

# Lemurology with Dr. Lydia Greene

## Ologies Podcast

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Oh hey, it's the bird hanging out near your park bench hoping that your sandwich crumbles into pieces, Alie Ward. And listen no matter what place in your life lemurs have, make some room because it's about to get bigger. What are these animals? Well, the most endangered mammals on Earth but also, I'm going to be a little shallow, they're the cutest. And in that Venn diagram of adorable and vulnerable there exists pure relevance.

So, this guest is someone whose work I've loved for years. She is based at Duke University in North Carolina, where there is a world-renowned lemur center; they've got free-range lemurs running all over the forests as lemur ecologists assist with conservation breeding programs, they take notes, they watch them, they collect their poop doing non-invasive research. It's a dream. You can also visit the Duke Lemur Center and look at lemurs if so inclined, which, who wouldn't be?

This ologist did their undergrad at Duke in Evolutionary Anthropology, and a PhD in Ecology, studying lemurs in Madagascar. She's worked at the Duke Lemur Center, did a post-doc at a lemur lab studying adaptation and hibernation, and she is an excellent science communicator and a champion of lemurs.

We're going to get into it, including questions you submitted via [Patreon.com/Ologies](https://patreon.com/Ologies), which you can join for a hot dollar a month. Thank you to Patrons and to everyone out there wearing *Ologies* merch from [OlogiesMerch.com](https://OlogiesMerch.com). Thanks also to everyone who has ever written a review which really helps keep us up in the charts where more people can find us. I read every one, including one this week from Haley, a cancer biologist, and another from MMarshall20 who wrote:

*If you need to reignite your sense of wonder and awe of the universe because hyper-focusing on all of your problems has made you forget that we are statistically anomalous flesh sacks on a spinning rock in space, this podcast may help.*

MMarshall20, I'm right there with you, on this rock. I'm ready to hear about lemurs.

So, due to time zones, I got up a little early and this was recorded in pajamas.

**Alie:** [sings] La-da-da-dum... Lydiaaaa.

**Lydia:** Good morning!

**Alie:** [sleepy voice] Good morning. 7:30 AM Pacific Time, we're talking lemurs.

**Lydia:** It's a good thing to talk about first thing.

And yes, it was. So, first off, the word lemur comes from the Latin for ghosts or spirits of the dead because of their nighttime prowlings. And yes, people who study lemurs are lemurologists, just straight up, that's the word; it's on their LinkedIn bios, it's a term used in journals. Lemurologist is a thing you can be, and you might want to be after this.

So, tuck in or hop around, to hear about dangerous fateful journeys, button noses, saucer eyes, striped tails, movie flimflam, tiny demons, giant, uh, anatomy, weird toe claws, matriarchies, Madagascar landscapes, folklore, travel tales, and why intelligence is really all about how you use it, with wildlife ecologist and lemurologist, Dr. Lydia Greene

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**Lydia:** My name is Lydia Greene and I go by she/her pronouns.

**Alie:** Lemurs, lemurs, lemurs. I've known of you, we've been friends, mutuals, as they say, online for quite some time. I've wanted to come down to the Lemur Center and have not been able to, and you've so graciously let me interview you remotely. Can I still come to the Lemur Center at some point?

**Lydia:** Yes, but what I would suggest would be even better is if you came with me to Madagascar.

**Alie:** Okay! Great, what time? Give me a G-Cal invite, I'll just click yes without looking at details. [*giggles*]

**Lydia:** Sounds good, we've got to make sure the time zone works out, but you know...

**Alie:** [*laughs*] How often do you go to Madagascar?

**Lydia:** As often as I can but in a good year, I would say I try to go once or twice a year for a two-to-three-month trip. It really just depends on the project and what we're trying to accomplish while we're there.

**Alie:** What is Madagascar like? I have clearly never been, but I can't even picture it.

**Lydia:** It is extraordinary. It's a really large, diverse island. In fact, there's one argument to be made that it's so big and so diverse that we should really think of it more like a continent than we should like a country, just in terms of its geographic features: mountains, oceans, beaches, forests, rainforests, dry forests, highlands. It's got everything you could possibly want. And so, the biodiversity and also the cultural diversity are equally as diverse to match that geographic diversity. So, there's no one way to describe Madagascar. It's just extraordinary.

**Alie:** And are lemurs just Malagasy or do they live in other parts?

**Lydia:** So, lemurs are endemic only to the island of Madagascar. In fact, many of us define a feature of lemurs as they're living only endemically on Madagascar. There is a population of some lemurs on the Comoros Islands, but there is pretty strong evidence that they were introduced by people and do not naturally live there.

**Alie:** How many species of lemur do you think...?

**Lydia:** So, we currently recognize 108 species of lemur. There are also subspecies that push that number up. [*"That's so many."*] But it really kind of changes across years and that's in part due to advancement in genetic sequencing because there's quite a lot of diversity in lemurs that we can't necessarily see with our own eyes because that diversity isn't present in how the animals look but that diversity is present in their genomes. And so, we need to do the genetic sequencing to see the diversity that we can't visually see. So, as the community is sequencing more and more animals, they're gaining more clarity about how much diversity there really is and so that's been causing a big increase in the number of species, which is why we keep seeing "New lemur species discovered." We, of course, knew that animal lived there, but it's through understanding changes or differences in the genomes that we're understanding how many species there actually are.

**Aside:** So yes, genetic testing helps lemurologists take a headcount of how many species are roving about this over 200,000 square mile island nation, which is about two and a half times the size of the UK. If you're getting a visual picture, think rocky deserts, brilliant blue lagoons, rainforests, mountains, and savannahs silhouetted with Madagascar's iconic, towering, thick-trunked baobab trees. I have never Google Image searched Madagascar but my heavens, it's a gorgeous place. Also, it's filled with a primate that for some reason burrows into my very heart. Every photo of a lemur hits you like it's your favorite child. And there are again, 108 species plus more subspecies, which Lydia helps keep track of.

**Alie:** How does that work? Do you, like, meet a lemur, you make friends with it, you're like a little bit of sleepy time, and then do you do a cheek swab, like they do for like 23andMe?

**Lydia:** So, it really would depend on the species and the size of the lemur. From the bigger animals where we can do really close behavioral observations because we can see them and they're active during the day, a lot of the genetics is done through fecal samples that are just collected off the forest floor.

For the small nocturnal lemurs, particularly the mouse lemurs that are, as their name implies, the size of a mouse, being able to collect fecal samples from that animal as it's leaping through the treetops at night is near impossible. [*Alie giggles*] So, for those species, we tend to use live traps like Sherman traps or Tomahawk traps, baited with banana or peanut butter, and then we'll give the animals a brief physical exam under anesthesia so they're super comfortable and don't know what's going on. Then we'll usually take a small skin punch, like a little ear clip or something that they don't even really notice and grows back pretty well. After they recover from anesthesia, we'll give them another snack and then we'll release them that evening to their home territory. So, they're removed from the forest for less than 24 hours and we make sure that they have a safe place to sleep at camp during the day.

**Alie:** Oh, mouse lemurs!

**Lydia:** Yeah!

**Alie:** What do they look like?

**Lydia:** They look like primate mice, I guess would be the... So, there are about 25 species of mouse lemur, so there's actually quite a lot of diversity within that genus. But they're about 40 to 80 grams at adult weight. So, they're super small.

**Aside:** So, they have a round body like a little pear, and even with their little furry tail, a mouse lemur is shorter than a human foot, most human feet. Many species have cute little pointy elf ears, sometimes they've got a tiny tongue sticking out of their mouth, and of course, a set of these gorgeous hazel eyes; they look like marbles shoved into a slipper.

**Lydia:** They have very large eyes and they have quite the Napoleon complex; because they're so tiny, they can be quite feisty. But they're pretty remarkable in how they just navigate treetops, being so small.

**Alie:** I mean, if you had asked me like a pub quiz, how many species of lemurs? I would've said max four, three to four. I'm shocked by this.

**Lydia:** That is incorrect, on your pub quiz, you would not gain that point. [*Alie laughs*] There are in fact five families of lemurs that diversify into 15 genera and then over 100 species. I think what happens in, sort of, the American public knowledge is that we see images of a select few species that tend to be overrepresented in captive institutions, or that are really easy for people to see in the wild and then get photographs of. But there are also all these other species like the sportive lemurs, the woolly lemurs, all these different species of mouse lemurs, the fork-marked lemurs, that people don't really see or have as much connection to because some of them don't live in captivity or that wouldn't be the thing you would go see on a tour in Madagascar. So, we're just less familiar with those species in pop culture compared to say, the ring-tailed lemur.

**Alie:** Mm-hm. I've got to say, I'm shocked that there aren't more influencers that have mouse lemurs just as an exotic pet.

**Lydia:** Oh my god, I'm so glad they don't.

**Alie:** *[laughs]* I imagine if they have a Napoleon complex and jump around, it might be a little more difficult than having a squirrel.

**Lydia:** Yeah, I think, you know, lemurs are primates; they're smart, they're social, they live their best lives in the environments in which they evolve to live. And so, it's just not a great life for a lemur to be living by itself in somebody's house, eating food it didn't evolve to eat. [*"You want a hot dog?"*] So, we tend to think about lemurs as living their best lives out in nature, in a nice quality habitat, where there are plenty of fresh figs on the trees.

**Alie:** Oh, did you say figs?

**Lydia:** Yeah. Ficus trees are a big part of the diet of a lot of the fruit-eating lemurs.

**Aside:** But let's backtrack and get to basics, what even is a lemur? In an email setting this up, I wrote to Lydia, I was like, "Hey, the *Ologies* feed is just screaming for a good monkey episode. Are lemurs monkeys? Just one of my many questions!" To which she was forced to reply, "Well, no. Lemurs are decidedly not monkeys." What? I was kidding when I asked that, they have long curly tails, they bounce around in forest canopies, they are fuzzy, they live off the coast of Africa. Of course, they're monkeys. What else are they going to be? ... Hairy alligators? ... Tree elephants? ... Not monkeys?

**Alie:** And here we are, lemurs are not monkeys and they live on one island in the world. What is going on? What are they? Describe them, thank you.

**Lydia:** Yeah. *[chuckles]* So, lemurs are not monkeys, but they're relatives of monkeys. Like monkeys, lemurs are primates; they are one lineage within the order Primates, that's the mammalian order that we belong to as well. And so, the Primates really split into two major groups: the Strepsirrhines and the Haplorhines. Now we humans are Haplorhines, apes are Haplorhines, monkeys are Haplorhines. And the lemurs along with the lorises and the "bush babies" clump over in the Strepsirrhini category.

Those words, Strepsirrhini and Haplorhini, actually have to do with the shape of the nose. And so, you can classify Primates first and foremost by what type of nose they have. So, *strepsis* for turning in and *rhis* for nose and Greek. So, they have these sort of curlicue noses on their ends, the Strepsirrhines do. They're also known as the wet-nosed primates because lemurs have a wet, fleshy tip at the end of their nose called a wet rhinarium, just like your dog or your cat would have. Whereas the Haplorhines like us are the dry-nosed primates. And so, as that name implies, they have a pretty good sense of smell and are much more sensitive to odors than we humans are.

**Aside:** So, if I hid a cantaloupe, and you loved cantaloupe, could you find the cantaloupe? You could if you were a ring-tailed lemur. According to the 2021 paper, "Ring-tailed lemurs use olfaction to locate distant fruit," researchers launched essentially an Easter egg hunt with melons, but also hid some melon-like objects that the paper called "sham cantaloupes." The results... Our ring-tailed friends could sniff out the real cantaloupe from nearly 50 feet away when the breeze drifted in their direction. The sham-taloupe remained unfound. Also reading this study, I learned that klinotaxis is a term that means to snoot around sniffing the breeze until you find treasure, just twitching your little snooty snout sniffer toward a snackie. Klinotaxis.

But it's not all sweetness and juicy melons. A 2018 press publication out of Lydia's own Duke University was titled, in all caps, "LEMURS CAN SMELL WEAKNESS IN EACH OTHER." It referenced the study "Costs of Injury for Scent Signaling in a Strepsirrhine Primate." The researchers found that first off, lemurs can get into tussles, little fights, especially when everyone's horned up and wants to bang. But sometimes when lemurs get in fights, if one male is injured, others can tell just by his smell. The paper detailed "Lemur genital secretions were significantly diminished and

altered during injury.” So, smelling the wounded male’s secretions meant he’d be picked on more because the other males know he felt like shit.

But wait, back... I’m sorry, back up. So, what secretions? Oh yes, cool. Male and female lemurs have glands in their crotches that ooze out sexy juices made up of up to 300 different chemical compounds. And then they rub the stuff on branches like graffiti that’s a Hinge profile. One researcher at Duke said that this love butter is “quite pungent and musky,” and “not something you’d want to get a big whiff of!” But luckily, as simple-nosed Haplorhines, we wouldn’t be able to smell as well as our lemury, wet-nosed Strepsirrhini friends, would we?

**Lydia:** Especially me. So then, within the Strepsirrhines, the lemurs are the sort of most diverse group within the Strepsirrhines, and they live only on Madagascar. But there are also bush babies or galagos, and lorises that live in continental Africa and then over in Asia, and they belong to the same group, the Strepsirrhines. But monkeys are all the way over in the Haplorhines. So, they’re quite divergent from the lemurs.

**Alie:** I had no idea. Does that come up a lot? Is that the biggest question that you’re having to correct? Do people just say, “Look at that monkey with the big eyes!”?

**Lydia:** I would think that was the case maybe about 10 years ago. The other big one for people who study anthropology or primatology is that chimpanzees are not monkeys, that’s a big one in pop culture that people get cranky about as well. But I would say right now, the biggest question I get is, “Do they like to move it, move it?” [*I like to move it, move it. I like to move it, move it.*] That is the *Madagascar* movie, that is the dance that they do, and I have to clarify that lemurs in fact do not like to move it, move it.

**Alie:** [*laughs*] This is good to know. And how did they all wind up on Madagascar?

**Lydia:** Okay, so now we’re getting into one of my favorite things on Earth to talk about [*Alie laughs*] and you’re going to have to cut me off when I ramble too much. [*No, never.*] Actually, people usually ask me what’s my favorite thing about lemurs, and I say it’s the diversity of species and how that diversity came to be because it’s actually a rather extraordinary story.

So, we have to go back to Pangaea, when all of Earth’s land masses were smooshed together in one landmass sandwich. Madagascar was sandwiched between continental Africa and India and was actually attached to Antarctica as well. This was, of course, the age of the dinosaurs, primates had not yet started evolving, but Madagascar had this connectivity to both continental Africa and to India. As Pangea separated, Madagascar separated first from mainland Africa about 130 million years ago, and then separated from India about 80 to 90 million years ago, which means that it’s been an island for 80 to 90 million years, which makes it one of the oldest standing islands that’s left around today.

For those of us who learned about the dinosaur extinction and the rise of the mammals and like middle school science, you might have the number of 65 million years ago in your brain. That is the asteroid that killed everything and like fire and, you know, brimstone and dinosaurs going extinct. And from there, that mass extinction event is what allowed the mammals to sort of take dominance over the planet, including the rise of the primates. So, we see primate evolution in the fossil record as really taking off around 55 to 65 million years ago, but Madagascar had already been an island for 15 million years and primate evolution is taking off in mainland Africa.

So, this big question in lemur biology had always been how did they get to Madagascar? Because there’s this huge time gap in between when primates are evolving in Africa and when Madagascar became an island.

**Aside:** So, Madagascar kind of chunked off Africa like a bite out of a cookie, and then India sailed off to its current place as well, but very, very slowly and again, roughly 90 million years ago.

**Lydia:** And one of the unfortunate things about Madagascar is we don't really have a great fossil record around 55 to 65 million years. This exact window when lemurs would've first been getting to Madagascar, we don't have a fossil record. So, we were all, as a community, pretty stumped by this question for a while – and I like how I'm calling myself “we” as if I was part of this community, this all got done way before I got to college, [*Alie laughs*] but I'm going to give myself a little credit here.

So, the first thing that happened is people like Dr. Anne Yoder, who used genetics as sort of a puzzle-solving technique, started to ask the question, well, can we place a molecular clock on the time at which lemurs got to Madagascar by comparing the genes of today's lemurs to their relatives in Africa, say the bush babies or called the galagos? And can we figure out the date when these guys split from each other? And also, if all lemurs stem from one ancestor or if we think there were multiple colonizing events.

**Aside:** So, by looking at their sweet-faced bush baby cousins on the African continent, from a molecular genetic standpoint, they can figure out how many times groups of lemurs – I guess they're called a conspiracy of lemurs – came to this island to then branch off into the over 100 different species. So, okay, wheuf! Listen up this is so cool, I love lemur origin story gossip.

**Lydia:** And those data demonstrated a date of around 58 million years ago, plus or minus, and also, that all lemurs stem from one colonizing event. So, we know from genetics that lemurs got to Madagascar once, and it happened about 58 million years ago, which is a pretty good window on when we think things were happening.

**Alie:** How far off the coast of the mainland is Madagascar?

**Lydia:** It's a couple hundred miles. [*Alie gasps softly*] Yeah.

**Alie:** Do you have to look to the Galápagos to try to figure out similar islands with a lot of diversity? Any correlations there, do you think?

**Lydia:** I think there could be in that island systems often operate under similar dynamics, but where we really need to give credit is to a guy named George Gaylord Simpson, who in the 1940s, before genetic dating, before all of these, sort of, modern techniques, said, “Well, what if they rafted?” [*Alie gasps*] And he came up with this idea of rafting as a way that animals would move between land masses and across oceans.

So, this is where the genetic data get combined with the ocean current data, with Simpson's hypothesis about rafting and actually help us tell this story. What we think happened is some 58 million years ago, some small family group of early primates got washed out into the Mozambique channel on a giant mat of floating vegetation in the middle of a cyclone. And the way the ocean currents worked back then, it would've blown this vegetative mat from Mozambique over to Madagascar. This happened probably once for lemurs and it's just by luck that they got there. What's extraordinary as well is that the same thing seems to have happened in more recent history with the rodents, the tenrecs, and the carnivores.

**Aside:** Some of those other mammals include a narrow-striped mongoose, flying fox bats, and tenrecs, which PS, when she said that, I didn't know what a tenrec is, but it sounds like a mid-size SUV, like the new Hyundai Tenrec. But no, it's a little hedgehog pointy-snouted mammal whose closest relative is an African shrew. So, imagine all these critters' ancestors, each on their own journey just swept to sea on a plant boat, just hoping for the best. That's some real main-character stuff right there.

**Lydia:** So, there were in fact four rafting events that gave rise to the mammalian biodiversity of Madagascar that we see today. Because, of course, mammals were starting to evolve after Madagascar was already an island.

**Alie:** I wonder how long it would take in a cyclone to make it from the coast to an island, on a mat of vegetation.

**Lydia:** So, I have heard of estimates as short as three days, I think, I've heard ones as long as a month. There is one camp that suggests that those early primates that made that journey must have been hibernators in order to survive that. There's another camp that says hibernation in lemurs evolved *de novo* or newly evolved once they arrived in Madagascar. So, there's sort of a lot of playtime in us trying to understand how this could have happened. But of course, without a fossil record, it's all just sort of like everyone making their best, educated guess.

**Alie:** And does it not have a fossil record just because it doesn't have certain sedimentary rock climates?

**Lydia:** So, my sister's a geologist and she's going to roll her eyes really hard when she hears me try to explain this, [*Alie laughs softly*] so I apologize, Sarah. But from my understanding is that for the past 65 million years, Madagascar has sort of been favoring erosion rather than deposition of soils. And so, there's just not really good rock preservation for what was happening at the time when the first lemur would've arrived to Madagascar.

**Alie:** And if you had to describe a lemur, what are some features that are common? Let's say that you're looking at a lineup of fictitious and real lemurs, what makes a real lemur?

**Lydia:** So, they have a lot of primate traits; forward-facing eyes, 3D vision, five fingers and opposable thumbs, also opposable toes (big toes that is), fingernails instead of claws. So, all of these sorts of characteristic primate traits. They also have a couple of things that make them distinct from the other type of primates, the monkeys and the apes, including us, the Haplorhines. They have this thing called a grooming claw, which is that the second toe has a claw on the end of it instead of a nail, and that's for, you know, scratching in your ear. In some of the older literature, they call it a toilet claw, which I just think doesn't sound that nice to say anymore so we've upgraded it to a grooming claw. [*Alie laughs*]

They also have some weird things. Most lemurs, not all of them have some weird things with their bottom front teeth. So, their incisors and their canines are sort of fused together and they lay flat, and it looks like a comb. This is how they groom their fur because lemurs do have opposable thumbs, but they do not have the manual dexterity that a monkey has. And so, they're not very good at pinching and so they end up using their teeth to groom, this sort of grooming tooth comb in their jaws ends up how they clean their fur and their group mate's fur. So, not so much with the hands.

**Aside:** Hey, if I like you and we're buds, I'll rake my teeth through your hair and maybe I'll eat what I find, it's cool.

**Alie:** What does lemur fur feel like? They look so fuzzy.

**Lydia:** So, don't touch wild lemurs, just as a preface to this. [*"Gotcha."*] But there's a lot of variation in their fur. So, some fur is super thin and super soft for animals that live in a warmer climate. For animals that are living in a colder climate, say the central highlands where it's really cold in winter, they have really big thick fluffy fur to keep them warm. The ruffed lemurs that live on the very canopy of the rainforests where it's quite wet because it rains a lot, it's also cold, have a very, very thick coat that helps protect them from water. Aye-ayes have very wiry sort of bushy fur. So, it really,

you know, different furs for different animals and different habitats for different functions. The story of lemurs is the story of diversity.

**Alie:** Why do aye-ayes look like you put a demon in the wash, and it shrunk?

**Lydia:** That's what we did. [*Alie laughs*] That was the evolutionary process by which we got aye-ayes. Yeah, I can say that for sure, washing machine.

**Aside:** Okay side note, if you need a visual on these, picture something the size of a small cat, but resembling a wingless bat with possum ears and a shock of black and silver hair that looks like a middle-aged hangover. The name aye-aye is thought to come from a Malagasy term for "I don't know what the fuck that is." It literally means, "I don't know." Imagine a creature so weird, so unsettlingly horrifying, and cute that its name translates to "IDK-IDK." On top of that, they have long beef jerky fingers that look like twigs, but alive, and they use one skinnier finger to drum on branches and then they lean their ear on the wood to listen for chubby maggot snacks inside, and then they use a different, thicker finger to dig them out like a toddler would plumb a nostril. So yeah, saying that aye-ayes "fulfill a particular niche in Madagascar" is one way to put it.

**Lydia:** No. So, some things about aye-ayes are just indescribable in terms of why. But basically, aye-ayes evolved to fill a very particular niche in Madagascar which is that they specialize on resources that are hard to extract. So, think grubs inside trees or really fleshy nuts inside very, very hard cases, for example, coconut fruit. So, they are anatomically set up to be able to extract these resources so they have very, very strong, ever-growing teeth that can just gnaw into anything, including a padlock in captivity I've seen, or cement in captivity. They're extraordinarily strong in their jaws. But then they have this delicate, flexible, sensitive, long middle finger that can scoop out resources. They can scoop out, for example, a soft-boiled egg out of its shell. They can also scoop out the flesh of an orange or the flesh of a coconut after they've made a hole or a grub from inside a hole that they've gnawed in a tree. So, they just have this morphological toolkit to extract the resources that they need. You see commonalities with other primates. So, chimpanzees use a stick to fish for termites; aye-ayes have their stick just in their body, it's their finger.

But if you'd like to be extra horrified, there was actually an extinct giant aye-aye, *Daubentonia robusta*, that I'm actually kind of glad is extinct because I think it would be absolutely traumatizing to see that thing in the wild at night. But there was this very, very large cousin to today's aye-aye that has now since gone extinct, like the rest of the giant lemurs.

**Aside:** Lydia says that the vast majority of lemurs are nocturnal but not all of them. So, what's up with their big ol' headlights?

**Alie:** Orange eyes, huge eyes... What do we know about that?

**Lydia:** So, not all lemurs have orange eyes. I would say lemurs do have huge eyes, particularly the nocturnal species, because seeing at night is difficult so the bigger the eyes the more light they can capture. So, probably because early lemurs were likely nocturnal, and I can already hear people yelling at me that we don't know that for sure, which is the case, but it's possible that early lemurs were nocturnal and so the sort of big eyes was sort of built into them as a thing to help them survive. And you see even bigger eyes in primates like tarsiers which is just... Go spend an hour on YouTube looking up "Tarsier eye videos" and you'll be astonished.

**Aside:** So, okay, all right. Think of a Furby that got photoshopped to have eyes twice as big and a nose half the size. A tarsier, it's not a lemur but rather a small, camel-colored animal that hugs tree branches and whose eye-to-face proportion is closer to a Roswell, New Mexico alien head than any other mammal on the planet.



**Lydia:** So, I think part of it just has to do with capturing light. Even the species that we think of as diurnal, like ring-tailed lemurs and particularly the brown lemurs, are actually cathemeral, which means they can be active at night or during the day depending on what's better for them. So, we see a lot of brown lemurs foraging at night during the warmest parts of the year when it's just really, really energetically expensive to forage in the heat, so they'll forage at night instead. And so, for them, there is a really good reason to maintain big eyes that capture a lot of light. So, it probably just has to do with functionality.

But you do see a range in eye color across species from very, very dark like if you look at the all-black sifaka, they have very, very dark eyes. And then if you look at the Coquerel's sifaka, their eyes can be deep orange to light orange, to yellow, to even light green. And then you have the blue-eyed lemurs who of course have blue eyes and they're like sapphire blue. With everything in lemurs, it really depends on the species and there's this huge range. But the fact that even within a population you can have variation from light green to dark orange suggests to me that it's just variability. We do see more variability in coat coloring. In some species that has to do with camouflage. So, there was a paper that came out, particularly for the sifaka, showing that they tend to be darker where the habitat is cooler and wetter, which makes sense.

**Alie:** Why do we see so many ring-tailed lemurs in captivity?

**Lydia:** Because they are a flexible generalist that adapts well to different habitat conditions, and they survive well in captivity and breed well in captivity and they're very easy to care for in captivity. They're sort of like the rabbits of the lemur world, I guess. Whereas a lot of the other species are quite ecologically specialized, so they maybe only live in one geographic area, or they evolved to eat one particular type of food. They're very locally adapted so finding ways to maintain them outside of the place where they've really evolved in that place, finding ways to maintain them outside of that can be very difficult.

**Alie:** They're just down to hang?

**Lydia:** Yeah.

**Alie:** Okay. What about you? How did you get yourself to Madagascar, a life journey? I understand that you were a ballet dancer before. Can you tell me a little bit about how the world conspired to make you a lemur scientist?

**Lydia:** Yeah, I think this is... I mean, like the arrival of lemurs in Madagascar, I think my story is one of accident rather than intent. So, I grew up in New York City in a household of classical musicians. I was a very energetic child who was not going to be playing an instrument, so I got put in dance instead [*Alie laughs*] and ballet was the way by which I could connect to my family's love of classical music, but do it in my own way, I think.

So yeah, I trained to become a professional, which didn't work out very well. And luckily my college advisor in high school had suggested that I apply to Duke as a reach school and nobody thought I would get in, but I did, very grateful for that still to this day. And so, after a two-year deferral when I tried to make my ballet career happen that didn't happen, I came to Duke looking for something else to do with my life. I had been out of school for a while; I couldn't remember how to do basic algebra, I was very nervous about getting back into academics, but I signed up for classes that sounded interesting, which included an introduction to evolutionary anthropology. I feel like that sounded like a science class that I could handle. Also, I really knew that I liked animals, and they talked a lot in the synopsis for that course about primates, and I knew that those were animals, so I kind of latched onto that.

And then at the same time, I needed a work-study job and the then Duke University Primate Center, which has now become the Duke Lemur Center, was hiring undergraduate tour guides. So, I was simultaneously taking a class about lemurs and primates and the place of humans in nature while I was starting to lead tours of this facility to talk to the general public about lemurs. So, I sort of talk about how my career as a science communicator sort of co-evolved at the same time as my career as a scientist.

Then when it came time for graduate school, I knew I wanted to spend time in Madagascar. I like working with the lemurs in captivity, but I'm an ecologist. I mean, I'm a lemurologist for the purpose of this episode but I really think of myself as an ecologist. I fundamentally study lemurs in the context of where they live so that environment becomes really important. And so, I wanted to base quite a lot of my dissertation work in Madagascar. And then I ended up meeting my wife in Madagascar, she's Argentinian, but was also working at Duke. And so, together, we've done quite a lot of fieldwork and she's really the field expert in our family. So, I sort of follow her around, kind of like a puppy a lot in Madagascar as she sorts things out. There was no master plan here, it was just fumbling around and finding things that I thought were interesting.

**Alie:** Well, I was going to ask, you mentioned that you're, before we started recording, that you're there for a few months at a time and I was like, "What... What about your wife though?" But she comes with you as well?

**Lydia:** Yeah, actually more often than not, she leaves me behind. [*Alie laughs*] So, she just got back this week from a three-month trip where I stayed here and took care of our cat and our house and she went off gallivanting through the countryside, working with our colleagues and our students there and collecting some data that we needed to fill in some gaps. So, Marina has been working in Madagascar since 2004, so coming up on her 20-year work-iversary there and she's got quite deep ties to the island, a really solid network of collaborators and students. I think she really feels comfortable, really, really comfortable in Madagascar and in a tent. I just follow her around.

**Alie:** How long is the flight?

**Lydia:** It depends on which way you go, but usually it will take us about 24 hours door-to-door. You can fly through Paris, you can fly through Ethiopia, you can fly through Kenya, you can fly through Johannesburg. Just depends on which flights are cheapest.

**Alie:** Do you just knock yourself out? Do you just Benadryl it the whole time?

**Lydia:** Uh, no. I wish I could. I don't sleep on flights. I usually end up watching the entire extended edition of *The Lord of the Rings*. [*Alie laughs*] I think there was one year where I got through like five of the seven or eight *Harry Potter* movies in a row. At some point you're so bored, you sleep for a couple hours and then they wake you up with food and you just arrive usually pretty, pretty knackered and you sleep for a day when you get there.

**Alie:** Oh my god. Can I ask you questions from patrons?

**Lydia:** Yeah!

**Alie:** Oh, they're excited about it.

**Aside:** But first, let's show some love for lemurs by donating to a cause of Lydia's choosing. She would love a donation to go to the Mahaliana Labs which is an NGO running a veterinary science and training lab in Madagascar's capital city. Lydia says that Mahaliana Labs are training the next generation of wildlife scientists and vets in Madagascar and doing wonderful work. So, to find out more about them, visit [Mahaliana.org](http://Mahaliana.org), which will be linked in the show notes. That donation was made possible by sponsors of the show.

[Ad Break]

Okay, if you're a Patreon member at [Patreon.com/Ologies](https://www.patreon.com/Ologies), for a dollar a month you may have submitted questions before this recording. So, let's make some heads and tails of these, starting with a great one, asked by patrons Lovely Bites, Earl of Greymalkin, Curly Fry, Sadie Vipond, Allie Brown, Keegan Newman, Colleen Sellwood, and first-time question-askers Heidi & Qtip...

**Alie:** Want to know: What's going on with the ringed tail? Why the rings? Why is it so fashionable?

**Lydia:** I mean, who doesn't love a bold fashion statement?

**Alie:** I love stripes, long-time stripe-wearer. But how did they get them?

**Lydia:** So, there are sort of two schools of thought, and probably they're both right in terms of function because, for something that exceptional to evolve, it's probably going to be functional in some way. And so, one school talks about it being actually functioning for camouflage. Much like we don't think zebras would be very camouflaged with their stripes, but they are. And so, there's an idea that the tail actually helps with camouflage.

Another is that it helps with social communication. So, ring-tailed lemurs are quite terrestrial. They're the most terrestrial of all the lemurs; they spend the most time on the ground, up to 80% of their time can really be on the ground. So, when the troop is coordinating movements, you'll often see the dominant female lift her tail in the air and that's sort of a symbol for everybody else to follow her. The males also use their tails in this, sort of, competition, stink-fighting thing that they do. As a prequel or maybe to stave off being physically aggressive with one another, they actually fight with each other by getting their tails full of their different smells from their different scent glands and then wafting it at each other or wafting it at the females as like a "come hither" kind of a thing. [*Alie chuckles*] And so, the tail serves definite communicative functions in ring-tailed lemur societies, but also probably helps with camouflage.

**Alie:** Aha!

**Aside:** Like a feather boa soaked in butt cologne, which also lets you go low profile in a tree. A must-have accessory.

**Alie:** Allie Brown wants to know: What noises do lemurs make?

**Lydia:** So many noises! So, all the species have a different vocal repertoire and there are noises for all sorts of things like "Ah! Predator," and like, "Ooh! Friend." Also, like "Uso. Come here and find this food with me." So, there's a lot of group coordination that happens. There's also a lot of like, "Hey, let's tell that group to back off," that happens, so territorial vocalizations. It really just depends on the species.

Probably the most iconic vocalizations come from the ruffed lemurs. [*rapid, roaring alarm call*] And these animals live up way in the tippy top canopy of the rainforest. There used to be some aerial predators that were much larger than today's predators that could pick them off when they were at the top of the trees. And so, they have a quite elaborate alarm call repertoire to warn each other of say, an incoming aerial predator. That eagle that used to pick them off no longer exists, but you know, airplanes still look kind of scary when flying overhead. And so, they still maintain this elaborate vocal repertoire to warn about predators.

And then the other really iconic vocalization would be the indri, which is the largest living lemur today. These animals live in pair-bonded, male-female pairs with their offspring, so quite a small social group, but they maintain very large territories and they do that through vocal communication. So, the male and the female pair will duet with each other [*high-pitched whooping*

*calls play in the background*] in this sort of series of cascading and de cascading, "Whoops," that they make, especially early in the morning. It's a way for the pair to maintain their bonds and also to tell other pairs nearby like, "Hey, this is our territory. Leave us alone." [*calls fade away*]

**Alie:** Augh, it's like the good morning text. That's so sweet.

**Lydia:** Yes.

**Alie:** And, you know, I keep swooning audibly because it's too much adorability for me to handle. A bunch of people wanted to know, in Abby Grieb's words: Lemurs seem so cute and loveable. Are they actually as sweet and nice as they seem? Marianne Thomas said: My wife heard that they, "will kick seven shades of shit out of an unfamiliar lemur." Is this true? What's going on with their behavior?

**Aside:** This was also on the minds of Macy Abbott, Mariia K, Joshua Tauzin, and Matt Hirschl's wife Jenna, who wanted to know about their talents. But yes, in first-time question-asker, Mariia K's words: OMG! LITERALLY FAVORITE ANIMALS EVERRRR but I've heard that some of them are violent?

**Lydia:** So, I don't think that they're like nasty animals by nature. I think that when there's no reason for anger or violence, it tends to be actually very calm. Lemur societies tend to be very pro-social, so there's a lot of beautiful affiliative interactions like grooming and play and huddling and snuggling. So, you do see all of those beautiful interactions as well.

However, they are wild animals. And so, when there's competition over food, over breeding, over territory, like yeah, they'll cut a bitch when they need to [*Alie laughs*] because that's just life in the wild, right? Life in the wild is not always this peaceful thing that we imagine. And so, if there's a fight over dominance in a ring-tailed lemur society, the females can get mean towards each other. If there's a fight over who gets the best sleeping spot, or who gets the best food resources, yeah, they can be mean. But I don't think they are nasty by nature. It's just sometimes the situation calls for a little bit of aggression and they are certainly capable of throwing punches and shade when they need to.

**Aside:** They just have boundaries, people. You should try it sometime... Oooh, shit.

**Alie:** Do they use their grooming claw as kind of like packing a blade?

**Lydia:** Nah, they got teeth for that.

**Alie:** Okay. [*laughs*] Gemma wants to know, behaviorally: Are lemurs silly guys?

**Lydia:** The juveniles can be. So, one of the most wonderful things about primates, all primates and including lemurs, is that we have this extended period of juvenility between when we're infants and when we're adults. And that extended period of juvenility often serves as a place where animals can gain the social and the life skills that they need to survive in adulthood. Lemur societies are socially complex and there are a lot of rules you've got to learn and a lot of bonds you've got to form and a lot of things you've got to try and figure out.

So, in that period of juvenility, we see a lot of things like play. We see gangly animals who haven't reached their adult size yet, but their limbs seem to have grown faster than their brains. We see big ears and we see lots of falls and we see a lot of silliness. And that sort of period of juvenility is a really wonderful time to watch animals grow and develop and, you know, get their own little personalities and figure out their own place in their group.

**Alie:** Olivia Eliasson wants to know: Is it true that they do drugs?

**Lydia:** [*chuckles*] No. Yes. No, yes. There is this sort of famous situation of a pair or a group of common black lemurs, I should really say a population of common black lemurs, in the northwest of Madagascar that have a habit of using the toxin from centipedes or millipedes as a way to, like, coat their body in this toxin so that they're maybe less attractive to predators or maybe more attractive to friends. But also, maybe there is a little bit of a drug-induced stupor that they seem to enjoy.

**Aside:** What is in these magic millipedes? I know you want to know. According to the 2018 study "Potential self-medication using millipede secretions in red-fronted lemurs: combining anointment and ingestion for a joint action against gastrointestinal parasites?" So, it's benzoquinone, which helps ward off mosquitos, which carry malaria, and bonus, it also helps with the worms that live around their anus. So, they chew these millipedes, then they rub them all over their body like a deodorant stick, and then many times, they end up chewing them like a rope of licorice, eating the whole thing up which induces a narcotic-type intoxication that involves naps and so much drooling. They're drooling all over the place like a bloodhound, but drunk. But humans do that with beer, and it offers no protection from malaria or anal worms. Oh, speaking of liquids...

**Alie:** Krista Jones wants to know: Why do lemurs hate water so much? It seems like all it takes to contain them is a small moat.

**Lydia:** They don't swim. They do like to drink water, but they're not great swimmers. So, they definitely didn't get to Madagascar by swimming. And so, yeah, swimming is not their jam. But of course, there are a lot of lemurs that live in a rainforest, so they can't hate water that much because it rains a lot in the rainforest. But certainly, they're not, you know, doing high dives off the diving board.

**Aside:** Listen, some of us don't like getting our hair wet, maybe lemurs are the dry shampoo type, they do a little styling with some millipede poison, and they're good to go.

But what about lady lemurs? Are these insular primates more evolved than the United States government? You want to know about social structures, patrons Curly Fry, Hannah Gorrie, Olivia Eliasson, Holly Spencer, and...

**Alie:** Emily Herbert wants to know: How did they evolve to become a species, "run by women"? You mentioned they might be matriarchal, is that true?

**Lydia:** Yeah, so with the exception of one group of brown lemurs, lemurs are female-dominant. So, they are matriarchal, or the females are in charge, the females can be mean actually more often than the males, the females run things. And it's funny when you give tours, there are a lot of women who are like, "That's the way it should be!" And their husbands are like, "That's the way things are!" [*I love my wife.*]

What we see in lemurs is this clear female dominance. And I think this question is a good one, which is not just is that the case, but if so, why? Why do we see female dominance in lemurs when you don't necessarily see this in other primate societies? And it goes back to Madagascar because one feature of Madagascar is that it is extraordinarily heterogeneous and stochastic, meaning that the environments are super, super variable. There is variation across seasons; we have a yearly rainy season and a yearly dry season. So, that means there's a time of plenty and a time of scarcity. We have variation across years in how strong those rains are or how dry the year might be. So, some years you might have really bad fruit even in the season of plenty. And then Madagascar frequently gets hit with these stochastic, sort of, random climate events like cyclones, droughts, and floods that are of course now getting more frequent and more intense.

And so, what that means is for lemurs is they have to expect at some point in their lifespan for there to be really bad times. How are females supposed to support pregnancy and lactation if there's this expectation of not-great food around? So, one idea for the evolution of female

dominance and lemurs is that the females basically took control so they could be guaranteed access to food to be able to support pregnancy and lactation.

**Aside:** Access to childcare, reproductive rights... That's interesting. Interesting stuff... Maybe in another 55 million years, who knows?

**Alie:** Piper Jones, Earl of Greymalkin, Amanda, Mary of the Grapefruit, Ron, Dicken Crane, and Raja R want to know what their intelligence is like. Mary asked: Just how smart are they?

**Lydia:** Yeah, I also get this question a lot and I think it's a good question to unpack because I think we have to think about how we're defining intelligence. I think we, as humans, tend to really place emphasis on things like cognitive intelligence; on counting, on reasoning, on math, on puzzle-solving. So, in some cases, lemurs do very well on those tasks. Ring-tailed lemurs can count up to say, about seven. They can do some level of transitive inference; if A is bigger than B and B is bigger than C, they can infer the relationship between A and C. But if you're comparing their cognitive reasoning skills to that of an ape, they're always going to look dumb by comparison.

However, if we think about intelligence instead as an animal's ability to survive in its environment, and we get rid of this focus on cognitive capacity as being the thing that defines intelligence, if we think about it as an ability to survive where they are, lemurs are really, really smart. They're doing pretty well in their habitats. They know how to find food, they know how to find mates, they know how to live and thrive, so I think they're pretty smart. But each species has its own different intelligence because they each have different problems to solve.

**Aside:** Are you figuring out your shit? because that's the smartest a person can be. Put different people in front of a subway map, wish 'em luck. Ask me to drive a wheat combine, watch me cry at the dashboard. Intelligent at what? If it's doing life, you're doing fine. And lemurs, they have street smarts to help them survive. But for how long though?

**Alie:** Lovely Bites, asking for their son Elliot, and Aoife Holmes want to know: How long do they live? What's their life expectancy?

**Lydia:** Also super depends on the species. So generally, the larger animals live longer. So, the smallest animals, the mouse lemurs, I would think in the wild, you know, a 7-year-old mouse lemur would be pretty old. In captivity, we can extend that up to 15. Their slightly larger cousins, the dwarf lemurs can live up to 29 under human care. We have aye-ayes under human care that are in their mid-30s. So, they can live pretty long lives. There are cases of animals in their thirties in the wild just kickin' it, chillin', doing their thing. So, they are not as long-lived as the apes, but they are very long-lived compared to other mammals of their size.

And probably, my wife would be angry at me if I didn't mention that there's this correlation in the lineages that do hibernate, between hibernation and longevity. So, there's one genus of lemurs called the dwarf lemurs or the *Cheirogaleus*, and they are obligate hibernators meaning every individual of every population and every species hibernates every year, no matter what.

**Aside:** So, according to a 2021 paper titled "On the modulation and maintenance of hibernation in captive dwarf lemurs," published in the journal *Nature*, fat-tailed dwarf lemurs can hibernate for up to seven months out of the year," bless them. How do they sleep so long without a snack or a bevvie? Well, they don't call them fat-tailed for nothing. In the feeding season, they can store up to 40% of their body weight in their chubby tail, along with water. So, it's like being hooked up to a nutrient hose. And if you've ever needed an inspiration to slow down, the fat-tailed dwarf lemur's heart rate drops from around 180 beats per minute to around 8. And fun aside aside, one of the authors on this paper was Dr. Lydia Greene herself and so was Dr. Marina B Blanco who is Lydia's wife. Augh! Life, love, lemurs.

Now, this next question came from Joshua Tauzin, and they say it rhymes with causin' problems.

**Alie:** Are they hibernating in nests in trees? Are they in burrows like Austin Powers suggested? Where are they sleeping?

**Lydia:** Yes, and yes. So, it depends on the habitat. In the east, in the rainforests, where you have really spongy, thick, you know, really nice soil, they bury themselves underground. In the west, where we're on dry deciduous forests where the soil is much sandier and they probably can't dig into that, they use tree holes.

**Alie:** [*swoons*] Oh god, everything is so, *so* cute, I can't handle it.

**Lydia:** Fascinating.

**Alie:** Destiny Lam wants to know: How fast are lemurs? Could they personally outrun one? Olivia wants to know: Why do some of them run, skip sideways? Mckaylia Marshall wants to know: Why it jump like that tho?

**Lydia:** [*laughs softly*] That's my favorite one.

**Alie:** Jaarmst wants to know: Has there been any measurement of lemur leaps? These jerks can jump! How do they do it? How far do they leap?

**Lydia:** Also depends on the size of the species. And this gets into sort of some of the variation in morphology because we have lemurs that are quadrupeds, so they run on all fours, just like your dog or your cat would, so think of your ring-tailed lemur is always on all fours. They run pretty fast, they can outrun me, I'm not a runner but they're pretty speedy animals. To outrun predators, they've got to be. The ones that, why do they move it like that though? Are probably referencing the sifaka or the group of lemurs called the *Indriidae*.

**Aside:** You'd know these lemurs. So, they are an ivory white everywhere except their deep purplish-red colored bellies, and they're the ones skipping and leaping and bouncing like a 4th grader with a belly full of Monster energy drink.

**Lydia:** So, these species along with the sportive lemurs practice a different style of locomotion called vertical clinging and leaping or VCL, if you're in the know. And so, here the animals are vertically oriented, and they have very, very long, very powerful, muscular back legs. They move from tree trunk to tree trunk in an upright posture, sort of leaping off, pushing with their back feet, rotating in midair, and then coming into the next tree trunk facing forward. Our leaf-eaters tend to live mid-canopy and so being able to leap vertically when you're going from tree trunk to tree trunk is really helpful.

The problem for those vertical clingers and leapers is when they get on the ground because they are not quadrupeds so they can't run like a dog, or a cat and they have to do this awkward hop. And that's because their legs don't really swing in their hip sockets the same way that a quadruped would because they're adapted for this vertical clinging and leaping. And so, they have to do this awkward, sideways sashay, you stay, hop on the ground. And they're much faster in the trees, but they can still outrun a predator if they need to. [*"Now... Sashay away."*]

**Alie:** Spencer J and Nick Thayer want to know, in Spencer's words: What role do lemurs play in Malagasy folklore?

**Lydia:** Mm, that's also a great question. So, lots of different roles because there are lots of different lemurs. Also, Madagascar has more than one ethnic group so it's a really diverse culture as well, there's no one thing that is Malagasy culture necessarily. So, it really depends on the region. I'm

going to be wary about speaking for Malagasy society because of course I'm not Malagasy, but this is what I've learned from my Malagasy friends and colleagues.

Basically, a lot of Malagasy society is governed by what are called *fady* or taboos. There are some *fady* that protect wildlife. So, in many places, there's *fady* against hunting lemurs, particularly sifaka and indri, in part because they feature heavily in the origin story of humans, and there's a lot of recognition of humanlike features in some of these vertical species. So, I've heard stories about how sifaka moms carry their babies on their backs the same way that many Malagasy women carry their babies on their backs. So, there's a recognition in some of those species that contribute to these *fady* that protect them from being hunted. There are other *fady* that say aye-ayes are evil and they should be killed on site because they're a bad omen. So, it's really varied in terms of how the folklore relates to the lemurs and the region as well.

Probably the most famous story, at least in Western culture, has to do with the indri, babakoto, or the son of Koto. There are a couple of different stories of babakoto and how the injury came to be. Some tell of man and indri being brothers. Some tell of a father and his son, and the kid gets lost, and his father becomes the indri or becomes babakoto. But all of them share the sort of intertwining history between humans and lemurs as a recognition of each other.

**Aside:** So, indris, side note, are lemurs that are stark black and white, they're like a dog-sized panda that's mixed with a koala, with these two fuzzy pom pom ears and light green eyes that interrogate your being. Their vocalizations sound kind of like a surprised cowboy, like "Whooo-wee!" And yes, there are folkloric tales about the indri lemur saving someone, and then becoming revered. So many species of lemur are prey to poachers looking for bushmeat, which feeds both malnourished folks below the poverty line, all the way up to wealthier classes who prefer exotic game. But it's considered taboo to hunt the indri because they can be looked at like our ancestors. Speaking of family lines...

**Alie:** Well, you mentioned babies. Madison Woofter, first-time question-asker, wants to know: How many babies do they typically have? Alexandre Catulle wants to know: Lemurs 101, sex ed, let's get the dirty. Sarah King wants to know: Do they mate for life? Storm has a question from their mum: Why do lemur mums just leave their young if they're not strong enough? She's still mad over that one David Attenborough episode where the lemur mum abandons her baby because it couldn't hold on. So, how are they making other tiny, cute lemurs?

**Lydia:** Yeah, so again, this is going to go back to Madagascar, which is that when you evolve in a very, very seasonal environment, your reproduction can become seasonal. And so, basically all breeding in lemurs, with kind of the exception of the aye-aye, but excluding the aye-aye, the rest of the species, their breeding is timed such that the kids are weaning in the season of plenty. Different lemurs have different gestation periods or different periods of dependence on the mom for nursing and so they all breed at different times. But basically, then all the kids wean and start eating solid food at around the same time regardless of species in the rainy season because you want your kid to have the best chance of going up healthy and strong. And so, that best chance would be when there's food around.

So, it really depends when they're breeding, on when they're actually going to give birth, and how long the kids are going to nurse, so it's super variable as well. The mouse and dwarf lemurs have only about a 60-day pregnancy. [*"That was quick."*] The sifaka, it's more like five months, five and a half months. So, it's again, super, super variable. The smaller lemurs like the mouse and dwarf lemurs will have anywhere from a singleton to triplets. I've also heard cases of quads, but that's pretty atypical. Your *lemuridae*, so your ring-tailed lemurs, your brown lemurs, and your bamboo lemurs usually have singletons or twins.



Your ruffed lemurs can have the biggest litters of four up to five, I've heard cases of. And they do this fascinating thing where they have these boom or bust years. So, in really good years, basically, all the females will reproduce and then they co-raise their kids in kindergartens together where there's a lot of allomaternal care, so caring for other mom's kids and then she cares for your kids as well. So, that's sort of this fascinating system if you're going to be a really heavy fruit eater and you want to time everything for years of really, really good fruiting. So, there's a lot of variation in it, but basically, it's very, very, *very* seasonal.

**Alie:** And how are they doing the nasty? Do they mate for life, or do they have orgies in treetops?

**Lydia:** *[laughs]* It depends on the species. So, we have some species that are pair-bonded for life. The most classic and beautiful example I think would be the red-bellied lemur; they live in just these beautiful pairs that mate for life. A lot of dwarf lemurs also will be in very, very strongly bonded pairs that mate for life, indris are the same.

**Aside:** Aww, some are so romantic. Others, less so.

**Lydia:** And then we have the other end of the spectrum, which is the ring-tailed lemur, which is a very promiscuous, multi, multi-male, multi-female, kind of like a frat party that happens around mating season where there's a lot of competition and there's a lot of female choice. There are even things like paternity confusion, so mating with multiple males so nobody knows whose kid is whose, and yeah, it's just kind of a mess.

**Alie:** I mean, I'm feeling like because they're so cute, they have tiny, tiny dicks. Is that true?

**Lydia:** It depends on the species as well. So, what we tend to see in primates and probably in other mammals as well, is that when there's intense competition for paternity, you tend to have much bigger testes and much bigger sperm competition. So, for example, male mouse lemurs have just enormous testes in the breeding season.

**Aside:** Mouse lemurs, of course, smaller than a microwave burrito, about the size of a small squirrel. They're furry, golden-brown, huge eyes, they could sit in your palm but its nard sack is the size of a walnut, the largest among all primates. The lead researcher on the job offered the visual, "If humans had testicles of an equivalent size, they would be as large as two grapefruits." Oh lemurs, we've gotten to know you so well.

**Lydia:** And again, the season is a really short window, so outside of the breeding season, they regress their testes, and you can't really see them at all because it's a waste of energy to maintain those enormous testes. But we tend to see smaller testes in pair-bonded species where the males are pretty confident that they're going to be the dad and they don't need to fight for it at all. So, once again, sociality and evolution go hand in hand.

**Alie:** I love that having big balls is actually the sign that you're a cuck.

**Lydia:** Yeah, exactly.

**Aside:** One thing that a lot of people talk about, the obvious question that we have not yet answered, was asked by patrons Mouse, Mish the Fish, Amanda Kamlet, Susan Singley, and Fi Cameron.

**Alie:** No one talks about that.

So many people, which is why I've saved it to the end, want to know, Nova, first-time question-asker: What do you think about King Julien from *Madagascar*? How do you feel about the portrayal of lemurs in the *Madagascar* movies?

**Lydia:** I wish you could see the eye roll on my face right now. [*Alie laughs*] So, I want to give the movie credit where credit, I think, is due, which is that over the course of my career, the questions went from “What is a lemur?” to, “Oh, I know what lemurs are because of this movie and now I want to know more.” So, I do think that the movie gave the general public an understanding of lemurs and where they come from in a way that wasn't present before the movie franchise. However, I do think they could have gotten things a bit more accurate. My favorite being, of course, is that King Julien should be Queen Julien. [*Alie laughs*] Lemurs are female dominant and that was such a good opportunity to teach everybody that there is more than one way to structure a society and that women and females can play a really important role in governance and being in charge, based on a real-life situation and they missed that boat.

**Aside:** Or that raft of vegetation.

**Lydia:** So, that's the part that makes, I think, a lot of us pretty annoyed. And also, like there are no giraffes in Madagascar. None of the African megafauna is in Madagascar. [*Alie laughs*] They all missed the raft, none of them got from continental Africa over to Madagascar. So, there's just also some misinformation that has resulted from the, sort of, poster of the movie being the title *Madagascar* with, like, a giraffe and a hippo and like a penguin and a lemur. So, it gets some credit, but it also could have made things a bit more accurate.

**Alie:** I had no idea. Thank you for clearing that up. A bunch of people...

**Aside:** Anne, Kyla C, Red Cedar, Lily, Jenn Macgillivray, Sarah Piette, Alia Myers, Katie Harris, Emily Hebert.

**Alie:** Also wanted to know about... Zoo and Boo... Zoo and Buddha?

**Lydia:** *Zoboofafoo*.

**Alie:** Thank you.

**Lydia:** This was a TV show for kids. [*Zoboofafoo theme song “It's the Kratt Brothers! While walking in the woods one day, Chris and Martin saw something strange, a little leaping lemur who liked to bounce and play.”*] I was a little bit too old to ride the *Zoboofafoo* bandwagon, but this was a show that was filmed for *Wild Kratts*. There are a lot of ties between the Kratt Brothers and Duke because they went to Duke, and they were involved out at the Lemur Center. And so, they chose a Coquerel's sifaka, which by the way is the best lemur species, they chose a Coquerel's sifaka as their mascot, and it was this puppet named Zobo. And they did some filming for their entrance sequence using a real lemur whose name was Jovian. So, Jovian is actually Zobo and he lived his whole life at the Duke Lemur Center and has a bunch of kids and grandkids, I think even now great-grandkids that are out there. And so Jovian actually was part of my senior thesis, he contributed to data for my dissertation. So, I had a long history with that family outside of the TV franchise.

**Alie:** Did he pass away?

**Lydia:** He did. He was, I think 20. So, he got to be a decent age.

**Alie:** A lot of people want to know...

**Aside:** Amy ZM, Rayna, Adam Weaver...

**Alie:** Connor Chapman wants to know: Are lemurs at risk or endangered?

BeckytheSassySeagrassScientist: How can we help the precious baby lemur loves? Do you need volunteers at the Lemur Center (please I'm begging you), says Taylor Wade. And also, of course, Pavka34 wants to know: What impact will climate change have on lemur populations? How are they doing? How can we help them?

**Lydia:** So, lemurs are super endangered for a number of reasons. Part of it is just that a lot of lemurs are naturally geographically or ecologically specialized, meaning they only live in one place, and they really only survive by eating, for example, one thing. And so, for some of these species, there's not a whole lot of natural resilience or flexibility encoded in how they operate. And so, those species tend to be quite at risk from habitat loss or habitat fragmentation, or also climate change. So, there is this real pressure for many species in the wild that is just present and real.

Where I would spend a little bit more time talking is not about the fact that they are endangered because, like most wildlife, they are endangered. But we tend to spin why they're endangered as being the fault of Malagasy people for destroying their habitat. And I think *that's* the part where we need to have a change in conversation, which will also feed back into like, how do we help? The reality is that like Malagasy people also need land, it's also their country and so there is this competition over space for farming. Malagasy people, many of them also have a deep respect for the forest and for the environment and they rely on the forest and don't want the forest gone. There's a growing ecotourism industry in Madagascar that also is dependent on intact habitats and healthy habitats and healthy ecosystems and lemurs being there. So, we have to change how we talk about the conservation crisis in Madagascar and where we place blame because a lot of the problems actually developed as a consequence of colonialism on the island and not necessarily because of what the Indigenous population is doing.

So, to the answer of, how can we help? I think we have to make sure that we are lifting up Malagasy leaders, conservation leaders, and scientific leaders who are being agents of change in their own country and recognize that the voice of Westerners cannot be louder than the voice of Malagasy because it's not our country. And so, making sure that we are donating to and supporting causes that are run by Malagasy leaders and Malagasy experts that are providing training opportunities for Malagasy students. So, if you can find organizations that are run by Malagasy leaders that are doing good work, even if it's small scale, I think that's a really, really good way to help.

**Alie:** Wonderful. Thank you for the suggestion for where to donate.

**Lydia:** Yeah, so can I give a particular shoutout to Mahaliana, run by Dr. Fidisoa Rasambainarivo and Elizabeth Toomey who are doing really good work in Madagascar to support veterinary and conservation students, basically teaching them all the things that a scientist needs as they're growing into their own.

**Aside:** Again, we'll be linking those in the show notes. And this answer is shocking to me.

**Alie:** I mean, the underlying question I feel like we all have is like, why are they so cute? What's happening in our brains when we see them? Is it the gigantic eyes?

**Lydia:** I think it probably is the gigantic eyes. So, this is where me and other primatologists might differ because the closer I get to human-looking, the more scared I am and the less cute I find them. [*Alie laughs*] Like I'm very intimidated by baboons and macaques and by chimpanzees and gorillas. I really don't ever want to come in contact with any of those animals. It's so great, like, so happy that people are studying them, but that is just not my jam.

So, for me, lemurs are basically on the other end of the primate spectrum where they could almost not be primates and they fall into sort of the bucket of cute mammals, but they still have fur and they're still like, you know, they're small, they're not terrifying. Maybe some of the extinct lemurs that were, like, the size of female gorillas, I would've felt more intimidated by. But there's something very not intimidating about a lemur, maybe unless you're another lemur. So, for sure it's the eyes, it's the fluffiness, it's the beautiful coat colorings. Often the pictures that we're seeing and the videos we're seeing are of animals, you know, that are eating really nutritious food and so look

wonderful and healthy and super fluffy. The kids are adorable. It's just, you know, I'm here being a scientist and talking about how cute they are, which just sounds very not, you know, objective, but they are just adorable.

**Alie:** What about the hardest thing about studying lemurs? What sucks about your job other than maybe the flights?

**Lydia:** The flights are not great. [*Alie laughs*] For sure it is working on an endangered system. Sometimes you just have to put it out of the back of your brain like how endangered these animals are to focus on the task at hand. It can just be mentally exhausting. It is exhausting when a population you've been studying gets hit by a hunting wave or by a cyclone, seeing animals that you've spent a long time studying go missing or get lost is just really, really difficult, it's also just part of nature sometimes. I think recognizing that nature is just harsh is part of it. It can just take an emotional toll. So, sometimes you need, like, a nice hot shower and a cup of tea to remind yourself of why you got into this.

And then there's the other, like, physical aspect of it. Fieldwork is really difficult; it is physically difficult, it is emotionally difficult, sleeping in a tent, not having access to running water or a bathroom, getting up early in the morning, not getting the data that you expected to get, worrying that you're not fulfilling your obligations to the community or to your grant that you promised because you can't find the animals that you thought were there. All of that takes a toll over time, but I mean... Would I do anything else? Probably not.

**Alie:** What do you love the most about it or what is your favorite lemur? I feel like you maybe mentioned the sifaka but I'm not sure.

**Lydia:** Yeah, there are nine species of sifaka and the best one is the Coquerel's sifaka and I can hear people yelling at me through Instagram right now. [*Alie laughs*] For me, it's the Coquerel's sifaka just because it's a species I've been working on, working with I should say, for close to 17 years now. So, there's just a familiarity with that species that I have. I also think their coloring is beautiful; the warm maroon of their arms and legs with the, like, luscious cream of their body, this variation in eye color that we talked about. They're just beautiful to look at. They're dopey in behavior, they're smart. They just have it all.

I think the best part is seeing them in the wild and it's also recognizing that as much data as I generate and as many papers as I publish, or students as I mentor, ultimately those animals are there just living their lives having nothing to do with me. Just getting to see them do their thing without them caring *at all* that I exist is actually really rewarding. They're up foraging, they don't care that I'm there, they're up grooming and don't care that I'm there; I just get to observe without disturbing and that's sort of an extraordinary place to stand there and be in, just to see.

**Alie:** Thank you for taking us to Madagascar from an oral standpoint. I mean, this has been an absolute thrill to talk to you about this. It's been a long time coming and you're just a gem in this field.

**Lydia:** Oh, that's so kind. Yeah, I think the next step is actually a collaborative trip to Madagascar.

**Alie:** Send me details. Honestly, I will go. [*"Can I come too?"*]

**Lydia:** What month? I should tell you what month. Do not go in the rainy season.

**Alie:** Okay.

**Lydia:** So, sometime between April to October is the best time of year.

**Alie:** Let me know when you're headed there next. Seriously. We have it on record. Deal. Well, thank you so much doc, this has just been the best.

**Lydia:** It was my pleasure. Thank you so much for having me.

**Alie:** Ahhhh! I love thiiiiiiis. Oh my god, it's the best.

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So, ask smart people not-smart questions because you're going to remember the answer long after they've forgotten you ever asked it. And huge, huge thanks to Dr. Lydia Greene for hopping on this episode with me. You can follow her and her wife, fellow lemuropologist Dr. Marina Blanco, on Instagram @LemurScientist. We'll put more links, including to the NGO charity and we'll of course have more links on our website at AlieWard.com/Ologies/Lemurology.

We are @Ologies on Twitter and Instagram and I'm @AlieWard on both. We also have *Smologies*, which are shorter, classroom-friendly episodes that are all available to download for free at AlieWard.com/Smologies, which is linked in the show notes. Erin Talbert is our *Ologies* Podcast Facebook Group admin, Emily White of The Wordary makes our professional transcripts. Noel Dilworth is our scheduling producer, Susan Hale is our managing director, and Kelly R Dwyer makes our website and can make yours too. And the rare specimen who pieces the show together each week is lead editor Mercedes Maitland of Maitland Audio. Nick Thorburn wrote the theme music.

And if you stick around until the end of the episode, I tell you a secret, and this week it's that one of the ornaments on our Christmas tree this year is this rock-hard *pão de queijo*, I think I'm pronouncing that right, it's this Brazilian cheese roll. When we were decorating the tree a year ago with our friend Jason, he strung the Trader Joe's appetizer cheese biscuit on a popcorn garland for us to find later and I was so touched that I kept it and froze it for a whole year and now it's a holiday fixture, we've made it into an ornament. So far nothing else is trying to eat it, it really is like a geological specimen at this point.

Also, another secret, this is the quickest turnaround I've ever managed on an episode. It's now midnight, and I recorded this with Lydia at 7:30 this morning. But I shuffled some episodes around because I really wanted this one to go up. I think we all needed it. Okay. Also, my dog looks like an aye-aye, look it up. Berbye.

*Transcribed by Aveline Malek at TheWordary.com*

#### **Links to things we discussed:**

[The Duke Lemur Center](#)

[LEMURS CAN SMELL WEAKNESS IN EACH OTHER](#)

[Ring-tailed lemurs \(\*Lemur catta\*\) use olfaction to locate distant fruit](#)

[Lemurs move-it moving it: a fiction](#)

[Mouse lemur](#)

[Ruffed lemur vocalizations](#)

[The Legend Of Babakoto](#)

[Who Eats Lemurs... and Why?](#)

[On the modulation and maintenance of hibernation in captive dwarf lemurs](#)

[Lemurs Smear Bugs on Their Privates to Ward Off Infection](#)

[Bonkers lemur videos](#)

**Supplemental reading:**

[Reassembling the Strange: Naturalists, Missionaries, and the Environment of Nineteenth-Century Madagascar](#)

[The Sloth Lemur's Song: Madagascar from the Deep Past to the Uncertain Present](#)

**Other episodes you may enjoy:**

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