

Plumology with Dr. Allison Shultz

Ologies Podcast

March 31, 2020

Oh heey, it's cauliflower rice, which smells like farts and knows that you have your doubts, but is excited to prove you wrong, Alie Ward, back with another episode of Ologies. This one is just light as a feather, nothing but wall-to-wall behavior, and biology, and trivia, and weirdness, and history! Let's get into it! But first, I wanna say thank you to everyone who buys Ologies merch at OlogiesMerch.com, thank you to everyone supporting on Patreon.com/Ologies, and for everyone who tells friends, or rates the show on iTunes, or subscribes. That keeps it up in the charts. Or reviews, which you know I creep gently, so I can pull a fresh catch each week, like this one from The Dusty Wrangler, who says:

Hearing how normal all these scientists are is making returning back to school a lot less intimidating and that's just what I needed. One thing though, now every time I wash my hands I DO hear you whispering in my ear to "milk my thumbs" and I only resent that a little bit. Thanks for the reminder.

Thank you to The Dusty Wrangler for that, and all the reviewers, especially to Mike the nighttime nurse for listening, and much more so for saving lives. We love y'all.

Okay, plumology! Did you know this was a thing? I did not. It comes from the Latin for 'down' or for 'first beard', and later *plume* came to mean like a stream of smoke. So we're talking all manner of feathers! Now, I have already covered ornithology, it came out in November 2019, early adopter. Now in case any bird nerds have not found it, go way on back, you'll find Ornithology. But I was thrilled when this ologist at the Natural History Museum of LA suggested via email that there were many, many more sub-ologies with feathered friends, including them dang feathers themselves.

So I made haste to the museum one sleepy Wednesday afternoon right before they closed for the day, and I met up with this ologist, who was wearing a flowery blouse and a museum ID on a dangling lanyard. She got her bachelor's studying birds at UC Berkley, and got her master's from San Diego State, and her PhD at Harvard working on the genomics of bird feather colors and organismic and evolutionary biology. Now, as a new-ish curator of ornithology at the NHMLA, she met me at the entrance and then led me through the staff-only behind-the-scenes, through the shuttered hall of dioramas now off-limits to the public, past cases and cases of taxidermied specimens dating back a few hundred years, through more doors to the archive of hundreds of thousands of birds in the museum's collections.

Dr. Shultz: Let me go get a stepstool.

Alie Ward: [*excited squeal*] Oh, yeah, they go all the way up! Oh, my god!

Dr. S: Where did all our stepstools go? We've got 122,000 bird specimens.

Alie: 122 *thousand*? You know, you've been here for a year, how do you get used to where everything is? Have you opened up each one of these?

Dr. S: I have not opened up all of them, there are definitely like certain ones that I open up over and over, because it's like, this is where the cool stuff is!

And then we went to her bright and airy office, and we took a seat before a few stuffed specimens in a tray waiting for us, and I asked her aaalllll the quilled questions that would rattle out of my dome, as well as yours. So shake off the dust and get ready to soar the sky and learn about what makes a feather a feather, how they evolved, why they're important, the sounds they can make, the longest bird tail, some feather heists, sexual selection gossip, peacock plumes, bird spotting, iridescence, the blackest black, tiny feathers, huge ones, dinosaur myths, and mysteries, and more, with feather researcher and professional plumologist, Dr. Allison Shultz.

[Intro Music]

Alie: Now, you are a plumologist?

Dr. S: Yeah, I'm a plumologist. I study bird feathers and how they evolved, and kinda more specifically I think about the colors of feathers, but the structure, and development, and all that is integral into the whole picture.

Alie: I did not know this was an actual study, and when you emailed me I was like, fingers igniting the keyboard, "Hell yeahhh!" I was so excited. So you're an ornithologist and then plumology is kind of a subset of it?

Dr. S: Exactly. Yeah, so it's not actually the only thing I do, but it's probably one of my favorite things I do. Because bird feathers are amazing, they're beautiful.

Alie: They're gorgeous. I mean... This is a very stupid question, just right off the top: Do any other living animals on the planet have feathers that aren't birds?

Dr. S: No living animals.

Alie: Okay.

Dr. S: Yeah. So actually, we used to think that that was one of the defining characteristics of birds, was feathers. But once they started finding feathers in all of these non-avian dinosaurs, that became not true anymore. So now we know that feathers evolved long before birds did.

Alie: And all birds are dinosaurs?

Dr. S: All birds are dinosaurs, yes, that is true.

Alie: That still rocks me. Like, what?! Living dinosaurs.

Dr. S: Yeah. I participate in Dino Fest now, we have a table representing living dinosaurs. And it's funny to me how many of the kids actually know that birds are dinosaurs and adults don't. It's like the perspective is shifting, but we're not quite there yet.

Aside: Now, what about her as a kiddo? Was she an itty-bitty bird nerd?

Alie: Did you always like birds?

Dr. S: You know, I'm not one of those kids that grew up loving birds. I always loved animals and I always loved biology. But I was like actually a big cat lover. I used to go to the zoo, I loved *Zoobooks*, I loved documentaries. It wasn't really until college that I took this class, Natural History of the Vertebrates, where we went on field trips every week and learned about birds. And then I took Ornithology the next year and started doing fieldwork and working in

museums. And that's kind of... That class was really what did it for me and what led to this whole career.

Alie: And was there a moment in the class? Was there a particular chapter or some kinda photo where you're like, "Hot diggity!" [*"This is really cool!"*]

Dr. S: Oh, that's a good question. I don't think it was a chapter or photo, it was actually more of a field trip, when I could actually start to identify the birds myself with my field guides. I think I remember the first one that I identified was a tricky one, it was a hermit thrush, and I was very proud of myself.

Alie: [*laughs*] What is it with birding? Why do you think bird people are so bird people?

Dr. S: That's a great question. I think it's because, well, birds are a thing you can do all the time. Birds are all around us and there are different ones everywhere, so it's like once you get into it, you start realizing that, "Oh my gosh, I can go to the beach and look at some birds, and I could go to the mountains and look at different birds!" There are also rare birds that show up at some times, so I think there are a lot of people that have a collector in them and that makes them really love birding. And also, birds are just fascinating creatures. They're so beautiful and they're so different than us in many ways. I think that draws a lot of people to them as well.

Alie: It's kinda like Pokémon Go. [*Pokémon GO theme music starts to fade into background*]
Without the phone.

Dr. S: That's what I was just thinking! [*both laugh*]

Alie: I wonder if there's something about people who like scavenger hunts and augmented reality that love birding. [*music fades out*] My friend, Sarah M, used to be really into geocaching and she's become an avid birder, and she's always been that kind of adventurer. And I wonder if there's something about going out to collect things, but not actually killing them and taking them home.

Dr. S: Yeah, yeah. I dunno. But it could be. And you know, one thing about birds is that you can out and you're almost guaranteed to see birds, no matter where you go. Even in the middle of the city, there's tons of species that we see here. And unlike mammals, for example... I mean, you might see some mammals, like squirrels and things, but you're not going to see 60 different species in one day. And most of them aren't active when we would be active. So you would mostly be seeing a sign, like scat, or burrows, or things like that. Not quite as satisfying in my mind.

Alie: Looking at a turd isn't quite as satisfying as seeing a beautiful bird! [*both laugh*] Turd versus bird. Yeah. I mean, if there were tiny, flying raccoons everywhere in different colors... Can you imagine a tiny, flying possum that was, like, purple?!

Dr. S: That would be pretty amazing.

Alie: Yeah. But we have birds that are that! Which is why birds rule.

Dr. S: Exactly!

Alie: So, okay. Feathers. Is a feather like a modified hair? What's happening?

Dr. S: That's a great question. They're somewhat related to hairs in that they're made out of keratin and they're an external structure that grows out of the skin, but they're actually much more related to scales. ["What?"] Yeah, so both feathers and hair are made out of keratin, but different kinds of keratin. There's this kind of keratin called alpha-keratin that mostly makes up hairs, and our fingernails, and mammalian structures, whereas beta-keratin is what makes up birds' feathers and actually more reptile scales and things like that.

Aside: Beta-keratins are the proteins that make reptile and bird scales badass, and tough, and waterproof, but they're not to be confused with beta carotene, which is a pigment that makes fruits and veggies orange, and which gets converted into retinol, which keeps our skin and our eyes healthy. So that is beta carotene. We eat it with ranch dressing.

Now, beta-keratin, again, is in birdy scales, and beaks, and claws, and feathers, which evolved from scales. Imagine something like an alligator scale splintered into thousands of fluffy shreds, selected through millions of years of getting it on. Boom. You have feathers. Well, you don't. But birds do.

Alie: So it's kinda like a scale just got elongated? A little bit?

Dr. S: Yeah, ya know, they started as scales. If you think about it, birds actually still have scales on their feet.

Alie: Oh, yeah.

Dr. S: Yeah! That's something that we forget. And feathers are such complex structures that we do think they first started off as very simple, almost hair-like structure, and then evolved these more and more elaborate structures.

Alie: And so do you think they were more like quills, like a porcupine quill?

Dr. S: No, they would've been soft. They would probably look a lot like fur.

Aside: So a bunch of dinos had fur-esque proto-feathers. And they were stomping around like big, fuzzy Muppets, and even before *Archaeopteryx* - which was a raven-sized, feathered, avian dinosaur, long considered history's first bird - flight feathers were all over the place in dinosaurs. Also, while researching this aside, I accidentally found out - you wanna hear something weird? - that *T. rex* had wishbones! Nothing to do with feathers, I just think it's weird. *T. rex* had big 'ol honkin' wishbones, like a turkey. Oh, life, y'all! Anyway. But the feathers came first, and then the flight.

Dr. S: So feathers, you think of them as being really important for flight, which of course they are, but feathers evolved long before flight did, so they actually didn't evolve for flight, they were co-opted to be used in flight. You can look at the microscopic structure of feathers and actually see the shapes of the pigment molecules in them that correspond to different pigments and how they're placed. So we actually can reconstruct what the probable color was of some of these dinosaurs.

For example, *Microraptor*, which is this really cool relative of early birds that we think actually had four wings - so both their front legs and their hindlegs all had flight feathers on them, so they probably used them all for flight - we think they were iridescent, kinda like a blackbird, or a starling, or something like that.

Alie: Ooh! And that's based on the color of the pigment capsules?

Dr. S: Yeah, so it's based on how the pigment capsules are arranged.

Alie: Oh, my god.

Dr. S: Yeah. The mechanisms of color and how they're produced, that's like one of my favorite topics of study.

Alie: What did you think of the feather trapped in amber that was found, like, ten years ago? Someone just bought a chunk of amber at a market and they're like, "Holy smokes! This is a dinosaur feather!"

Dr. S: Dinosaur feather, ya know, pretty much looks like a regular feather. There's some very cool feathers that they found to be trapped in amber, and found feathers that don't even look like modern feathers!

Aside: Okay, so I looked up pictures, and there's a 99-million-year-old, tiny baby dinosaur tail, and it looks kinda like if you encased a shaft of wheat in a block of fossilized ginger ale. So obviously, they have evolved and changed over the millions of years, but all of this just makes the "Holy shit! A seagull is a dinosaur?!" so much clearer knowing that these paleo-lizard scales got shreddy and long, thereby helping them take flight. But what are feathers exactly?

Alie: So walk me through the anatomy of a feather. There's like the main shaft, almost like a leaf has a vein? And then the ones off the side... what's going on?

Dr. S: Yeah, that's a good question! So okay, our typical kinda feather structure, when you think of what a feather looks like... The main shaft, we call that the rachis. So that's the part that actually has all of these little branching structures and a part that's bare at the bottom, and that's what's gonna be attached to the skin. If you think of a writing quill, that's where you would dip the ink in and use it to write with. And so those little branching structures off of the main shaft, we call those feather barbs. Each of those feather barbs actually has little branching shafts off of them. These are hard to see with your eye, but you actually can if you look really, really closely, those are called barbules.

And in many feathers, especially feathers that need to be strong, like flight feathers, the barbules also have these little, tiny hooks that we call barbicels that actually link them together. So think about how if you find a feather on the ground and you kinda break it – ya know what I mean, like you can split the different barbs – you can zip it back together. And so that's actually because you're making those little hooklets reattach to each other. So that's how feathers maintain their shape.

Alie: Oh! They're like little, Velcro-y kinda hooks?!

Dr. S: Exactly! Just like that.

Alie: Oh gosh, okay. I always wondered about that because yeah, you can make a feather look like a hot mess so fast, and then you're like "JK, I'm all put together!" You're like, "Way to go, feather!" [*Let's do a makeover!*] How do you feel when you see feathers on costumes, and if you see a vase full of peacock feathers in a corner, do you have to go up and touch them, or are you like, "Oh, what a tragedy that we're using them for decoration"? How does a plumologist react to that?

Dr. S: Well, I don't feel sad, necessarily. I like them, I think they're beautiful. Birds lose their feathers every year, often. Many bird feathers they molt at least once a year if not sooner, so it's not like birds are being harmed to get these feathers, so I don't really see anything wrong with using them in fashion or décor. Especially like peacock feathers, those are some of the most elaborate feathers that you could think of, they're just so cool. So that's usually my reaction, "Wow! Those are so cool."

Aside: So yes, peacock feathers, just fall off of their butts once a year, and peacock farms just go around and pick 'em up of the ground! Which is awesome, so we're done here.

Hmmm... "No we're not," my brain said, "Let's keep googling," so I did. And therein I found that peacocks are native to India and they are the national bird so it's illegal to export peacock plumage from there. So most peacock farms are in China, and a lot of the birds are slaughtered, and plucked, and their feathers are sold pretty cheap. So before you go purchasing a bundle off of Wish.com for, like, a buck a piece or, say, \$2,5000 Burberry trench coat made of peacock feathers, maybe do some research on the ethics and the origins. I'm talking to you Anna Wintour. (Please don't be mean to me.)

Alie: Any pop cultural references to feathers, any feathers in movies that annoy you? When you watch CGI of birds, like in animated shows, are you ever like, "Mmph, that's not what feathers look like"?

Dr. S: You know, I've actually been more impressed, especially lately, with how well feathers are represented. I think animators are actually doing a pretty good job of accurately representing feathers.

Alie: Yeah, I feel like the people at Pixar probably hunker down over encyclopedias of natural history.

Dr. S: *[laughs]* Exactly. You know they'll actually come here to the museum and look at specimens so that they can accurately show how things really are, which is really cool.

Alie: In terms of functions of feathers, can you walk me through some different varieties, like a menu of feathers?

Dr. S: Yeah. Feathers have many different functions and one thing that makes them really interesting to study is that oftentimes they're doing these functions simultaneously. Let's think about this really complex structure and try to understand what it's doing and how it evolved. My specialty is in feather color evolution and feather color itself has many different functions. For example, thermoregulation, birds keeping warm, that's one obvious use of feathers. In fact, we've co-opted it for ourselves, if you think about a down jacket, birds have that built in all the time.

Alie: And does that trap air so that it retains heat?

Dr. S: Exactly, so it's like having this really warm air blanket right next to your skin, basically. Birds can actually control how warm they want to be by either fluffing themselves up or having the feathers be more flat. So if you think about a really cold morning... I was in Boston for a really long time, so sometimes when it's snowing you see a bird outside that looks like a little puffball.

Alie: *[squeals at the cuteness]*

Dr. S: And that's because they're increasing how much warm air that they have next to their skin, which is pretty cool.

Alie: Oh my god. I had no idea they could do that. They're like, "Watch this, I can get cuter *and* warmer."

Dr. S: Exactly. "I'm adorable. I'm going to become almost a complete sphere."

Alie: *[laughs]* So they have a combination of down, like an undercoat? And they have flight feathers on top of it?

Dr. S: Yeah, so there are different types of feathers. Downy feathers are one type of feather, and those feathers don't have the central rachis in the same way as what we call a contour feather (which is a body feather) has, or a flight feather would have. They also don't have all the little hooklets that are going to be hooking their feather barbs and barbules together because they don't need to be hooked together. It's actually better for them to be more unorganized, because they can trap air molecules more efficiently that way.

Aside: So down on a bird is chaotic good. PS. Some down jacket trivia, 'cause I think it's interesting. They were invented by a dude in 1936 named - you ready for this? - Eddie Bauer. That's right, THE Eddie Bauer. So, Bauer almost died of hyperthermia while winter fishing and was like, "Hell no, Mr. Freeze! You have been thwarted. I'm making a jacket." Then he patented them in 1940.

But before we see all down as good, hmmm, let's look at where that comes from. *[hopefully]* I thought that maybe birds were done with their down, I wanted to believe. And I hate to tell you this, but the best down - ugh this is so terrible! - is taken from live birds. That does not feel good to the birds. Which is why there are so many down alternatives on the market which are bird approved. I'm sorry to be the bearer of heavy feather news, but that's the truth.

So there are the contour, or body, feathers; the warm, down feathers underneath; and then what other kind of feathers?

Dr. S: There's another type of feathers that's really cool called rictal bristles. If you've ever looked really closely at a bird like maybe... there's a bird called a nightjar or a bird that is an insect eater like a flycatcher, you might see little, almost hairs coming around the bill, almost like whiskers, kind of. These are special feathers that only have this central rachis, they don't have any of these barbs or barbules.

Aside: Imagine a lip-liner but made out of false eyelashes. Boom, rictal bristles. It's a mood.

Dr. S: And for a long time, people didn't know what these feathers were doing, and thought that since a lot of these birds that have these are insectivores, they're probably funneling insects into their mouths.

Alie: *[gasps]*

Dr. S: But actually, experimentally it's been shown that wasn't the case. What they are probably doing is protecting the eyes of the bird.

Alie: Really?

Dr. S: Yeah.

Alie: So they can't hit themselves on things?

Dr. S: Well, more so that like little debris doesn't get in the eyes. So, when you're out chasing a bunch of bugs, and in the air your eyes aren't getting full of, you know, junk.

Alie: Oh my god. Now what about a horned screamer?

Dr. S: What about a horned screamer?

Alie: What is that dingle-dangle on top?

Dr. S: Well that's actually, like, part of the skull, kind of, not made of feathers, but is a hard projection.

Alie: Oh I didn't know that, okay. I wasn't sure. I have seen pictures and they are terrifying and hilarious.

Dr. S: [*enthused*] Oh yeah!

Aside: During the tour she gave me, Allison showed me that some actually have those bristles in the... mouth... area... places... [*whispers*] Wow.

Tour audio

Dr. S: And some birds even have modified feathers on their eyes that look like eyelashes, like hornbills, have you seen that?

Alie: No! Is that also to get debris out?

Dr. S: Yeah.

Alie: Oh my gosh, I didn't know that. That's very fancy.

Aside: During the tour we also looked at a tray of carrion eaters who were fashionably featherless in the head region.

Dr. S: You don't want a lot of feathers getting in the way of all of your head functions.

Alie: Makes sense.

Dr. S: And birds like condors or vultures, they'll have pretty bare heads. That's true of most carrion eaters because you don't want to have your head in a carcass getting all gunky and bloody then have it all in your feathers. That's just not helpful, right?

Alie: [*laughs*] That's like someone with a beard eating a cheeseburger. It's kinda gross.

Dr. S: Exactly, it just gets all in there.

Interview in Dr. Schultz's office

Dr. S: I mean, there are other birds that have crests or other various special feathers. We talked about thermoregulation as one use, but one of the other big uses of feathers, of course, is signaling. Whether that's being cryptic, so you're trying to hide from predators – think about a brown bird that's maybe on the ground and hard to see – or to become more conspicuous, so they are actually trying to show off. Plumage color is one of the things that birds can use to demonstrate its qualities. They use their color to attract mates, for example, or to fight off rivals. You know, males, instead of fighting over a territory or something like

that, males will be able to look at some of these colored patches and decide “Oh, this guy’s not worth my time,” or “This guy’s going to be a competitor, I’d better fight him.”

Alie: *[laughing]* That’s so judgy! That’s amazing. They’re looking each other up and down, sizing each other up.

Dr. S: Yeah! Like have you ever seen a red-winged blackbird? You know these blackbirds with red patches?

Alie: Yes.

Dr. S: There was an experiment done, I believe it was in the eighties, where they either made those red patches twice as big, or they colored them black so they were half as big or so there was no red patch at all. And they found that when they made that red patch twice as big, actually those males had way more other males attacking them. So, males were like, “Oh my gosh, this guy is totally going to come and steal my territory, I better fight him off right away.” Whereas, if they made the patch half as big or not red at all, then these males wouldn’t get attacked much at all because they’re like, “This guy is not a threat, I don’t have to worry about him.”

Alie: Oh my god, that’s so petty. I love it.

Dr. S: And one of the things I do study is how male and female plumage evolves differently in birds because we can learn a lot about... trying to pick apart these natural-versus-sexual selection. That’s what we call selection due to getting more mates, for example. So, in birds, all they have to really show off is their plumage or their song. Some birds might have a fancy song; some birds might have a fancy plumage. That’s how they can show a mate that they are worthy of being their mate, whether that’s a one off as happens sometimes. You know, in some places all of the males with very fancy plumages will get together in what’s called a lek and they’ll all show off at the same time. The female will come and basically be able to compare them all. [*“Very nice selection. I’m going to start on this end.”*] She’ll be like, “Hmmm, which one do I like better... Oh I think I’ll go with this one.” There’s actually this really awesome species of bird called cock-of-the-rock. That’s literally their name.

Alie: Oooh my god. Are you serious?

Dr. S: I’m serious.

Alie: Are they British?

Dr. S: Well, the person who described them was probably British.

Alie: That sounds like the most British thing I’ve ever heard. *[laughs]*

Dr. S: Yeah.

Aside: Did I research who named this bird cock-of-the-rock? I sure did. And it appears to have been an explorer and biologist named Sir Joshua Wilson, but I looked up and down the internet, friends, and I swear this is the only detail I can find out about the man. So you know what? You never know what your big hit in life might be. Now, for Sir Joshua, it was cock-of-the-rock.

By the way, if no one is using that as their morning show DJ name at a classic rock station in New Jersey, please go for it. [*cheesy radio DJ voice*] “Cock of the Rock sayin’ rockadoodledoo!”

Anyway, these cock-of-the-rocks are a showstopping orange, Allison explains.

Dr. S: They’re these bright orange birds, and they live in the rainforest in South America, and males will fight over patches of light. Instead of having territories, they will defend their light patches and that’s because they’re all together in the same place. When the female comes, they’ll all get in their little light patches and kind of jump around to try and get her to choose them.

Alie: Like they each have spotlights on them?

Dr. S: Exactly.

Alie: [*slow gasp*] Cock-of-the-rock.

Aside: Male birds are sometimes up in treetops, just having a Lady Gaga spotlight moment. How do they get into the treetops? Good question. Flight feathers, of course. So how are birds achieving all of our wildest dreams and soaring through the air so casually? Well folks, feathers. That’s why we’re all here.

Alie: How are these flight feather working?

Dr. S: One of the key aspects of a flight feather is that its asymmetrical. And what does that mean? So if we look at a flight feather, you’ll see a central rachis, that central shaft; the barbs on one side will be shorter than the barbs on the other side.

Alie: Ohhhhhh!

Dr. S: So think about seeing a feather. That’s an indicator that the feather you have is actually a flight feather. And the way it works is that when air goes over these feathers and over the wing itself, the distance that it has to... Wings are not flat, they’re kind of concave, and the distance it has to travel going over the wing is shorter than it has to travel going under the wing. Because of that, air molecules are going to fill that pressure differential that it creates, and actually that’s going to create lift. And part of that is the structure of these asymmetrical feathers.

Alie: Really? That’s really cool. I never knew that they were asymmetrical like that. Where are the flight feathers on the bird?

Dr. S: If we think about the wing of a bird - I am extending my arm but of course I have to describe it with words [*laughs*] – the really important flight feathers are the ones that are extending, basically, from the wing tip as you get closer to the inside of the wing. If you’re looking at a flying bird, they would be pointed at the tail.

Alie: Oh wow.

Dr. S: Yeah. And those feathers are probably the most constrained of all bird feathers. Once you start looking at bird wings, you’ll start noticing that, even though many other parts of the bird will be many different colors, those feathers are never any other color. That’s because of one of the types of pigments that color birds’ feathers, melanin.... Melanin is familiar, it’s also what colors our hair and skin; it’s very common throughout the animal kingdom. It also

provides strength for feathers, so you almost always see flight feathers that look almost identical. I mean, not completely, but much more than any other feather on the body. And that's because they're evolved to be so specifically tailored to be able to provide flight.

Alie: And they're usually the darker ones on the bird?

Dr. S: Exactly. That melanin gives them this kind of blackish brown color. One way we know this is so important for providing structure and making feathers stronger is when you see an albino or a leucistic bird. That's a bird that's missing its melanin. Albino would be no melanin at all in the body, so the bird would be completely white and have pink eyes. Leucistic means that whatever was producing the melanin broke, so you'd see these random white patches on the bird.

And this bird called the frigatebird... Frigatebirds are really awesome flyers. They're a type of seabirds. They're arguably the best fliers. Most maneuverable. They're called pirates of the sky because they steal fish from other birds. [*clip from The Office (S08E15): Leslie David Baker, "I'm a pirate."*] One washed up on shore that was an albino frigate bird. It was completely white, and its wings and tailfeathers were deeeestroyed. They were completely... Almost all the barbs were broken off, so this bird probably couldn't even fly anymore.

Alie: Oh my gosh! So it is really structural? That's so interesting. What about silent feathers? Like those owl feathers?

Dr. S: Yeah so owls, on the part of their wing that would be kind of facing forward when their wing is out...

Aside: On the leading edge of the primary feathers. The primary feathers are the ones closer to the wing tips.

Dr. S: They have a small fringe of little structures, they almost look like very small eyelashes, that are lining the front of the feathers that are on the forward-facing part of the wing. That is disrupting the airflow which allows them to fly silently. Have you ever noticed that when you go up to a pigeon and it starts flapping really fast it makes a bunch of noise? They actually try to make themselves louder. [*clip from Mean Girls: Tim Meadows, "Let me hear you make some noise!"*] So their flight feathers are such that they're actually going to increase the amount of noise.

Alie: Is that to scare off predation?

Dr. S: Probably yeah, to make themselves more obvious like, "Hey, I'm flying away from you!" Did you know that other birds can make completely other types of sounds with their feathers? Did you know hummingbirds can sing with their tails?!

Alie: Noooooo. Can they seriously?! What does it sound like?!

Dr. S: They seriously can! It depends on the species. It's very species-specific. For example, Anna's Hummingbirds will fly up really, really high in the air. They do these courtship dives, and they'll dive down, and they'll go super-fast and at the bottom of their dive they'll spread their tailfeathers out and make this really loud beeping noise like [*high pitched*] beep!

Alie: What?! Oh my god! And then the lady is like, [*suggestive*] "Ooooooh okaaaaay."

Aside: Okay I looked it up: Here is the noise of an Anna's Hummingbird showing off flying abilities and trying to get laaaaaid. As described way more tastefully by a vintage Britannica encyclopedia film:

The courtship is marked by extraordinary displays by the male, who swoops, dashes, and soars high until he is almost out of sight, then dives back down at a speed that may reach 60 miles per hour. [buzzing, followed by a quick chirp]

Now, this behavior is called a 'courtship dance' in birds, and 'thirstiness', or 'a flex' in human primates.

Alie: When it comes to plumage, and colors, and displays, what's your favorite? What's the most dazzling?

Dr. S: Well, it's hard to argue with the birds-of-paradise. They've got it all. They've got some of the most elaborate plumage out there. You think a peacock's tail is elaborate - and it definitely is very elaborate - but the structures you can see in different species of birds-of-paradise are more elaborate than, I would say, any other family of birds out there. These are birds that only live on New Guinea, and one cool thing is that, as elaborate as their plumage is, they have equally elaborate dances to go along with them. They don't just have this plumage - they have very specific ways that they show it off. *[clip from Magic Mike: Channing Tatum, "Magic. Magic Mike."]*

There's this one species that almost does a little ballet dance, where it actually dances, like, under the female and it will show off in intervals, like it has this kind of shield on its breast and the female will be looking down from above and it will flash it to her. And that's just one species. They're just amazing. There's a really good documentary that the Cornell Lab of Ornithology and National Geographic put together that I highly recommend. It's really fun.

Alie: Do you have a collection of feathers? If you see them do you pick them up? Or is that disgusting? Are they full of mites?

Dr. S: Well that's actually a great question and one thing I'd like to tell all the listeners out there is: Technically it's illegal to pick up feathers off the ground.

Alie: What?! What if it's on your property?

Dr. S: Doesn't matter. There's this law called the *International Migratory Bird Treaty Act*. I believe 1918 was the year it was founded. Basically, it says that possession of any part of a migratory bird is illegal, because they don't know if that came from a feather you found on the ground or a living bird feather. As a museum scientist, I do collect these things. I have a special permit that will allow me to pick these things up, and also dead birds - because you know, we're a museum, we're into that sort of thing- and bring them into the collection.

Alie: *[gasps]* And so do you take them and then sort of note where you found them, and when, and what it might be?

Dr. S: Exactly. I usually won't pick up single feathers. It's much more interesting and of-use to me if I have the whole bird. So, if I find a dead bird for example.

Alie: *[laughs]* Do you have gloves in your car?! Purell?!

Dr. S: ... baggies...

Alie: [*continued laughter*] I mean, you're talking to someone... I have a couple of dead birds in my freezer right now, and I don't know if that's illegal, but...

Dr. S: You should bring them in. I will take them, here in the museum.

Alie: I know! I need to make sure that I'm not going to get imprisoned.

Dr. S: It'll be okay.

Alie: So, if someone finds a dead bird can they call up a museum and say, "Hey I've got a dead bird here."

Dr. S: Yeah! Please do! Call up your local museum. That's one of the main ways we're growing our collection these days is people are bringing... give us or let us know about dead birds and we arrange pick up of the dead bird. We build our collection by about 300-400 birds every year that way, either by people bringing them in or wildlife rehabilitators. The key is just noting the date and where you found it. Without those two pieces of information, unfortunately the bird will be of much less use for research.

Alie: Right.

Aside: P.S. I don't know why but at some point I started to look up 'Can you eat feathers?' and some birds, like Grebe can eat their own feathers to line their stomachs which protects them from getting internally shanked by fish spines. [*excited*] They eat their own feathers! On purpose! But as human people, it won't do much for us to chow down on down. Until recently. Some researchers were trying to figure out what to do with the feather waste from poultry farms, and it turns out with a little handy acid hydrolysis and then adjusting the pH to neutral, feathers can be dried and powdered, and they're, like, 90% protein!

Now, there was one 2018 study published in the *Journal of the International Society of Sports Nutrition* - [*sarcastic*] I thumb through those all the time - and researchers found that feather keratin protein from chicken feathers helped participants put on more lean body mass than dairy protein did! Now, did the feather protein have a waxy texture in the mouth? Yes. Did some participants like that? They sure did. And really, is it any weirder to eat melted feathers than it is to drink from the teat of a cow? I mean, shake a tailfeather? More like *tailfeather shake*. Oh, speaking of...

Alie: Question about peacock feathers. How do they fly with those ding-dang tails?

Dr. S: They don't fly well. There are a lot of birds that have really long tails and oftentimes its actually kind of a handicap for males. If the male can survive and do well with the super long tail that prohibits it from being good at flying, then probably it's a pretty healthy bird and I want to pass those genes onto my offspring. So, that's actually how these crazy tails have evolved, is what we call 'runaway sexual selection' where females will choose a trait and it will become more and more elaborate over time.

Aside: Are you guilty of a term pickup artists call 'peacocking?' Well, that is also known as runaway sexual selection because it makes people want to run away from you.

Alie: Now, what about different color plumages? What range are we talking? Can they go everything from opalescent to, obviously, to black? Like, what colors have you seen working in feathers?

- Dr. S:** Oh! That's a great question! One of my favorite topics is bird colors. Birds can come in every color of the rainbow, including colors that we can't see!
- Alie:** Really?! Other birds see it??!!
- Dr. S:** Yes! Other birds can see colors that we can't see. Birds can actually see ultraviolet colors.
- Alie:** Can they?! I didn't know that!
- Dr. S:** They can. So, we can see... If you think about what is color? It's wavelengths of light that, we have cone cells in our eye that will be activated or not by certain wavelengths and that gets translated into our brain as a color. Think about humans: There's a lot of variation in terms of what color people can see. There's colorblind people, for example. We have three types of cones in our eyes that can see from about 400 to 700 nanometers. But birds have four types of cones in their eyes, so they have a whole other kind of cone. That cone resides from about 300 to 400 nanometers, so they can actually see from 300 to 700 nanometers.
- Alie:** So, there could be disco birds out there that we have no idea about?!
- Dr. S:** There could be. I actually brought a few birds out here with me, and one of the birds that I brought was this bird called a Palm Tanager. Tanagers are the kind of special family that I study a lot of. This bird you look at it, it looks pretty greyish, yellowish... not that exciting. It's related to a whole bunch of extremely colorful tanagers. Just google *Tangara* Tanagers and you'll see these amazing plumages. And people are like, "Why is it in this genus? It's kind of drab looking. It's not that exciting." But if you look at this plumage using what's called a reflectance spectrophotometer, which is a machine that we use to actually objectively measure how much light is coming off of feathers at certain wavelengths, you can see that almost all of the reflectance is in the ultraviolet. So, this bird would be much, much brighter to a bird than it is to us.
- Alie:** Really?! So, it looks kind of like an olive color, like an army green-greyish color, but it might be, just, holographic disco bird?
- Dr. S:** I mean, probably not holographic disco bird, but it would be quite a bit brighter.
- Alie:** [laughs] Do you think it would be in the, like, greenish spectrum?
- Dr. S:** UV is much more like purplish. So, it's probably... I mean, it's hard to say because we can't see it. It's not even that we can't see UV colors, it's that with this whole extra type of cone it's like there's a whole other dimension of color that birds can see that were missing.
["Wooooow."]
- Aside:** Allison says she gets asked a lot about her favorite bird feathers, and one that she looooooves is a fruit eater from Africa called a turaco. Turacos are about the size of a parrot but are not parrots. They have a deep green olive-y plumage with red underneath their wings. You might be like, "Green bird, so what?" How dare us! Their green color is super, super special to plumologists. Like, if feather experts were your friend who collects vinyl, turacos would be like a platinum edition, signed copy. Why the fuss?!
- Dr. S:** Most green in birds is made by blue feather structure plus yellow pigment. If you think about mixing finger-paints together, blue and yellow, what does it equal? It equals green. But these birds actually have a true green pigment, and it's a copper-based pigment. It was

the first pigment to be described in birds but it's the one that we know some of the least about.

Alie: Someone's gotta get on that!

Dr. S: Exactly! One of the things that I love about our museum collection here is we actually have a lot of East African birds, so we have almost all turacos represented.

Alie: Why in some regions of the world are birds more drab and why in other areas they're flashy?

Dr. S: That's a great question. For the most part, birds are more brightly colored in the tropics and so there have been a lot of hypotheses proposed as to why that is. Just think about the environment that birds are living in. For one, there's generally more food year round there. A lot of birds there don't migrate, so they don't have to worry about this really expensive migration which happens once a year.

Also, one thing to keep in mind - I was going to save this for the flimflam question, but I will debunk the flimflam now - [*Alie laughs*] is that when you see a bird that is really brightly-colored like a parrot for example, you have to think about where its coming from. A bright green parrot, we think of it as being bright, but it's actually very cryptic in the habitat that it's from. If you ever try to find a parrot in a green tree, you'll very quickly understand that these birds are actually super hard to see. If you ever go birding in the tropics, you'll find its very difficult to see many birds. It's because there's this great variety of habitats and light environments that makes it really hard to see all these birds.

Alie: There are some flocks of parrots in L.A. Do you ever get to see them?

Dr. S: Oh yeah! I see them almost every day. The Yellow-chevroned Parakeets will come and feed in some of our trees here at the museum.

Alie: Is it true or false that some of those parrots, the green parrots, were from a pet store fire in Burbank. Have you heard that hypothesis?

Dr. S: I have heard that urban legend.

Alie: True or false?!

Dr. S: Probably a grain of truth there. The truth is that we've got 10 to 12 species of parrot here in L.A. that are now what we call naturalized, which means that they're breeding. All of these birds came from the pet trade.

Aside: Parrots, by-the-by, are from tropical and subtropical regions. So, like... not Southern California. From elsewhere. These stunning beauties arrived here on the hopes they'd make someone a buck, but they ended up breaking free of the system and then just bubbling about kind of aimless. Just like most of us L.A. transplants.

Dr. S: It's probably a combination of pets getting away, potentially shipments of birds getting loose. If you have a small flock it makes more sense that they would become established. A pet store fire could have had something to do with it but probably not everything.

Aside: I told Allison that I see some in my neighborhood when I go for walks, which lately have been more frequent.

Dr. S: Yeah, the red crown parrot's up there.

Alie: Yes! I think that's what I see. I heard them at night, just [*Alie mimics parrot call*].

Dr. S: Yeah, they're so loud!

Alie: And I was like, "What animal is that?!" [*clip of parrot screeching*] I realized later that it was a parrot, but I get so excited when I see them. It's like, woah!

Dr. S: I know. It's fun to... I love seeing flocks of parrots. They're very apparent when they're coming because they're so loud.

Alie: I know! How come there aren't more blue birds that would blend in with the sky?

Dr. S: Oh! Good question. Part of that has to do with how blue is made. Let's circle back to the point I was making earlier about how bird colors are made. There are two ways that birds can make colors. One is by refracting color off of the structures of their feathers. That happens when light comes in and certain wavelengths are reflected based on how the feather nanostructures or molecules are shaped. The other is based on pigments that absorb certain wavelengths of color.

Aside: So color can be strobed up pigment or structural. Got it.

Dr. S: So, we talked about melanin, and browns and blacks are all melanin molecules. Melanin is a pigment that absorbs almost all wavelengths of light. There is a pigment called carotenoids which is the other most common bird pigment. This produces almost all oranges, yellows, and reds in birds, but blue in birds is not produced by pigment. It's produced by the feather structure. It might be harder to evolve a blue feather structure, for example. It's the evolution of these coloration mechanisms. It's something that's somewhat new and up-and-coming in the field.

Alie: Oh, that's so interesting. I never knew that.

Aside: Okay, so I looked this up, and it's almost like there's a spongy layer made of keratin and air that sits on top of a melanin layer, and it's the structure of that sponge that throws light in the blue-range back. Now, iridescent colors have a few layers of melanin that scatter light depending on your angle to the sun and the feather. All of this is happening deeeeeeep in the teennny barbs and barbules to make up birds in all shapes, and sizes, and degrees of flamboyance.

Alie: What about head crests? Is that mostly just display?

Dr. S: Yeah. There are certain regions of the bird that we might often see more colorful. Crests are one way that birds can use for display and social signaling. One convenient thing about crest colors is that birds can show them off when they want to or hide them when they don't.

Alie: [*laughs*] They can just go [*badoinks*] and just have it up.

Dr. S: Exactly.

Alie: So sneaky.

Dr. S: So when they want to show off to their lady or their guy depending... because sexual selection works both ways. It's not just females trying to get males, males try to get females, too. When they're foraging and they don't want to attract a predator, they can put down their crest and make themselves less conspicuous.

Alie: *[gasps]* That's genius. I've never realized that.

Dr. S: Yeah. You know, the ultimate crest is in this bird called a monarch flycatcher.

Alie: What is it?

Dr. S: Flycatcher is a bird, an insectivorous bird, but the crest looks like a crown. It's called a monarch because the crest looks like a crown. It's bright orange and blue. I highly recommend googling that.

Aside: Dr. Shultz, because she's awesome, emailed me after our chat, to let me know that she meant to say royal flycatcher. Not a monarch fly catcher. Now, she also attached a picture of a royal flycatcher and, y'all, imagine if, on your face, you grew a traffic cone orange polka-dotted fan. Just a fan right between your eyes. It's spunky. It's bold. In the photo she sent, the bird's mouth is just slightly open and the corners look kind of raised in an expression that reads: "I know, right? It's way cool." I will now change the subject to bird legs.

Alie: Owl legs. So hairy. Who knew?! Does it ever freak you out that owls have such long legs that are just covered in furry pantaloons?

Dr. S: That's good... You're full of great questions, Alie.

Alie: I'm peppering you with so many! It's such a barrage. *[laughs]*

Dr. S: First of all, actually, a lot of birds do have much longer legs than you think they are. They hold them close to their body cavity so you don't realize how long bird legs are. I think furry owl legs are so cool.

Alie: God, they're so cute. So weird.

Dr. S: Probably has something to do with both thermoregulation... Owls aren't the only ones that have furry legs. There are a lot of birds that live in ice and snow, like these birds called ptarmigans that also have furry legs and furry feet to keep them warm. Not all owls have furry legs, only some of them.

Alie: Do you sign important paperwork with a quill pen?

Dr. S: I don't, but I should. That's a great idea. I like it.

Aside: Yes, there are many, many YouTube videos that can usher you down a rabbit hole of making your own, authentic, goose quill ink pen. And they involve baking the quill in a skillet of hot sand to cure it and then slicing it at a precise angle. I watched several with rapt curiosity. And then I saw them use the quill to write, and they can write one splotchy word before having to re-dip it, and I was like, "Fuck this, dude." Uni-ball gel pens and indoor plumbing forever. Antibiotics. I'm good with modern times, thanks. So, yeah. Quill pens can't hold much ink. But what about the feather barbs? What can those things sop up?

Dr. S: Can I just tell you a quick feather fact that's so cool?

Alie: Oh, yes!

Dr. S: There's this really unknown, but really cool species of bird called a Sandgrouse. It's a species that lives in the desert. The adult birds have specialized belly feathers that hold water. They'll fly for kilometers every day to the watering hole and soak their bellies and fly

back to their baby birds and bring them back the water to drink. They drink the water from the belly of the adult bird. They have these really cool looking spirally feathers if you look at them under a microscope.

Aside: Okay, yes. I looked this up. Instead of straight barbs, they're kind of heliacal, kind of like a curly ribbon on some festive gift wrap, just slurping up water for the bebehs. So, next time you're in the kitchen, just like, dunk your perm in a 2-liter of Mountain Dew and suck it dry back at your desk. Which is now a card table in the garage.

Now, we're about to get the Patreon questions (so many good ones!), but before we do, each week we donate to a charity of the Ologist's choosing. This week, Allison chose the Ornithological Council, which is a Birdnet.com/OC. They do a lot of great work to connect ornithologists to the public including meeting with policy makers and they provide timely information about birds to help ensure scientifically based decisions and management actions. They're also very helpful for all things permit-related, she says. A donation went to them, and that was made possible by sponsors of the show, which you may hear about now.

[Ad Break]

Okay, and now back to the feather questions that'll tickle your curiosity.

Alie: Allison Einolf wants to know: Do feathers really carry diseases?

Dr. S: Birds do carry diseases and certainly contact is one of the ways that diseases get carried. Just like we carry diseases on our hands, birds will carry diseases on their feathers as well.

Aside: Yep, we recorded this in late February, before COVID-19 had really started to hit its global stride... before we all began to diligently milk our thumbs in a sudsy panic. Milk your thumbs!

Dr. S: Birds also have parasites. They'll have lice, for example. Those can carry diseases. So, it is true. Thinking about finding a feather on the ground... I'm not super worried about getting a disease from that because most diseases from birds don't jump to humans. Although, that's not necessarily true... West Nile Virus, for example. Maybe don't pick up a dead crow that you see.

Alie: Okay, unless you're a museum person. If you find a feather, even though it's illegal to take it home with you, if you were to, say, spray it with an alcohol solution... would that be okay?

Dr. S: You know, if a feather's been on the ground for a while, most parasites will disperse very quickly once they're not attached to a living host anymore. They're like, "There's no food. I want to leave." A lot of diseases will also disperse pretty quickly.

Alie: Okay, so it's probably not what you're going to die from, of all the things.

Aside: Now, the folks who asked that, by the by, were Melissa Vono, James Huffstulter, Allison Einolf, Jessica Chamberlain, Kira Gowan, and Jessie Dragon. And yes, I checked that out, and I didn't know that West Nile Virus is a mosquito transmitted disease that has corvids as a reservoir. That was news to me. Also, let's just make a pact right now: let's not pick up too much dead stuff right now. Let's keep our hands clean. We're learning a lot of valuable lessons these days. Nobody poach any pangolins, alright? Agreed? Appreciated.

- Alie:** Tineasha Brenot wants to know (first-time question-asker, by the way): Why do birds grow feathers as opposed to fur or hair?
- Dr. S:** That's a great question. That's due to evolutionary history. Hair and fur evolved in the lineage of mammals, which of course branched off from the common relative of both birds and mammals, long before either hair or feathers existed. You never know what evolution is going to come up with. In the case of mammals, it came up with fur. In the case of dinosaurs, it came up with feathers and these protofeathers before they became the complex feathers we know today.
- Alie:** So just a roll of the DNA mutation dice.
- Dr. S:** I would say so!
- Alie:** Euan Munro asked: Is it true that if eagles or other birds, they're not sure, lose a feather on one wing they will lose the equivalent feather on the other side to balance?
- Dr. S:** Generally, that's not true. They'll grow a new feather in if they lose one feather, but you do see equivalent lost feathers on both sides is when they're actually molting them off. When they're molting, it's all pretty timed, so they'll lose the same feather on both sides.
- Alie:** Are there different seasons where you're bound to find more feathers on the ground?
- Dr. S:** Oh, yeah. Definitely during transitional times. Some birds molt in the fall and some birds molt in the spring for breeding season. Generally, you won't find many feathers during breeding season because birds don't want to do expensive things like feeding young and molt at the same time.
- Aside:** Oh, and by the by, when a feather is molted, how does a new one come in? It grows in as a pin feather, or blood feather, and it looks like a spike. It's filled with blood to help it grow and birds have to nip and preen the keratin sheath off of it as it grows. Also, if it breaks off mid-growth, it can just spurt blood! So bird owners... you have got to look out for pokey-blood-faucet-pinfeathers as they grow in. Also, understandably, pin feathers are a little sore... a little ouchy. Birds are like, "Back off, I'm feeling a little bitchy." I'm imagining it must be a lot like PMS only without as many snacks or crying at commercials.
- Alie:** Is it ever really frustrating for bird watchers to know, like, when you see a bird, not only do you have to know what the bird's plumage looks like, but you need to know both sexes and what time of the year they might be a different color....
- Dr. S:** And different ages. Sometimes young birds will have different plumage. Gulls are the worst (or the best, depending on your perspective). They have different plumages until they're 4 years old. I think for a beginning birder it may be potentially frustrating, but for a more experienced birder, it's actually viewed as one of the cool things. It's a challenge, like, "What is this bird?"
- Alie:** Yeah, you're leveling up [*level up video game music*] Mo Casey (first-time question-asker) wants to know: How do waterproof feathers work? Primarily on puffins, because they're the cutest, but other waterproof birbs are good too.
- Dr. S:** Most feathers on birds are waterproof to some extent. On a bird like a puffin or even a penguin that spends a lot of time... There will be a certain density that will make it difficult for water to go in. A bird on the opposite side of things, a bird called an anhinga, for

example, a bird that dives underwater actually has very dense barbs and feather barbules, and this helps them to dive down because they don't have all the air trapped. But because water will get in, then you see them standing with their wings outstretched. Cormorants will do this sometimes too. They're actually drying themselves out.

Alie: Oh! I always wondered why they don't get chilly.

Dr. S: They probably do get a little bit chilly, but you know, even these puffins, for example, that live in cold places, or penguins, they've got some of the most numbers of feathers on them. I think the most is a swan, which I think has, like, 25,000 feathers on it. The tundra swan.

Alie: WHAT!

Dr. S: Yeah. Crazy. The least number of feathers counted is a ruby-throated hummingbird, which has, like, 965 or something like that. So, there's a huge variation in how many feathers you have. And if you have waterproof feathers and you have this really nice downy layer, then you've got, like, a really awesome wetsuit, basically. You're going to be fine from the cold.

Aside: And unlike our wetsuits, birds never have to strip it off on the side of Pacific Coast Highway and shake sand out of the crotch.

Alie: Robin Kuehn wants to know: What is up with emu feathers and their double feathers? Do emus have double feathers?

Dr. S: Yeah! So, the double feather is called an afterfeather. That's just true of some birds. Some birds have that, and this is especially true of birds that are flightless. Emus, for example, they can't fly, right? Same with cassowaries, kiwis, ostriches, these are all birds called ratites. Once you lose that flight constraint, your feathers can do a lot more things, because they... You don't have to worry about being aerodynamic anymore or having these flight feathers. So then they can evolve... A lot of them have lost their hooklets that hook them together. Think about, like, an emu plumage. They're pretty furry looking. It's kind of, like, hairy. And that's because they don't have to fly anymore so they can use their feathers for other things.

Aside: This next question came from patron Kaydee Coast.

Dr. S: How do I feel about feathers in fashion... I think as long as they're ethically sourced feathers, I have no problem with that. Birds lose their feathers once a year or something like that.

Alie: So they're around.

Dr. S: They're around. I don't see anything wrong with using those feathers.

Alie: I've got some questions, some hot goss. Tea has been requested to be spilled. Davis Born and first-time question-asker Chelsea want to know a little bit about Edwin Rist's great feather heist of 2009 and how you feel about it. How does the feather community feel about it?

Dr. S: Yeah. I'll speak more from the museum community, the ornithologist community, than the feather community.

Alie: [laughs] Okay.

Aside: Quick background. In 2009, a then-22-year-old American flutist posed as a photographer and cased a vault in the London Natural History Museum, then came back

with a suitcase at night at made off with nearly 300 specimens to sell on the fly fishing black market! Then used the money to buy a nice flute! He never even served jail time! He just moved to Germany, and now he posts heavy metal flute videos on YouTube under the username HeavyMetalFlute, and he goes by Edwin Reinhard, a nom de plume, if you will. He's just livin' his life, like no big deal. So what does Allison think of this caper?

Dr. S: It does make me worry as a bird curator, which is, you know, my job. I worry, "Is somebody going to come in and try and steal some of my birds to sell on the black market?" It's a real fear. Museums, they have some security but, you know, there may be some holes in the security potentially. So, I think it really was eye-opening to the museum community with just, you know, how vigilant we need to be. It was, honestly, a tragedy. I feel very sad because of it. 299 birds were stolen from the Tring museum in the UK. A lot of these birds are irreplaceable. They're very rare species, some of them collected by Alfred Russel Wallace, the compatriot of Charles Darwin. They're things that we'll never be able to get back. So, it's just super sad.

Alie: And they're out there somewhere.

Dr. S: Some of them are, you know, they're sold on the black market for fly tying.

Alie: [*sadly whispering*] Fly tying. What a waste. You know what I mean? Just...

Dr. S: Yeah. They did recover some of the birds back, but on some of them, you know, the tags had been removed, so we didn't know where and when those birds were from. And so if we don't have those data, a specimen becomes virtually useless.

Alie: Oh yeah. This is all coming back to me now, and now I'm starting to get very mad.

Dr. S: The book *The Feather Thief* by Kirk W. Johnson is really good. I recommend it.

Alie: Oh! What a... Wow. That guy. I'm surprised they don't tar and feather him.

Dr. S: Yeah. I mean it would be very apt...

Alie: Just in like, sustainable, feathers.

Aside: PS, tar and feathering people as a form of ridicule and punishment started at least in the 12th century - that long ago! - and in the United States, unruly mobs would go around punishing people with it. And as someone who has waxed various parts of her body, I'm gonna go on record and say it sounds real awful. And this next question was asked by patron Kelli Brockington:

Alie: Do you have any idea... Some people are asking, why some folks are allergic to certain feather and down pillows?

Dr. S: Different structures? Some birds have these feathers called powder down feathers, which are instead of being molted, they're continuously grown and they actually will, like, fragment, so they'll produce kind of a white powder. This is especially true in birds like herons for example. And so yeah, I'd say most down feather pillows and things are probably from geese and chickens, but there could be some varieties that maybe have slightly different feather structure for whatever reason, which could cause that.

Alie: Have you ever had to pluck a bird, like pluck a goose?

Dr. S: Um, yes.

Alie: You *have*?! What was the deal?

Dr. S: Well, you know, one of the ways that we actually preserve bird specimens here at the museum is we'll skeletonize things. And so one of the steps of skeletonizing things can be removing the feathers. Now, I saved those feathers because they're useful for research and you know, it's... it is what it is.

Alie: Are they hard to pluck? I've never...

Dr. S: They are, some of them. The feathers are really stuck in there.

Alie: I bet that hurts so much if someone plucks one out of them, right?

Dr. S: Well, they're not alive anymore.

Alie: Well yeah, but if you were one let's say, you know what I mean?

Dr. S: Oh yeah! Especially the flight feathers for example, and the tail feathers, those can be actually stuck in the bone. You know, if you look at some of the bones in an avian wing, they actually have little knobs where the quills hook in.

Alie: Whaaat! All the way through!

Dr. S: Well, not through the bone, but like attached to the bone.

Alie: Oh my gosh. I once got a chicken from Trader Joe's and it still had feathers on its butt. I had to pluck them before I cooked it.

Dr. S: How did you feel about that?

Alie: I was like, "I'm not equipped for this!" That, and when you roast like a five-pound chicken, it just is a lot like a human infant and it's uncomfortable, you know? But then having to pluck feathers from its butt, only on the butt? I took pictures. Let's see... Seth Suchy, first-time question-asker, wants to know: What's the weirdest feather?

Dr. S: Ooh, the weirdest feather. That's such an interesting question. Okay, I'm going to give two examples. One: there's some cool feathers on the birds-of-paradise that are, like, totally bizarre. Like on the king bird-of-paradise above their tail, the feather has a super long rachis. So it's bare, bare, bare, bare until the very end and it has this little green curlicue. It's a really cool looking feather.

Aside: She showed me these later in collections, and y'all, they look like lollipops. Like lollipops made out of iridescent emerald green feathers. It was wild.

Tour Audio:

Alie: Oh those tail feathers are just... What would be the evolutionary advantage of having a tail feather that's really long with a rosette at the end?

Dr. S: Attract more ladies, spread your genes on! That's the only advantage.

Alie: *[laughs]* Just aesthetics? Just creatures are drawn to aesthetics. *["It's art!"]*

Aside: And then other birds-of-paradise have this fluffy plumage. If you've ever seen a video of David Attenborough being savagely interrupted by a bird? That's the one. Now still other birds-of-paradise are dark, velvety black; we'll talk about those types of feathers in a minute. There's also the King of Saxony bird-of-paradise that has two long striped feathers

on either side of its head, way longer than its body. And then, there's a bowerbird that looks for that species' molted head feathers, and then uses them as a brag to get ladies into his lair. Feathers, man! It's a whole world. This episode should've been, like, ten parts long.

Interview in Dr. Schultz's Office:

Dr. S: Another really cool feather, there's this bird called the club-winged manakin, this little bird from the tropics. These manakins, they'll make sounds. They use their flight feathers with sound. And on the club-winged manakin, the shaft part is very thick and kind of dense and heavy because it actually will bang them together to make like a clicking noise.

Alie: Oooh!

Aside: Okay, I looked this up, and the Cornell Lab of Ornithology had a video of a little black and white and brown birdie, with a russet crown, and a little like scarlet pompadour. *[clip of tiny screamyish bird chirp]* That is a very cute and tiny way to scream, "I'm hornyyyy!" *[repeated in slow-mo]* I'm hornyyyy."

Alie: Devin Galardo wants to know, first-time question-asker: How is it we can keep feathers we find for years and they don't decompose?

Dr. S: We've got feathers in our collection that are... bird specimens that are over 150 years old. The key for keeping a feather in good quality is to keep it out of the light because light can degrade feathers, and keep bugs away from it, and ideally temperature is controlled too. So if there's no bugs to eat it, if the light is away from it, feathers will stay good and stay the same color kind of indefinitely.

Alie: Ooh! I've illegally picked up feathers from the ground. I have some sitting in my living room now and I'm like, *[awkward little "uh oh"]*. Well I found a Cooper's hawk, striped one. In my backyard.

Dr. S: Super cool.

Alie: I was thrilled.

Dr. S: Just between you and me, nobody's going to go after you.

Alie: I hope not. I know I've mentioned it publicly. Let me see. This is so funny. Someone left a question about pot and caffeine and procrastination. And I was like, "What?" And then I realized that they put it on the wrong... I was like, "Pot and caffeine! I don't think birds are doing that!"

Dr. S: Although birds do get drunk sometimes.

Alie: Birds get drunk?!

Dr. S: Yeah! You didn't know that?

Alie: No! Which birds?

Dr. S: So berries will ferment on trees or fruits or they'll fall down and birds will eat them and they'll actually get drunk and they'll have a really hard time flying.

Alie: Do you think they do it on purpose?

Dr. S: Probably not. *[laughs]*

Alie: Okay. Oh my god. Lena Faye, first-time question-asker, wants to know: When doing stuff like mating dances, how much fine motor control do birds have over their feathers? Like can they move clusters or does it just look like it because of all the booty shaking?

Dr. S: That's a good question. So birds do have actually pretty fine control over their feathers. Not really over individual feathers, but they can control what are called feathered tracts. So feathers don't continuously cover a bird's body. I mean, you know, they do when they're all spread out, but the way feathers are grown is in specific regions of a bird's body. And so there'll be like these, just like she said, kind of clusters of feathers that they can control all together.

Alie: So they *can* move them around.

Dr. S: Oh yeah.

Alie: Oh! Aarika wants to know: are the colored craft feathers real feathers and what birds do they come from? How do they collect them? Can I dye feathers? All these questions from Aarika.

Dr. S: Okay. So, they are real feathers. Almost certainly they're chicken feathers, so they come from some farm. I don't know exactly how they harvest them, but almost certainly they're all white feathers when they start. So they are dyed feathers and you should be able to dye a feather with just most dyes. And you can blow dry them once they're wet and they'll have their normal form.

Alie: I have a feeling you've done this before. *[laughs]*

Dr. S: Yes, I have.

Alie: Kendyl wants to know, or rather a comment: My chickens are so grumpy when they grow new feathers or when they're in pin feather stage as tweens. Does it hurt? Why are they so grumpy?

Dr. S: Yeah, we don't know a lot exactly about animal pain. I can imagine it's pretty uncomfortable, but think about how many resources they're putting into growing all of these new feathers. A) It's probably making them tired, B) it's probably not that comfortable because they've got, you know, all of these little feather shafts kinda growing out of them. And then the feathers aren't doing what they normally would in terms of helping them do thermoregulation, protecting them from water, from bugs, all these things. And so I would probably be grumpy if I was a bird.

Alie: Why do some birds lose their feathers or pluck them if they're stressed out?

Dr. S: That's most often seen in parrots in captivity. It's kind of like a neurotic behavior, you know, as humans will do weird things to themselves when they have that. And so plucking feathers is something that the birds can do.

Alie: Yeah. I'm thinking about how, you know, when you get up real close to a makeup mirror, and then you're like, "One over there..."

Dr. S: And then you start going for it and then it's, like, too much. Yeah.

Alie: It's kinda soothing. Okay. Miranda Panda, great name. First-time question-asker wants to know: Which bird has the longest feather recorded. How long do they get?

Dr. S: So in terms of any feather, there are breeds of chicken where they have actually bred them to have these incredibly long tails. So, I don't remember exactly how long those are, I want to say something like five feet long. There's actually... if you come to the bird display at the LA Natural History Museum, we actually have an example of that in our bird diversity hall. There's like this case of like prize-winning birds. And so we have a chicken with a really long tail.

Alie: Can I take a picture of it?

Dr. S: Yes.

Alie: [*whispers*] Yessss!

Aside: After I did this interview, we went to the bird hall, and I saw this rooster, with maybe an eight-foot tail, and of course I took a picture! And also some of these long-tailed fowl can sport a party in the back up to fourteen meters, or 45-50 feet long! And their breeders have to roost them in these special sleeping armoires, so they don't tangle up at night, because they grow a meter or so a year. Can you imagine, stepping on your own feather tail? I don't even want to think about bird doo-doo in a 35-foot-long feather train. Speaking of crappy...

Alie: What's the crappiest thing about feathers? What's the most annoying thing about your job?

Dr. S: The permits.

Alie: Really?

Dr. S: Yes.

Alie: What kind of permits do you need?

Dr. S: So to work with birds, we need both state and federal permits. You know, you think about museums going around and just getting whatever they want, but that's not true at all. You know, we work really hard to determine what's the minimum number of samples that we would need for something. And then we have to apply to state fish and wildlife agencies and get permission to collect or salvage birds, find them on the ground, and also to the federal agencies. And importing and exporting, anytime you want to ship things to another country, there's forms to fill out. To get things, there's forms to fill out. Paperwork is, like, the least fun part. [*rifling through papers*]

Alie: What about the coolest thing about feathers? Like what's the neatest... what just, like, gets you up in the morning?

Dr. S: It's just thinking about the fact that my job is to understand why birds are the color that they are. I mean, how cool is that, right? I mean, just think about colorful birds. Why are birds this incredible rainbow of, you know, iridescent colors, browns, blacks. We just described a new type of plumage called super-black plumage, which is like where the way that the barbules are shaped, will actually collect more light than just regular feathers. The barbules, instead of just being flat, they're actually thicker and pointed at about a 40-degree angle. And that angle actually captures more light than just the... yeah.

Alie: That's amazing. It is really velvety. It's so pretty.

Aside: If you've ever seen the once blackest human-made material dubbed Vantablack, it looks kind of like you're staring into a black hole. It's just a void of shape or color. Vantablack achieves that hardcore space gothness because these carbon nano tubes capture the light, up to 99.65% of it. But last year, some MIT researchers accidentally made something darker! It's 99.995% light absorbing. Now, what about this birb's feathers? Same thing. Pretty much. So their structure, zoomed in through a scanning electron microscope, looks like a hairbrush that kinda nabs light, and researchers a few years ago found these super black bird feathers can absorb up to 99.95% of light, almost as much as Vantablack. But the coolest part is those birds were like, "Oh, congrats lab nerds. Guess what? I made almost Vantablack just by hopping around and eating fruit and pooping." [*"Cash me ouside, howbow dah?"*]

Alie: Do you have to stop people and say, "Hold on, I'm just looking at this bird," like, when you're out for a walk?

Dr. S: Oh yeah. Yeah, of course. All the time. My husband will tell you, "Ugh, she's like the worst going hiking with, 'cause she's always stopping all the time."

Alie: [*laughs*] Do you tell people you're a plumologist?

Dr. S: I usually say I'm an ornithologist, but I'm a plumologist in my heart. Yes.

Alie: I think the more you use it, the more you give permission to other feather experts to use at dinner parties. Thank you so much for talking feathers with me.

Dr. S: Yeah, it's been really fun. My pleasure.

So ask smart people stupid questions, and if you find a feather, just change your name and hide from the feds in a bunker in the woods, if you're not already in one, *am I right?* Okay, so to learn more about the Natural History Museum of LA County, you can visit NHM.org, I love them! And to follow Allison, she is [@AJShultz622](https://twitter.com/AJShultz622) on Twitter, and her website is AllisonShultz.com. I will link those in the show notes. More links to videos we talked about, and references from the episode, and discount codes to the sponsors and to the charity are always up on AlieWard.com on each individual episode page. We are @Ologies on [Twitter](https://twitter.com/Ologies) and [Instagram](https://www.instagram.com/Ologies), I'm [@AlieWard](https://www.instagram.com/AlieWard) on [both](https://www.instagram.com/AlieWard). Please, find me, be my friend.

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Former intern and now paid employee, Caleb Patton is working on the bleeped episodes. Welcome back Caleb! Congratulations on graduating! And thank you to Erin Talbert for adminning the [Ologies Podcast Facebook](https://www.facebook.com/OlogiesPodcast) group. Thank you to Shannon Feltus and Boni Dutch for managing merch, which is available at OlogiesMerch.com. Boni and Shannon, side note, host the comedy podcast *You Are That*, which is very funny if you want to listen to a new comedy podcast.

And thank you to assistant editor and quarantine hunk Jarrett Sleeper of the mental health podcast *My Good Bad Brain*, who also does a weekly live stream with our traumatologist Dr. Nicolas Barr, we'll link to that in the show notes as well. And of course to everyone's favorite dino and kitty enthusiast and editor extraordinaire Steven Ray Morris of *Purrrrcast* and *See Jurassic Right* podcast, for stitching these together each week. Nick Thorburn wrote and performed the theme music.

Each week I tell you a secret. This week the secret is, mah dog, Gremmie, she looks like a tiny raccoon, and she has fallen behind on her regular haircuts. She needs to get trimmed like every 2-3 months because she's some kind of poodle mutt. But because of isolating, groomers are closed, we're staying in, and so she was getting a little tangley. So Jarrett and I decided we're just gonna DIY it, and what resulted is a very patchy lion's cut. But you know what? We took a risk; we think she looks even more beautiful than ever! We're in lockdown, cut bangs. Text your crush. Things will grow back, take a risk! Why not? Another secret - a little twofer for you - is that I saved all her hair, and I put it in a Ziploc bag, and I'm hoping to have someone spin yarn out of it. Is that weird? You can tell me. Okay, berbye.

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