

A PUBLICATION OF THE DUKE LEMUR CENTER

LEMURS

The
WHERE
Issue

ONE PLACE,
A WORLD OF
IMPACT



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EDITOR:

Sara Sorraia

Special thanks to my colleagues, who are brilliant at everything and whose writing, illustrations, and photographs make this magazine sparkle; to Abby Flyer, Megan McGrath, Glenna Rowe, and Gavin Rowe, whose proofreading and suggestions improved this issue immensely; and to designer Regina Barnhill, whose technical skill, creativity, and patience make working with her a joy. Any mistakes are my own.

Comments, questions, or something you'd like to see in our next edition? Email sara.sorraia@duke.edu.

ON THE COVER:

Kidman (March 1994-January 2025), a critically endangered blue-eyed black lemur, pictured just shy of her 29th birthday. Her dam, Lamour, was imported from Madagascar and was one of the original founders of the DLC's blue-eyed black lemur (*Eulemur flavifrons*) conservation breeding program. Kidman had nine infants, including twins, before "retiring" in 2017 as a non-breeding social companion. She was named the DLC's "Lemur of the Year" in 2023 and was the oldest blue-eyed black lemur ever to be maintained in human care. Rest in peace and climb the trees with your ancestors, Kidman. We miss you dearly. Photo by Sara Sorraia.

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LETTER FROM THE DIRECTOR



WHO WOULD have thought that a small collection of mixed primates brought to Duke Forest in 1966 could grow into a global force in lemur care, research, and conservation? 58 years later, the Duke Lemur Center (DLC) continues to evolve, thanks to the unwavering passion of our dedicated staff, students, volunteers, and partners around the world.

In this issue, you'll travel across the globe to learn more about the projects and programs that the DLC supports in our efforts to protect the forests and lemurs of Madagascar.

You'll also meet several long-term collaborators whose pioneering spirit, vision, and dedication planted the seeds of possibility and opportunity from which these programs have grown. Of these, I'd like to acknowledge two individuals to whom I owe a personal debt of gratitude for all they have done to help the DLC achieve its mission during my tenure as director.

The first is Dr. Rich Kay, Professor Emeritus of Evolutionary Anthropology. Rich's fingerprints are indelibly captured throughout the DLC's fossil primate program. Rich's early work, some in collaboration with former DLC Director Dr. Elwyn Simons, opened the door to key discoveries in primate evolution in Egypt and South America. As the leadership of the fossil primate program changed over the years, Rich provided the steady hand that kept the program moving forward. With his mentorship, the DLC's Curator of Fossils, Dr. Matt Borths, has developed new programs that actively engage students in our paleontological field work around the world.

The second is the Lemur Center's longtime Conservation Coordinator, Charlie Welch. When it comes to planting seeds, there is no one who has literally done more of that work. For almost 40 years, Charlie has led the DLC's conservation efforts in Madagascar, working side-by-side with his wife and former DLC Curator, Andrea Katz, to establish one of the first-ever long-term conservation programs in Madagascar. Anyone who has worked with Charlie knows his drive to protect the flora and fauna of Madagascar comes from his love of the Malagasy people. Traveling with Charlie throughout Madagascar is like a marathon family reunion. It's easy to see the respect he has for local communities, many of whom he has worked with for decades, and the joy it brings him to reunite with old friends and colleagues.

As he prepares to step into a well-earned retirement, he leaves a forest in his wake. A forest built one sapling at a time, one relationship at a time, with determination and kindness.

As Charlie says, May the great tree embrace you!

GREG DYE

Executive Director, Duke Lemur Center

ABOUT THE DLC

CARING FOR AND PROTECTING EARTH'S MOST ENDANGERED MAMMALS SINCE 1966

Located on the campus of Duke University in Durham, North Carolina, the Duke Lemur Center is a world leader in the study, care, and protection of lemurs—the most endangered group of mammals on Earth.

Since 1966, the DLC has cared for over 4,315 primates, welcomed more than 3,400 infants through our conservation breeding program, played a leading role in conserving lemurs and their natural habitat in Madagascar, produced more than 1,600 peer-reviewed scientific publications, and shared our lemur care expertise with zoos and conservation organizations around the world.

Today, with our irreplaceable colony of nearly 250 lemurs across 12 species, the DLC houses the most diverse population of lemurs outside of Madagascar and ranks among the most precious collections of endangered primates anywhere on Earth.



The Duke Lemur Center is accredited by the Association of Zoos and Aquariums (AZA), which means we meet the highest standards for animal welfare, health, and nutrition. At our most recent inspection (2021), the DLC received an extremely rare perfect score.

The Duke Lemur Center is also accredited by AAALAC International, which means it meets the highest standards for animal welfare, health, and nutrition for animals used in research. (All DLC research is non-invasive.) AAALAC-accredited institutions like the DLC help raise the global benchmark for animal wellbeing in science.

The DLC is proud to be the only organization in the world that holds accreditations from both the AZA and AAALAC International.



Through non-invasive research, staff at the DLC learn how to better care for lemurs in captivity and conserve them in the wild. “By learning what most affects lemurs’ survival and reproduction, we can better focus our conservation efforts in Madagascar,” says Director of Research Erin Ehmke, Ph.D. “And for the lemurs living here in Durham, we can focus our husbandry practices on ways that best accommodate lemurs’ dietary, social, and other needs.” Pictured: A research intern conducts observations on a troop of ring-tails. Because the DLC’s lemurs free-range in large tracts of forest and live in natural social groups, researchers can observe similar behaviors, social structures, and age classes that would be observed in the wild. *Photo by Bob Karp.*



A truly global institution, the Duke Lemur Center works in the United States in North Carolina, Wyoming, and Utah; La Venta, Columbia; Santa Cruz Province, Argentina; Wadi Moghra and the Fayum Depression, Egypt; and in numerous fossil and conservation sites across Madagascar. *Artwork by Talia Felgenhauer, 2023-25 Undergraduate Fellow in Communications.*



Our Student Projects team connects students with volunteer, work-study, research, and internship opportunities at the DLC and in Madagascar. “The students profiled in this issue, like so many others we’ve had the privilege of working alongside, give me hope that the conservation problems we struggle with today can and will be solved by their generation,” says Executive Director Greg Dye. Pictured: Interns visit the fossil collection. *Photo by Bob Karp.*



The DLC’s daily enrichment program promotes lemurs’ curiosity, exploration, and mental stimulation and is a critical component of the animals’ care and wellbeing. Pictured: Aye-aye Agatha with a specialized mealworm feeder, which encourages natural tapping and gnawing behavior. *Photo by David Haring.*



ARACUS:

A Lifetime of Care at the Duke Lemur Center



By **ABBY FLYER, M.A.**
Communications and Education Specialist



Aracus was a stud in the fall of 2003.

He lived in one of the Duke Lemur Center's free-ranging forest habitats in a troop with six other ring-tailed lemurs, three of whom were breeding females. At 12 years old, Aracus would've been approaching the end of his lifespan had he grown up in the spiny desert of southern Madagascar; but as a lemur born at the DLC, he was barely old enough for a mid-life crisis.

Aracus was born into this troop in 1991. By 2003, he had worked his way up the hierarchy of males and was judged by the females—the dominant sex—to be the ideal mate choice. "Aracus was seen breeding with Dory on Sunday afternoon," husbandry staff noted, "keeping Agnostes and Selaucius at a distance. Philocles, too, had sense enough to stay away."

Photo by Sara Nicholson

While the three males gave Aracus a wide berth, the females did not. Aracus bred with all three—Dory, Cleis, and Sosiphanes—and even earned a spot in the girls’ lemur ball, a sleeping arrangement in which lemurs curl up and huddle together like eggs in a nest. The other males were excluded, forced to sleep solo on the forest floor a few feet away.

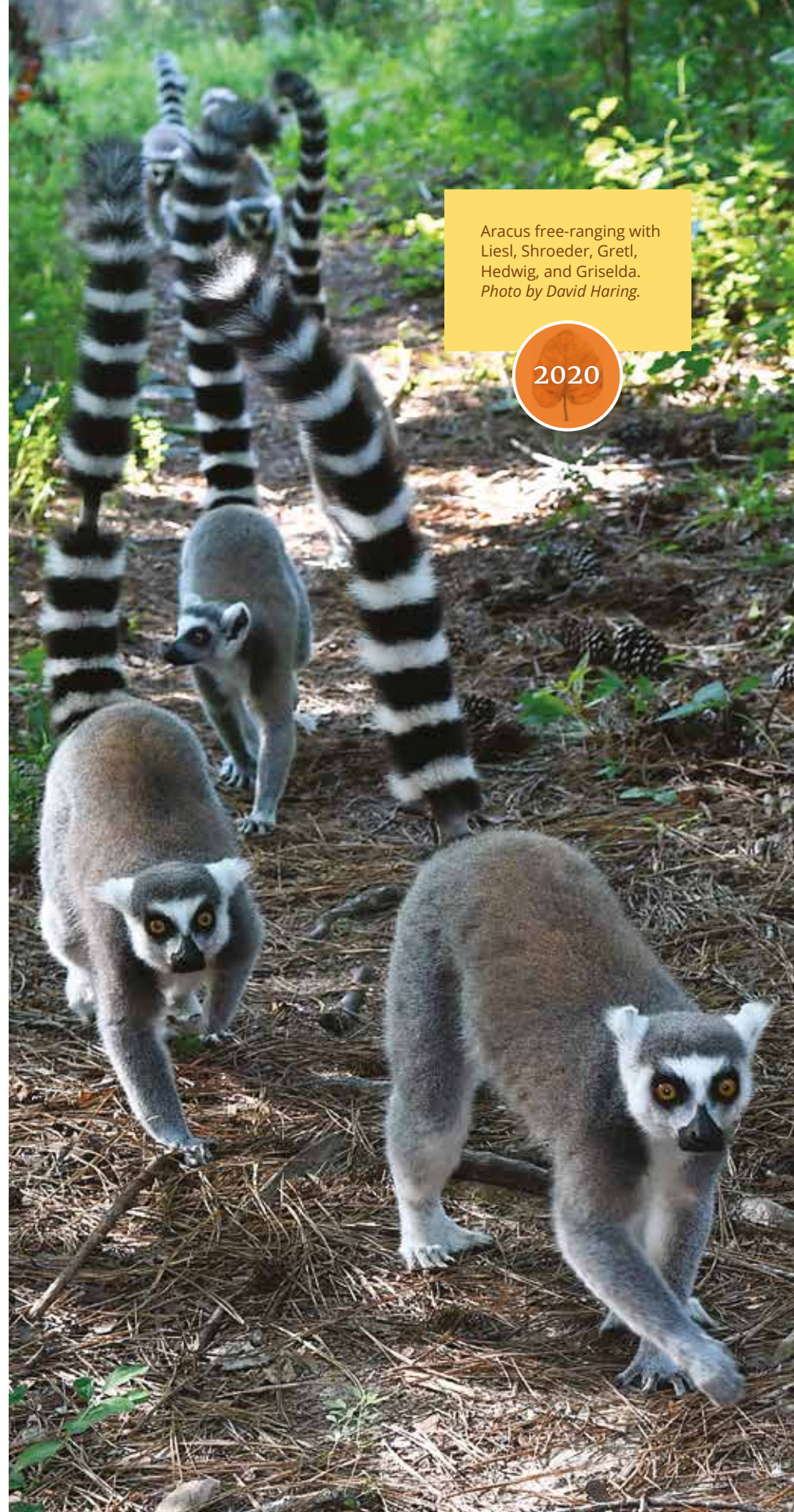
By the time he was transferred to a new group in September 2005, Aracus had dominated his troop’s gene pool, producing nine offspring with his three breeding partners. Charles Darwin would have been proud.



WHEN I STARTED working at the DLC in January 2023, it was hard for me to imagine Aracus in his prime. As the second-oldest resident of the Lemur Center, he carried a mythos and a reverence, as if he had always been old and wise. (His age was eclipsed only by that of Poe, a 37-year-old aye-aye.) Diving into Aracus’s past feels like seeing your dad’s high school yearbook photos—slicked-back hair and aviators, a rakish grin that feels foreign on the face of the man who raised you.

Though two decades past his reproductive peak, Aracus was as charismatic as ever. When I crouched with my notebook in the family’s outdoor enclosure, he spotted me and broke into a gallop. He could gallop much faster than his age suggested, and the gentle triplet patter of his hands and feet hitting the ground sounded like a horse the weight of a house cat approaching.

Aracus had two speeds: the rhythmic amble that betrayed his age, and the spirited gallop that seemed to defy it. He stopped inches



Aracus free-ranging with Liesl, Shroeder, Gretl, Hedwig, and Griselda.
Photo by David Haring.



from where I stood, rising up onto his hind legs. Though his hands shook and his fingers were gnarled with age, he reached for my notebook to mark its pages with scent from the glands on his wrists. *This is mine*, he was saying, a message to his peers that I didn’t have the nose to fully comprehend.

But a contact call from Liesl, the troop’s dominant female, drew him away. Ring-tailed lemurs communicate with a language seemingly Frankensteined from the sounds of other animals: the clucking grunts of hens, the whines of an impatient puppy, an owl’s gentle coo, loud mewls from a cat determined to wake its owners at midnight. Ring-tailed lemurs are one of the most vocal primates, with at least 28 distinct calls, and Liesl and her daughters are particularly chatty. Their enclosure often erupts into a chorus of clucks and whines, like a group of friends reuniting, armed with an arsenal of gossip.

Aracus locked his eyes on me for a moment—soft, pale yellow irises

As the second-oldest resident of the DLC, Aracus carried a mythos and a reverence, as if he had always been old and wise.

dotted with foggy pupils—and then turned tail, abandoning my notebook to gallop toward Liesl’s call.



ARACUS BECAME a father on March 18, 2004, when Dory delivered twin girls. Sosiphanes soon doubled his offspring with a pair of twin boys. Sosiphanes’ and Dory’s mother, Cleis, bore him another son in May. Aracus’s season of love had paid evolutionary dividends.

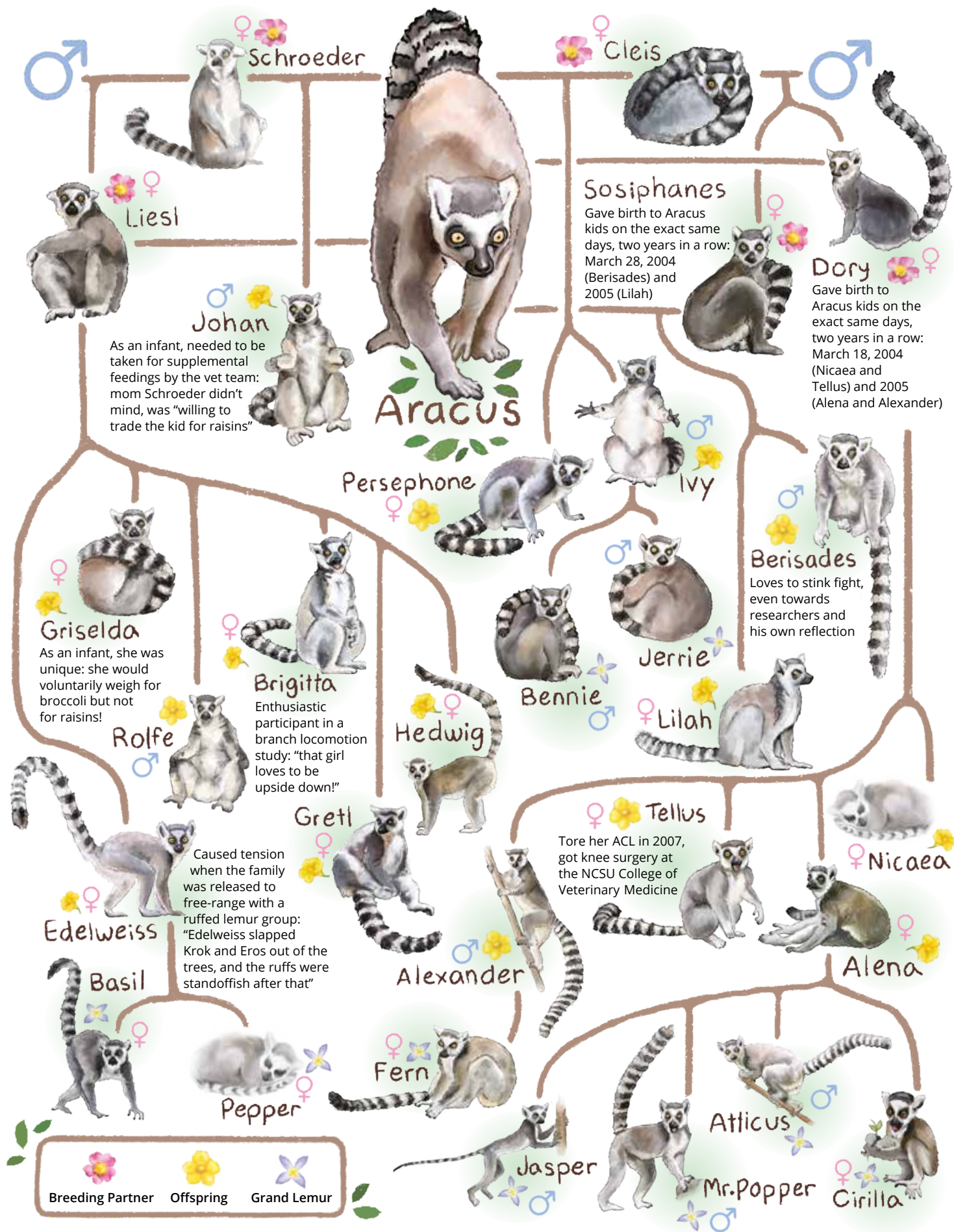
Aracus was a hands-off dad. In Madagascar, ring-tailed lemur troops range from six to 24 individuals, with most females mating with multiple

males in quick succession. Because males have no way of confirming the genetic relatedness of any infants born within the troop, from a Darwinian standpoint it doesn’t behoove a male to invest energy into caring for kids that might not share his DNA. This evolutionary pragmatism drives these primates to absentee fatherhood, stepping back and letting the females shoulder the duty of infant care.

Females are dominant in ring-tailed lemur society. When I knew him, 33-year-old Aracus took his marching orders from 15-year-old Liesl, the mother of seven of the 17



Aracus and Liesl met in 2009. He was recommended for breeding with Liesl’s mother, Shroeder, but it was the juvenile female who took a shine to 19-year-old Aracus.
Photo by Sara Nicholson.



From his impact on the DLC's conservation breeding program to the health and behavioral data gathered throughout his life, Aracus's legacy lives on beyond beloved memories.

offspring Aracus had sired over the course of his life. Aracus and Liesl lived with their three youngest daughters: Gretl, Griselda, and Hedwig. As the only male in the troop, Aracus occupied the bottom rung of the social ladder. Even if he had lived with his sons, he was still likely to be the lowest-ranking member. Hierarchy in ring-tailed lemur troops is largely determined by the dominant female: Who will she back in a fight? Given the choice between her offspring and her breeding partner, the matriarch will almost always side with her kids.

Liesel has ears that stick straight out from the side of her head like airplane wings. A shaved section in the middle of her tail helps less-familiar observers single her out, but I know her so well that I can spot her in pictures taken over a decade ago. As the dominant female, Liesl has premiere access to the tastiest food, the warmest sunbathing locales, and the undivided attention of the rest of her troop.

Danielle Lynch, Assistant Curator at the Duke Lemur Center, describes her as a "subtle matriarch."

"If you don't know that group, you wouldn't realize she's in charge," says Danielle, who has worked with Liesl and family in a consistent capacity since 2018. "She doesn't have to do much, and the girls follow her." While Liesl will occasionally enforce her reign using physical aggression, more often she controls the troop through something as understated as a quick glance.

Having lost interest in my presence, Aracus joined Liesl on a sunny branch in their forested enclosure. Liesl was "sun worshipping," sitting up tall on her haunches like an obedient kindergartener during circle time, arms raised laterally to expose her belly to the light. Aracus ambled along the branch in pursuit of warmth, settling a short but respectable distance away from her. He leaned to his left just far enough to groom the nape of Liesl's neck. She angled her head to reciprocate,

tooth comb running one, two, three times through his scruffy gray fur. From my vantage point, the pair were haloed in the gentle late morning light, a blinding white silhouette tickling the tips of their ears.

EVERY LEMUR at the DLC visits the Borruel Center, our state-of-the-art veterinary facility, at least once a year for a routine physical exam. Geriatric animals like Aracus tend to visit more frequently. He had a tumor removed from one of his scent glands and was repeatedly treated for severe spondylosis, a condition caused by age-related wear on the spine that caused his tail to droop. He took gabapentin for joint pain. But he remained healthy and spry enough to free-range, and even in his 30s, the husbandry notes describe him as "climbing and trotting through the woods, keeping up with his ladies."

He needed to be separated from the girls during mealtimes. "Most geriatric lemurs that I have worked with, especially ring-tails, are not good eaters," explained Danielle. "Getting Aracus to eat was the biggest challenge." Feeding him separately gave him ample time to pick at his food bowl without the girls swooping in and devouring his leftovers.

Even so, it was hard to keep Aracus focused on eating for long. "He was old, but he was still very fiery," Danielle laughed. "Sometimes he'd

OPPOSITE PAGE: Lemurs are the most endangered group of mammals in the world, and at least 17 species have already gone extinct. In partnership with the Association of Zoos and Aquariums, the DLC's conservation breeding program works to create a genetic safety net for lemur species threatened with extinction. By fathering over a dozen offspring with five breeding partners, Aracus contributed to a genetically diverse population of ring-tailed lemurs in human care that will survive and thrive for decades after his passing. *Illustration by Talia Felgenhauer, 2023-25 DLC Undergraduate Fellow in Communications.*

get distracted while he was eating, and I'd be like, 'No, no! You were eating! Go back and finish eating!' But no, he wanted to chase after the girls, because even though they're contracepted, he doesn't understand that he can't breed them. The breeding urge is usually the last thing to go."



IN LATE JUNE 2024, a series of diagnostic tests determined that Aracus was on the brink of complete liver failure. "His bloodwork has shown us that his disease is progressing," noted DLC veterinarian Brendan Johnson, D.V.M., Ph.D.

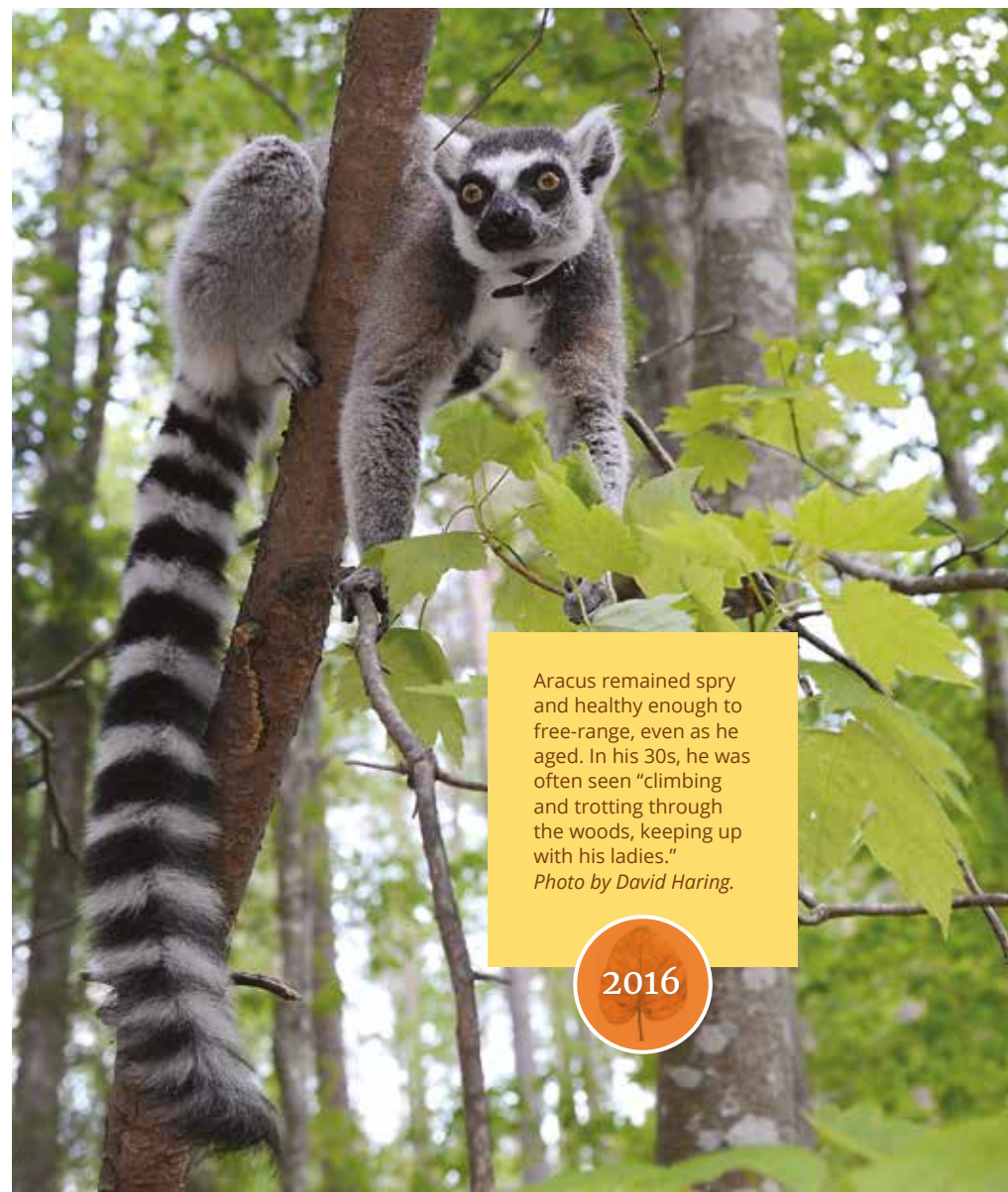
"While outwardly he may seem okay, his liver is worsening." To prevent him from suffering, the animal care team made the decision to humanely euthanize Aracus on July 10, 2024.

On my last day of observations with the family, I left my notebook in my office. As I stood, quiet and still, I was approached by eight-year-old Hedwig, the youngest of Aracus's 17 offspring. She plopped down in front of me, legs stretched, back feet closed into loose fists, hands flat against the ground. She wasn't sniffing me, or eating, or scent-marking, or sun-worshipping. I was seeing her as she exists in the moments in between—blinking, breathing, wind gently rustling her fur. So much of my writing and my work with lemurs centers around stories, facts, and behaviors. Usually, when I observe the lemurs, they're running around with one another, and I exist outside of the action, a silent voyeur. But for a couple of minutes, we were just two primates, two feet apart, watching the world turn.

ARACUS'S LEGACY lives on beyond beloved memories. DLC husbandry staff, veterinarians, and researchers keep detailed notes on each animal over the course of their lives, and Aracus's 200-page document tells the story of three decades of attention and care. Insight gained throughout his life could impact the lives of other lemurs at the DLC for years to come, and many of his 17 offspring and 10 grandkids still live at zoos across America and continue to bring joy to visitors in every corner of the country. In the words of DLC Colony Curator Britt Keith, "What a great animal. What a great life he has had." 🐾



Aracus, his longtime partner Liesl, and their three youngest daughters rest in a "lemur ball" on a late spring morning. Photo by Crystal Silva.



Aracus remained spry and healthy enough to free-range, even as he aged. In his 30s, he was often seen "climbing and trotting through the woods, keeping up with his ladies." Photo by David Haring.



FREQUENTLY ASKED QUESTION: HOW DOES THE DLC KNOW SO MUCH ABOUT EVERY LEMUR?



By **ABBY FLYER, M.A.**, Communications and Education Specialist

WHEN IT comes to our lemurs, there's no such thing as "too much information."

DLC husbandry staff, veterinarians, and researchers keep detailed notes on each animal throughout the course of his or her life. These notes include as much information as possible: diet plans, training regimens, medical records, research participation, behaviors, and much more. Internally, these notes allow us to provide the best possible care for our animals and manage our colony. A keeper assigned to care for a new lemur family can read up on each individual to become more familiar with the animals. If a lemur displays an odd behavior, we can search through decades of records to reference similar cases. When a researcher needs to recruit participants for a study, we can check to see which lemurs have been eager to participate in past projects.

The impact of our life history data extends beyond our facility. "We're sort of the go-to for anything lemur-related," says Amanda Mazza, the DLC's Data Manager and Registrar. The large sample sizes, exact dates of events, and longitudinal data that in many cases span an animal's entire life make these data sets unique, particularly within the primate literature. Anyone who wants to learn more about our lemurs can access summarized species values

for variables relating to ancestry, reproduction, longevity, and body mass. Often, researchers don't realize how much data the DLC has available, and a single request for a specific piece of information can spark a multitude of questions. "The depth of what our life history can bring to a researcher opens a door for more research, more questions, more curiosity."

Our database is still growing. Since we first released our data in 2014, we have added information from over 100 new animals. We've also been able to fill in some of the blanks from the DLC's early days. "We have a volunteer who's finally able to go through hand-written husbandry notes from the 60s," Amanda says.

These deep dives into the Lemur Center's history through the lives of its residents highlight just how much we've changed since our founding in 1966. "Just seeing how things were done in the early years of the DLC to where we are today... Our progress is immense." And as much as we have evolved over the past 59 years, one thing remains consistent: the level of attention and care that our staff put into these incredible primates.

On a personal level, it's comforting to know that beloved animals like Aracus are survived by more than just our memories. "Just because the animal is not alive anymore doesn't mean they're not still 'living' in a data sense," says Amanda. "Data never dies." 🐾

The Lemur Center's archive of life history data is available for free download online. By making its data available to the world, the DLC hopes that the information will (a) help institutions better care for lemurs in captivity, and (b) help researchers and conservationists better understand lemurs' health, reproduction, and social dynamics so they can better protect them in the wild. Pictured: Indigo, an infant mouse lemur, during a routine weighing. Photo by David Haring.





Digital scans of skeletons in the Museum's collection can be shared globally and contribute to lemur research revelations, especially when paired with the individual's life history data from her time at the DLC. Nefertiti, pictured here and on page 16, lived at the DLC for 24 years. Her mandible is missing from the scan because it was sent to researchers at the University of Missouri School of Medicine after her death in April 2003. Biological samples collected after Nefertiti's death also contributed to research at Marshall University and the University of Chicago. *Postmortem CT scan courtesy of the DLC Museum of Natural History.*

DIGGING UP NEW DATA:

LESSONS FROM SKELETONS



By **MATT BORTHS, Ph.D.**, Curator of the DLC Museum of Natural History, and **KARIE WHITMAN**, Fossil Preparator

“Can you help me dig up some lemur bones?”

The question, posed by Dr. Laurie Godfrey, professor emerita in the Department of Anthropology at the University of Massachusetts, isn't an odd one to hear at the DLC Museum of Natural History. Arguably, it's our primary mission. We journey to Wyoming, Egypt, and Madagascar to dig up fossilized lemur bones and the bones of our primate relatives.



AFTER THEY DIE, LEMURS CONTINUE TO TEACH US THROUGH THEIR REMAINS.

WHAT MADE this question unusual is that Laurie's lemur bones had been in the ground for only a few years. Or maybe months. Or days. This was much fresher material than paleontologists are used to handling. But when someone needs help collecting specimens—especially specimens that will help us understand the biology of the lemurs that live at the Lemur Center—the DLC Museum team swings into action.

Laurie has been a friend of DLC paleontology for decades. She worked with DLC Museum founder Dr. Elwyn Simons and Curator Prithijit Chatrath to collect and describe giant lemurs from Madagascar in the 1980s and 1990s. For a project studying living lemurs in 2001, she traveled

to the Bezà-Mahafaly Reserve in southwestern Madagascar.

Bezà-Mahafaly has been a hub of lemur field research for nearly forty years. Researchers there have compiled detailed life histories, behavioral details, and genetic records for more than 850 Verreaux's sifakas (*Propithecus verreauxi*) and more than 250 ring-tailed lemurs (*Lemur catta*).

One day, while Laurie was unhappily collecting lemur poop at the Bezà site, a sifaka carcass was found in the forest. Usually, a specimen collected by naturalists has only a little data associated with it: where it was found, what species it is, maybe how much it weighed when it was collected. But this was a Bezà sifaka, which meant that there was information about this individual's diet, social life, and ranging pattern. Laurie jumped at the chance to collect a fresh specimen with so much data.

Later, she found an unorganized collection of osteological (bone) specimens in the Bezà camp. With the blessing of site director

Dr. Alison Richard, then at Yale University, Laurie began organizing the Bezà-Mahafaly specimen catalogue. She also encouraged the team to bury any additional deceased lemurs they discovered, letting nature break them down to skeletons. The graves would be marked so that the bones could be exhumed later and added to this incredible archive.

In late 2022, Laurie hosted Alison in Massachusetts. Alison implored Laurie to come dig up the Bezà-Mahafaly bones. If anyone was going to get data from those skeletons, Laurie was essential for the effort. She also needed to bring in partners as excited about lemur bones as she is.

At the Lemur Center, we save our skeletons. Before that—of course—every animal at the DLC receives incredible care. Multiple teams work to ensure that each lemur lives a socially engaging, complex life while participating in a robust non-invasive research program that helps us understand lemur and human biology. After they die, the lemurs continue to teach us through their remains. We collect genetic samples, freeze entire cadavers, scan the bones, and make scans available to researchers and educators on the

Nefertiti, whose postmortem CT scan is pictured on the preceding pages, was born at the Cologne Zoo in 1977. In 1978, she was part of the first-ever group of crowned lemurs (*Eulemur coronatus*) to be brought to the DLC to help found our crowned lemur conservation breeding program. She lived to 25 years old and gave birth to 13 surviving infants, and has grandlemurs and great-grandlemurs still living at the DLC today. Photo of Nefertiti with her infant Amenhotep (1994) by David Haring.



Dr. Laurie Godfrey delicately brushes dirt off the skull of a freshly exhumed Verreaux's sifaka skeleton, taking care not to break it or drop any teeth.



website MorphoSource. Keeping track of those data is not a simple task.

Scientific discovery can look like people trekking through the forest, digging in the badlands, or watching chemicals dramatically change from red to green. But getting to eureka moments also takes meticulous data organization. Spreadsheets don't scream adventure, but they are core to helping us answer big questions about lemur health, conservation, and evolution.

DLC Data Manager Amanda Mazza is working with the DLC Museum and the DLC Department of Research to pull all our lemur life history data together into a single database. As scientists and paleontologists, we want to know how locomotion, diet, and disease impact the skeleton, connecting modern lemurs to their extinct relatives.

Bezà-Mahafaly offers a vital perspective on the animals and



During the 2024 season at Bezà, the team added 50 new lemur specimens to the database. Now the Bezà collection has nearly 250 skeletons or partial skeletons of Verreaux's sifakas (*Propithecus verreauxi*), ring-tailed lemurs (*Lemur catta*), Petter's sportive lemurs (*Lepilemur petteri*), and reddish-gray mouse lemurs (*Microcebus griseorufus*). Pictured: Duke student Erika Kraabel, fossil preparator Karie Whitman, anthropologist Laurie Godfrey, and paleontologist Manjaka Rasolonjatovo in the Bezà lab.

specimens at the DLC. Many lemurs at the DLC free-range in multi-acre natural habitat enclosures, in family groups that echo the social structures they have in the wild. But the lemurs are still in managed human care, receiving veterinary visits and regular meals. The wild lemurs of Bezà-Mahafaly are also monitored throughout their lives but receive no managed care, so the Bezà-Mahafaly osteological collection is a trove of

data that we can use to compare lemur populations in Madagascar and in Durham. Ideally, we'll discover how to better care for animals at the DLC and how to interpret changes in ancient lemur anatomy.

But first, the Bezà skeletons needed to come out of the ground. Fortunately, Karie Whitman was eager to help. Karie wears a lot of hats at the DLC: fossil preparator, graphic designer, and agricultural



researcher in Madagascar. Karie joined Laurie on the Bezà-Mahafaly osteological collection team, taking her specimen preparation skills and Malagasy language abilities to southwestern Madagascar, funded by a grant from Duke Arts and Sciences.

Duke undergraduate Erika Kraabel also joined. Throughout the 2023-2024 academic year, Erika had been learning fossil preparation from Karie and specimen archiving with Physical Collections Manager Cat Riddle. She also took courses in anatomy, primate evolution, and primate behavior, making her the perfect field assistant for the project. A generous donation from Dudley Houghton designed to help undergraduates gain research experience in Madagascar made Erika's trip possible.

The team, which also included Malagasy geologist Peterson Faina (Columbia University) and paleontologist Manjaka Rasolonjatovo (Centre ValBio), descended on Bezà-Mahafaly in 2024 with shovels, scalpels, and Sharpies. As living ring-tails and sifakas bounded around the gallery forest camp, the team brought order to the Bezà-Mahafaly collection and expanded the dataset with newly-unearthed skeletons. Thanks to Manjaka, who will regularly visit the Bezà site, the collection will continue to grow as more skeletons are exhumed.

Now the DLC Museum has



Long-time colleagues and friends Dr. Laurie Godfrey and Professor Dame Alison Richard happily meet once again in the camp mess hall at Bezà-Mahafaly.

an active collaboration with Bezà-Mahafaly and plans to share its incredible collection online alongside the Lemur Center's own specimen collection. As we build our toolkit at the DLC and push data to iDigBio—an international project that networks museum data from around the world—we're excited to have new partnerships in Madagascar. And with a growing database and specimen collection, we have a whole new perspective on the incredible primates springing through the Malagasy and Durham forests.

So, do you need any help digging up some lemur bones? 🧐

**THE COLLECTION
WILL CONTINUE
TO GROW AS
MORE SKELETONS
ARE EXHUMED.**



Kate Neely, Digital Collections Manager, holds a lemur skull with its CT scan displayed in the background. Kate scans fossil and osteology specimens and uploads the data to MorphoSource, a Duke-supported data repository that makes specimens available to anyone with an internet connection. Kate also helps researchers and educators analyze the data and prepare it for 3D printing.





Step one of the project was to exhume the skeletons.

STUDENT SPOTLIGHT



I'M A TACTILE LEARNER. Being able to touch, feel, and inspect what we discuss in class makes it all real. Given this, it's no surprise that Human Osteology and Primate Field Biology (which included observations of lemurs at the DLC) have been my favorite classes in Duke's Department of Evolutionary Anthropology. This thread of hands-on learning also strings together why I started working at the DLC Museum of Natural History (DLCMNH) my junior year and how I ended up in Madagascar in August 2024.

At the DLCMNH, I've been learning the foundations of fossil preparation and have been involved in rehousing the DLC's osteological collection. In May 2024, I was offered the opportunity to travel to Madagascar to be part of the Beza-Mahafaly osteological collection team. The team's goal was to update the Beza osteological collection by exhuming and cataloging the bones of deceased lemurs. It was possibly the fastest "YES" I have ever given!

I flew to Madagascar with Karie Whitman, fossil preparator and researcher at the DLCMNH, by way of New York and Nairobi. We landed in Madagascar's capital city, Antananarivo, slightly ahead of the rest of the team. We had just enough time for quick 4:00 AM showers before boarding a bus to Andasibe-Mantadia National Park, about 90 miles (four hours) east of the capital.

Straight off the bus, Karie and I hiked into the rainforest for my crash course in Malagasy wildlife. We saw all kinds of chameleons, insects, and

lemurs, and most notably we heard the indri sing! After our field trip, we headed back to Antananarivo to meet the rest of the team.

The Beza-Mahafaly Special Reserve is a longstanding research site in southwestern Madagascar. The resident ring-tailed lemurs (*Lemur catta*) and Verreaux's sifakas (*Propithecus verreauxi*) have been monitored since the reserve's inception, making it a hub for researchers from around the world. All it took was two days, a plane ride, and a lot of four-wheel drive to get us there! After setting up our campsite, we sat down to a family-style dinner to meet all the other people working at the reserve. We were also welcomed by a group of ring-tails wandering through the camp.

I spent the first part of the project falling halfway into holes trying find each and every bone. After exhuming the skeletons, we cleaned and labelled them with unique numbers prior to adding them to the catalogue. In all, we added 50 specimens to the collection. However, this number doesn't include all our additional reorganizing and labelling so that the collection can remain an invaluable resource for years to come.

Outside of the project, I learned so much just being in Madagascar—especially since our travels took us to different regions of the country. We spent a day in the port city of Toliara and toured the Rova in Antananarivo, where I learned more about the history of Madagascar. Most important were all the moments in between: trying foods like mofo

gasy and ravitoto, learning Malagasy words, and listening to "Mipaipay marigny," which quickly became our anthem—or earworm, depending on who you ask.

The trip was full of academic discoveries, and for me, there was also a personal one. Going into the trip, I hoped that I would find out if I truly enjoyed being in the field, and it's safe to say I adored it. 🥰

Our campsite was tucked away behind the rest and was a well-trafficked area for the resident sifakas.



Sitting on the ground for hours digging up bones allowed the opportunity for curious ring-tails to drop by and investigate our activities!

One Place, A WORLD OF IMPACT

INTERNATIONAL PARTNERSHIPS IN ANIMAL CARE



By **GREG DYE, M.Sc.**, Executive Director, and **DUKE LEMUR CENTER STAFF**

Although based at Duke University in Durham, North Carolina, the Duke Lemur Center hasn't stayed put! With partnerships across the globe, the DLC's reach and reputation as a world leader in lemur conservation and care has been on full display this year.

The DLC's Colony Curator, Britt Keith, and other members of the curatorial team have been working with our zoological partners in Europe and our friends and colleagues in Madagascar's Ministry of the Environment and support critical ex situ conservation programs that directly impact the future of several lemur species.

Thanks to an on-the-ground conservation program started almost 40 years ago by the DLC's

Andrea Katz and Charlie Welch, the DLC has nurtured a strong relationship with many Malagasy communities and officials to advance the conservation of lemurs. Those relationships, built on trust and respect, are critical to the success of the DLC's long-term

conservation programs and emergency response to unforeseen events, as described below.

We are honored to play a small role in these initiatives and applaud the efforts of our European and Malagasy colleagues on the front lines of these crucial programs.

WHAT IS EX SITU CONSERVATION?

Ex situ initiatives address the conservation and care of lemurs living *outside the forest* in zoos, private parks, and conservation centers across the island. In situ conservation initiatives, on the other hand, focus on lemurs still living in their natural habitat (Madagascar's forests).

Ex situ conservation measures complement in situ methods in that they provide a genetic safety net (or "insurance policy") against a species' total extinction. These measures also have a valuable role to play in recovery programs for endangered species.



TO EUROPE, TWO BY TWO

1 ▲

This fall, two breeding pairs of mongoose lemurs (*Eulemur mongoz*) were sent to Tierpark Berlin to boost the European population of this critically endangered species.

"The European population of mongoose lemurs was overaged and male-biased before the shipment took place," says Andreas Pauly, head veterinarian at Tierpark Berlin. "The Duke Lemur Center was ready to help and took over the matching of two mongoose lemur pairs."

Two mongoose lemurs (Javier and Zoe) were sent to the DLC from the Lemur Conservation Foundation, one (Natasha) was sent to the DLC from the Philadelphia Zoo, and the fourth (Nacho) was born at the DLC. All four departed from the Lemur Center and arrived in Berlin in November 2024. *Photo by Bob Karp.*

2 ►

In the early 1970s, the DLC established its conservation breeding program for the critically endangered Coquerel's sifaka (*Propithecus coquereli*). Over the decades, the program grew into the most successful breeding program in the world of any species of sifaka, and for years the DLC has been working with partner zoos in the U.K. and Germany to expand this breeding program to Europe.

In 2021, a half-decade of planning finally came to fruition: Four pairs of DLC sifakas were shipped to zoos in Chester, Berlin, and Cologne in a historic expansion of the Coquerel's sifaka conservation breeding program. They became the first members of their species ever to set foot on European soil—marking the beginning of a new chapter in lemur conservation.

Two additional male Coquerel's sifakas were shipped from the DLC to Tierpark Berlin in 2024. *Photo by Sara Nicholson.*





ANTANANARIVO,
MADAGASCAR



MARAZEVO,
MADAGASCAR



NOSY BE,
MADAGASCAR



TAMATAVE,
MADAGASCAR

ADVANCING LEMUR CARE IN MADAGASCAR

3

For the past two years, a DLC Conservation Technician has traveled to Madagascar to work side-by-side with keepers at Parc Zoologique Ivoloïna, a 700-acre conservation center and zoo near Toamasina on Madagascar's eastern coast. During these months-long trips, DLC technicians lived at Parc Ivoloïna and helped train zoo staff on animal husbandry, health monitoring, and breeding and birth season management techniques. Pictured: Grayson Pellerito unloads baskets of fresh fruits and vegetables for lemur diets. *Photo by Sara Sorraia.*

4

This summer, Grayson was joined by Colony Curator Britt Keith, Assistant Curator Danielle Lynch, and Lead Husbandry Technician Becca Newton. There, they assisted Parc Ivoloïna staff with body condition assessments, training demonstrations, and daily animal care. Pictured: Becca and Danielle, who both specialize in *Cheirogaleus* health and breeding, examine a dwarf lemur with zookeeper Rodey. *Photo by Sara Sorraia.*

5

Parc Ivoloïna is supported by the Madagascar Flora and Fauna Group (MFG), a consortium of zoos and other institutions committed to supporting conservation in Madagascar. The DLC has been a founding and managing member of the MFG since it was formed in 1988, and DLC conservationists Andrea Katz and Charlie Welch helped found Parc Ivoloïna as it is known today. Pictured: Greater bamboo lemur, black and white ruffed lemur, and blue-eyed black lemurs at Parc Ivoloïna. *Photos by Sara Sorraia.*

6

In 2023, the Duke Lemur Center and Madagascar's Ministry of the Environment and Sustainable Development (MEDD) entered an Accord of Collaboration concerning the status of *Propithecus coquereli* (Coquerel's sifakas) in private parks in Madagascar. For the foreseeable future, the DLC will be an active and collaborative partner with MEDD and four private parks with the development of a Coquerel's sifaka studbook and Species Survival Plan. Pictured: A Coquerel's sifaka at Lemurs' Park, Antananarivo. *Photo by Sara Sorraia.*

7

Lemuria Land, a wildlife park on the island of Nosy Be, houses four sifakas with coloring unusual for *P. coquereli*. Hair samples were collected to determine whether these dark colored individuals are hybrids or a melanistic population. "There are several species of sifaka living at this park," says Britt, "all of which can and will interbreed if given the chance. This artificially produces hybrids of two different species, which are not found in the wild populations. This threatens species' genetic integrity and 'muddies' the species, among other things. Interbreeding species is actively avoided in captive breeding programs in zoos for these reasons." *Photo by Sara Sorraia.*



3



4



5



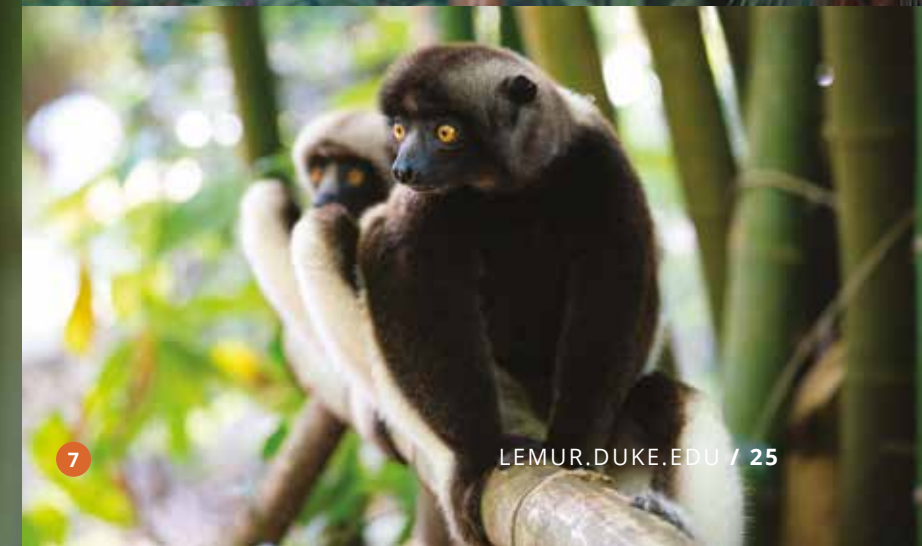
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6



5



7



Romeo Bezaralahy

Landscape Restoration Technician
Recent Graduate, University of Antsirana



I AM FROM CAP EST in the SAVA region of Madagascar. One thing I've enjoyed about being a part of the DLC-SAVA Conservation project is the joy of interacting with people who love to help and teach others about the world we live in and how to protect it. The DLC really teaches people to care about the environment and the precious wildlife we have.

The DLC has helped me and many others achieve our academic and research goals. This collaboration has been a great opportunity for many of us in the SAVA region to reach our goals, learn, and explore so many new things. I recently earned my master's degree, with a scholarship from the DLC, and now I am excited to join the DLC team as a landscape restoration technician! 🙌



8

8

8

In June, Colony Curator Britt Keith and Assistant Curator Danielle Lynch traveled to Madagascar to observe and verify the lemurs in each park. They also assisted in onsite data collection, delivered the microchips and scanners needed for accurate animal identification, and shared sifaka-specific information and husbandry practices with zoo managers and veterinarians.

Back in Durham, the data is being used to create a cooperatively managed Species Survival Plan, with breeding pairs chosen to maximize genetic diversity within the captive population. The goal? To protect this species from extinction by maintaining captive populations of lemurs that one day may be the best candidates for reintroduction to Madagascar's forests, to reinforce or re-establish wild populations. Pictured: Veterinarian and Madagascar Studbook Coordinator Hoby Andriamparany scans the microchip of a male Coquerel's sifaka at Lemurs' Park. Microchips are used to verify the IDs of individual animals, which is critical for colony management and planned breeding. *Photos by Sara Sorraia.*

9

In May 2024, authorities in Thailand rescued over 1,000 endangered animals—including 47 lemurs—from animal trafficking. As various conservation groups, parks, and rescue centers worked to return these animals to Madagascar, the Malagasy Ministry of the Environment (MEDD) contacted Colony Curator Britt Keith for logistical assistance, particularly with the care and safe transportation of the rescued lemurs.

Lemurs are, unfortunately, frequent victims of the pet trade. Trafficking has a serious, negative impact on wild populations as well as on the physical and psychological health of trafficked individuals. For these reasons and many others, the Duke Lemur Center is absolutely against all trade in pet primates, and against the holding of any prosimian (lemur, loris, bush baby, potto) as a pet. To learn more, visit lemur.duke.edu/not-a-pet. Pictured: A male ring-tailed lemur in Madagascar. This individual is *not* a victim of trafficking. *Photo by Sara Sorraia.* 🙌



9

Thank you to the JOSIAH CHARLES TRENT MEMORIAL FOUNDATION, MARGOT MARSH BIODIVERSITY FOUNDATION, DRs. ELISABETH AND RUSSEL COOK, and all of our DONORS TO THE MADAGASCAR PROGRAMS FUND for making these programs possible.



Antonin Andriamahaiavana

Ph.D. candidate at the University of Antananarivo



His partnership with the DLC

I obtained my master's degree in Animal Conservation Biology at the Mention Zoologie et Biodiversité Animale (MZBA), University of Antananarivo, in 2020. My research focused on the ecology and response to habitat disturbance of both diurnal and nocturnal lemur species in the rainforest of Masoala National Park, northeastern Madagascar.

I was excited to discover a Ph.D. research opportunity at the Duke Lemur Center for a project titled "The ecophysiology of dwarf lemur hibernation in the Anjavy forest in northwestern Madagascar." This three-year project (2023–2026) is a collaboration between the DLC, MZBA, and Anjavy le Lodge. It aligns perfectly with my passion for working with small-bodied nocturnal lemurs, which has been my dream since completing my master's degree. It's truly a dream come true to be selected to conduct this project.

How he conducts his research

Before the start of hibernation season, we capture, collar, and release wild dwarf lemurs living in the reserve. The collars allow us to track the lemurs wherever they go, and they also provide the temperature of the lemurs' skin. During the hibernation season, warm skin temperatures mean the lemurs are active, and cool skin temperatures mean the lemurs are hibernating. By tracking their collars, we can learn when, where, and how long they hibernate.

Why dwarf lemur hibernation is so fascinating

Among all lemur species in Madagascar, dwarf lemurs are special: They are the only obligate primate hibernators. I'm fascinated by their ability to stay in the same place for up to seven months. Dwarf lemurs will find a hole in the ground or in the hollow of a tree, close their eyes, tuck their heads under their thick fur, and remain in one place for months on end—and when they come out of hibernation, they haven't suffered any adverse effects such as muscle atrophy or bedsores.

What makes Anjavy special

My lab is at the University of Antananarivo, and my field research takes place at the Anjavy Private Reserve in northwestern Madagascar. Anjavy is such a fantastic place. It has different beautiful ecosystems, including dry deciduous forests,



When food is plentiful, fat-tailed dwarf lemurs gorge on food and accumulate fat in their tails. When food is scarce, they enter a state of hibernation and live off the fat stored in their tails. Photo by David Haring.

mangroves, savannas, karst formations called "tsingy", and abandoned agricultural land in various stages of recovery.

The ambient temperature at Anjavy stays relatively warm year-round, with temperature minima staying above 15 °C even in the coldest months. This condition is very different from other habitats in Madagascar where researchers have studied hibernation in dwarf lemurs, where temperature minima can reach below 5 °C. My work in Anjavy will provide data on hibernation in a novel environment in Madagascar, not just a new site.

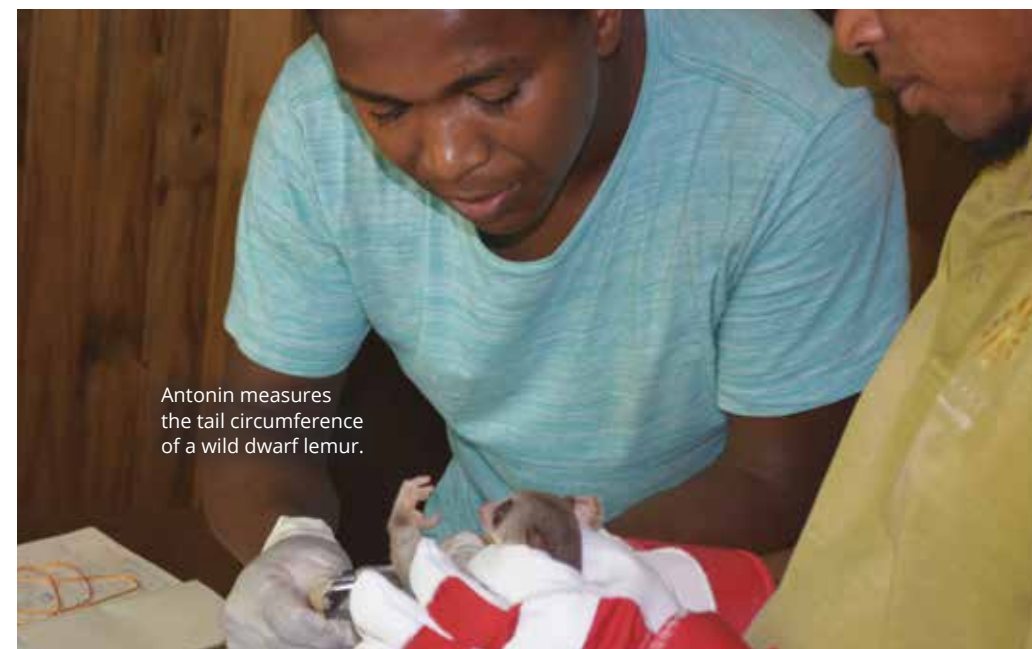
Another thing that I find special in Anjavy is its people. The local communities and the Anjavy le Lodge staff are very nice. I am so lucky to work in this paradise place and have developed very close friendships with them.

Why the relationship between Duke and Madagascar is so important

Duke provides training for students in relevant field methods, data collection, data analysis, and formal academic writing. Most importantly, Duke also provides funding for lemur conservation and research in Madagascar. Research is crucial to avoid lemur species extinction and for the conservation of lemurs both in situ (wild lemurs living in their natural habitat) and ex situ (caring for lemurs in zoos and conservation centers). This collaboration is important to protect and conserve Madagascar's unique biodiversity, as most of the lemurs are threatened with extinction.

His post-doctorate plans

After earning my doctorate degree, I plan to continue conducting research, particularly on lemurs, and train young conservationists to protect Madagascar's unique biodiversity, especially early-career Malagasy researchers. 🙌



Antonin measures the tail circumference of a wild dwarf lemur.

Thank you to **BOB AND SUE KNOX**, whose generous support helped establish the Anjavy field station where Antonin conducts his research.

PICTURE THIS

CIRCA 1000 CE: WHEN MADAGASCAR WAS THE LAND OF GIANTS

Illustrated by NATASHA MUTCH

This graphic was created for the DLC public tour path, thanks to a generous donation by Marc Dreyfors of Greenway Transit.

ONE IMAGE. A 1000-MILE, 1000-YEAR JOURNEY.

Modern lemurs are missing their neighbors. When people were building castles in Europe, there were giant lemurs living in Madagascar. Their giant bones are found alongside lemur species that are still alive today. To understand the ecological complexity of Madagascar, we need the full picture.

DLC Museum field crews began excavating giant lemur bones in Madagascar in 1983, and our search

for Madagascar's lost biodiversity still continues today. In collaboration with the University of Antananarivo and the American Museum of Natural History, we're leading field expeditions and using ancient DNA, isotopes, and the bones themselves to track extinction across the island. Our hope: that by understanding the extinctions of the past, we can protect these animals in the future. 🦠

Habitats depicted, from left: Tropical rainforest, dry deciduous forest, spiny desert. Key species depicted, from left (extinct species in orange): Furry-eared dwarf lemur, hibernating; Malagasy civets; Parson's chameleon; traveler's palm; red ruffed lemur; Madame Berthe's mouse lemur; aye-aye; Darwin's moth feeding on Darwin's orchid; Madagascar ground boa; Malagasy pygmy hippopotamus; silky sifaka; Madagascar moon moth; tomato frog; helmet vanga; fossa; Malagasy red giant millipede; starry-night cichlid; vanilla orchid; *Archaeolemur*; indri; blue-eyed black lemur, female; Malagasy crowned eagle; lowland streaked tenrecs and burrow; emerald pill millipede; Granddier's giant tortoise; pair of *Plesiorcyteropus* (giant tenrecs) and burrow; *Palaeopropithecus*; lesser hedgehog tenrec; Coquerel's sifaka; Granddier's baobab; Madagascar collared iguana; ring-tailed lemurs; Malagasy giant jumping rats and burrow; elephant bird (*Aepyornis*) and egg; white-footed sportive lemur; *Megaladapis*; octopus tree; radiated tortoise; skull of *Megaladapis*. Of the 31 extant (not extinct) species pictured, 13 are endangered or critically endangered.

MYSTERY AT THE MUSEUM:

WHY ARE THERE GIANT GROUND SLOTHS AT THE DLC?



By **MATT BORTHS, Ph.D.**,
Curator of the DLC Museum of Natural History
Photos courtesy of **DUKE LEMUR CENTER STAFF**

Sloths are weird. Metabolism: glacial. Skeleton: built for life upside down. But extinct giant ground sloths like *Pseudopreotherium*, found in 13-million-year-old rocks in Colombia and now on display at the DLC Museum, were even weirder. *Pseudopreotherium* was larger than a grizzly bear. Its most colossal cousins were the size of elephants. Some used their huge front claws—the largest claws of any known mammal—to dig thousands of metric tons of dirt out of the South American hillsides, leaving behind cave-size “paleoburrows” you can wander through today.



A humerus of a modern two-toed sloth (left) provides a size comparison for the much larger humerus of the giant ground sloth *Pseudopreotherium*.



In May 2024, Dr. Rich Kay taught his final class at Duke University before retiring from the Department of Evolutionary Anthropology. Over his exciting career, Rich sorted through the primate family tree, studied primate senses, and mentored graduate and undergraduate students. He also accumulated a massive research collection, including fossils from Colombia, casts of extinct primates from around the world, and comparative skeletons of primates, armadillos, and capybaras. Pictured: Rich searching for *Homunculus* and other fossil primates in Santa Cruz, one of the provinces of the Argentinean Patagonia, in 2004.



Sloths and their entire goofy supergroup, which also includes anteaters and armadillos, are preserved in the rocks of South America. Isolated from the rest of the world for most of the Age of Mammals, the South American continent was a natural laboratory for evolutionary experiments. Giant sloths evolved alongside saber-toothed marsupials, nine-foot-tall carnivorous terror birds, and camel-like creatures with short, prehensile trunks.

But a few familiar faces crossed oceans and found new homes in South America: monkeys and rodents. Both groups originated in Africa. More than 35 million years

ago, a few ancestral individuals washed out to sea on giant mats of vegetation and floated across the Atlantic. How did these African monkeys adapt to life on a new continent? How did the land of sloths get overrun by guinea pigs and capybaras? Duke paleontologist Dr. Rich Kay spent his career unraveling these and other South American mysteries.

Early in his career, Rich focused on the evolution of primate diets. He compared jaw muscles and tooth shapes, eventually revealing a correlation between primate body size and diet. Dubbed “Kay’s Threshold” by other appreciative researchers, Rich observed that

primates under 500 grams get their protein from insects. Above 500 grams, they can start to rely on leaves for protein. This observation—now introduced in every primate evolution class—raises all kinds of questions about the origins of primates, their guts, and their modern diversity.

In the 1970s, Rich worked with the DLC’s then-Director Dr. Elwyn Simons to secure grant funding for fieldwork in Egypt. But just like the monkeys and rodents that rafted across the Atlantic, Rich found his interest drifting to a different continent: South America.

At the time, the primate fossil record of South America was highly



Rowan Thomas

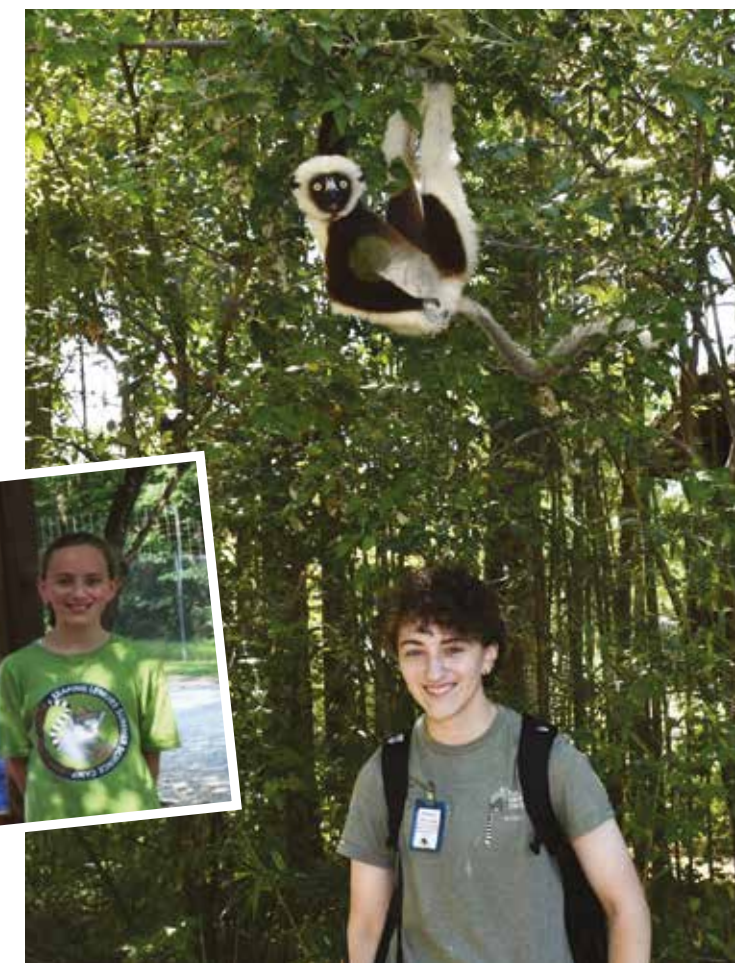
2024 Field Research Intern
Undergraduate, Amherst College

“AN IMPORTANT PART of the Lemur Center’s mission is to inspire and train the next generation of environmental stewards,” says the DLC’s executive director, Greg Dye. “Rowan’s story is a wonderful example of the impact of the Lemur Center’s education and student programs and how we’re helping train tomorrow’s conservation leaders.”

“I grew up in the Durham area, and ever since my first visit to the Lemur Center, the DLC has been central to the development of my passion for biology and ecology. My initial visit was for research for a third-grade animal project, and I returned later for tours and summer camps. Out of my initial fascination with ‘cute primates’ grew a genuine desire to learn more about such a unique superfamily of organisms. I’ve hoped to work at the DLC since I first visited, and as an intern, I was incredibly excited about the opportunity to give back to the place where it all began!”

– **ROWAN THOMAS** 🐼

Rowan at Leaping Lemurs Science Camp in 2016, and as a Field Research Intern in 2024.



fragmentary. It wasn’t clear when primates arrived in South America or when they diversified into the howler monkeys, marmosets, and capuchins that we know today.

His curiosity piqued, Rich contacted the Geological Survey of Colombia, secured \$1500 in seed money from Duke, and headed for the 15-million-year-old rocks of the La Venta Formation, where he found and named species like the meat-eating marsupial *Dukecynus* (“Duke’s dog”) and the distant relative of marmosets *Lagonimico* (“pancake monkey,” named for a crushed skull).

Over the decades, Rich collaborated with South American colleagues on

field projects in Colombia, Argentina, Bolivia, Chile, Venezuela, Ecuador, and Peru. His quest for ancient primates and the strange cast of characters that surrounded them took him into the thin air of the Andes and down to the Atlantic coast, where the team raced the incoming tide to chip nearly complete primate skulls out of coastal rock.

When he retired in 2024 after more than 50 years at Duke, Rich and his wife, retired Evolutionary Anthropology professor Dr. Blythe Williams, transferred their entire research collection to the DLC Museum of Natural History, opening up a whole new continent of exploration.

Today, the Kay/Williams Research Collection is used by researchers from all over the world to understand how a small founding population of primates from Africa survived and thrived not just in Madagascar, but also in South America. These astounding primate stories didn’t happen in a vacuum. Primates are shaped by their ecosystems as they adapt to changing climates, rising mountains, and the creatures living alongside them. Thanks to Rich’s research, at the DLC Museum we help visitors see the full evolutionary picture of primates—sloths included.



Dr. Rich Kay (second from right) joined students, colleagues, and DLC Museum of Natural History staff on the 2022 collecting trip to Wyoming. Field excursions like this one are a great opportunity for students to work together with experienced staff and esteemed professors like Rich! For this trip, Duke Ph.D. candidate Julia Stone (third from left) and DLC intern Regan Collins (center) joined the team and had a great time finding fossils and learning about North America’s early primates and ecosystems.



YOU CAN HELP

The DLC’s internship program offers opportunities for students to have hands-on experiences, exploring their interests in field research, animal husbandry, animal welfare, conservation education, and science communication.

A gift of \$8,000 fully covers one student for the 10-week internship at a living wage, opening the door to candidates who might otherwise be unable to consider the internship experience because of cost and the need to earn a summer income to support themselves or their families.

To learn more about this giving opportunity, please visit the Targeted Impact Gifts page on the DLC website: [LEMUR.DUKE.EDU/TIGIFTS](https://lemur.duke.edu/tigifts)



After planting thousands of trees and helping thousands of people while overseeing conservation programs in Madagascar for the Duke Lemur Center for 35 years, Charlie is set to retire this year. Pictured: Charlie, shown here in 2018, with one of the first trees he planted at Parc Ivoloïna. Photo courtesy of Charlie Welch.



Planter of Seeds

CHARLIE WELCH RETIRING AFTER 35 YEARS OF MADAGASCAR CONSERVATION WORK



By **ROBIN SMITH, Ph.D.**,
Senior Science Writer, Duke University

When conservation expert Charlie Welch introduces people to Madagascar, first he leads them through rainforests and wildlife preserves to photograph the island's iconic lemurs, but then he makes a stop, near the coastal city of Tamatave, by a very specific tree.

"It's one that's close to my heart," Charlie says. That because it's one of the first trees he planted, from a seed, at Parc Ivoloïna, a zoo and forestry station that he and his wife Andrea Katz helped revitalize in the late 1980s.

At the time, "there really there wasn't much left in terms of natural forest on the station at all," he recalls. Brambles and exotic pines had taken hold, blocking out the Malagasy species.

Now some 40 feet tall, the tree—known locally as hafopotsy—is one of tens of thousands of native species he and others have planted over the years on the 700-acre station.

After overseeing conservation programs in Madagascar for the Duke Lemur Center for 35 years, Charlie is set to retire this year. Reflecting on his decades-long career in conservation, he says, “It’s not what a lot of people envision.”

For most people, a career in conservation conjures images of days spent tromping in the woods following wildlife. But ask him what it takes to work in this field and his answer paints a different picture altogether. “It’s mostly working with people,” says Charlie. He estimates he spends 90% of his time working with everyone from villagers to animal caretakers to teachers to government officials, trying to understand and address their needs.

For people like Charlie, that means supporting everything from family planning services and more

“You have to convince the local people that it’s in their own interest to protect their forests.”

CHARLIE WELCH

fuel-efficient cooking stoves, to alternative sources of food and income for farmers.

“You have to convince the local people that it’s in their own interest to protect their forests,” Charlie said in a 2015 TEDx talk. “If you don’t, you haven’t created something that’s really sustainable, that will last in the years to come.”

Charlie first came to Madagascar in 1987, when the country’s government, after years of barring its doors to Western scientists, enlisted him and Andrea to try to help rebuild Parc Ivoloina, which had been badly damaged by a cyclone the previous year. Their first task was to help the park staff get more comfortable with the day-to-day care of the zoo’s

captive lemurs, which had been confiscated from the illegal wildlife trade, and whose cages had been torn apart by the storm.

“But Andrea and I felt like there was a lot of potential there beyond that,” Charlie says.

Building relationships and gaining trust took time. “We were pretty naive in the beginning,” he remembers. “We had to really learn that the conservation problems go back to poverty and people just trying to eke out a living on the land and feed their families.”

He joined the local Rotary Club. Gradually, he learned to get by in French and a sprinkling of Malagasy, spoken with a southern drawl through his signature walrus



Charlie says reforested areas like these are more than just patches of woods. They help restore food and habitat for the endangered lemurs and other species that live there—many of which are found nowhere else on Earth. They’re also a way to showcase the value of healthy forests for the people that rely on them for things like food, shelter, medicine, clean water, and more. Pictured: A free-ranging male crowned lemur at Parc Ivoloina in 2024. Photo by Sara Sorraia.

With Dr. Elwyn Simons at Parc Ivoloina. The DLC began collaborating with Madagascar’s government and universities during Elwyn’s tenure as director. Photo courtesy of Charlie Welch.

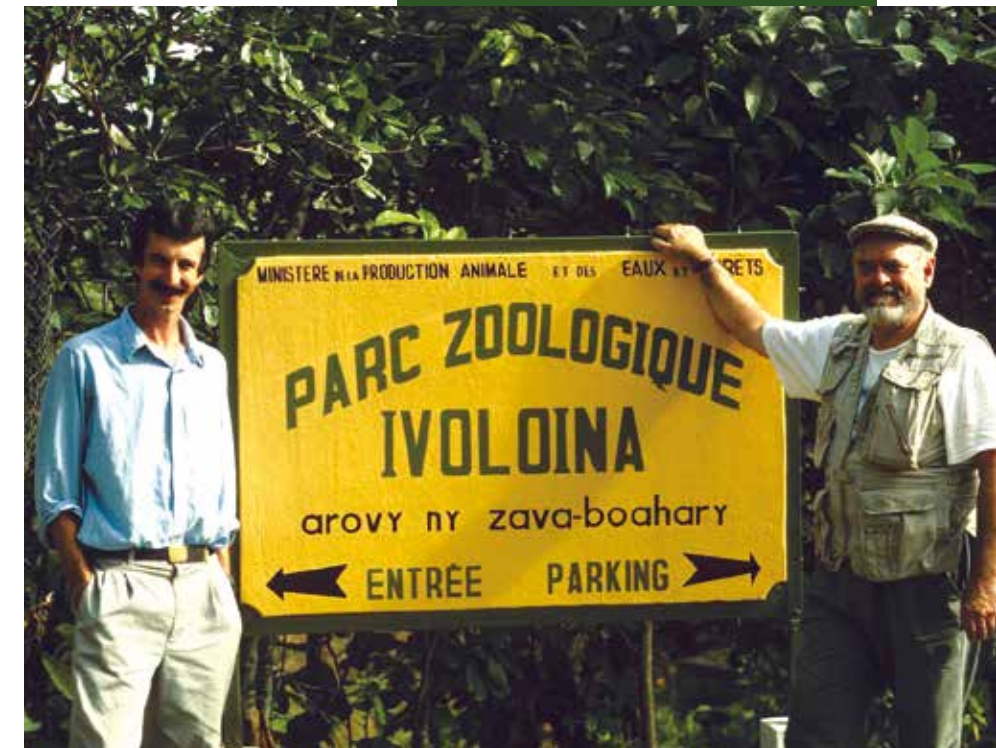


Charlie and his wife (and conservation partner) Andrea Katz with a black and white ruffed lemur that was making the long journey from the Duke Lemur Center to Parc Ivoloina, a conservation facility in Madagascar. The move was an effort to expand the gene pool of that particular lemur species at Ivoloina. Photo by Frank Skinner.

mustache. His lanky 6-foot-2 frame earned him the nickname “Lavabe.” “It means ‘big tall guy,’” he laughs.

Later, after their daughter was born, he became “Papa Alena.” “It’s common to call people by the name of their firstborn child,” says Charlie. “I was happy to be Papa Alena.”

The couple would live and work in Madagascar for 15 years—until 2004—both for the Duke Lemur Center and in partnership with the Madagascar Fauna and Flora Group, a consortium of zoos and other institutions committed to protecting wildlife in the country. Over time, they and the Malagasy staff they trained took what had been a crumbling former forestry station with a single animal keeper and transformed it into a nationally recognized center for conservation, captive breeding, and environmental education with dozens of employees. Today, its lemurs and other



wildlife attract as many as 20,000 visitors a year.

In recognition of their service at Parc Ivoloïna and later, at a reserve called Betampona, Charlie and Andrea were made “Knights of the National Order of Madagascar,” one of the government’s highest honors.

“It took our presence there year after year, working with people, building their confidence in us and in the projects and what we were all trying to accomplish,” Charlie told Duke Today in 2004.

Charlie grew up in the 1960s in Mississippi, and one of his first

jobs in high school was at the Jackson Zoo. He spent his summers there washing sidewalks, sodding grass, and unloading hay and feed for the animals. “It was mostly manual labor,” he says. But over the years he worked his way up to being an animal keeper at other zoos in Georgia and Louisiana, and eventually he took a special interest in primates.

It was a chance visit to the Duke Primate Center, as it was then known, to exchange lemurs as part of a breeding program trade, where he met Andrea. Within a few years he had married and moved to North Carolina, earning a degree in zoology from North Carolina State University along the way.

While earning his degree, he also worked as a field assistant for research projects on endangered spider monkeys and howler monkeys

in Panama, Costa Rica, and Ecuador, where he discovered he loved conservation and international field work.

“Loss of biodiversity is not a problem that’s unique to Madagascar. It’s not a problem that’s even unique to developing countries,” Charlie told TEDxDuke in 2015. “Extinction rates are a thousand times faster today than they were before humans were on the scene.”

More than 500 species of birds, frogs, mammals and reptiles are known to have disappeared in the last century. Another 500 could be wiped out in the next two decades alone, according to one recent study. Some of these species may be ones that pollinate our crops, or that keep pests or disease-carrying insects under control.

“Species are interconnected,”

Inspecting a tree nursery with longtime SAVA Project Coordinator Lanto Andrianandrasana. Reforestation is one of the many DLC-SAVA project activities. More than just returning trees to the landscape, reforestation also changes attitudes about the role and importance of forests. *Photo courtesy of Charlie Welch.*



Charlie says. “Very often, when one species goes extinct, it affects other species.”

He admits that conservation can be a bleak calling. In Madagascar alone, as many as 99,000 hectares (244,634 acres) of forest are lost each year, most of it cut and burned to clear new land for farming. That’s roughly 15 football fields of forest lost every hour. As the forest disappears, so does the habitat for Madagascar’s unique plants and animals. Nearly a third of all lemur species are now critically endangered.

What gives him hope, he says, is the overall heightened awareness of nature’s plight.

That’s another seed he planted: Many of the Malagasy students who participated in the early environmental education programs at Parc Ivoloïna have since become decision-makers in their own right.

“The appreciation of environmental issues has changed dramatically since the 1980s,” says Charlie. “There’s this whole generation of young people in Madagascar that are enthused about protecting the environment, protecting wildlife, understanding biodiversity.”

Now, when he goes back to Madagascar, the familiar sound of crowing roosters in the wee hours of the morning and the smell of ripe clove buds or eucalyptus smoke still feel like home.

For the past 13 years, the Lemur Center has focused its conservation work in an area of relatively unspoiled rainforest in the northeast called the SAVA region. Thanks to collaborations with Bass Connections, DukeEngage, and with faculty across campus, more than 100 Duke students have been involved in SAVA projects, ranging from investigating the health hazards of open-fire cooking to studying the link between deforestation and infectious disease.

After he retires, Charlie will stay involved with the Duke Lemur Center’s conservation work in an advisory role. He also plans to lead another Duke Travels tour that includes both Madagascar and South Africa, and this time not by land but by sea. “So it’s not

like I’m disappearing,” he says.

He’s looking forward to having more time for gardening, including managing the fruit and vegetable garden at the Duke Lemur Center.

“I call it a food forest,” says Charlie, showing off rows and rows of sumac shrubs, persimmons, redbuds, and pawpaw seedlings—all of which will yield fresh greens for the center’s leaf-loving lemurs. “We’ve got a lot to take care of.” 🌿

With Malagasy university students near the Betampona Nature Reserve. An important part of the DLC’s conservation work in Madagascar has been mentoring the researchers and conservationists of the future. *Photo courtesy of Charlie Welch.*



The Charlie Welch and Andrea Katz Fund

The Duke Lemur Center has created an endowment fund to commemorate the retirements of Charlie Welch and Andrea Katz.

Learn more at LEMUR.DUKE.EDU/WELCH-KATZ-FUND or email mary.paisley@duke.edu.



39 YEARS of MADAGASCAR CONSERVATION

Lemurs are found in the wild only on the island of Madagascar— one of Earth’s most threatened biodiversity hotspots. For 39 years, the DLC has partnered with the people and organizations of Madagascar to create opportunities for positive change and to play a leading role in protecting lemurs and their natural habitat. We conduct both in situ and ex situ conservation initiatives, with a strong focus on empowering local communities to be conservation leaders. Our aim is to preserve natural environments, as well as increase sustainability and resilience. We achieve these goals through community-based activities centered on education, reforestation, sustainable agriculture and animal husbandry, health, research, and much more. 🐼



The DLC’s conservation projects in Madagascar are funded entirely through grants and donations, so your contributions turn our conservation dreams into reality! Please scan the QR code or visit lemur.duke.edu/donate to make a tax-deductible donation today.





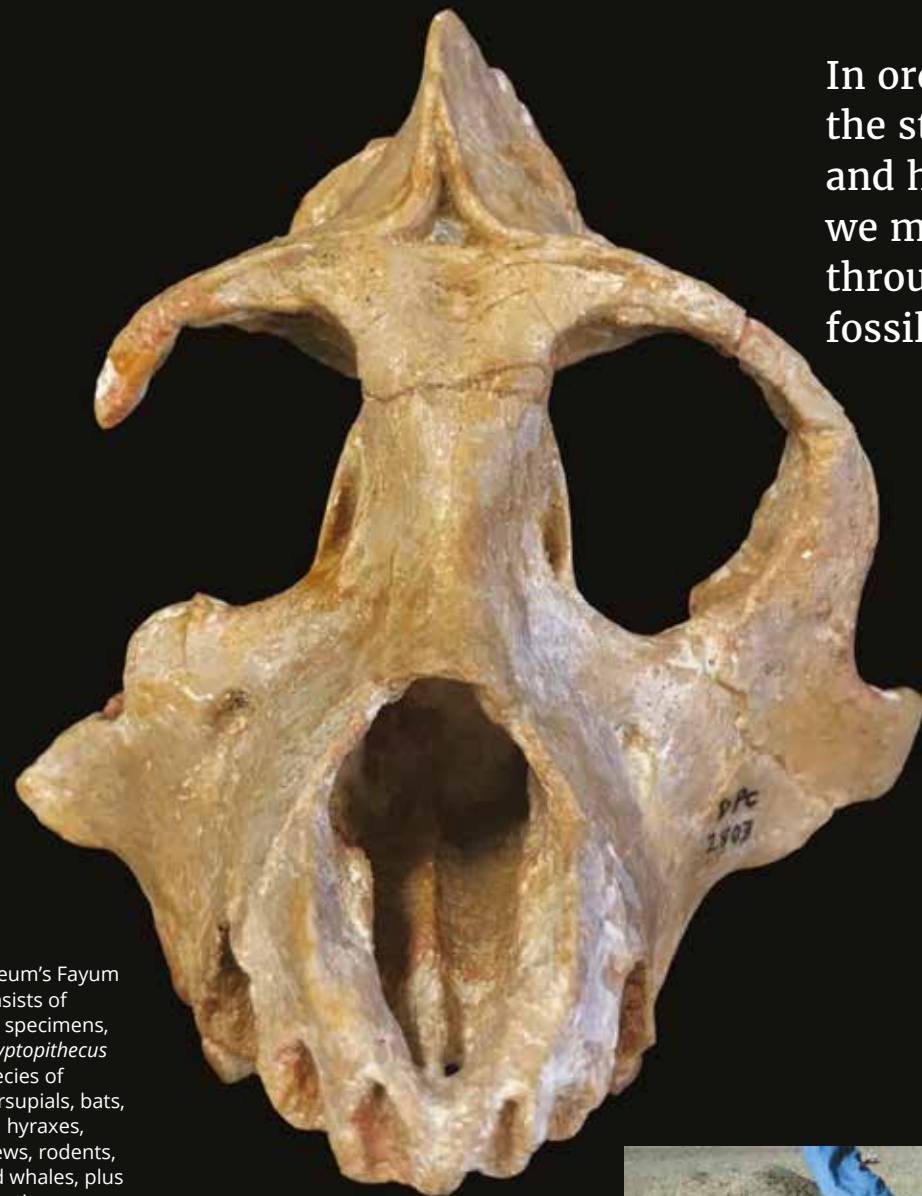
MYSTERY AT THE MUSEUM:

Why are there Egyptian monkey fossils at the DLC?



By **MATT BORTHS, Ph.D.**,
Curator of the DLC Museum of Natural History
Photos courtesy of **DUKE LEMUR CENTER STAFF**

In order to tell the story of lemurs—and humans—we must travel through the Egyptian fossil record.



The DLC Museum's Fayum collection consists of nearly 20,000 specimens, including *Aegyptopithecus* and other species of primates, marsupials, bats, hyaenodonts, hyraxes, elephant shrews, rodents, sirenians, and whales, plus several enigmatic groups found nowhere else in the world. **Left:** *Aegyptopithecus* cranium (male). The 30-million-year-old primate was Elwyn's most influential find. **Right:** Elwyn Simons in the Fayum pointing to a specimen of *Aegyptopithecus*.



No analysis of the primate story is complete without *Aegyptopithecus*. The cat-size, tree-dwelling primate sits in our family tree near the ancestor to all monkeys and apes from Asia and Africa. In a very real way, *Aegyptopithecus* is the 30-million-year-old great-grandfather of humans and baboons. Researchers from around the world come to the DLC Museum of Natural History to examine fossils of *Aegyptopithecus*, and even more view and download scans of the fossils from the museum's digital collection on the website MorphoSource.

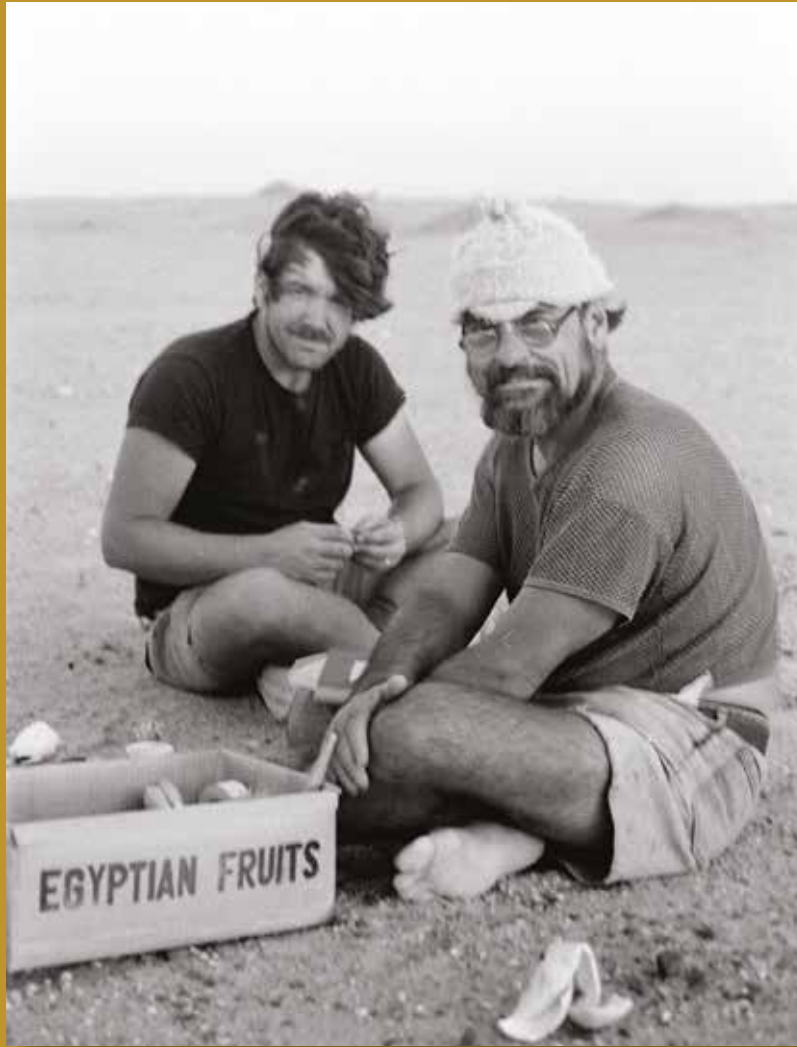
But how did the Duke Lemur Center—with its focus on lemur biology and conservation—end up in charge of this ancient monkey relative? In 1977, Dr. Elwyn Simons came down to Duke from Yale

University to become the second director of the Duke University Primate Center (now the DLC). As a paleontologist, Elwyn was fascinated by the entire story of primate evolution. For years, he had been studying 56-million-year-old primates from Wyoming, which look a lot like lemurs. He wanted to use DLC research with living lemurs to better understand the primate fossil record. He also helped the DLC become a genetic safety net for highly endangered lemur species from Madagascar.

Elwyn's research followed the fossilized ancestors of lemurs from the northern hemisphere into Africa. Separately from lemurs, ancient monkey relatives had also arrived in Africa and diversified. In the early twentieth century, a few scrappy primate fossils were discovered in the desert southwest of Cairo. Elwyn

and his close collaborator Prithijit Chatrath, the first fossil curator at the DLC, went into the desert with Egyptian researchers in the 1960s to see if there were more than scraps out there.

And there were indeed! Although now a desert, millions of years ago the Fayum region was a forested swamp teeming with early primates. Over decades of fieldwork, Elwyn and Prithijit found spectacular primate skulls and skeletons. There were monkey relatives (*Aegyptopithecus*, *Parapithecus*, and *Catopithecus*, to name a few) and lemur relatives (*Plesiopithecus*, *Wadilemur*, *Karanisia*, and more). Not only do these fossils reveal primates diversifying and making Africa home, they also reveal when that diversity came crashing down during a global climate change 34 million years ago. In order to tell the story of lemurs—and humans—



we must travel through the Egyptian fossil record.

Dozens of expeditions were conducted with permits issued by the Egyptian government. The agreement with the Geological Survey of Egypt is that half the specimens collected are to be housed at the Cairo Geological Museum (CGM) and half are protected at the DLC Museum. The goal is to create mirror collections. If two elephant jaws are discovered, one goes to the CGM and one goes to Duke. If disaster strikes, at least one of these collections survives.

The DLC Museum continues to collaborate with our Egyptian colleagues, exchanging specimens, hosting visiting researchers, and working together on new projects. It is all part of the DLC's commitment to better understand the epic evolutionary journey of lemurs, and primates like *Aegyptopithecus* are fascinating fellow travelers. 🐼

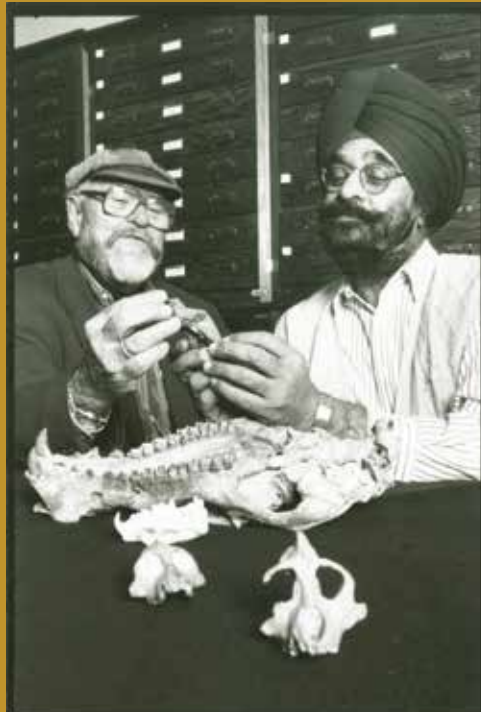
UNEARTHING AN ANCIENT PRIMATE ANTAGONIST

IN 2020, an Egyptian team led by Dr. Hesham Sallam returned to the quarry where *Aegyptopithecus* was discovered. Poking up out of the sand were a few long, sharp teeth. The team carefully dug a trench around the skull, revealing the most complete carnivore skull ever recovered from the 30-million-year-old site.

The DLC's Dr. Matt Borths, an expert on early African carnivores, was sent photos of the discovery as the team collected the skull. MUVF Lab Manager and Ph.D. student Shorouq Al-Ashqar prepared the skull of this ancient primate antagonist and, supported by grants from the Society of Vertebrate Paleontology, USAID, and the DLC, traveled to Duke to scan the specimen, conduct research with Dr. Borths, and learn fossil preparation methods with Karie Whitman. Shorouq named the hyena-sized meat-eater *Bastetodon* in honor of the cat-headed ancient Egyptian goddess Bastet. Shorouq is part of a rising generation of Egyptian paleontologists who continue to collaborate with DLC-based researchers.



Matt, **Shorouq**, and Karie stand in front of the DLC Museum of Natural History mural shortly after **Shorouq's** arrival in the USA in 2022. **Shorouq** was part of the Egyptian team that collected the *Bastetodon* skull.



Widely regarded as the founder of modern primate paleontology, Elwyn Simons was also a major figure in primate conservation. As Director of the Duke Lemur Center (1977-1992), he secured special permission from the Malagasy government to bring additional species of lemurs from Madagascar to the DLC. This boosted the DLC's aging population of lemurs, diversified the existing gene pool, and led to the founding of new conservation breeding programs for aye-ayes, ruffed lemurs, crowned lemurs, and other species as a second line of defense against extinction in Madagascar. In the 1990s, Elwyn also began the process of reinforcing dwindling wild populations of ruffed lemurs in Madagascar with USA-born lemurs, in partnership with the Madagascar Fauna and Flora Group. Pictured, clockwise from top: Elwyn (foreground) with geologist Tom Bown, now at Colorado State University; Elwyn with black and white ruffed lemurs; and Elwyn with Prithijit Chatrath, a paleontologist responsible for the permits, supplies, personnel, and camp management that allowed decades of successful fieldwork. Prithijit worked at the DLC from 1977 to 2011, and he and Elwyn were lifelong collaborators.



Elwyn trained many paleontologists, including Dr. Erik Seiffert (University of Southern California), who then trained DLC Museum Curator Dr. Matt Borths and Dr. Hesham Sallam. Dr. Sallam worked at the DLC for a few years and started the digital collections project before returning to Egypt to establish the Mansoura University Vertebrate Paleontology (MUVF) Lab, the first of its kind in the Middle East. The MUVF collaborates with the DLC Museum and continues to make discoveries in the Fayum. Pictured: Dr. Hesham Sallam, Director of the MUVF, in the Fayum with a student after the discovery of the cranium of *Bastetodon* in 2020 in the same quarry that produced *Aegyptopithecus*.



Camille works with dozens of colleagues from Madagascar and the United States. "When I'm in Madagascar, I work with so many talented, wonderful people and I'm always learning from them. I feel lucky and privileged to have such amazing colleagues and collaborators." Pictured: Camille (second row, fourth from left) with forest team members at camp. Not everyone is present. Photo by Jane Slentz-Kesler.



In terms of extinct lemurs, you can see legacies of what we call “ghost fruits”: fruits that are too large to fit the gape size of any living lemur. How were they dispersed? Potentially by some of the extinct giant lemurs.

With the living lemurs, there are models and simulations you can use to explore what might happen if a lemur species goes locally extinct. What could be the consequences for the ecosystem?

On the challenges of working in the rainforest

I love getting my boots dirty and working in the forest. But it's really hard, not just physically, but in terms of data collection. The lemurs aren't used to human presence and can be skittish. Often, before I can even approach a group of lemurs, they're already running away.

Thankfully, when I'm in the field, I'm just one of many team members, and most of my colleagues are amazing at tracking lemurs. I work with lots and lots of awesome local collaborators who have skills that I don't. Working with such excellent colleagues who are real experts in these data collection methods makes a huge difference in collecting all the data we can in the field, despite the inherent limitations.

Her work at the DLC in Durham, NC

I also do parallel studies at the Lemur Center, which gives me more experimental control than I can get in the wild. At the DLC, I can also access data about the individual lemurs I'm studying: body weight, age, sex, and other characteristics that could mediate the effects of lemur seed dispersal on plant germination success. That data is difficult to know in the wild.

On the other hand, working at the Lemur Center comes with its own limitations because you lack some of that ecological context. My hope is that by combining these two approaches—field-based experiments in the wild and work with the lemurs at the DLC—we can get the best of both worlds in trying to aggregate some of these ecological patterns.

Reasons for hope

My colleagues are really inspirational to me for their work in protecting the forest and promoting conservation in their community. Many community members are forest stewards, and there are lots of excellent local community-led initiatives that are promoting conservation in the area.

My project is also embedded in a greater context of conservation initiatives through the DLC-SAVA Conservation program, initiatives that are aimed at studying and addressing food and economic insecurities. If you address more of these drivers of resource use, then consequently you can promote conservation.

So it's important to acknowledge the role that local people are playing in land stewardship and working together to come up with creative solutions. And supporting people and meeting basic needs first is crucial. 🙌

ECOLOGISTS STUDY the relationships between living things, including humans, and their environment. By studying the complex ways that plants and animals are connected to each other and the world around them, we can understand how an ecosystem functions now and how it might change in the future.



▲ Camille's research focuses on the interactions between people, plants, and lemurs in the rainforest in northern Madagascar, where the health of one species depends on the health of others. "Most of my research is based in COMATSA-Sud, an 80,000-hectare forest corridor in northeastern Madagascar that connects national parks and protected areas in the region. It's a mountainous, rugged rainforest that is a community-managed protected area. We've observed nine lemur species there [including the small nocturnal mouse lemur pictured here] and seen traces of the aye-aye. So there's a lot of biodiversity, and it's adjacent to lots of human communities, too." Photo by Martin Braun.



Camille DeSisto

Ph.D. candidate at the Duke University Nicholas School of the Environment

Camille is a Ph.D. candidate in Ecology at Duke University, where she studies the relationships between plants and lemurs in Madagascar and at the Duke Lemur Center.

Specifically, she looks at the role of lemurs as **seed dispersers**: eating fruit and swallowing the seeds, which pass through the lemurs' guts and are excreted onto the forest floor as the animals travel through the trees.

She also works with conservation organizations, especially the DLC-SAVA Conservation program, to connect her research to conservation practices and policy.

Her research in a nutshell

I focus on plant and animal interactions, primarily seed dispersal, and how these interactions facilitate ecosystem functioning, especially in tropical forests. I'm also interested in how environmental change may be affecting these species interactions.

Why lemurs are important for forest health and composition

Lemurs can affect the probability that a plant will grow and where it grows. As lemurs travel through the forest, they spread seeds into different microsites, which can affect a plant's chance of germination—for better or for worse.

Also, when a seed passes through the gut of an animal such as a lemur, it can undergo physical changes that alter its probability of germination.

So the plant-animal interaction is really important, especially in tropical forests where the majority of plant species are consumed by frugivores (fruit-eating animals), such as ruffed lemurs.





RESEARCHER SPOTLIGHT

Nestorine teaching how to make a nutrient-dense baby porridge from locally available foods like sesame seed butter, corn flour, and moringa flour.



Nestorine

Ph.D. student at the University of Mahajanga
Food, Nutrition, and Food Security

I was born in the Farahalana countryside in the district of Sambava, in the SAVA region of northeastern Madagascar. I am working on my Ph.D. at the Doctoral School of Life Engineering and Modeling (EDGVM) at the University of Mahajanga. My research concerns food security and nutritional health of children and mothers living in the SAVA. More precisely, we are exploring the relationships between eating habits, dietary diversity, and nutritional status at the level of rural households.

Her partnership with DLC-SAVA

My first meeting with DLC-SAVA Conservation was in 2018, when their teams provided training on environmental protection to students at the Centre Universitaire Régional de la SAVA (CURSA). In 2021, we began a collaboration as part of the implementation of the project “Sustainability and Community Health: Improving nutrition, agriculture, and hygiene in the SAVA region of Madagascar.” Working with DLC-SAVA

increases my motivation to continue my research in the field of nutrition, broadens my knowledge, and develops my ability to work in a team.

Why Madagascar has the fourth highest rate of malnutrition in the world (World Bank, 2018)

In Madagascar, the level of malnutrition is high because of various factors such as the lack of diversity of agricultural production in certain regions due to drought, the lack of arable land, the lack of knowledge of mothers in terms of healthy and balanced diet, and especially the crucial lack of food purchasing power of the majority of the population. Stunted growth, anemia, below-average weight, vulnerability to diseases, and low cognitive capacity of young children are all effects of malnutrition.

In addition, the Malagasy diet is not very diversified and typically monotonous. It mostly consists of just rice and green leafy vegetables, often kale, in the majority of households. It lacks diversification because people do not eat enough other food groups, such as meat, dairy products, legumes, and especially fruits and a wider variety of vegetables rich in micronutrients essential for the proper functioning of the body.

Ways to combat malnutrition

Environmental protection, reforestation to avoid drought, diversification of agricultural products, livestock breeding, nutritional education, and job creation to increase household purchasing power all contribute towards fighting malnutrition in a sustainable manner.

In the short term, we can use food supplements for young children and women of reproductive age and organize school canteens serving nutritious foods for young children of preschool age.

Currently we are making moringa powder as a source of protein and micronutrients to mix with weaning foods based on cereal flour and/or tubers. I am exploring moringa’s effectiveness as a potential food supplement to combat malnutrition, and I hope to make this powder locally available once our products are proven effective and put on the market. 🌱



A LITTLE BIT OF MADAGASCAR

in the Heart of North Carolina



By MEGAN MCGRATH,
Education Programs Manager

THERE ARE SO many incredible things to add to your itinerary on a trip to North Carolina: barbecue, mountains, beaches, and... lemurs?! Although Madagascar is a world away, nearly 250 lemurs leap, nap, and play in the Duke Forest, and the options for visitors to see these amazing animals are as unique as the Duke Lemur Center itself.

You can watch lemurs leap through trees overhead on a Walking with Lemurs tour, learn from enthusiastic docents along the General Tour path, and glimpse a rare aye-aye snacking on treats you made during the Enrichment Wild Workshop. The one constant no matter the tour is the passion of our staff and volunteers—sharing the wonder of lemurs with everyone we meet. Because, as environmentalist Baba Dioum famously stated, “In the end we will conserve only what we love; we will love only what we understand; and we will understand only what we are taught.”

LEMUR.DUKE.EDU/VISIT

Photo by Gene X Hwang



CLOSE ENCOUNTERS OF THE LEMUR KIND



Written and photographed by **GENE X HWANG**,
Co-founder of Orange Photography



Ever since I was young, I've been fascinated by lemurs. One of the first organizations I donated to as a "grown-up" was the Duke Lemur Center, when I symbolically adopted a ring-tailed lemur as part of their Adopt a Lemur program: lemur.duke.edu/adopt. I received an adoption kit that included a photo of the lemur I adopted, and the funds I donated were used to care for that lemur and the others living at the DLC. I was very excited to have done this, even though for me, at the time, it was

a stretch to send the funds. But I had been enthralled by lemurs for years, and it was a cool way to support them.

I live on the West Coast, so I couldn't visit the DLC in person until this summer. For years, I'd been trying to line up a visit that coincided with a work shoot around the area, but the closest shoots were either in New York City or Orlando. Eventually, I decided to just book things and do it, and I'm so happy that I did.

I took the Walking with Lemurs tour, which was really fantastic!



This tour is so great because you are not only taken into the forest by guides who detail the work the DLC is doing in lemur conservation and research, but you get to see lemurs up close—and I mean that literally! The Lemur Center is a strict no-touch facility, but on the Walking tour you can get within six feet of the forest-dwelling lemurs and there are no barriers between you and them. The guides tell you to watch out and get out of the way of the lemurs, as they may come right by you on the path or in the trees, and that's exactly what happened several times on our tour.

There were eight or nine of us in our group (and there was another group with a separate guide with a similar number of guests), and we swapped enclosures with them to see different lemurs. First, we saw ring-tailed lemurs, the species I first fell in love with; then we saw red ruffed lemurs; and finally Coquerel's sifakas, which are my new favorites. They were all just living their best lives on the property—eating, resting, and modeling for us (as you can see in these photos!).

If you are interested in lemurs or animal conservation, the DLC is one of the best organizations you can support. And all the funds from tour

ticket sales go back into the care and conservation of lemurs, so it's a win-win all around. If you're in the Durham area of North Carolina, definitely schedule a visit—it's a really unique, fun, and educational way to learn more about these endangered primates and a rare opportunity to see them up close and personal! 🐼

*Come learn about lemurs with us!
Schedule your tour at*
LEMUR.DUKE.EDU/VISIT

See more of Gene's work at
ORANGEPHOTOGRAPHY.COM





IT TAKES A VILLAGE

When Lemurs Need Specialists, Duke Health ENT Answers the Call



By **ALEKSANDRA ZABIRAN**,
Director of Marketing and Communications
Head and Neck Surgery & Communication Sciences
Duke University Medical Center



At the Duke Lemur Center, every lemur receives meticulous care as part of a comprehensive preventative health program. Griselda, an endangered ring-tailed lemur born with her twin sister in 2016, is no exception. During a routine exam under anesthesia, it became evident that Griselda needed specialized attention from Dr. Matthew Ellison, an otolaryngologist and head and neck surgeon at Duke Health.

Lemurs are primates and are therefore anatomically very closely related to humans. The Duke Lemur Center's preventative exams are

thorough, encompassing physical exams, imaging (such as whole-body and dental radiographs, and abdominal ultrasounds), laboratory analyses (including bloodwork, urinalysis, and fecal exams), dental prophylaxis, body condition scoring, vaccinations, and routine TB testing.

Despite being a generally happy and healthy lemur, Griselda has experienced intermittent sneezing and nasal discharge since she was about four months old. These symptoms occasionally escalated to lower airway disease, including pneumonia. In 2023, a collaborative effort between veterinary specialists

from North Carolina State University's College of Veterinary Medicine and the Duke Lemur Center led to a sinus trephination procedure. This procedure, aimed at draining and flushing Griselda's maxillary sinuses, was informed by 3D-reconstructed CT scan images provided by an evolutionary anatomist at the Duke Lemur Center Museum of Natural History.

These images not only guided the trephination procedure but also helped identify anatomical changes that might have contributed to Griselda's condition. While the exact cause of her congenital or

developmental abnormalities remains unclear, the trephination has been beneficial. However, persistent fluid and infection in her ears prompted the Duke Lemur Center to seek Dr. Ellison's expertise.

Dr. Ellison's examination, conducted while Griselda was under anesthesia, included a thorough inspection of her ears and flexible rhinoscopy to assess her nasal passages. He found no active infection or inflammation in her ears but noted tissue remodeling due to chronic inflammation in her nasal passages. Dr. Ellison agreed that the current treatment and monitoring

plan was appropriate, and ear tubes were not recommended at this time. Should ear tubes be considered in the future, Griselda would need to be trained to accept post-operative ear drops with the help of her personal caretaker.

Following Dr. Ellison's visit, Griselda continues to actively participate in her own healthcare. Trained by her primary caretaker, she willingly participates in nebulization therapy, which encourages her sinuses and nasal passages to drain properly. Griselda is closely monitored for any new clinical signs.

The Duke Lemur Center is

▲ In 2023, the DLC's veterinary team, accompanied by two veterinary surgeons from North Carolina State University, performed the first-ever (to our knowledge) trephining and flushing of a lemur's sinuses, hoping to alleviate Griselda's symptoms. The surgery took place in the DLC's state-of-the-art lemur hospital, the Anna Borrueel Codina Center for Lemur Medicine and Research. Pictured: NCSU's Valery Scharf, DVM, MS, DACVS, flushes Griselda's sinuses. Also present were DLC veterinary technicians Cat Ostrowski, RVT and Megan Davison, RVT, NCSU's Tara Harrison, DVM, MPVM, DACZM, DACVPM, Cathy Williams, DVM, Dipl. ACAW, and the DLC Museum of Natural History's Steven Heritage, PhD. Because there was no information on how to do this type of procedure on a lemur, the veterinarians worked with Heritage to get critical CT images of a ring-tailed lemur skull to know where the sinuses are located, the best place to get access, and all measurements needed in advance of the surgery. Photo by Sara Sorraia.

recognized as a global authority on lemur veterinary medicine. The veterinary team includes a Board Certified Specialist in Zoological Medicine™ and a veterinarian trained in laboratory animal medicine, as well as two registered veterinary technicians. Together, they ensure the well-being of all 230+ lemurs living onsite and support non-invasive research at the Center. The team members are Julie Ter Beest, MS, DVM, Dipl. ACZM, Brendan Johnson, DVM, PhD, Catherine Ostrowski, RVT, and Chrissy Conrad, RVT.

Occasionally, the Duke Lemur Center partners with human doctors to provide the best possible care for their lemurs. With Dr. Ellison now on call, Griselda and her fellow lemurs can continue to receive the specialized care they need. 🐼



Griselda has had bouts of sneezing for most of her life, induced by seasonal allergies. To help ease her symptoms, the DLC's husbandry team has taught Griselda, through positive reinforcement training, how to participate in nebulizer treatments. Over the course of many sessions, Assistant Curator Danielle Lynch taught Griselda that she would be rewarded with her favorite snack (banana-flavored baby food, delivered consistently throughout treatment through a syringe) when she placed her face inside of the nebulizer mask. Now, Griselda will willingly sit for six-minute sessions without any physical handling required from our husbandry staff, which minimizes stress and allows her to actively participate in her own welfare. *Photo by Travis Stanley.*



“We are incredibly fortunate to be located in the heart of the ‘City of Medicine’ among so many talented medical specialists who are willing to assist us in providing excellent healthcare for our lemur colony. Not only do we tap into this amazing body of knowledge when an animal is unwell, but we also collaborate with these professionals to learn more about lemurs’ normal anatomy and physiology.”

JULIE TER BEEST M.S., D.V.M., DIPL. ACZM,
Director of Veterinary Services

Griselda (left) free-ranging with her sister Gretl. *Photo by Sara Nicholson.*

DLC-MADAGASCAR VETERINARY INTERNSHIP PROGRAM

Training the next generation of Malagasy veterinarians

By **JULIE TER BEEST M.S., D.V.M., DIPL. ACZM**, Director of Veterinary Services and **BRENDAN JOHNSON, D.V.M., Ph.D.**, Veterinarian

ONE OF OUR most rewarding partnerships is our **Malagasy Veterinary Internship Program**, a grant-funded program that enables us to host talented Malagasy veterinarians at the Duke Lemur Center to focus on various aspects of lemur medicine.

This spring, we hosted Dr. Santatra Randrianarisoa, who graduated from veterinary school at the University of Antananarivo, Madagascar, in 2022. During his three-month internship, Santatra received in-depth training on a wide variety of topics, including lemur medicine and surgery, anesthesiology, pharmacology, dentistry, diagnostic imaging, nutrition, laboratory analyses, pathology, and lemur husbandry. He participated in daily clinical cases, veterinary department case rounds, lectures and continuing education seminars, and veterinary journal

reviews. Dr. Randrianarisoa became proficient in providing veterinary care to multiple species of lemurs at the DLC and returned to his home country with the skills necessary to care for lemurs in Madagascar.

Dr. Randrianarisoa also attended local and regional One Health seminars to broaden the scope of his internship and develop analytical skills that may translate to a wide range of domestic and wild animals. Through connections established at Duke's Global Health Institute, Santatra attended the Triangle Center for Evolutionary Medicine's (TriCEM) Evolutionary Medicine Summer Institute, which covered approaches relevant to studying the intersection between human, animal, and ecological health.

As the final component of his internship at the Duke Lemur Center, Santatra developed a research

proposal investigating the potential presence and impact of leptospirosis in lemurs and other mammals in Madagascar. Dr. Randrianarisoa traveled back to his home country and resumed work as the Laboratory Manager at Mahaliana Labs in Antananarivo, a laboratory specializing in wildlife health assessments, including molecular analyses of biological samples. He plans to complete his research project and ultimately hopes to advance his studies in a Ph.D. program. 🐼

*Thank you to the
FS FOUNDATION
for making this
program possible.*



Dr. Santatra Randrianarisoa with the DLC veterinary team (left) and at Mahaliana Labs in Antananarivo, where he specializes in wildlife health assessments. *Photos by Sara Sorraia.*





For the Love of Lemurs



By **ERIN HECHT**,
Student and Volunteer Program Coordinator



THE LEMUR CENTER family extends far beyond our full-time staff! An important part of our mission is to engage students and the local community in the life and work of the DLC. Students, adults, and retirees from Durham, Chapel Hill, Raleigh, and beyond set college basketball rivalries aside in favor of a shared passion for wildlife conservation. This diverse group of passionate volunteers participate in a variety of meaningful service opportunities, and all are integral to the care and welfare of lemurs at the DLC.

In addition to our long-term volunteer roles, we also engage scout troops, student organizations, university staff groups, and corporate teams through half-day service events. Groups assist with outdoor grounds and garden projects while learning about the behind-the-scenes work that goes into the DLC's three-pronged mission: non-invasive research, conservation, and education.

To increase our reach in the community, we also connect with local non-profits. This year, we're partnering with Reality Ministries to host a weekly volunteer group for adults with intellectual or developmental disabilities, who prepare diets and enrichment for the animals. Our goal is to unite our entire community over the love of lemurs! 🐾

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Lemurs are the most endangered group of mammals on Earth. 17 species have gone extinct, and nearly one third of surviving species are Critically Endangered. Learn more and support our conservation programs at LEMUR.DUKE.EDU/PROTECT.

Conservation Status Legend:

- DATA DEFICIENT
- LEAST CONCERN
- NEAR THREATENED
- VULNERABLE
- ENDANGERED
- CRITICALLY ENDANGERED
- EXTINCT

Illustration by Talia Felgenhauer, 2023-25 DLC Undergraduate Fellow in Communications



Duke University
 Duke Lemur Center
 3705 Erwin Road
 Durham, NC 27705

YOUR SUPPORT MAKES A WORLD OF IMPACT!

Explore the many ways you can make a lasting impact by investing in the Duke Lemur Center's work: learning from, caring for, and protecting lemurs and their natural habitat.



Visit lemur.duke.edu/donate to learn more, or scan the QR code to give now.

The Duke Lemur Center is a nonprofit, tax-exempt organization operating under Duke University (EIN 56-0532129), and is accredited both by the Association of Zoos and Aquariums (AZA) and the American Association for Accreditation of Laboratory Animal Care (AAALAC).

Thank you to the following premier corporate sponsors and other organizations whose support provided a cornerstone to our success in 2024!



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