A features like that. So I quantified the way that shape changes in birds from the time they hatch to the time they become adults. And I also studied the way their bone cells grow and change from [00:13:00] the time they hatch to the time they become adults. So that does tie in a bit more to growth rate, but I wasn't explicitly measuring that. How do you look at bone cells and how they change? You have to chop the bones up into really, really thin slices. So thin that light capacity them. And then you look at them and during microscope and under the microscope you can actually see all kinds of features about the bone. You can see the places where the bone cells were in real life. You see all of the extra cellular [00:13:30] matrix around them. So basically everything that we look at and see as bone is that large extracellular matrix component.

Speaker 2: You can see the holes in the bone where blood vessels passed through in the animals living. So it contains a lot of information. So you must have used some sort of special sauce for this, right? Yeah. There are several methods you can use to thinly slice bone. One method is to decalcify the bone and then embed it in paraffin wax [00:14:00] and cut very thin slices. I did not use that method. I used another method that one uses for cutting up fossil bone as well. Um, so instead of decalcify in the bone, I embedded it in a polyester resin. And then I used a diamond embedded saw to cut slices. Uh, but the slices weren't as thin as I needed them. So then I hand ground them down, um, using grid paper to the thinness that I needed so that like could pass [00:14:30] through. So it was a little long process but rewarding and you get to work with your hands a lot, which is fun.

Speaker 2: Yeah. And uh, I heard a couple of good stories about how you managed to get some of these birds right. Do you want to share one of them? Yeah. One I decided I wanted to study postnatal ontogeny of modern birds and specifically the skeleton because again, as a paleontologist, I'm interested primarily in the skeleton. I started to look at museum collections in the United States and around the world to see [00:15:00] what museums had skeletons of baby birds. And the answer was pretty much nobody. Baby bird skeletons are not fully ossified. They're composed of a lot of cartilage. So when you try to skeletonize a baby bird, everything just falls apart and you have this pile of bones that's not pretty to look at. And that's not easy to interpret. So for a variety of reasons, it

was very difficult to find the specimens I needed so that I realized I had to get them myself.

Speaker 2: And [00:15:30] because I wanted to understand growth in a lot of different species of birds, I decided to sample opportunistically. So I kind of put the word out to a variety of people and institutions that I wanted donations of dead bird basically, and then just collected stuff for a few years. And at the end of the day I sorted through everything and was able to get a growth series for 14 different species. So I had gotten contact [00:16:00] with the uh, Lindsey Wildlife Museum. They have a wildlife hospital there. So as a place where when you find a little baby bird in your backyard or in your park or any wild animal that seems injured or ill, you can take it there. It's kind of like a vet for wild animals. And when they had one of their baby birds die or need to be euthanized, they gave them to me. I also received donations from the society for prevention of cruelty to animals in Monterey County.

Speaker 2: I [00:16:30] got some exotic birds from exotic bird breeders and some ostriches from the okay. Crowl ostrich farm and oral Grand Day California, which is in southern California in the high desert and it's actually very close to where I grew up and where my mother now lives, so we actually took a family trip out to the ostrich farm to see the live ostriches and pick up my dad hostages and there was a lot of fun. Yeah. You took another trip with some of these birds to write a a road trip, so to speak. [00:17:00] Can you tell us about that one? For my study of how shape changes as these birds grow, I needed to have three dimensional images of their skeletons and for that I decided I wanted to use CT scanning and I couldn't find any conventional CT scanner in the bay area that would allow me to scan my dead birds.

Speaker 2: Most of them are at medical facilities. And when you contact them and tell them you want to put dead birds on their scanners, where they usually put live people, they're not super excited [00:17:30] about it. And especially because I had several hundred that I needed to scan. So I got in contact with a colleague, Emma Schachner, who at the time was at the University of Utah as a post doctoral student in Coleen farmers' lab. And they were also interested in the CT scans of birds and they did have access to a CT scanner. So I had a road trip with several hundred birds and coolers at Salt Lake City by myself to CT scan all of the dead birds and then a fun [00:18:00] road trip back. Yeah, that's pretty, uh, that's pretty exciting. You know, you get some company, you know, they don't speak watch, but what, and so how did the fossils play into all this?

Speaker 2: So the goal was to be able to compare my results of the modern birds to the results of the fossils. And as you know, things never go quite as planned when we first start off with our studies. So because of the nature of preservation of the fossils, I haven't at least yet been able to do a similar study [00:18:30] of how the shape of their bones changes do the as they grow. But I was able to do a study of the cells of the bones of the fossil birds. It's called histology, um, where I was cutting up the bones and studying the cells. So I was able to acquire tissue samples from some fossil birds and I cut them up in the

same way I did my modern birds and I was able to compare them. Very cool. So do you have any like a big summary conclusions you want to share with us because you're [00:19:00] actually like done?

Speaker 2: So a lot of people I talked to are still developing projects, but in terms of shape change, most taxa or most species, at least the ones that I studied, they all tend to undergo the same shape changes as they grow from chick into adult. And there's actually not a huge amount of variation in the rate of shape change either. So that was interesting. I found that [00:19:30] in based on the bone histology and this we already kind of knew, but modern birds tend to grow very fast relative to extinct birds. But in extinct birds there actually is a much greater diversity of, uh, growth rates and growth strategies than we previously knew. Um, it was thought for a while that they were all growing very, very slow, especially relative to modern birds. But in my study I found some that have bone tissue samples and bone growth rates much more comparable [00:20:00] to modern birds.

Speaker 2: So that was fun. Yeah, no, it's always nice to see the range of variation that has gone extinct. Yeah. More than we see today. Even then, there's so much. So, uh, can I ask you what you're off to do after this or I want to talk about it. No, that's fine. I have, I do enjoy research very much, but I really love working with my hands and working in museum collections and I also love doing outreach. So I am looking for some sort [00:20:30] of longterm career that would allow me to combine some or all of those elements together. I was fortunate enough to receive a summer teaching fellow position at the Alf Museum and web schools in Claremont, California. So I will be teaching there junior paleontology scholars over the summer and I have some applications out to other museums and schools for more longterm positions. Hopefully we'll be hearing back soon.

Speaker 2: So that's relatively it. But I'm honestly not in a huge hurry [00:21:00] to get a longterm job because this has been exhausting and I'm looking forward to a little time off. Yeah, yeah, yeah, I'd agree with that. Um, yeah, outreach. I definitely know that's something that you're really interested in cause you've actually been doing it long before you even got into Berkeley, right? Um, yeah, I did a bit of outreach as an undergraduate. I did some public talks at the Academy of Natural Sciences and I would say it was mostly when I came to Berkeley that I started to get really, really into it though. Uh, there were so many opportunities [00:21:30] in the bay area and through Berkeley and through other institutions that are local here. Um, as you probably know, we just get pelted with emails all the time of just huge, huge amount of options for doing outreach if you want to do it.

Speaker 2: So and why do you want to do it and what do you like about outreach? First of all, since I was interested in science as a little girl and I was lucky enough to have people in my life who fostered that interest, I want to do that for other children and other students. So they used [00:22:00] to be me and it's really important to me to carry on that legacy.

Second of all, because the state of science education and literacy in our country is so appalling right now. I really want to do my part to change that. And so maybe going in a classroom and teaching a one hour science lesson doesn't sound like it could be hugely impactful. But I strongly believe that I am making a difference by doing that because even if the students don't really remember what I'm teaching [00:22:30] them, if I have just inspired one student in that whole class to take an interest in science and maybe try harder and their science studies or to pursue a career in science, then that's what really matters.

Speaker 2: Um, so I would say those are the two reasons and some pretty good reasons. Do you have advice for young researchers or undergrads or even just members of the general public who are interested in paleontology or other types of hands on research? I think that most scientists are, [00:23:00] you know, some are super busy, big names in the field, but most are really excited to talk about their research and at least just sit down and have a chat with you if you have questions for them and want to contact them. And that a lot of museums have volunteer opportunities if you're a member of the public or if you are not yet a college student and have those resources available to you through your university. Um, so just reaching out and contacting people and letting them know of your interest [00:23:30] and not everyone's going to get back to you, but be proactive about it because there are way more people out there who are nice and who want your help and who want to help you than there are people who are not going to respond. And you mentioned that southern California

Speaker 1: State Park, but is there anything up here in the bay you could recommend or just gone to the library?

Speaker 2: I mean, there are a ton of museums in the bay area, right? Whether it's cal academy or the exploratorium or the U C [00:24:00] and p or the MVC and I know,

Speaker 1: no, I'm sure among those that at least some of them have volunteer programs that people could probably get involved with. And University museums I think a little bit less just because they're not public museums. But even so we have, do we have public volunteers in these SCMP I'm not sure we have a few, but even if a not for volunteering, I mean there's so many different talks and I know there's like the East Bay science events in there, you know, all these different activities where people like us [00:24:30] go out and, and talk about our science and you know, the public's welcomed. Yeah, yeah, yeah. No, that's totally true. That's another great point. Like science cafes and seminars and stuff. Yeah, there are a lot of talks through Berkeley and through science tests at Berkeley, at local restaurants or whatever in the bay area. And yeah, that's also a great point. Yeah. So a, as we sort of wrap up here, do you have, uh, are there any major concerns in paleontology? Cause I know like with so many other fields, you know, [00:25:00] they're working on like very contemporary social issues or climate change issues. Is there anything we're thinking about in paleontology that we could mention here or is it all in the past? Well, I think first of all,

Speaker 2: paleontology as a science is highly relevant to understanding climate change because we've had mass extinctions in the past and we think we're probably in or on the brink of a mass extinction now. So understanding the causes and results [00:25:30] of previous mass extinctions is going to be invaluable in helping us understand what's going on now and how we can prevent it or at least mitigate some of those catastrophic results. And also, I think paleontology as a science is really helpful in humbling people. I think that people tend to, at least historically in today a lot too. We like to think of ourselves as just the best things on this planet and superior to everything [00:26:00] else. And as a paleontologist, I love sort of, I don't want to necessarily say a feeling of insignificance I get, but having that perspective of deep time of what the earth used to be like millions of years ago or thousands of years ago, you know, so much of earth's history has not had people in it, and so many amazing organisms have existed before us and will exist after us. So I think that's another really powerful and important image to take away, uh, as a paleontologist [00:26:30] because it gives you a greater respect for the, what we have in our environment today and the animals that we share the planet with.

Speaker 1: Well said. Well said. I think we've got to end it there cause I don't, I don't know if you could say anything even any better than that. Just, yeah. Well, thank you so much, uh, Jesse for being here today and yeah, so if hopefully you got a chance to tune in for this epic episode of the graduates here on KLX Berkeley. My name is Tesla Munson. Today I've been speaking with vertebrate paleontologist Jesse Aderholt [00:27:00] off to bigger and better things, hopefully in outreach and teaching and maybe even a little plastination. I know we didn't talk about that, but, um, but that's pretty cool too. So yeah, thank you for telling us about your path, you know, from Undergrad and, and all throughout life as a paleontologist, really inspiring to know that young people can get involved and all you have to do is find the right outlet. And, um, yeah. And it's always great to hear about your work as well. Mixing and fossils and modern birds. It's, it's pretty epic, [00:27:30] so, okay, that's gonna do it for this episode of the graduates. We'll be back with another episode two weeks from today. Every other Tuesday at 9:00 AM here on KLX. Again, my name's Tesla Munson. I've been speaking with Jessie Adderal. Hold, stay tuned. You're listening to 90.7 FM, k a l ex Berkeley.