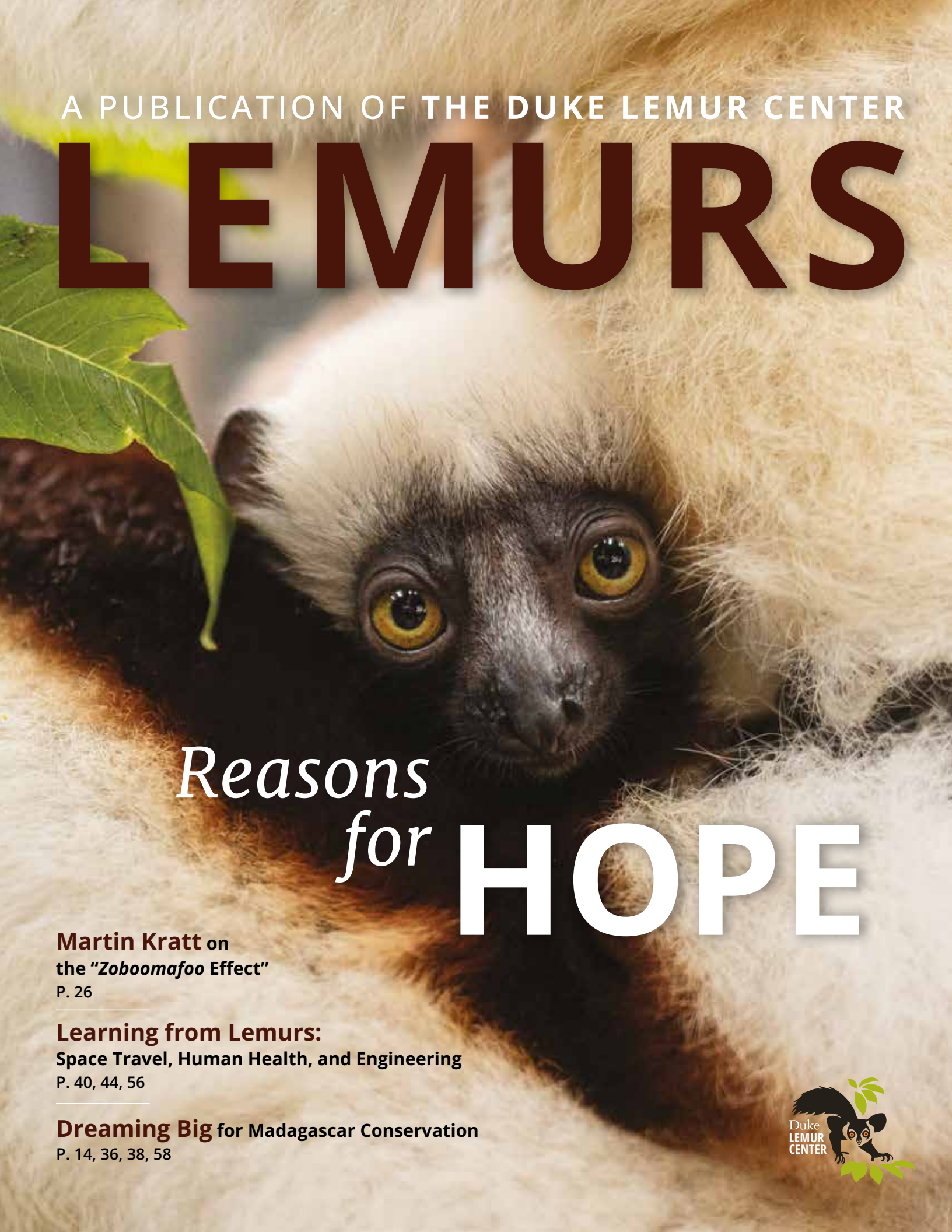

A PUBLICATION OF **THE DUKE LEMUR CENTER**

LEMURS

Reasons for HOPE

Duke LEMUR CENTER

CONTENTS

ON THE COVER:
Sydonie, whose parents arrived in England from the DLC in 2021, is among the first Coquerel's sifakas born on European soil—a tangible symbol of hope for the long-term survival of this critically endangered species. Read more on page 58. *Photo courtesy of Chester Zoo.*

RELEASED **FEBRUARY 2026**

EDITOR:
Sara Sorraia

If this magazine sparks your curiosity, moves you, inspires hope, or strengthens your connection to the lemurs of Madagascar, I invite you to help advance the DLC's mission.

Recent reductions in federal funding for research and conservation have placed real pressure on the Duke Lemur Center. Yet our commitment remains unwavering—and with your support, our work can continue to thrive. Every contribution, no matter the size, fuels scientific discovery, ensures excellence in our animal care programs, strengthens conservation efforts, and helps ensure a future where lemurs not only survive, but flourish.

Together, we can protect what is irreplaceable.

Learn more at **lemur.duke.edu/donate**.

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LETTER FROM THE DIRECTOR

I HAD A PROFESSOR who liked to remind our class, as we edged closer to an exam, that "hope is not a strategy." It was his way of urging us to put in the study time required to be prepared. The lesson was clear: Wishing for a certain outcome is never enough.

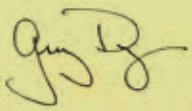
But over the years, I've learned something equally important: While hope may not replace strategy, it absolutely fuels it. Hope is what allows us to face daunting challenges without losing sight of what's possible. It gives us the courage to keep going, the imagination to envision a better future, and the resilience to build it.

In this issue of our magazine, Sara Sorraia and her team capture that spirit beautifully. Hope is not passive here—it is active, determined, and deeply rooted in the belief that our work can protect lemurs and safeguard their future.

And hope is not just inspiring our current projects; it is shaping the next generation of conservation and scientific leaders. Several stories in this issue were written by, or highlight the work of, young environmental stewards and emerging professionals who are already making their mark. They are using their curiosity, talent, and passion to raise awareness, advance scientific discovery, strengthen veterinary care, and bring conservation to life through education and art. Their efforts remind us that hope is a force that moves people to act.

Their contributions, grounded in hope, give us every reason to believe that together we can protect Madagascar's extraordinary biodiversity. They remind us that our collective actions matter, and that together, we can ensure that future generations will never know a world without lemurs.

With hope and determination,



GREG DYE
Executive Director, Duke Lemur Center

Artwork by Ben Wike. Ben was one of four individuals selected for the DLC's brand-new internship program (2025) for students from Durham Public Schools—a partnership made possible thanks to generous donor support.

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 (DLC) 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, educated hundreds of thousands of people through in-person and virtual programs, and shared our lemur care expertise with zoos and conservation organizations around the world.

Today, with our irreplaceable colony of nearly 250 lemurs across 10 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.

VETERINARY MEDICINE

The DLC is a global authority on lemur medicine and is home to the Anna Borruel Codina Center for Lemur Medicine and Research, the most advanced lemur hospital ever built. We share our expertise with veterinarians, students, and zoos around the world, improving the health and care of lemurs everywhere.

ANIMAL WELLBEING

The wellbeing of the animals in our care is our ethical responsibility and foundational to our mission. We're committed to the physical, social, and behavioral wellbeing of each individual throughout all life stages and promote curiosity, exploration, mental stimulation, and species-specific behaviors.

HOUSING

Our lemurs live on 100 acres in Duke Forest, with indoor/outdoor housing and naturally forested free-ranging enclosures. They live in natural social groups, giving researchers the opportunity to observe the same behaviors, social structures, and age classes that would be observed in the wild.

NON-INVASIVE RESEARCH

Through research, we 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." We do NOT allow any research that will harm the animals.

The DLC's lemurs are visited by researchers with interests in conservation, veterinary science, animal care, and biology. In addition, the DLC has a Museum of Natural History that brings the history of the DLC colony (the osteology collection) and the history of primates (35,000 fossils and subfossils) to each of these disciplines. No other zoo or museum combines these resources under one roof.

CONSERVATION

Lemurs are found in the wild only on the island of Madagascar—one of Earth's most threatened biodiversity hotspots.

For 40 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 to increase sustainability and resilience. We achieve these goals through activities centered on education, reforestation, sustainable agriculture, alternative protein sources (to reduce hunting), research, conservation breeding programs for critically endangered species, and so much more.

GLOBAL IMPACT

A truly global institution, the DLC works in the United States in North Carolina (the location of our main campus), Wyoming, and Utah; in La Venta, Colombia; in Santa Cruz Province, Argentina; in Wadi Moghra and the Fayum Depression, Egypt; and in numerous fossil and conservation sites across Madagascar.

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TINY LIVES, HUGE IMPACT

Baby Season at the Duke Lemur Center

By **MATTHEW BURKHART**, Communications and Education Assistant
Undergraduate, North Carolina State University

Every spring, as the Duke Lemur Center enters baby season, staff prepare for both excitement and uncertainty. Behind every new arrival, from the smallest mouse lemur to the most delicate Coquerel's sifaka, is a careful balance of instinct, science, and care. The first days of a lemur's life can be fragile, requiring constant attention from keepers and veterinarians who track every movement, grip, and gram.

For the team, each birth represents more than a milestone. It is the start of a long, careful effort to help the tiniest lives survive.

One-month-old Albus, a Coquerel's sifaka, peeks out of his weighing container during a routine wellness exam (2023). One of the ways the DLC monitors the health of an infant is its weight. Young Albus was weighed regularly and his growth curve was compared to other sifaka infants born at the DLC, which helped our veterinarians ascertain whether he was growing at a healthy rate. *Photo by Sara Sorraia.*

"Baby lemurs bring a smile to your face and make your heart beat a little faster," says Greg Dye, Executive Director of the DLC. "But they're also a reminder of what's at stake. They underscore the importance of the Lemur Center's work protecting these species from extinction. Our mission is to never know a world without them." Pictured: Grendel, an infant aye-aye, receives a routine wellness exam (2010). *Photo by David Haring.*

Lemurs require a long period of maternal contact and learning, which is crucial for normal development and behavior. Here, Radama the Great learns from his mother, Cassia, which forest foods are best to eat. Cassia sits just out of frame, nibbling leaves and keeping a close eye on her four-month-old son. *Photo by Sara Sorraia.*

Leonor is the first female mongoose lemur born at the DLC since the birth of her mother, Bonita, in 2016. *Photo by David Haring.*

FRAGILE BEGINNINGS: BIRTH AND FIRST DAYS

While mother lemurs ideally do the "hard work," the veterinary team is always on high alert during baby season, ready to provide intervention if the initial days take a worrisome turn.

"Ideally, we're not involved much at all, but our biggest area of involvement is the neonatal exam on day one," says Julie Ter Beest, M.S., D.V.M., DIPL. ACZM, the DLC's director of veterinary services. "We make sure that they're strong, gripping to mom, healthy, and then we're really monitoring their weight. Weight trends are the best early clue that they're nursing appropriately and thriving."

Veterinary technician Cat Ostrowski, R.V.T., emphasized the diligence required. "Every time we remove an infant for an exam, we check for hair wrapped around fingers or tails, because if the blood supply is cut off, just like in people, infants can lose digits in days," Cat says.

Hypoglycemia and hypothermia, common neonatal problems, are major concerns in these delicate first hours. If an infant is not thriving, the medical team can provide interventions such as subcutaneous fluids, warmth, glucose, and occasional oral medications. Still, as Julie and Cat emphasize, the mothers shape the outcome more than anyone else can.

THE CENTER'S UNIQUE BREEDING SUCCESS

According to Colony Curator Britt Keith, the Lemur Center's high breeding success "is the best possible outcome of the care of that particular species." The recipe

is complex: "the right spaces, territories, nutrition, and care."

But essential, she adds, is mate choice, especially for species like the mouse lemur, whose reproductive rate skyrocketed once females could pick their partners. "If you do not provide that species with everything they need, they're not going to breed," Britt says. "When all the stars align, that female will cycle, she'll be receptive, the male will breed her, she'll hold the pregnancy, and then the baby is born alive."

Nowhere is the DLC's expertise more critical than with its more sensitive species. For critically endangered Coquerel's sifakas, for instance, "every baby is absolutely vital for the population."

The Lemur Center works closely with other accredited zoos, exchanging lemurs to ensure the genetic health and diversity of the species in human care.

Unlike other diurnal species, ruffed lemurs build nests for their infants instead of carrying them on their bellies or backs. Red ruffed lemur infant Spock tried to climb out of his nest on the day he was born! *Photo by David Haring.*

"Females are more likely to be successful moms if they've had infant care experience with siblings, so growing up in a family group helps," says Colony Curator Britt Keith. Twins Elisabet and Doris are part of a family of six, including parents Sophia and Randy and older sisters Nemesis and Nyx. *Photo by Sara Nicholson.*

A TINY SUCCESS STORY: RADAMA THE GREAT

Radama the Great, a Coquerel's sifaka, was born at the DLC on April 5, weighing just 85 grams—about the size of a clementine. His small size didn't go unnoticed by the staff, and it meant he had a rough start compared to typical sifaka infants.

"He was born in sort of a bad situation; he didn't have a lot of things going for him," Lead Technician Madison Armand says. "He was born at a lower weight than we want, and he ended up fighting and getting through it."

During those first weeks, Radama needed extra help, with more handling and treatments from staff than most infants receive. He was treated for gastrointestinal illness,

"For clinging infants like sifakas, milestones like latching, exploring, and eating first leaves or fruits are all tracked by staff," says DLC veterinarian Dr. Julie Ter Beest. Pictured: Six-week-old Arcadius clings to his mother, Gisela. *Photo by David Haring.*

Mitsiky is the only blue-eyed black lemur born this year (2025) in human care, in any facility in the world. Especially for the most vulnerable lemur species, every successful baby makes a world of difference. *Photo by Madison Armand.*

with fluids and oral medication from the veterinary team. "His weight trends weren't what a normal sifaka infant's weight trends look like, but he continues to thrive," Julie says.

Madison adds that although the husbandry and veterinary teams supported Radama's recovery, his progress ultimately came down to his own determination. "He's just very feisty. He's a fighter. It takes a very big personality to deal with the things that he's dealt with so far in life," says Madison. "Some animals just have the fight in them."

Now, Radama is steady on his feet, sticking close to first-time parents Cassia and Eustace but happy to climb branches on his own. Staff say he's quick to join in grooming sessions, chewing leaves, and taking in the sights.

After plenty of highs and lows in Radama's first few months, Duke's keepers are just happy to see him steady, curious, and growing up fast.

KEEPING HOPE ALIVE: MITSIKY

This season's most significant success has been the birth of Mitsiky, the only infant of her species this year in human care, in any facility in the world. Blue-eyed black lemurs are among the rarest primates and most endangered lemurs, both in the wild and in zoos.

"She's super important," says Britt. "She's a female, so she can produce offspring. And she's sired by an animal from Madagascar, captive born, but still outside of our population, so that's critical. We call them founders, and having founder animals that have babies in the population really increases that species' genetic diversity."

Mitsiky's father, Mangamaso, was relocated from Parc Ivoloina in Madagascar to Durham in 2017 and is a "founder"—the first of his lineage to be introduced into the North American lemur population, bringing in new genetics to diversify the genetic

makeup of his species in zoos and conservation centers.

Greater genetic diversity is linked to better health and immune responses and increased ability to adapt to environmental pressures.

Especially for the most vulnerable lemur species, every successful baby makes a world of difference. Lemur Center husbandry staff take extra steps and precautions to ensure the baby's success, which often aligns with giving the baby's mother everything she needs.

Mitsiky's mother, Charlie, struggled with anxiety and was closely monitored by staff, which is common among blue-eyed black lemur mothers. In its husbandry guidelines, the DLC warns that mothers may be assertive in keeping family members away from themselves and the infant, especially in the first weeks after birth.

"Charlie did most of the care for Mitsiky, but she was very protective," Madison says. "We were very strict about how staff interacted. No towering over her, no direct eye contact, no unnecessary foot traffic through her wing of the building."

Although mothers almost always take charge, Madison says it helped that Mangamaso is a particularly experienced and involved father.

"He gave her the space that she needed. He was very respectful. He didn't try to investigate before she was ready," says Madison. "He listened to what Charlie wanted him to do. And when Charlie offered the baby to groom, Mangamaso groomed her, and it was really lovely to see."

EMOTIONAL HIGHS AND LOWS FOR KEEPERS

Ask any DLC keeper about baby season, and the conversation quickly turns to emotion. The joy of watching an infant take first steps or safely explore "comes with so much reward," says Madison, but "there's a lot of pressure. When the behaviors are subtle and the risks high, even an experienced team can have sleepless nights." Every survival "is special," she says, "but every loss is hard, and it stacks up on the spirit."

Yet hope abides, even after setbacks.

"There's something about these animals—they are so keen on living, teaching us lessons every day and reminding us of the importance of keeping animals like them alive. Watching them grow, play, learn—it's a privilege and the ultimate reason to keep working," Madison says.

LOOKING AHEAD

As another baby season closes at the Duke Lemur Center, staff are already thinking about next year. With every infant born, they gain new insight into the care, behavior, and resilience of the species they work to protect. Their efforts reach beyond Durham, shaping global conservation and research aimed at securing a future for lemurs within human care and in the wild. Every infant is another reason for hope and a reminder that the work of conserving Madagascar's primates has never been more critical or more meaningful.

Small nocturnal lemurs, like fat-tailed dwarf lemurs, have a relatively short gestation period—only about 60 days! *Photo by David Haring.*

THE ULTIMATE ADOPTION:

Joyful and Heartfelt Generosity

IN 2025, the Duke Lemur Center introduced an extraordinary opportunity that blended conservation with personal connection: Donors who made a new commitment for a gift of $20,000 or more were offered the rare opportunity to name one of our infant lemurs and receive quarterly "baby's first year" updates from the DLC's Adopt a Lemur program!

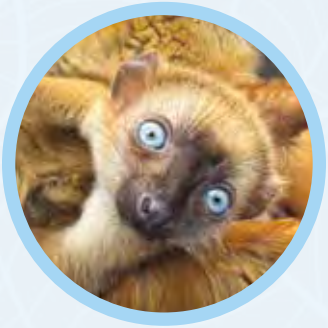
What began as a creative approach to help raise new, larger gifts to offset a particularly challenging budget year quickly evolved into a story of remarkable generosity. The new program was shared widely on social media, and our education team and docents enthusiastically promoted the opportunity to visitors. Several wonderful DLC friends responded, embracing the chance to make a deeper impact and finding meaningful ways to fulfill their commitment—whether by honoring loved ones, leveraging IRA distributions, or dividing their gift into two installments. Each contribution reflected not only financial support but a heartfelt commitment to the future of lemurs and the DLC's mission.

The infant-naming process itself became a touching collaboration. Several donors invited our animal care team to share their favorite names meeting the guidelines of each species' naming theme, creating a bond between those who nurture the lemurs and those who champion their care. This friendly and joyful exchange underscored the spirit of partnership at the heart of our mission.

Thanks to this program, we celebrated the newest members of our colony, made new friendships, and raised generous contributions to further our mission. As we look ahead to 2026 and beyond, we hope this unique initiative continues to inspire individuals, families, and organizations to join us in safeguarding these extraordinary animals.

Learn more at **lemur.duke.edu/adopt**.

IN 2025, THE LEMUR CENTER CELEBRATED SIX ULTIMATE ADOPTIONS:



MITSIKY

Born March 6, 2025

Mitsiky is the only blue-eyed black lemur infant this year in human care, in any facility around the world. She was named by Cindy and Tom Cook, who collaborated with the DLC's husbandry technicians to choose a Malagasy name for her. "The name 'Mitsiky' means 'smiling' in Malagasy," Cindy explains. "Charlie and her infant are known amongst the staff for their upturned lips that make it look like they're smiling. She makes us smile, too, so the name was just perfect!"

RADAMA THE GREAT

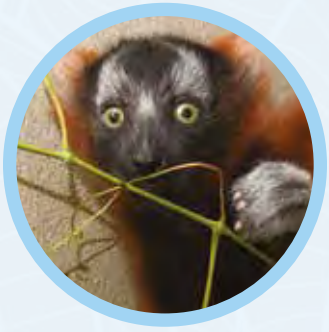
Born April 5, 2025

Radama the Great is a Coquerel's sifaka infant and the great-grandson of Jovian, star of the PBS Kids show *Zoboomafoo*. He was named by the donor of the Anna Borruel Codina Center for Lemur Medicine and Research. Radama's mother, Cassia, was one of the first lemurs treated in the Borruel Center's ICU. Radama, who is named after a Malagasy king, also required intensive care. But although his birth weight was much lighter than most sifaka infants', dedicated care from his parents and the DLC's husbandry and veterinary staff has helped this little lemur grow into a sweet, curious juvenile!

ELISABET AND DORIS

Born March 27, 2025

Generosity is contagious at the DLC! We were thrilled when a dedicated DLC volunteer chose to adopt endangered ring-tailed lemur twins Elisabet and Doris. Inspired by the incredible story of a small group of docents who collectively raised $20,000 to adopt and name Spock and help the DLC during a particularly difficult budget year, she felt moved to give back in a meaningful way. Her gift is not only an act of compassion—it's a tribute. With this adoption, she honors the memory of her beloved family members, Elizabeth and Doris, two sisters whose legacy of kindness lives on through this contribution.



SPOCK

Born April 15, 2025

Red ruffed lemur Spock was named by Education volunteers Cindy, Donna, Freda, Marsha, and Leslie, who have dedicated over two thousand combined hours of service to the DLC. His name was inspired by the beloved *Star Trek* character, whose pointy ears bear a resemblance to this infant's unique white face markings. Passionate about the DLC's mission, these five women rallied together to donate to the care and conservation of these critically endangered primates, helping ensure that lemurs "live long and prosper!"

LEONOR

Born March 31, 2025

Leonor, a critically endangered mongoose lemur, was a superstar of the summer tour path! Whether she was actively searching her environment, using her mom as a trampoline, or trying to entice her father to play, this little girl stole the hearts of our staff, volunteers, and guests. Most of all, she introduced thousands of people to mongoose lemurs and the urgent need for their care in captivity and conservation in Madagascar. When her adopters, Melanie and Carl, visited the DLC on a Behind the Scenes tour, they were so impressed by their "super guide," educator Ethan Moore, and the Lemur Center that they made a generous donation of $20,000 to name this beautiful, charismatic infant.

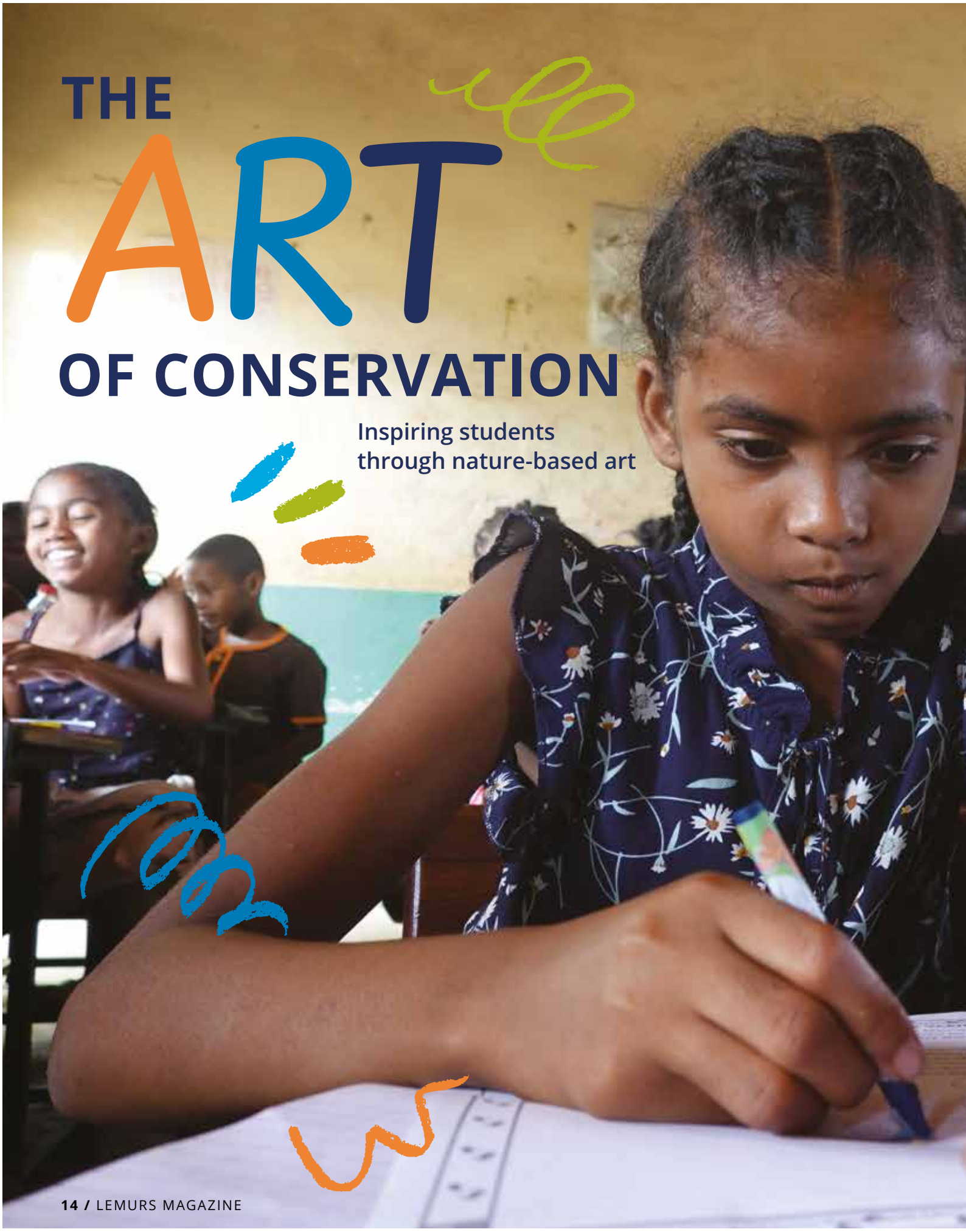
BUDGIE AND FLAMINGO

Born May 17, 2025

Cathy and Dave Higgins were moved to make a generous donation when they learned about our non-invasive research program—specifically research with mouse lemurs that has helped shed light on devastating human diseases like Alzheimer's. In addition to symbolically adopting fat-tailed dwarf lemur twins Budgie and Flamingo, they generously contributed to the DLC's cognition research with mouse lemurs. "Both of us have had close family members suffer from Alzheimer's," explains Dave. "We're fortunate to be in a position to support critical research that may identify potential treatments to minimize the effects of Alzheimer's and perhaps one day a cure."

THE ART OF CONSERVATION

Inspiring students through nature-based art



The DLC-SAVA Conservation project encourages students to express their interests in the environment through art.

By **EVRARD BENASOAVINA**, DLC-SAVA Education Specialist

and **JAMES HERRERA, Ph.D.**, Director of Conservation

Photos courtesy of the **DLC-SAVA CONSERVATION TEAM**

People learn in many different ways. Some people are visual and hands-on learners, and others have a natural artistic inclination. That is why many environmental education programs incorporate art into their lesson plans. Through the DLC-SAVA Conservation project in Madagascar, we encourage students to express their interests in the environment through art. Since there aren't many opportunities for such learning in Madagascar's standard curriculum, it's something new and fun for students to do and it inspires them to learn more about nature.

Our education program includes field trips to natural spaces like national parks and private reserves. While in nature, we provide notebooks and colored pencils and encourage children to nature journal, with simple prompts like "Draw the plants or animals you see that you really like," "Draw your favorite fruits that you get from trees," or "Draw a healthy environment." It's always so fun to see what children draw. Many times, they draw domestic animals they like at home, like chickens and cows. Many times, they draw birds and chameleons that they see during their visits. This exercise encourages thoughtful reflection while in nature and builds self-confidence through the students' abilities to express their thoughts.

Visits to national parks are a special opportunity for students to be immersed in nature.

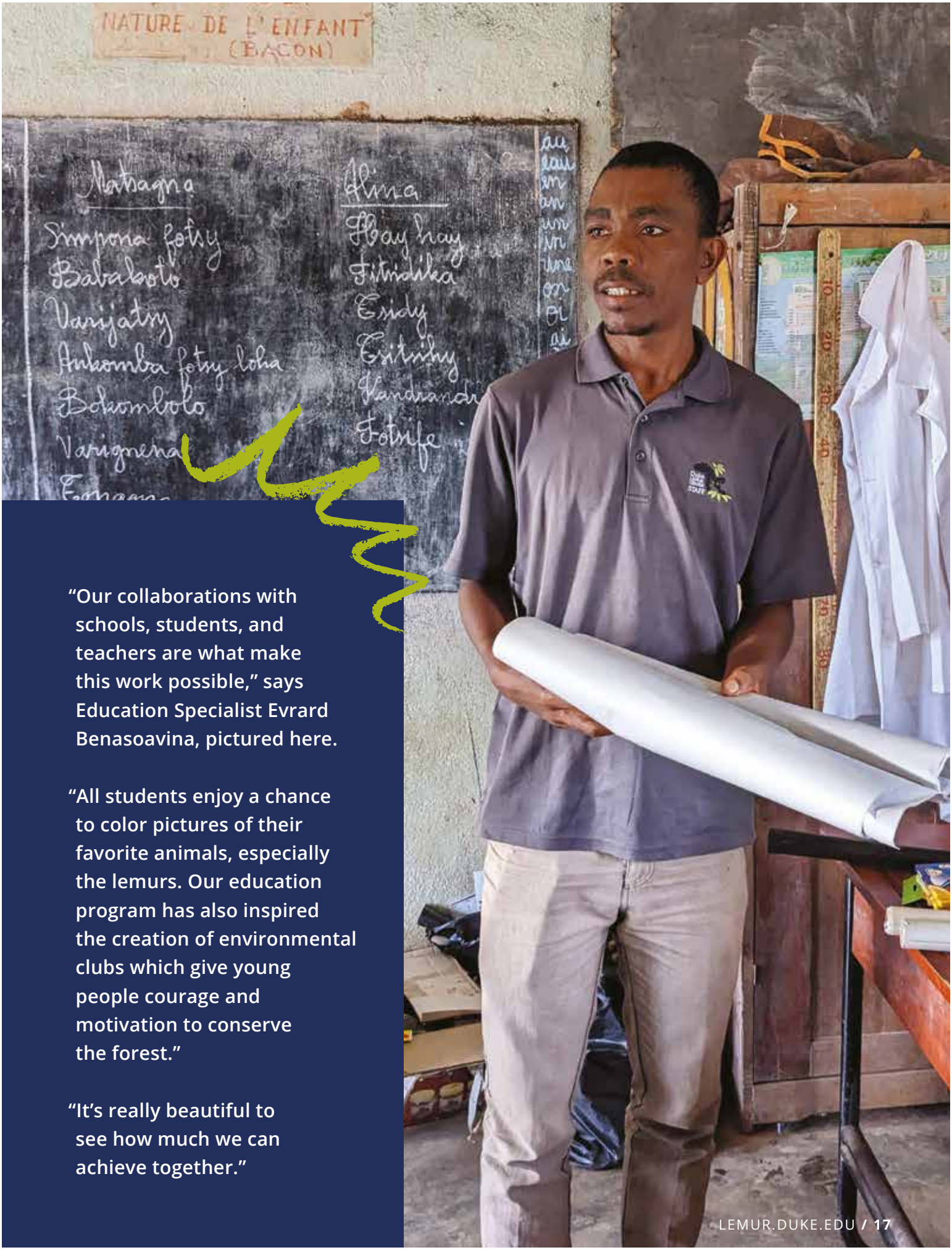
We also use coloring books specifically made in the local Malagasy language that tell all about lemurs, the most famous animals in Madagascar. The pictures are fun to color, and the information is easy for the students to learn about why lemurs are so important. The children color the pictures, and then we glue them onto posters that are displayed on the classroom walls.

After our lessons, we come back to the schools to do evaluations. We ask questions like, "Do you think you have changed at all after our lessons?" We have been so proud of the responses. Some children have said that they were amazed to learn about how many lemurs there are and that lemurs are like gardeners, planting trees by eating their fruits.

What has inspired us the most is their compassion and love for nature. Some students said they no longer hunt wild animals like lemurs or keep them as pets. Others have become environmental ambassadors, telling their families and neighbors why it's important to protect the environment. We really see that the children's mentality and behavior about the environment has had positive changes.

With these inspiring results, we are motivated to do more with local schools. We invite them to create environment clubs and then help the clubs to do projects in their school yards. One group made fish farms, which we helped them create and stock with fish. After just eight months, the fish were big and could be sold so the club could make money for their activities. Four schools made vegetable gardens, and another planted fruit trees all around the yard. We help them by providing tools, seeds, training, and refreshments to celebrate their successes! We want to make more school gardens, so every student can connect with nature and see reap the benefits of their efforts.

Children can be agents of sustainable change, and many become environmental ambassadors to their families. "When we see lemurs, we will not kill them, we will not sell them, we will not have them as pets at home."



"Our collaborations with schools, students, and teachers are what make this work possible," says Education Specialist Evrard Benasoavina, pictured here.

"All students enjoy a chance to color pictures of their favorite animals, especially the lemurs. Our education program has also inspired the creation of environmental clubs which give young people courage and motivation to conserve the forest."

"It's really beautiful to see how much we can achieve together."

Julia Stone

Ph.D. student,
Duke University Evolutionary Anthropology

Photos courtesy of **JULIA STONE**

MY LOVE FOR FOSSILS really snuck up on me.

I've always been interested in anatomy and bones, which initially drove me toward medical school; but a single introductory course in Biological Anthropology introduced me to a very different path. I realized two things: Medical school wasn't the only way to study bones, and paleontology wasn't just focused on dinosaurs.

The giant reptiles of the Jurassic are undoubtedly cool, but something about the smaller and often cryptic mammal fossil record sparked a fascination in me that I cannot fully articulate. The fact that small primates were roaming the forests of the Eocene not far from my Texas hometown truly spurred my research path, ultimately landing me at Duke University for graduate school. Duke is home to the Duke Lemur Center Museum of Natural History (DLCMNH), an incredible collection of more than 35,000 fossils with a historic focus on primate evolution.

My advisor, Dr. Doug Boyer, has spent his career studying the history of primates and their close relatives. Shortly after he offered me a spot as a graduate student in his lab (the Boyer Lab in the Evolutionary Anthropology department at Duke), he put me in contact with Dr. Matt Borths, the curator of the DLCMNH, to discuss a potential fieldwork expedition. The trip would focus on Eocene (56–34 million years ago) sites in Wyoming. This aligned with my research focus on primate origins, as primates were abundant in North America at that time in Earth's history. So, without knowing much about what it would entail, I said yes, hoping for an opportunity to find a primate fossil. Four field seasons and a few primate teeth later, I am hooked!

My first two summers focused on the Bridger Basin in the southwest corner of Wyoming. This area is known for its amazing mammalian

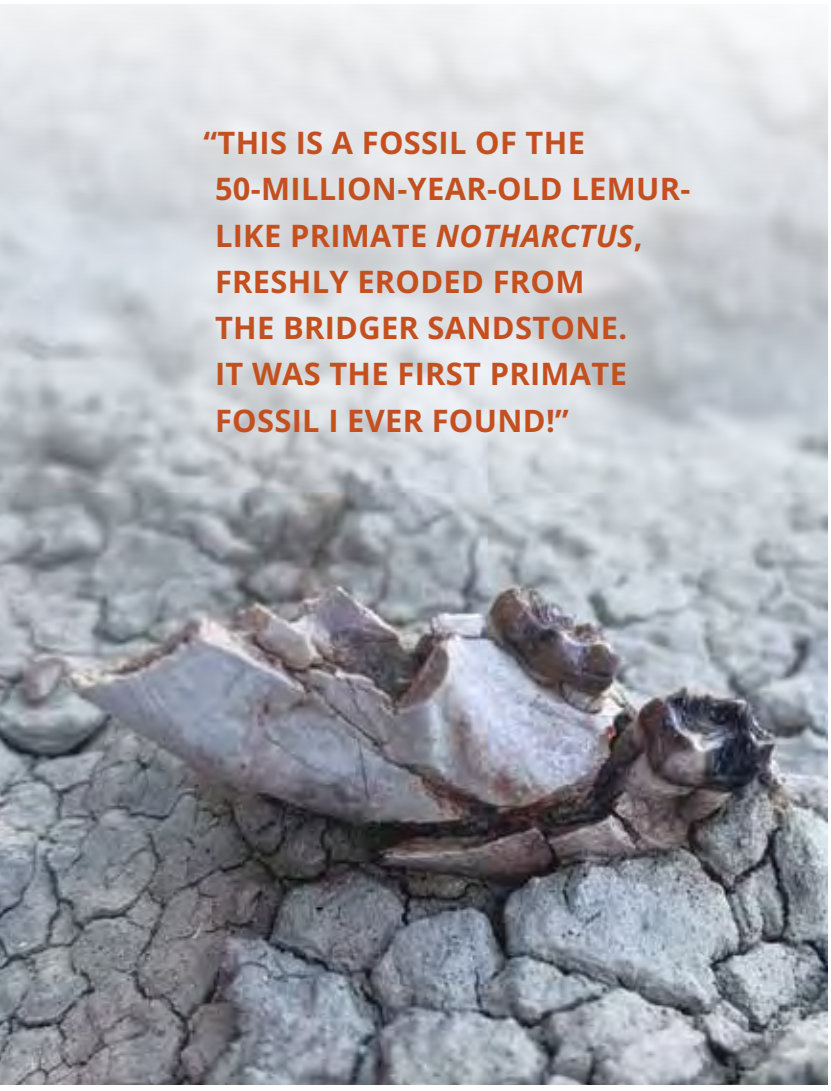
skeletons, including the famous *Notharctus* specimen, called "Ima," housed at the DLCMNH. Fossil material abounds here, and it was a wonderful place to learn the logistics of a day in the field.

The summers of 2024 and 2025 have focused on sites that have been untraversed for decades in an area north of the Bridger Basin called South Pass. Dr. Gregg Gunnell, the former director of the DLCMNH, documented these sites in the 1980s and 90s. Though the fossils here are less pristine, they are no less important to the story of North American primates.

And to me, it feels even more invigorating to explore these nearly forgotten sites.

My time in the field has taught me much more than I ever expected. I've learned about the animals that wandered North America in the distant past, as well as the modern mammals that make their home in our hemisphere. And most importantly for my future fieldwork endeavors, I've learned to navigate rocky two-track roads with a Jeep… and, inevitably, how to change flat tires on that Jeep.

Days in the field can feel like a rollercoaster: The hours spent finding nothing, suddenly forgotten when a small mammal molar is plucked from the dirt. The majority of my first summer was spent showing Matt bags of ordinary rocks thinking they must all surely be incredible fossil finds. But something clicked for me on our most recent trip into the field, and my confidence in the identification and location of fossils has grown exponentially. I am already looking forward to another trip back in time to discover even more of the wonderful world of the Eocene in Wyoming.



"THIS IS A FOSSIL OF THE 50-MILLION-YEAR-OLD LEMUR-LIKE PRIMATE *NOTHARCTUS*, FRESHLY ERODED FROM THE BRIDGER SANDSTONE. IT WAS THE FIRST PRIMATE FOSSIL I EVER FOUND!"

Q+A WITH JULIA

Best dinner after a long day of fieldwork?
Grilled cheese and tomato soup

Most exciting find?
My first summer I found a small primate jaw with two molars which turned out to belong to *Notharctus*!

Essential equipment for the field?
A weekly pill organizer to keep track of really tiny fossils, especially teeth

Favorite animal(s) that lived in Eocene Wyoming?
Hyracotherium, a dog-sized horse ancestor

Hyracotherium, initially named eohippus, was featured on a US postage stamp in1996. *Illustration courtesy of the National Postal Museum.*

TOPER NAWI:

A NEW SITE WITH ANCIENT INSIGHTS

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

A camel herd grazing near Lake Turkana. The lake is part of the East African Rift System, a crack in the Earth's crust that runs from the Red Sea to Mozambique. The shifting rift preserves many chapters in the primate and human story.

I was a dinosaur kid. I loved getting books from the library filled with weird dinosaur names and fun facts. This blizzard of ancient Greek and solid numbers led me to believe that paleontology—and science in general—was basically complete. I assumed that all of the important sites had been found, all of the important questions answered. I may have been a dinosaur kid, but I couldn't be a paleontologist adult. There was no future in the past.

But then, after exploring history, linguistics, medicine, and political science, I took a geology class in college. It was taught by a paleontologist. I learned there were indeed sites to discover, and fossils waiting to reveal their secrets. I charted my path, cautiously optimistic that there were still big questions to answer. I could hope that maybe I'd get to work on a new and important site. Someday.

Not all fossils are pretty. Matt holds an upper molar of a zebra-sized giant hyrax.

The reconstructed lower tooth row of a new fossil primate being examined by the Topernawi research team. 3D models of the specimens allow the international team to study the specimens all over the world.

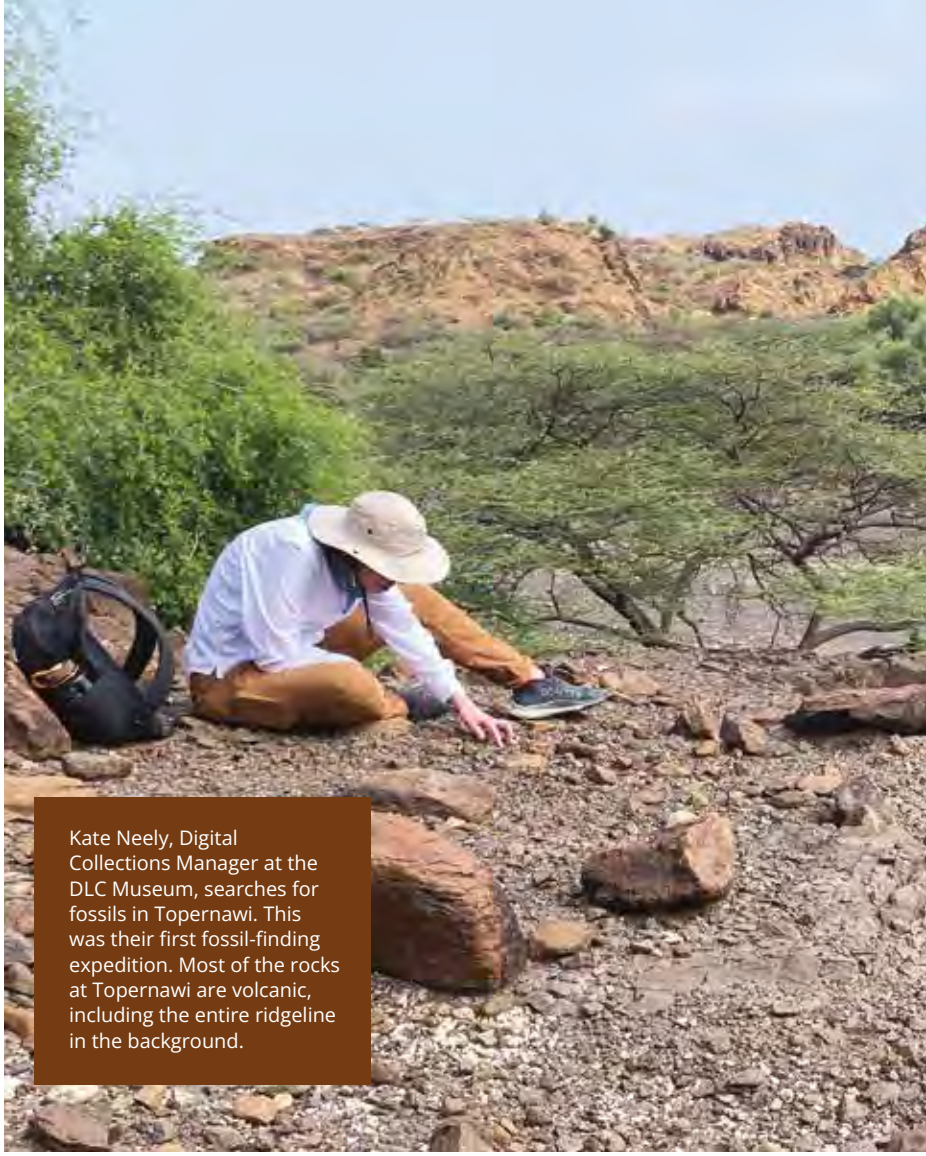
In 2019, a geology team working on the shores of Lake Turkana in northern Kenya ran an analysis on volcanic rocks from an area called Topernawi. They wanted to figure out how old the the basalt was so they could date the fossils sandwiched between the volcanic layers.

Turkana is a massive area that paleontologists have been exploring for decades because some layers of sediment preserve fossils of our bipedal ancestors (mostly from 1 to 5 million years old). But the fossils near the undated basalt did not include classic early-human neighbors like rhinos and antelope, a clue the site was a little older. Maybe 10 or 15 million years old?

Then the date came back: 29 million years old. Shockingly old. No mammalian fossils from anytime close to that had ever been discovered near Lake Turkana. In fact, no productive fossil site near the equator in Africa had ever been dated to this crucial window of time, when genetic and sparse fossil evidence suggests that apes originated. If paleontologists could find more fossils from this area, maybe they could piece together the environment that shaped our tail-less ancestors.

In 2021, the paleontology team—led by Patricia Princehouse (SUNY-Oswego), Isaiah Nengo (Turkana Basin Institute), and Natasha Vitek (Stony Brook University)—contacted me about the discovery. The Duke Lemur Center Museum of Natural History has a large collection of fossils from the Fayum Depression in Egypt. The Fayum preserves African fossils that are between 37 and 29 million years old. The Egyptian fossils are essential for sorting out the identities of the creatures stalking or climbing through the Kenyan forest 29 million years ago.

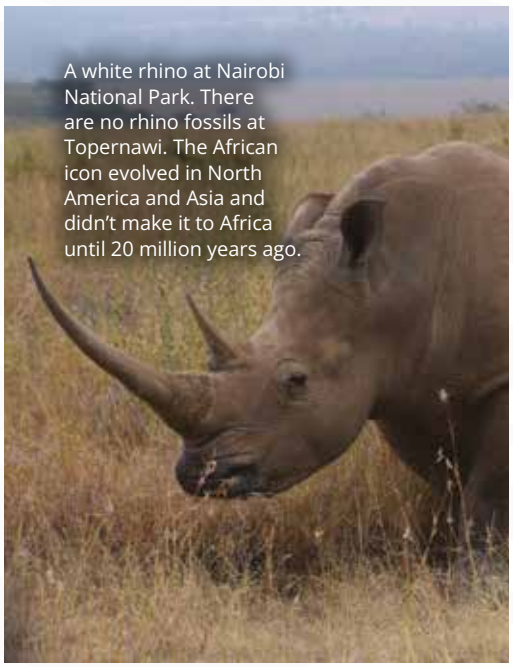
Here it was. A new window into an ancient world, filled with previously unknown, extinct animals. Maybe we could catch a glimpse of our ape-like



Kate Neely, Digital Collections Manager at the DLC Museum, searches for fossils in Topernawi. This was their first fossil-finding expedition. Most of the rocks at Topernawi are volcanic, including the entire ridgeline in the background.

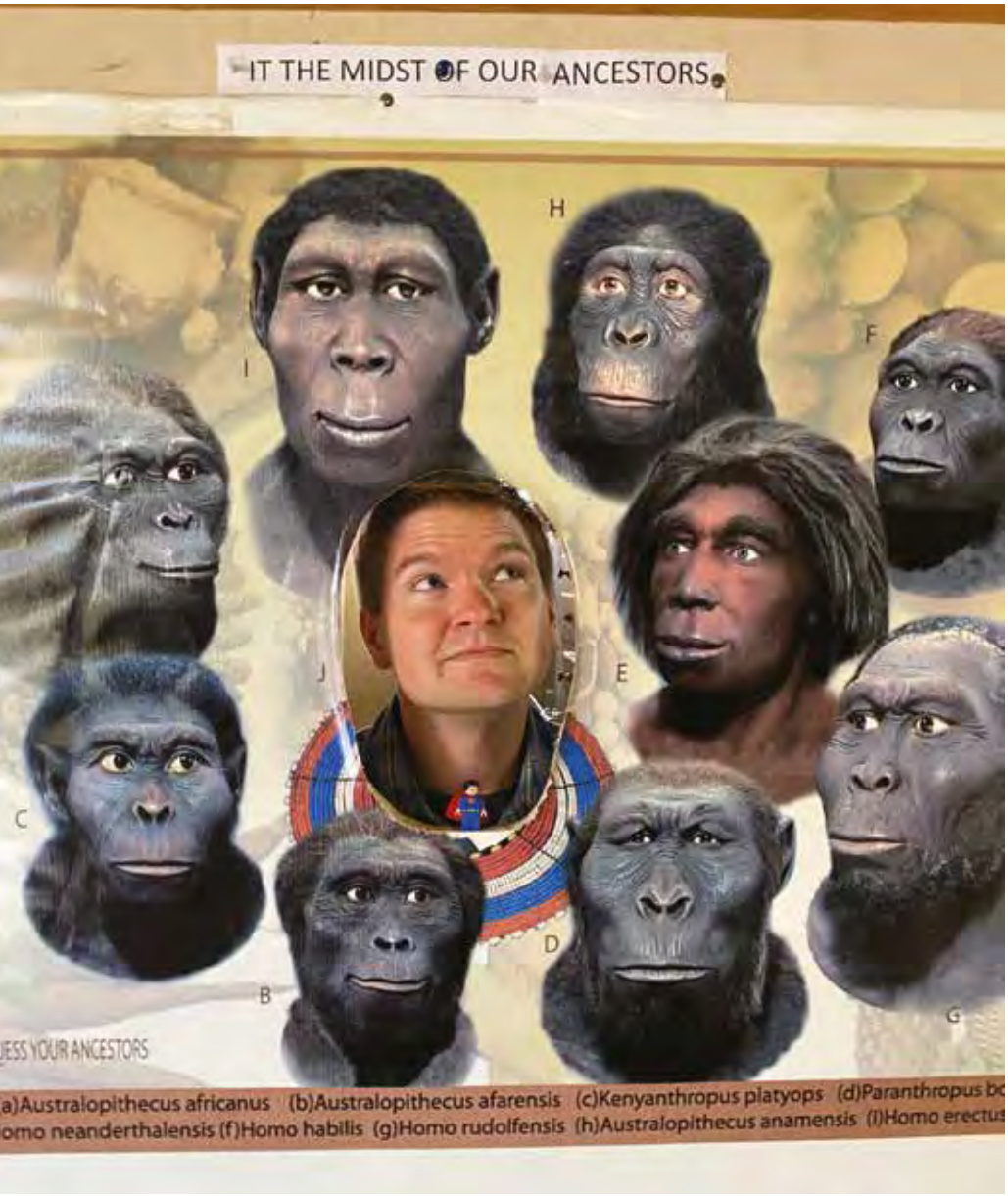
Matt and Kate working in the collections at the Turkana Basin Instutite in Kenya. We use collections in Kenya and collections at the DLC Museum to identify the creatures at Topernwai.

Negohyrax, a giant hyrax discovered at Topernawi, filled the same niche as an antelope millions of years before antelope arrived in Africa from Eurasia. Today, hyraxes are all rabbit-sized mammals with tiny tusks, evidence that hyraxes are relatives of elephants. Pictured: *Negohyrax* with *Aegyptopithecus*, an ancient cat-size, tree-dwelling primate. *Illustration by Karie Whitman*.



A white rhino at Nairobi National Park. There are no rhino fossils at Topernawi. The African icon evolved in North America and Asia and didn't make it to Africa until 20 million years ago.

John Lonyala, sitting on the volcanic rock that was dated to 29 million years, is a second-generation Turkana fossil hunter at the Turkana Basin Institute (TBI). TBI was founded by Richard and Maeve Leakey to support research near Lake Turkana.



Matt at the Nairobi National Museum, surrounded by some of his extended family. Turkana is most famous for preserving hominin fossils, artifacts, and footprints. The Topernawi primates were ancient history to our oldest bipedal ancestors.

ancestors, or even the ancestors of lemurs before they drifted over the Mozambique Channel to Madagascar. We worked on a grant to fund expeditions to Topernawi, securing support from the National Science Foundation to spend a few weeks each year crawling the buttes and gullies for scraps of our ancient ancestors.

Meanwhile, as the Topernawi project was getting organized in 2021, my wife and I were figuring out how to be a new family of three. Then we welcomed a second baby in 2024. My expanding family meant that traveling to Topernawi myself wasn't possible for a few years. Instead, I helped identify new species of hyraxes, elephants, and primates from Topernawi from my office at the DLC Museum.

In July 2025, thanks to generous logistical support from my family, I was finally able to travel to the western shores of Lake Turkana, getting my boots dusty at Topernawi. The DLC Museum's Digital Collections Manager Kate Neely also joined the team. Since starting at the DLC Museum in 2024, Kate has helped the Topernawi team make fossil comparisons by creating 3-D scans of Fayum fossils in the microCT lab at the Shared Materials Instrumentation Facility at Duke. Now, Kate was on their first fossil expedition, learning to recognize fragments of enamel and how to read the rocks while prospecting for new localities.

Turkana is not an easy place to work. We were there during the "cool" dry season, when daytime temperatures still soar over 90°F and humidity is high from the lake. At night it barely cools off. I'd drink a liter of water before bed, then wake up thirsty from sweating it all out overnight. Tent zippers clog from the fine lake dust, and acacia spines pierce every kind of fabric. But the dry, dusty conditions are worth it for the fossils, which we searched for with help from local Turkana fossil hunters who have generations of experience combing the rocks in search of early human fossils.

The fossils themselves are

not much to look at. Most were deposited during churning flood events that shattered bone, leaving behind petrified logs and only the densest parts of the skeleton: teeth and the occasional ankle chunk. But even fragmentary teeth are enough to help a crew of paleontologists and geologists resurrect horse-sized hyraxes, hippo-sized elephants, and dog-sized ape relatives.

To find these fragments, the team walks the badlands, our eyes trained on the ground. From a distance, it looks like a dozen people who lost their keys among the acacia roots and basalt cobbles. When someone spots a glint that could be a tooth, or a rock with a suspiciously biological curve, they stoop down to investigate. If it's a fossil, they clear the area around it and call over the field manager, who takes photographs of the specimen and collects exact GPS coordinates along with a preliminary ID.

Usually the ID is a species of hyrax. Today hyraxes are small, football-sized mammals with tiny tusks, evidence of their ancient connection to elephants. But 29 million years ago, some hyraxes were massive, filling niche space occupied today by antelope, zebras, and rhinos.

Hyraxes are not primates, but it is still thrilling to find scraps of these strange beasts. Fossils at Topernawi are neither abundant nor pretty. There's a reason the site took so long to be discovered. But without Topernawi, we would have no evidence of what was happening near the equator during a time of massive environmental change. 29 million years ago in places like Europe, Asia, and North America, lush forests were transforming into open, dry habitats, and glaciers were expanding across Antarctica.

Ongoing research will tell us if places like Topernawi were a refuge for our ancestors, insulating them from the climatic upheaval that lead to the extinction of primates on the northern continents. Ongoing research is also probing how the fragmentary primate fossils the team has unearthed connect to the larger primate family tree. Have we found ancient apes? Are there lemur relatives hidden among the hyraxes that could help us date the primate colonization of Madagascar?

We have years of research ahead of us at Topernawi. More fossils to find. More researchers to collaborate with. More sites to discover. If I had known there were places like Topernawi out there when I was surrounded by my fossil fact books, I would have imagined a career in science much earlier than I did. Now, I hope this discovery shows aspiring paleontologists, biologists, and geologists that there are still mysteries to solve.

Science isn't finished.

And we need your help.

"THERE ARE STILL MYSTERIES TO SOLVE. SCIENCE ISN'T FINISHED."

Today, zebras and other large herbivores thrive in African grasslands, but grass-dominated habitats didn't appear until millions of years after Topernawi primates and hyraxes. Topernawi gives us an older baseline for the transformation of African ecosystems.

DID YOU KNOW?

The DLC Museum of Natural History houses the largest and most diverse collection of fossil primates in North America—and you can come and meet your distant kin! Visit our website to schedule a visit, contact us for a virtual tour, or keep an eye out for weekend open house events.

LEARN MORE AT
LEMUR.DUKE.EDU/FOSSILS

THE Zoboomafoo Effect

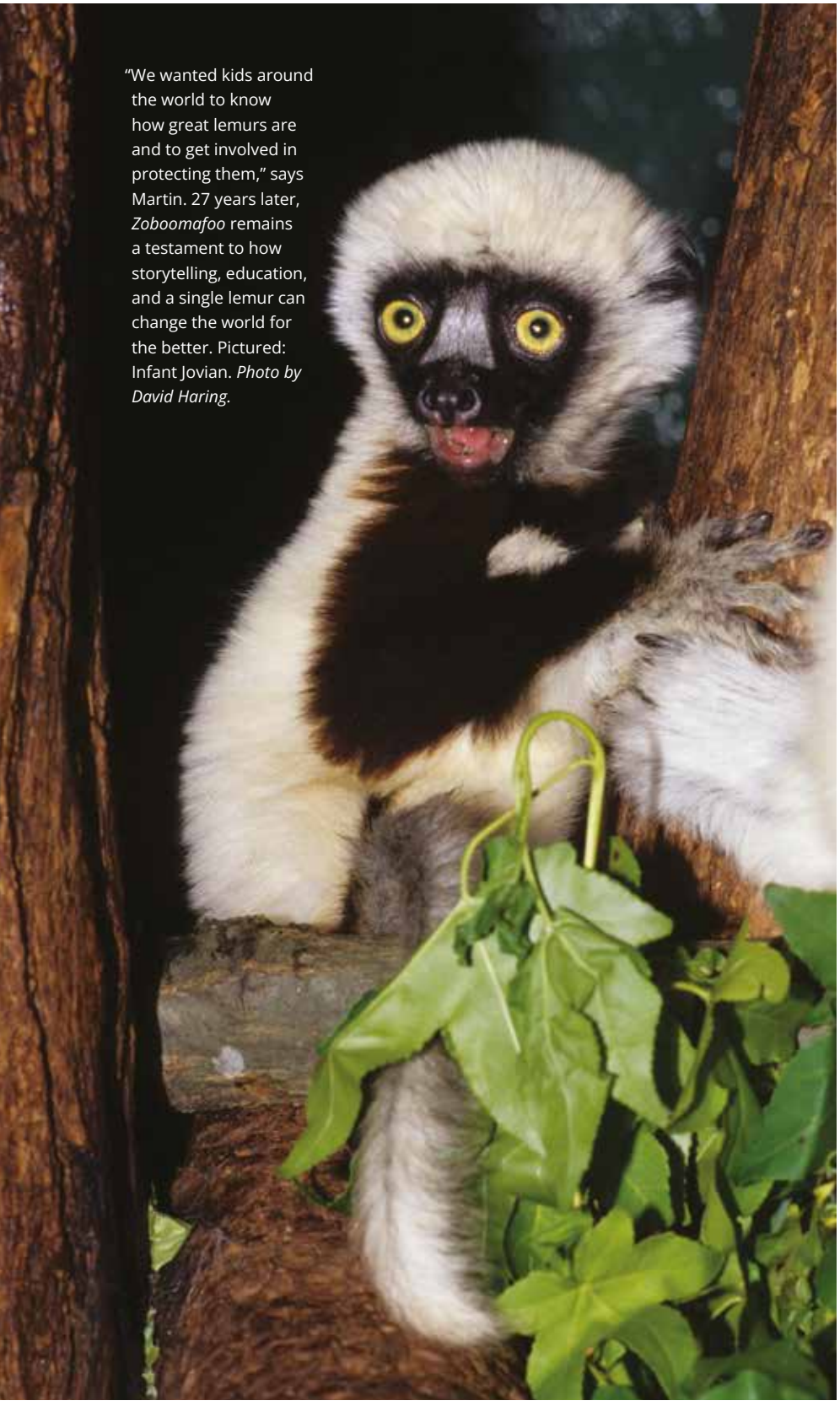
How Jovian Leapt into Hearts and Inspired Generations

By **MATTHEW BURKHART**,
Communications and Education Assistant
Undergraduate, North Carolina State University

With **MARTIN KRATT**, Duke '89

Few animals have inspired children and conservationists alike as profoundly as Jovian, the Coquerel's sifaka who brought primate conservation into living rooms around the world as the star of the children's television show *Zoboomafoo*. Born in 1994 at the Duke Lemur Center, Jovian's charm and playful energy captivated audiences and made him an enduring symbol for Earth's most endangered mammals.

"We filmed Jovian at the Duke Lemur Center in a specially constructed enclosure with one-third of the Animal Junction set inside," says Martin. "It was a great month of hanging out with this very lovable lemur. Don't forget that his mom Flavia and his dad Nigel were always on set too, and sometimes they took their turn in the role of Zoboo! If you look closely, you might be able to tell; but the main star was Jovian, and he was such a sweet guy." *Photo courtesy of the Kratt Brothers Company.*



"We wanted kids around the world to know how great lemurs are and to get involved in protecting them," says Martin. 27 years later, *Zoboomafoo* remains a testament to how storytelling, education, and a single lemur can change the world for the better. Pictured: Infant Jovian. *Photo by David Haring.*

THE SHOW THAT EXPOSED THE WORLD TO LEMURS

Zoboomafoo debuted on PBS Kids in 1999 with a fresh, innovative format combining live animals, puppetry, and education. Co-created by brothers Martin and Chris Kratt, the show highlighted Jovian as a lovable, inquisitive lemur co-host alongside the Kratts. Its 65 episodes not only entertained, but also opened doors for children worldwide to engage with wildlife and conservation. The brothers' decision to star a Coquerel's sifaka, a charismatic lemur with an expressive face and bipedal sideways hopping, helped create an unforgettable character.

"We're so happy that so many kids have connected to animals, nature, and science through *Zoboomafoo*," says Martin. "We hear pretty often from people who credit the show for inspiring them to pursue career paths in science and conservation."

The Kratt brothers were inspired by the Duke Lemur Center's research and conservation efforts, which made it possible to showcase lemurs authentically. Martin notes that prior to the show, most people had little awareness of lemurs, much less the breadth of diversity found in Madagascar. Through storytelling and Jovian's charm, they created a lasting emotional connection with audiences.

"Kids understand and retain information the best when it's presented within a story," Martin says. "And when you have a lovable lemur like Jovian, aka Zoboomafoo, as a main character, it becomes a great way to engage kids and introduce them to all the amazing animals with whom we share this planet."

Jovian was born at the Lemur Center in 1994. As a young adult, he became famous as Zoboomafoo—the leaping, prancing co-star of the PBS Kids show by the same name. *Photo by David Haring.*

JOVIAN'S FAMILY AND LEGACY AT THE DLC

Jovian was not just a star on screen; he was also a key figure in the Duke Lemur Center's conservation breeding program. Over his lifetime, he sired 12 offspring, contributing directly to the genetic diversity and future of his critically endangered species.

Jovian was born in 1994 to Flavia, a female who had been imported from Madagascar in 1986, and Nigel, who was born at the DLC in 1972. When the Kratt brothers visited in 1997 in search of a live-action co-star for their show, Jovian and his family's playful personalities and ease with people made them an obvious choice—a perfect fit for the role of "a little leaping lemur who liked to bounce and play." For weeks, cameras captured Jovian's leaps and gentle interactions on set, infusing the on-screen Zoboomafoo with his real-life curiosity and grace.

"I remember Jovian was very inquisitive and interactive," recalls Martin. "And his hands were so soft when he took a garbanzo bean from you at the pedestal where he'd snack."

Chris Smith, coordinator of current science programs at the North Carolina Museum of Natural Sciences and former keeper and education manager at the Lemur Center, was Jovian's secondary keeper and guided guests to see Jovian and his family on tours.

Chris remembers Jovian most for his exceptional love of peanuts and his calm and submissive demeanor, which he credits for Jovian's success as the long-term mate to Pia, with whom he had nine offspring.

"Pia was bigger than all the other members of the family; she was strong, and she was strong-willed," Chris says. "And Jovian was down there, kind of like a thinner old man lemur, and he was just trying to keep it all chill… He used to be on TV, but in this hierarchy, Jovian was at the bottom, and I'd say he played the part well."

Britt Keith, longtime DLC colony curator and Jovian's primary keeper, remembers Jovian most for his role as a father.

"He was wonderful with the babies," says Britt. "They would ride on him, and he would get annoyed with them once they were starting to be weaned because they wouldn't get off. He would nip at their hands on his shoulders, and they wouldn't let go! He would just give up when he couldn't reach right around his back."

Of Jovian's direct descendants, daughter Gisela (13), son Ferdinand (12), grandsons Silas (4) and Arcadius (1), granddaughters Francesca (10) and Cassia (5), and great-grandson Radama the Great (9 months) live at the Duke Lemur Center. Other family members have been moved to AZA-accredited zoos across the country and Europe, particularly in Germany, to diversify the genetics of the species worldwide.

Jovian's contributions extended well beyond public engagement. His calm temperament and comfort around humans made him ideal for a range of non-invasive behavioral and physiological studies. The DLC's Director of Research, Erin Ehmke, Ph.D., says that Jovian participated in 17 projects during his lifetime and 10 projects post-mortem.

She noted his involvement in cognitive studies, a surprise given that sifakas are not generally studied for their intelligence. Jovian also helped researchers study gut microbiomes and stress responses, revealing insights critical to captive care and conservation.

Erin remembers Jovian for his unique eye color, as most Coquerel's sifakas have yellow-orange eyes.

"I'll always remember his brilliant silvery green eyes," she says.

Chris (left) and Martin (right) Kratt with Jovian in their portable "Animal Junction" set onsite at the Lemur Center. Martin is a Duke alumnus and became involved with the DLC during his time as a student. "The truth is," says Martin, "*Zoboomafoo* would never have happened without the Duke Lemur Center and all the great researchers like Elwyn Simons, Pat Wright, and Ken Glander, who helped us and worked in lemur conservation at Duke and in Madagascar." *Photo courtesy of the Kratt Brothers Company.*

ZOBOO MADE LEAPS AND BOUNDS IN MAKING LEARNING FUN

Ethan Moore, a professional educator at the DLC, grew up watching *Zoboomafoo* and was a self-proclaimed "big PBS kid." He believes part of what made the show so impactful was the excitement the Kratt brothers shared for lemurs.

"They were just a blast to listen to, the level of energy and excitement they had," says Ethan. "You could hear the true love and appreciation they have for the animals. They were having a great time."

The Kratts' excitement came easily, thanks to the sifakas' spunky nature.

"Of all the lemurs I've worked with, sifakas are the most expressive and playful," Ethan says. "People are drawn to them."

Visitors to the DLC often react with delight when they realize they are seeing the real-life Zoboomafoo. Ethan noted that millennials and older Gen Zs, those who grew up watching the show, are particularly excited. "Guests squeal with excitement, saying things like, This is his grandchild! This is his daughter!'" For many guests, the connection to *Zoboomafoo* makes lemur conservation feel more immediate and personal.

THE DAY THE WORLD SAID GOODBYE

The news of Jovian's death in November 2014 sent shockwaves well beyond the Duke Lemur Center, quickly reaching fans around the world. Within the DLC itself, the sadness was palpable, with keepers and staff reflecting on the end of an era for one of their most significant animal ambassadors.

Preparations for announcing his passing showed just how much Jovian meant to people everywhere. As Chris, who managed the Center's social media at the time, recounted, the staff anticipated overwhelming interest.

"We knew that when we said, this animal has passed away, we were going to make headlines. Just intuitively, this is a story that a lot of people are going to see and pick up on," he recalls.

The Center worked closely with Duke's communications team to carefully craft a public response, drafting an obituary, staging press releases, and preparing social media posts so that admirers worldwide could mourn and celebrate Jovian's legacy.

The public response was immediate and intense. So many people flocked to the Lemur Center's website

to read the obituary and share condolences that the server crashed almost instantly, prompting staff to temporarily redirect visitors to the Duke University homepage just to handle the flood of traffic. Messages came pouring in from across the globe as parents, scientists, and children who had grown up with *Zoboomafoo* sent tributes and recalled moments of discovery sparked by the PBS show and Jovian's joyous leaps.

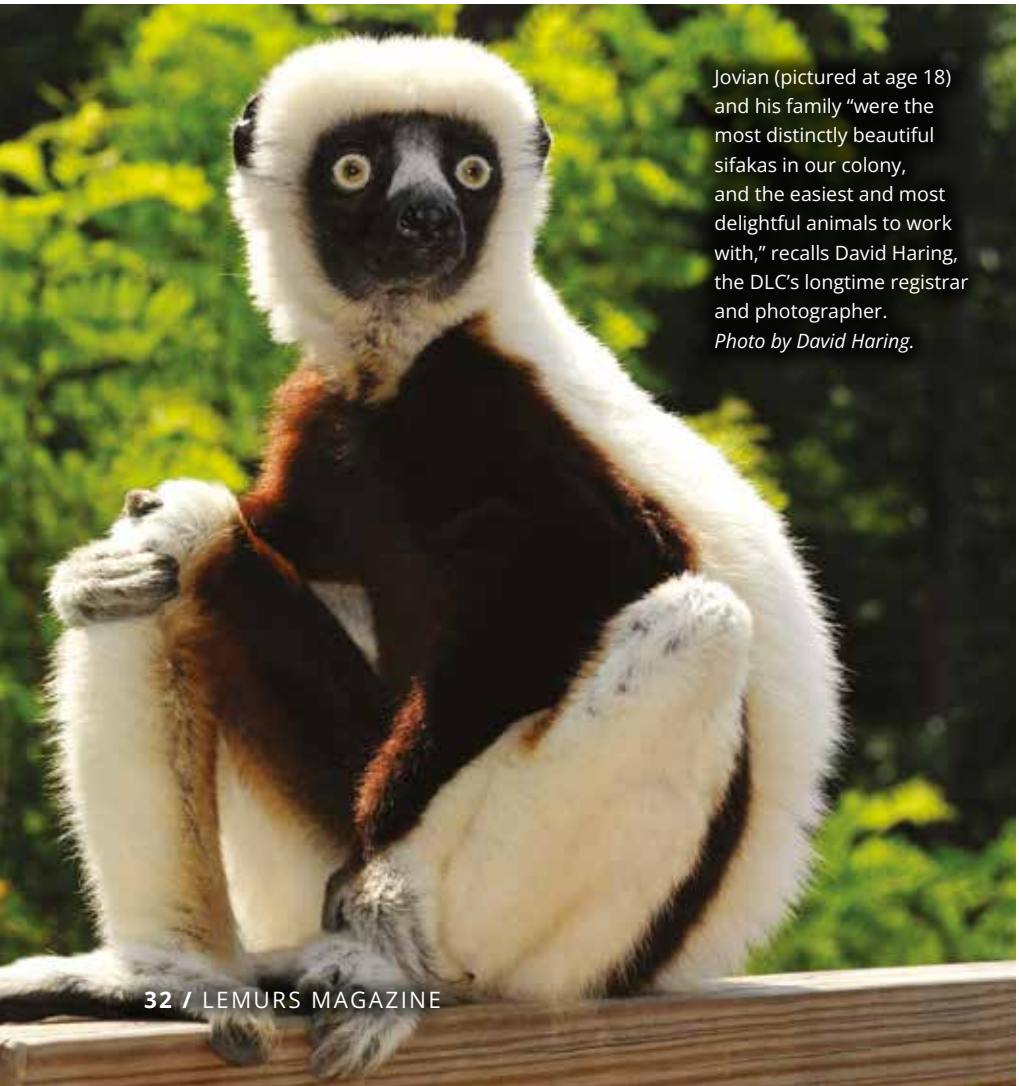
Those who worked most closely with Jovian spoke about the mixture of grief and gratitude.

"Every lemur that you lose breaks your heart," says Chris. "The Coquerel's sifaka has a special place in everyone's minds because the Lemur Center puts so much special attention into their care, because they're such a specialized animal."

Jovian's passing did not mark the end of his influence. The DLC, and its extended network of educators and fans, continues to see the ripple effects, both in the enduring "Zoboomafoo moment" that greets visitors each day as they see Jovian's descendants and in the ongoing work to protect lemurs and their habitats for future generations.

MEDIA, CONSERVATION, AND JOVIAN'S BROADER INFLUENCE

For keepers, educators, and visitors, Jovian has always been more than just a famous face. "His day job was being a lemur at the Duke Lemur Center. His side project was being a TV superstar," Ethan said. After his passing, he "rose to legendhood," with staff noting that his fame grew as newer generations of keepers and educators arrived.



Jovian (pictured at age 18) and his family "were the most distinctly beautiful sifakas in our colony, and the easiest and most delightful animals to work with," recalls David Haring, the DLC's longtime registrar and photographer. *Photo by David Haring.*

The depth of Jovian's influence runs throughout conservation. When asked to quantify his impact, Britt Keith pointed to his unique contributions.

"His level of education to the world, the way he made people aware of what interesting animals Coquerel's sifakas are—this rare, critically endangered species from Madagascar," says Britt. "People didn't know much about lemurs, certainly not the rarer species like the sifakas. Jovian brought that awareness."

Staff members saw firsthand how having a named, real animal was vital for connecting people to conservation.

"Animals that have names and stories do a better job of building empathy for wildlife and for conservation than animals that do not have names and stories," Chris explains. "Which doesn't mean we anthropomorphize, but having a mascot seems to matter."

ME AND YOU AND ZOBOOMAFOO

The story of Jovian and *Zoboomafoo* endures in every tour, every educational program, and every new lemur born at the Center. The lasting effect of a charismatic character and a story told with authenticity continues to inspire new generations of scientists, educators, and advocates.

"We hoped *Zoboomafoo* would inspire kids to help endangered species throughout their lives," Martin Kratt says.

With Jovian's family thriving and new generations still drawing inspiration from *Zoboomafoo*, the Duke Lemur Center remains not just a place of non-invasive research, but a living testament to how storytelling, education, and a single lemur can change the world for the better.

Just as every *Zoboomafoo* episode ended: "Go make an animal friend today!"

Q+A WITH MARTIN KRATT

LOOKING BACK, WHAT DO YOU THINK IS THE BIGGEST IMPACT *ZOBOOMAFOO* HAS HAD ON PUBLIC ATTITUDES TOWARD LEMURS?

Back in the 80s and 90s, lemurs weren't really known to the general public. I worked as a lemur caretaker at the Duke University Primate Center (that's what the Lemur Center was called back then!) as a student in the late 80s, and that's when I was first introduced to this unique animal group. Then in 1992, Chris and I spent a year in Madagascar filming lemurs, camping across the island in the habitats of indri, aye-ayes, ring-tails, mouse lemurs, and of course sifakas! So we got to know lemurs very well. After *Kratts' Creatures*, when it came time to create a new show, we knew lemurs had to be a part of it! We wanted kids around the world to know how great lemurs are, and to get involved in protecting them. We're so happy that so many kids have connected to animals, nature, and science through *Zoboomafoo*.

IN THE YEARS SINCE *ZOBOOMAFOO* AIRED, HAVE YOU ENCOUNTERED CONSERVATIONISTS, SCIENTISTS, OR EDUCATORS WHO DIRECTLY CREDIT THE SHOW, OR JOVIAN, WITH INSPIRING THEIR CAREER PATHS?

We hear pretty often from people who credit *Zoboomafoo* for inspiring them to pursue career paths in science and conservation. When we were performing a *Wild Kratts* live show at Iowa State, 15 students from the ecology program came to say hello and told us stories of how much *Zoboomafoo* and *Wild Kratts* meant to them, as well as share that the shows were why they are pursuing their science careers. It's an outcome that means a lot to us.

ARE THERE ASPECTS OF LEMUR BEHAVIOR OR CONSERVATION THAT YOU WISH YOU COULD HAVE HIGHLIGHTED MORE ON *ZOBOOMAFOO* BUT COULDN'T DUE TO TIME, FORMAT, OR AUDIENCE?

We would've loved to do more *Zoboomafoo* episodes, 65 just wasn't enough! But seriously, we're so happy that *Zoboomafoo* had the run that it did. We also continued highlighting lemurs after *Zoboomafoo*. For example, we returned to Madagascar for six episodes of *Wild Kratts* that featured different species of lemurs. I'm really glad we produced *Zoboomafoo* when we did, and in the way we did. I think today, it would be hard to pitch a character created with a mash-up of a real lemur and a puppet, and there'd be a lot of pressure to do it with CGI given all the advances. But the very reason we chose a sifaka lemur as a co-star is because they looked so much like a puppet in the first place! And I think going back and forth between the real lemur and the puppet gave *Zoboomafoo* its charm and has made it such a nostalgic, classic show.

ADOPT GISELA, JOVIAN'S DAUGHTER!

You can symbolically adopt Jovian's daughter, Gisela, through the Duke Lemur Center's Adopt a Lemur program! More than just a cuddly friend, each huggable sifaka plush comes with a code to sign up for an entire year of quarterly updates about Gisela and her family. You'll also receive a complete adoption kit—an irresistibly cute, thoughtfully curated, and educational "gift for good" for yourself or someone you love.

LEMUR.DUKE.EDU/ADOPT

The power of **HOPE** *in action*

HOW THE DLC'S DONORS TRANSFORM HOPE INTO GIFTS THAT FUEL OUR VISION AND IMPACT

By **MARY PAISLEY**, Director of Development

Photo by David Haring

As beautiful as it is to believe in the possibility of something, hope alone isn't enough. At the Duke Lemur Center, hope is an actionable attitude. There are, indeed, many reasons for hope: for the future of lemurs, for the excitement of scientific discovery, for the positive momentum our conservation programs are building in Madagascar, and for the marvelous mix of people and passions that define the DLC.

But it's our donors who transform that hope into purposeful action through their financial support. Thanks to them, we're empowered to do more and be more each year, forging ahead toward bold new goals. Together, we're a part of something important and extraordinary, with the resolve and resilience to make a lasting difference.

We're deeply grateful for annual gifts of all sizes, planned gifts, and legacy commitments that secure our future. THANK YOU to everyone whose support is integral to our work and impact.

Here are just a few examples of how our donors are making a difference.

Why do you support the Duke Lemur Center?

"We're so impressed by the breadth of programs that the DLC has supported for years, both locally and abroad. The DLC's efforts on the ground in Madagascar have touched our hearts. The Lemur Center works to not only educate all age groups on the importance of protecting lemurs and the environment, but also to improve the health and welfare of individuals and communities through access to healthcare and by conducting workshops on high value crops, sustainable farming practices, safer methods for cooking, reforestation, and nutrition."

"Before I retired, I flew from Los Angeles to Raleigh-Durham every six weeks for about 10 years. Knowing how much I love lemurs, one of my North Carolina colleagues told me about the Duke Lemur Center. Upon my first visit to the DLC, I was smitten. I found the Madagascar and NC conservation mission, the facility itself, and the dedicated staff to be amazing. I donate annually and made a legacy donation because I am a staunch supporter of conservation and I simply love lemurs."

"We established our first planned legacy gift to the Duke Lemur Center in 2021 to support the internship program. As career research scientists and also educators, we want to help enable a wide population of students to learn how to conduct scientific research and gain vital skills and experience which allows them to pursue careers in conservation and environmental stewardship."

"We support the DLC because we consider it the preeminent lemur conservation organization in the US. We visited Madagascar to see the lemurs, fell in love with them, and decided we would like to contribute to their survival. We are particularly impressed with DLC's work in Madagascar."

"I support the Lemur Center because of the major roles it plays in providing a path to preserve the long term genetic viability of lemurs, and its work to help protect habitat in Madagascar. And, there are few places more rewarding to visit!"

"My daughter began college during the pandemic and I'll never forget the profound sense of hope and gratitude I felt when the DLC reopened for private tours. Visiting my daughter at Duke for the first time and seeing those lemurs in person was a sign that the world was still turning."

"I love lemurs, our environment, and the Malagasy people. I can help all at once very efficiently and effectively by donating to the DLC-SAVA Conservation project. Even a small donation can help preserve the natural environment for lemurs and also help needy families in Madagascar for many years."

"Our favorite part of the DLC (besides the lemurs, of course!) is the staff. They take care of the lemurs as well as advance science and research in Madagascar. We are so grateful to everyone who took care of Aristides as he aged and work to keep all the lemurs happy, healthy, and enriched."

"All throughout my childhood I was infatuated with lemurs. In 2017, I finally was able to visit for the first time and we spent three weeks traveling throughout Madagascar... Not nearly enough time. It is the most fabulous place on Earth and dear to my heart. The work the DLC is doing to save it is appreciated."

"I began donating to support the DLC's leadership and commitment to biodiversity, and to deep scientific research and conservation efforts on the ground in Durham and in Madagascar. The DLC is unique in the world outside of Madagascar. It is not a zoo."

"My first donation was in 1986 when I was just out of vet school. We were paying back student loans and saving money to buy a house, but I knew the DLC needed it more than we did. I love lemurs and haven't stopped giving since."

"I support the Lemur Center because by nature, I am an animal lover; and because my uncle did some of the original lemur research in Madagascar during the 1930s."

Jonia Rasolofoniaina, D.V.M.

2025 DLC-Madagascar Veterinary Intern

Advancing Conservation Medicine in Madagascar

I AM Jonia Herizoa Rasolofoniaina, a veterinarian from Madagascar, born in Ambatondrazaka to a family originally from Antananarivo. I graduated from Veterinary School at the University of Antananarivo in 2013 and currently lead conservation and research initiatives at Anjajavy Lodge and within the Anjajavy protected area in the northwest part of Madagascar.

My professional journey bridges scientific research, rural development, and wildlife conservation, reflecting a strong commitment to sustainable development, animal health, and biodiversity protection.

I completed my veterinary thesis on the seroprevalence and risk factors of Rift Valley Fever in Madagascar

The DLC's **Malagasy Veterinary Internship Program** is a grant-funded program that enables us to host talented Malagasy veterinarians at the Duke Lemur Center for three months' intensive training in various aspects of lemur medicine. Thank you to the FS Foundation for making this program possible! Pictured: Jonia Rasolofoniaina, D.V.M., in the examination room of the Anna Borruel Codina Center for Lemur Medicine and Research. *Photo by Sara Sorraia.*

"[MY TIME AT THE DLC] HAS INSPIRED ME TO APPLY CONSERVATION MEDICINE PRINCIPLES IN MADAGASCAR, FOCUSING ON LEMURS, TORTOISES, AND BROADER BIODIVERSITY INITIATIVES."

(2010–2011), contributing to a better understanding of zoonotic disease dynamics in tropical environments. Between 2014 and 2023, I collaborated with AVSF (Agronomes et Vétérinaires Sans Frontières) on food security and rural livelihood enhancement projects, supporting agro-pastoral communities through improved animal health and sustainable agricultural practices. In 2018, I joined the Turtle Survival Alliance (TSA) Madagascar as an associate veterinarian, participating in wildlife rescue and rehabilitation of critically endangered tortoises confiscated from illegal trade.

Since 2023, I have been responsible for ecological monitoring of animal species in the Anjajavy protected area. I lead two flagship conservation projects: the rewilding of Anjajavy with giant tortoises, and the conservation of the Angonoka tortoise, the rarest tortoise species on the planet. Future initiatives include translocation and reintroduction of the aye-aye and ecological monitoring of fossa populations. (The fossa is Madagascar's largest carnivorous mammal.) These programs integrate animal health, ecological research, and ecosystem management, reflecting a holistic conservation approach.

My passion lies in conservation medicine, which explores the intersections of animal health, environmental stewardship, and biodiversity through a One Health lens. My internship at the Duke Lemur Center has been a pivotal experience, deepening my understanding of wildlife health, primate research, and ecosystem balance. This has inspired me to apply conservation medicine principles in Madagascar, focusing on lemurs, tortoises, and broader biodiversity initiatives.

Looking ahead, I aim to pursue a master's or Ph.D. in conservation medicine to strengthen my research expertise and actively contribute to biodiversity conservation in Madagascar and internationally.

A family of critically endangered Coquerel's sifakas, including a mother with her infant, forages in a baobab tree within the Anjajavy protected area where Dr. Rasolofoniaina works. *Photo by Sara Sorraia.*

DREAMING BIG
FOR MADAGASCAR CONSERVATION

The Lemur Center looks to the future

By **JAMES HERRERA, Ph.D**,
Director of Conservation

When I joined the DLC as Program Coordinator for the DLC-SAVA Conservation project in 2019, I'd just finished my second postdoctoral fellowship following a decade of lemur research for my Ph.D. The DLC-SAVA Project Coordinator, Lanto Andrianandrasana, and the Lemur Center's longtime Conservation Coordinator, Charlie Welch, briefed me on the dozen ongoing projects—all of which centered on communities and local partnerships—and I immersed myself in them. I learned who our partners were and what our collaborations entailed. And by applying my research from social network analyses, I saw gaps that could be bridged for building stronger networks. By bringing diverse actors together, like the regional university and the Madagascar National Parks service, I started to see how the Lemur Center could be a catalyst for new directions in conservation.

TOP: Charlie Welch (middle) initiated the SAVA Conservation program in 2011 with Lanto Andrianandrasana (right), and James Herrera (left) will continue the mission as Director of Conservation.

BOTTOM: The silky sifaka (*Propithecus candidus*) is one of the rarest primates on earth, with the few remaining individuals mostly found in the remote rainforests of northeast Madagascar. *Image by Riccardo Morrelas.*

In 2022, after being sidelined in the U.S. for two years during the Covid-19 pandemic, I began spending 10 months every year in Madagascar helping run our projects. I'm so proud of what our teams have accomplished in just a few years.

We've spent weeks on missions to remote forests and villages where we studied lemurs, farming, food security, nutritional health, and more.

We've expanded our education program, reaching over 100 schools and 10,000 students.

Our reforestation program started by planting 60,000 trees in 2021, and today more than 350,000 trees on over 500 acres have been restored. The trees we planted in 2021 are flourishing, some already 15 feet tall!

In 2019, we trained a cohort of 50 farmers in sustainable agriculture, and today we have more than 2,500 farmers engaged in our growing network.

More than 9,000 women in more than 40 communities have benefited from our reproductive health program, with regularly scheduled visits ensuring that women receive follow-up care.

More than a dozen Duke University students have been engaged in our projects, with four completing master's degrees and one recently earning her Ph.D.

I assumed the role of Director of Conservation in 2025, and looking forward, I am beaming with optimism. I see a new era in the future for the Lemur Center's impacts in Madagascar. My vision is to demonstrate that our projects are scalable, transferrable, and transformative. We will continue to forge consortia that bring together diverse actors to synergize activities and reach our common conservation goals.

The network of farmers we created is having a snowball effect: Farmers are teaching their neighbors and creating their own cooperatives. Interns we trained in previous years have created their own social enterprise, focused on training farmers and creating equitable value-chains. Students we've taught have created environmental clubs that practice what they've learned and create school gardens, fish farms, and more.

This kind of self-sustaining progress is only possible because of our deep commitment to community-driven conservation: The communities own the projects and steer the directions, and we provide support. We're focusing on what we're doing *right* and building on this positive momentum. Daring to dream big, we are confident that the future holds bright promise for the Duke Lemur Center's role in Madagascar conservation.

TOP: The Duke Lemur Center team at our headquarters in in Sambava.

BOTTOM: Trees we've planted since 2021 are flourishing, restoring ecosystems for people and lemurs.

The DLC's conservation projects in Madagascar are funded entirely through grants and donations, so your contributions turn our conservation dreams into realities. Please consider supporting us with a tax-deductible donation today!

LEMUR.DUKE.EDU/DONATE

FROM LEMURS TO LIFT-OFF

LEMURS ARE LAYING THE GROUNDWORK FOR INTERSTELLAR TRAVEL

After astronauts wake up from hibernation, will they still be able to drive the spacecraft? DLC researchers are studying lemurs to find out

By **SUSAN MILLER**, Science Writer, Duke University | Photos by **DAVID HARING**

From fairy tales—such as Sleeping Beauty and Rip Van Winkle—to science fiction films, including Planet of the Apes and Alien, people have long been fascinated by the concept of humans undergoing prolonged periods of sleep.

For Ana Briet, Ph.D., the fascination started with her studies of body temperature regulation and hibernation. Her early research focused on bats, which can double their weight before entering a months-long hibernation state. A year ago, when she joined the Duke Lemur Center as a research scientist, she began studying fat-tailed dwarf lemurs.

"Being able to study hibernation in the closest relatives to humans able to hibernate is an incredible opportunity," says Ana, who, along with Duke Lemur Center colleagues, received a $30,000 NC Biotech Flash Grant to study hibernation at warmer temperatures.

While many space films have depicted humans in cryogenic tubes during long space flights, in reality, this kind of "synthetic hibernation" would lead to numerous health-related challenges, including a loss of cognitive function.

To preserve cognitive function, inducing synthetic hibernation in humans will likely require temperatures warmer than those seen in traditional cold-weather hibernation. That's where lemurs come in.

LET THE HIBERNATING BEGIN

The DLC houses the only breeding colony of fat-tailed dwarf lemurs within human care. All research conducted at the Lemur Center is non-invasive. It has two state-of-the-art hibernacula rooms, which each hold up to 10 hibernating lemurs and allow researchers to control the ambient temperature and mimic Madagascar's light cycles. The annual change in light cycles is a reliable signal for hibernating animals to prepare for winter. Respirometry equipment measures metabolism, while radio collars track skin temperature.

Researchers hypothesize that hibernating at warm temperatures—warm enough to maintain important homeostatic processes and cognitive function but cool enough to save energy—is essential for the success of long-duration space exploration missions.

Hibernation by humans in space would serve several purposes: It would reduce the amount of food or water required, require far less oxygen (because respiration during hibernation is significantly

Imperceptible brain activity

Respiratory rate drops from **60 breaths** per minute to **less than 1**

EFFECTS OF HIBERNATION

Core temperature drops from **98° to just 2°** above ambient temperature

Heart rate drops from **300 beats** per minute to **only 8**

BENEFITS OF HIBERNATION BY HUMANS

1. Reduce the amount of food and water required on missions
2. Require far less oxygen, since respiration during hibernation is signifantly lower
3. Prevent muscle and bone deterioration
4. Cut down on boredom or loneliness during extended space voyages

less), prevent muscle and bone deterioration, and cut down on boredom or loneliness during extended space voyages.

While hibernation has long been studied in rodents such as ground squirrels, no primate or tropical mammal was documented as being able to hibernate—until 2004, when German researchers published a study in *Nature* detailing how fat-tailed dwarf lemurs spend up to seven months in tree holes hibernating. As their name suggests, these lemurs store fat in their tails, which can make up to 40 percent of their total body weight.

During hibernation, fat-tailed lemurs enter periods of energy conservation called torpor, which involves a significant reduction in metabolism, heart rate, and breathing, resulting in body temperature that matches ambient temperature. These are broken up by active rewarming phases known as interbout arousals, short temporary periods of normal metabolic levels that interrupt prolonged periods of hibernation.

"So, we know the basis of mammalian hibernation," explains Ana. "But we need to know specifically how that will translate into humans. And dwarf lemurs are this primate, this intermediate step, to looking at how it could work in humans."

COMPARING TEMPERATURES

Like many animals that hibernate, fat-tailed dwarf lemurs do so because of a lack of available food. For them, that's during the dry season in Madagascar. At the Lemur Center, the animals will go into hibernation toward the end of October or early November, until March or April.

Ana's research compares two groups: One group experiences extreme daily temperature swings, while the other remains in a more stable environment. Hibernating mammals need to rewarm periodically. Lemurs in the room where temperatures fluctuate between 53 and 89 degrees Fahrenheit can passively rewarm each day, saving energy. Those in the stable room, where temperatures range from 64 to 71 degrees Fahrenheit, must actively rewarm, spending more energy and burning through fat reserves.

COMPARING LEMUR POPULATIONS

Ana is also interested in how immune function and inflammatory responses are affected by hibernation. To determine whether these and other homeostatic processes are shut down during certain points during the hibernation season, Ana is working with researchers across the country. This research will tell us whether lemurs (and potentially humans) could get sick while hibernating.

To ensure the lab-based findings reflect natural behavior, Ana's team is running a concurrent field study in Madagascar during the island's dry season. Antonin Andriamahaihavana, a Ph.D. student at the University of Antananarivo in Madagascar, is partnering with the Duke Lemur Center to study wild dwarf lemurs in their native habitat, collecting energetic data in naturally fluctuating environments. This fieldwork helps validate the lab

results and ensures the research isn't just observing the hibernation traits of lemurs in human care.

Cognitive testing is another aspect of the study. One of Ana's collaborators, Brendan Johnson, D.V.M., Ph.D., a DLC veterinarian and primate cognition researcher, is leading memory and problem-solving testing. Lemurs are given small puzzles to solve, often motivated by a treat like half a craisin. Their performance is scored based on how many levels they complete and how quickly they solve each task. These tests are repeated after hibernation to assess changes in cognitive function. The guiding question: "After astronauts wake up, are they still able to drive the spacecraft?"

Ana's research program is building on foundational work conducted by previous Lemur Center researchers. The infrastructure, protocols, and baseline data they established allowed Ana to step in and immediately begin asking high-impact questions. In the past, researchers could only measure skin temperature. Now, she can determine how much energy is spent at different temperatures and during periods of arousal.

"If they hadn't started the hibernation program here, I wouldn't be able to conduct the research that I do," says Ana. "It allows me to build off questions they've already asked. And I can add different layers to it that make it even stronger."

What began as a curiosity about body temperature has evolved into a mission to help humans sleep their way to the stars—guided by the rhythms of tropical lemurs, the precision of modern science, and the power of interdisciplinary collaboration.

Researchers hypothesize that **hibernating at warm temperatures** — warm enough to maintain important homeostatic processes and cognitive function, but cool enough to save energy — **is essential for the success of long-duration space exploration missions**.

The field of hibernation is *hot, hot, hot*

And dwarf lemurs are the hottest topic of all

By **ANA BREIT, Ph.D.**, Research Scientist at the Duke Lemur Center

WHEN PEOPLE THINK of hibernation, they tend to picture animals in dens deep beneath a layer of snow, waiting out the winter. But this is just one example of what hibernation can be.

Although traditionally focused on arctic and temperate species, today the field of hibernation is *hot, hot, hot*—figuratively and literally. And because dwarf lemurs are the closest relatives to humans capable of hibernation, they're the hottest topic of all.

When people think of hibernation, they think of cold weather

Traditional views of hibernation are based on studies conducted predominantly in North America and Europe. Marmots, bats, and ground squirrels all hibernate during the harsh winter months. To survive without eating or drinking, these small mammals greatly reduce their metabolic rates (the rates at which they convert food into energy), which allows their body temperatures to drop drastically, often reaching or hovering slightly above ambient temperature.

Unlike cold-weather hibernators, Madagascar's tropical hibernators save huge amounts of energy by passively warming their bodies on warm days or when temperatures rise in the afternoons. Pictured: Ana with a tenrec, a Malagasy hibernating mammal. *Photo courtesy of Ana Breit.*

Traditionally, hibernation research has focused on cold weather species in North America and Europe, such as marmots (pictured), bats, and ground squirrels. Hibernation in these animals is punctuated by brief but energetically expensive periods of rewarming, called interbout arousals. *Photo licensed from Wirestock Creators.*

Take bats, for example. During winter, a bat's body temperature drops to around 39°F, the temperature of the cave where it hibernates. The bat stays in this lowered metabolic state, called a **torpor bout**, for a few days or weeks. Then, its body spends energy rewarming for a short period of time (about 24 hours) before dropping back down into a torpid state. This brief period of rewarming is called an **interbout arousal (IBA)**. The bat's body temperature continues this torpor–interbout arousal pattern for the entire winter, until its body rewarms and the bat flies from the hibernaculum in the spring.

Because IBAs are where most of the hibernating animal's energy budget goes, it was thought that they must play a critical role in hibernation. Researchers are still debating what role: to flush waste? to restore sleep? to repair cellular damage? Why else would an animal engage in a process that is so energetically expensive?

For a long time, researchers thought that small hibernating mammals needed to have regular, active (energetically expensive) arousals to sustain their bodies through their winter hibernation. But that changed when we took a closer look at Madagascar.

Why tropical hibernation is so cool (er, hot)

Today, we know that hibernation doesn't just happen in cold environments. It happens in the warmer tropics, too! Tropical hibernators, like Madagascar's tenrecs (small hedgehog-like and shrew-like mammals) and dwarf lemurs, enter months-long hibernation periods not because of extreme cold, but

Dwarf lemurs, the closest relatives to humans capable of hibernation, hibernate at warm temperatures—likely a key component to human synthetic hibernation. *Photo by David Haring.*

because of the dry season and its accompanying reduction in food and water availability.

The most exciting part of this discovery is that unlike North American and European hibernators, these Malagasy hibernators don't seem to need active, energetically expensive IBAs to warm their bodies. Why not?

During Madagascar's dry season, temperatures can fluctuate widely, peaking at temperatures nearing dwarf lemurs' and tenrecs' active body temperatures. In the wild, hibernators need to have an IBA only when the temperature is below 86°F for multiple days in a row—something that always happens during the cold winters of higher latitudes but is much rarer in the warm tropical winters. In the tropics, on warm days or when temperatures rise in the afternoons, hibernating mammals can passively rewarm with the warming air, thus effectively getting a warm internal body temperature for "free."

This is vital, as it saves the animal a huge amount of energy.

My research at the DLC

Early hibernation research relied on measuring the difference between body temperature and ambient temperature to infer the depth of an animal's hibernation; but this method was unable to show the true energetic cost of each IBA. Was the animal's body doing the work of warming itself, or was it just riding the wave of the warm afternoon temperatures?

Today, using respirometry (measuring an animal's breath composition), we can quantify the caloric cost of every minute of an animal's hibernation.

At the DLC, we analyze the breath composition of each hibernating lemur by pulling the air from the nestbox into an oxygen and carbon dioxide analyzer, allowing us to measure how much oxygen the

By conducting both lab and field studies, researchers at the DLC can answer questions ranging from broad population-level inquiries like "Who?" and "When?", down to cellular-level questions like "How?" and "Why?" Pictured: Ph.D. candidate Antonin Andriamahaihavana and the research team humanely trapping wild dwarf lemurs in the Anjajavy forest (below). A wild dwarf lemur settles in for hibernation season at the Anjajavy Field Station (left). *Photos by Miriam Gordan.*

During hibernation, each dwarf lemur is given a nestbox (pictured, held by Ph.D. candidate Antonin Andriamahaihavana) outfitted with a camera taking regular screenshots and videos for behavioral analysis, a small tube drawing air from the nestbox to analyze the animal's breath composition, and a small temperature sensor to record the hourly temperature of the nestbox. *Photo by Sara Sorraia.*

animal is consuming and how much carbon dioxide it is producing. By comparing those values to baseline air composition, we can quantify the VO_2, a proxy for metabolic rate. In this way, we can calculate the caloric cost of the entire hibernation period, and even more interestingly, the cost of each torpor bout and IBA that an animal undergoes.

In this way, we've shown that by adjusting the ambient temperature of the hibernaculum, we can passively rewarm hibernators so they never have to actively rewarm during a hibernation season. Instead, the lemurs passively rewarm with the increasing temperatures, which is much less costly in terms of energy.

Why tropical hibernation matters

This research has enormous translational potential for human synthetic hibernation, with applications for both long-duration space missions and for biomedical insights into humans here on Earth.

Dwarf lemurs, the closest relative to humans capable of hibernation, hibernate at warm temperatures—likely a key component to synthetic hibernation. Why? Because primate hibernation was previously assumed to be impossible because of the brain and its high energetic demand. Cold temperatures would entail a myriad of potential complications, such as dysregulation of homeostatic processes (like gene expression and protein synthesis) and extreme reduction in cellular processes, that humans are not adapted to deal with. But dwarf lemurs can hibernate at high temperatures and still achieve huge energetic savings, which may ease those constraints.

During our next hibernation season, our team at the DLC will quantify the energetic costs and savings of hibernation and rewarming periods in different temperature conditions. We'll also investigate immune and inflammatory responses (could astronauts get sick during hibernation?), fat composition (are different fats burned at different points during hibernation?), aging-related processes throughout the hibernation cycle (do warm hibernators live longer?), and cognitive effects of hibernation (after waking from a torpor-like state, will the astronauts still be able to fly the spacecraft?).

Besides its relevance to space travel, hibernation research has broad biomedical implications that could inform therapies for coma management, diabetes, cancer, heart disease, and trauma recovery. If we were able to safely induce torpor in humans, we could mitigate muscle atrophy and pressure injuries in immobilized patients, reduce metabolic demand, and slow disease progression.

Being a research scientist is an incredibly rewarding job. Not only do I get to do ground-breaking research that I get to nerd-out on (don't even get me started on the evolution of endothermy!), but I also contribute to a greater understanding of physiological processes that can inform medical interventions and push the limits on human space travel.

The best part of being a scientist is that each exciting discovery leads to more questions. We'll never stop exploring.

MAKING DATA TALK

BUILDING A COLLABORATIVE FUTURE FOR ZOOS AND MUSEUMS

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

The Duke Lemur Center is home not only to an incredible collection of lemurs, but also to a unique wealth of data. Our combination of osteological, biological, and life history data is a veritable gold mine—but how can a small institution like the DLC make this information usable and searchable for researchers around the world?

Enter the Global Biodiversity Information Facility, or GBIF. GBIF (gbif.org) is an internationally supported repository for biodiversity data. "Typically GBIF is for museums," explains Amanda Mazza, the DLC's data manager and registrar. In Amanda's words, GBIF has typically housed information about "dead things," such as data from fossils and osteological specimens and biosamples collected from cadavers. "The DLC is the first zoological institution to publish data from a living animal collection."

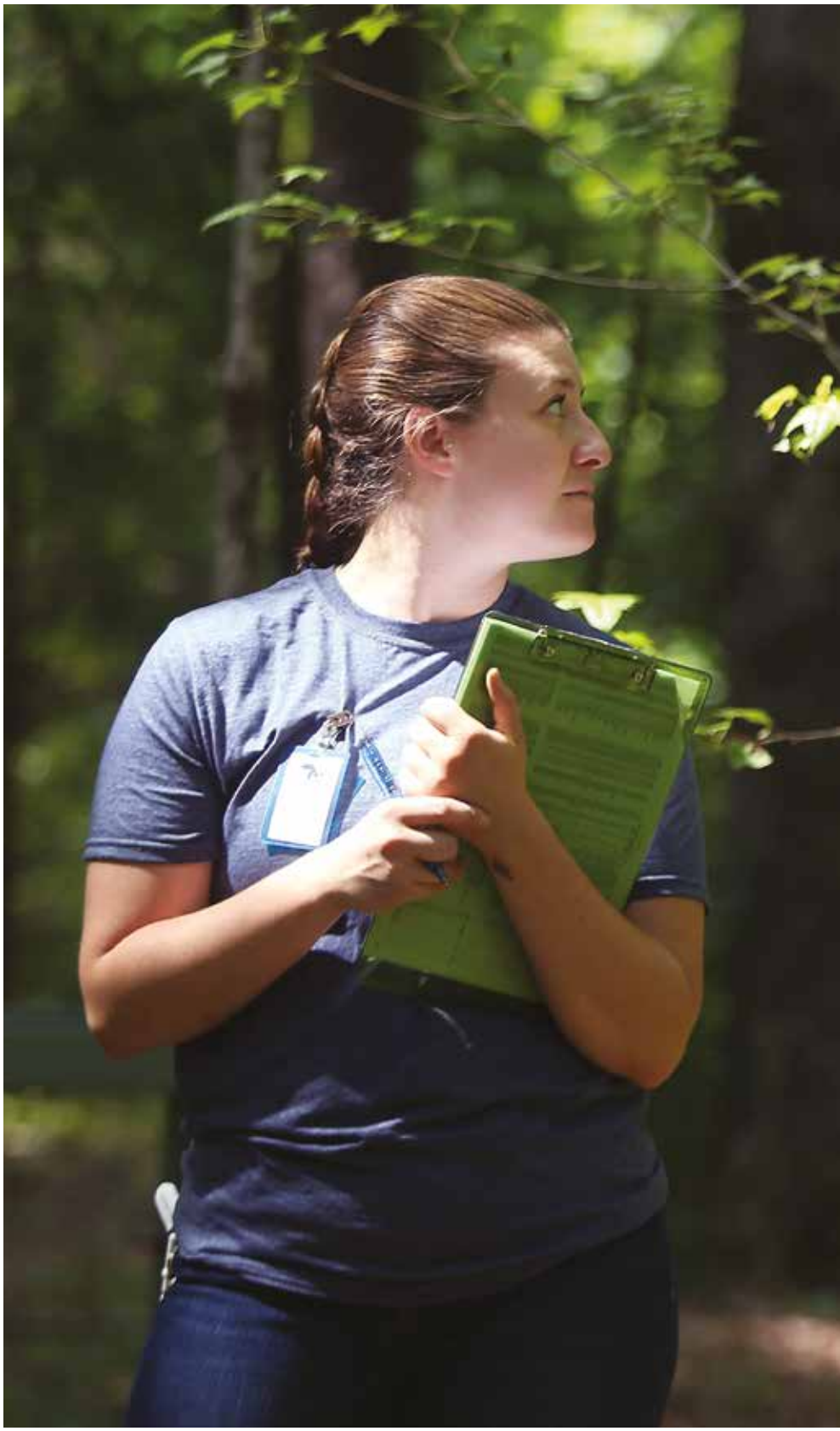
Data from fossils and osteological specimens at the DLC Museum of Natural History (DLCMNH) allow researchers to understand primate evolution, from extant species through deep time to our earliest primate ancestors and beyond. Our biobank of tissue samples and the remains of lemurs who have died from natural causes allows for research spanning from molecules to ecosystems, including genetics and genomics analyses of critically endangered species. Medical and life history data for generations of lemurs from our living colony represent dozens of species, including species newly flourishing in human care because of standards of care developed by DLC staff.

Making any one of these datasets publicly accessible and discoverable would be valuable to the biodiversity and ecological research communities. When brought together, they form a model for sharing data that we believe is the future for zoos, museums, and other research institutions.

Amanda has been collaborating with Kate Neely, the digital collections manager at the DLCMNH, to pair osteological data from deceased animals with life history data from their time in our care: weights, medical history, parentage, diet information, and photographs. Suddenly, a researcher isn't just looking at a CT scan of a lemur; they're looking at the CT scan of Tertulla, a female fat-tailed dwarf lemur (*Cheirogaleous medius*) who was born at the DLC in 1985, traveled to Memphis State University in 1988, gave birth to two infants in 1990, returned to the DLC in 1993, and died at age 21. And they can match that CT scan to historical weight data to know that Tertulla weighed exactly 233 grams at the time of the scan.

"We are adding more data, giving these 'dead things' more power," says Amanda, "because now you

WHEN BROUGHT TOGETHER, [THESE DIVERSE DATASETS] FORM A MODEL FOR SHARING DATA THAT WE BELIEVE IS THE FUTURE FOR ZOOS, MUSEUMS, AND OTHER RESEARCH INSTITUTIONS.



Staff at the Duke Lemur Center observe and record virtually every aspect of an animal's life from birth to death. They know when each animal was born, who her parents were, how fast she grew, what she ate, which animals she mated with, how many offspring she had, and when and why she died. *Photo by Bob Karp.*

have more information about an animal's life."

"It's a way that you can build large-scale research projects and ask the 'big questions,'" adds Matt Borths, Ph.D., curator of the DLCMNH. For example, if a researcher wants to examine the impact of stress on the health outcomes of an animal, they will have access to more than just scans of the animal's body at different life stages. "Where was it in the social hierarchy? How many kids did it have? Do we have cortisol samples from that animal?" This information can supplement physical evidence to build a more detailed picture of the wear and tear that animal's life may have had on their body. As Matt explains, "It's all about making data talk to each other."

By partnering with GBIF, the Lemur Center aims to standardize, curate, combine, and publish our varied data, increasing accessibility and reaching new audiences around the world.

"The DLC is at the forefront of this new model for data-sharing and collaboration between zoos and museums," says Kate. "We want to set the standard and demonstrate to other institutions what is possible."

Customized CARE

UNIQUE SOLUTIONS FOR UNIQUE PRIMATES

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

When caring for the world's most endangered group of mammals, no cure is "one size fits all."

Between 55 and 25 million years ago, the ancestor of aye-ayes and the ancestor of all other lemurs were blown out to sea, drifting across the Mozambique Channel from mainland Africa and landing on the island of Madagascar.

For the next tens of millions of years, in a process called adaptive radiation, these primates diversified and spread across the island, developing different strategies for survival based on geographic region, available resources, and competition. Today, lemurs are a remarkably diverse group of primates: There are more than 100 different species of lemur, in addition to at least 17 species that have already gone extinct.

The Duke Lemur Center houses the most diverse population of lemurs on Earth outside their native Madagascar. Not only are we committed to meeting the needs of the 10 lemur species under our care, every individual lemur—nearly 250 of them!—receives an individualized diet plan, enrichment, and veterinary care. And just like humans, no two lemurs are exactly alike.

From neonatal care to accommodations for our oldest residents, these six individuals highlight the extraordinary measures that the DLC's animal care team takes to ensure that every single animal in our colony receives the highest quality of care.

CIRILLA

RING-TAILED LEMUR Cirilla was born weighing just 37 grams and, at barely half the weight of an average 70-gram infant, is tied for the second smallest surviving ring-tailed lemur birth in DLC history. Her temperature was low, and she had difficulty holding up her head and clinging to mom Alena. Mom and baby were rushed to the Anna Borruel Codina Center for Lemur Medicine and Research and into the ICU incubator.

Veterinary and husbandry staff took turns positioning Cirilla to nurse on Alena every two hours, throughout the day and night. Cirilla also received oral and subcutaneous doses of dextrose and was held against a heat pack to help her maintain an appropriate internal body temperature.

After three full days in the ICU, Alena and her daughter returned to their home enclosure, where they remained under close supervision. Cirilla had gained four grams and was able to nurse without intervention. By four days old, Cirilla's eyes finally opened.

Over a year later, Cirilla has grown into a thriving adult lemur. While she remains small in stature, Cirilla has a big personality and is eager to explore the forest as she free-ranges with her mom, dad, and older brothers.

Photo by Sara Nicholson.

OZMA

WHEN OZMA, a 34-year-old aye-aye, developed a dental abscess on the right side of her jaw, the DLC veterinary team drained and treated it, as usual, with antibiotics. When the infection didn't clear, she was driven to the Veterinary Dental Clinic of North Carolina, where the clinic's owner, Don Hoover, D.V.M, had offered the use of his small animal CT scanner. Dr. Hoover's CT scans allowed the team to visualize Ozma's problem more clearly: She had a major tooth fragment on the right side of her mouth.

After determining that a 3-D print would allow better visualization of the problem and more precise surgical planning, the team met with Chip Bobbert, a Digital Fabrication Architect at the Duke University Office of Information Technology. Bobbert's team agreed to create the model in their 3-D printing lab on campus and soon delivered a prototype to the vet lab, but printing in a single color made it difficult for the veterinary team to see what was tooth and what was bone. So the DLC veterinary team worked with Susan Whitney, who converts CT scans into 3-D printable files, to create an improved two-color model of Ozma's mandible.

The two-color model helped the vets better identify what was tooth, what was abscess, and what was bone. The model was so detailed and true-to-life, it even enabled the vets to determine where to administer lidocaine before making the extraction.

Ozma's heart rate did not increase at all during surgery, indicating that the nerve block had worked and she was feeling no pain. The entire surgery—from placing the anesthesia monitors and the IV catheter, to administering the nerve block, extracting the tooth, instilling the antibiotic gel, suturing the surgery site, and turning off the anesthesia—took only an hour.

Photo by David Haring.

OZMA LOWER MANDIBLE

ARISTIDES

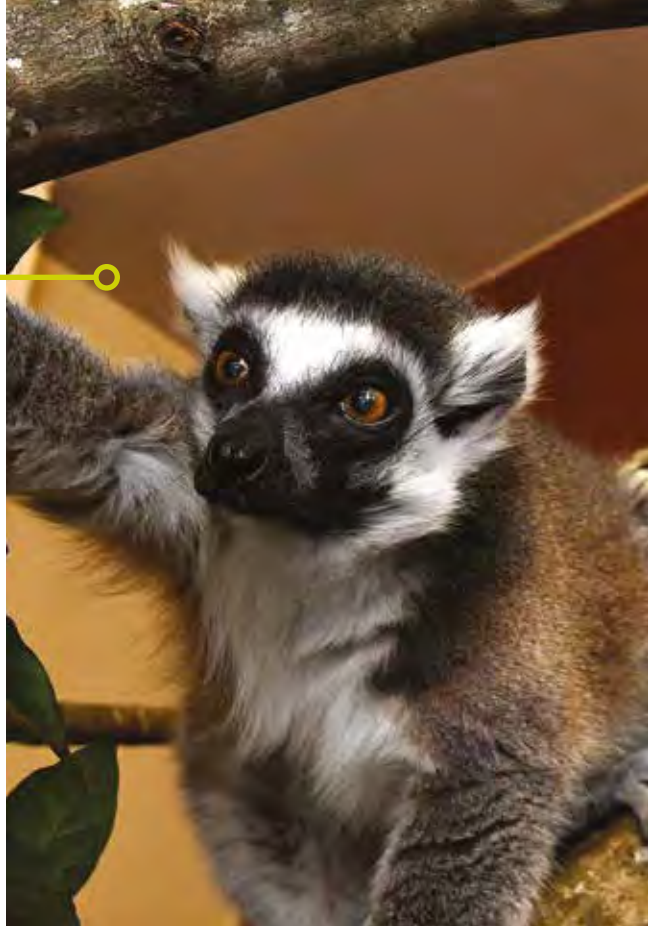


Photo by David Haring.

WHEN IT comes to branching geriatric lemurs' enclosures, the DLC's husbandry technicians need to take extra precautions. Ring-tailed lemur Aristides lived to 32 years old and spent the latter years of his life with degenerative joints, making it more difficult for him to jump and move about his enclosure. Sarah Midolo, one of Aristides's primary caretakers at the end of his life, always considered Aristides's physical limitations when building his structural enrichment.

"I gave him a lot of textured, thick branches so he had something to grab onto," she explains. "I made sure that he had an avenue everywhere and that he didn't have to jump for any of it, that he could just walk along the branches kind of like a big ramp system."

The doors between Aristides's indoor and outdoor enclosures were too high, so she installed mesh and metal ramps to help him transition smoothly between the two environments. Sarah used twice as many zip-ties to secure each of his structures. "I made sure everything was extra supported. I didn't want anything wobbling and him falling."

Photo by David Haring.

KIZZY

20-YEAR-OLD KIZZY, a black-and-white ruffed lemur, has developed arthritis in her hips and elbow. In addition to a joint supplement, Kizzy has begun photobiomodulation therapy with the DLC's veterinary technicians. This laser therapy is a non-invasive treatment that can help decrease inflammation and swelling, speed up healing, and encourage blood flow to the area treated. To the lemur, it just feels like a gentle touch with the warm laser head, and Kizzy participates voluntarily during training sessions.

"Each species of lemur has different qualities that you have to account for in treatments," explains Cat Ostrowski, R.V.T., one of the DLC's vet techs. "Skin color, size, ability to be involved in training… One species may love to be on the ground, so we will train on the ground; but not all species are comfortable at ground level, so we use their natural history to inform us of what positions we can ask for during a training session and then build our treatment sessions around that." Currently, Kizzy receives laser therapy on her hips twice a week.

Photo by David Haring.

MOTMOT

AT 12 YEARS OLD, fat-tailed dwarf lemur Motmot was anesthetized for a veterinary exam when DLC staff noticed that her left nictitating membrane—a third eyelid present in many animals, including lemurs—was thicker and more prominent than normal. The vet team carefully collected a tissue sample, and upon inspection by a pathologist, the suspected diagnosis was cancer (later confirmed to be lymphoma).

To determine whether the eyelid required surgical removal, the DLC's veterinary team consulted with Sophie Rajotte, D.V.M., M.S., DIPL. ACVO., a veterinary ophthalmologist at Animal Eye Care of Durham. The situation was uniquely complicated due to the time of year: Motmot was about to enter torpor. "Animals' slowed metabolic rate during the torpor season means that healing can be slowed during this time," explains DLC veterinarian Julie Ter Beest, M.S., D.V.M., DIPL. ACZM. The team elected to monitor the eyelid rather than attempt surgery and prescribed steroid drops to reduce inflammation.

After a couple of months, it became evident that surgery would be necessary. By this point, the torpor season was ending, and Dr. Rajotte was able to surgically excise the nictitating membrane with no complications. Two years later, Motmot still has routine checks to monitor her recovery, but so far, she has remained cancer free.

VIRGINIA CREEPER

IN THEIR NATIVE Madagascar, gray mouse lemurs only live three to five years. Here at the DLC, these tiny primates can live into their early teens!

13-year-old Virginia Creeper is the oldest gray mouse lemur in the DLC's colony. At this late stage in her life, Virginia Creeper struggles with decreased mobility, vision loss, and cognitive decline. Encouraging her to eat has been particularly challenging. "She's been experiencing mandibular swelling," explains Allie Monahan, one of the DLC's husbandry technicians and the geriatric mouse lemur's primary caretaker. "I soak her chow before feeding her to make it easier to eat."

The idea came to Allie while planning a special birthday treat for Virginia Creeper, offering her gruel (primate chow mixed with water and a tasty flavoring, like honey or coconut milk) rather than her standard solid food. "When I gave it to her, she chowed down like I've never seen before, and I've been soaking her chow ever since! Since then, she's been more consistent in her eating and has gained weight."

Allie has to consider not just what she feeds Virginia Creeper, but how she feeds her. "I always feed her in the same place," says Allie, which helps ensure that the lemur can consistently find her food bowl as her vision and memory decline. "Also, she's only fed in flat dishes to make the food more easily accessible."

Photo by David Haring.

SPECIALIZED GUTS

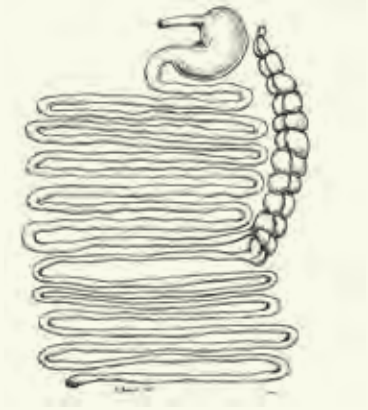
LEMURS AREN'T just diverse in appearance—their guts also vary in length and complexity. Longer relative digestive tracts allow a greater relative surface area for nutrient absorption. As a result, animals with a higher intestine length to body length ratio are able to digest more complex foods.

Coquerel's sifakas (*Propithecus coquereli)*, who are specialized leaf eaters, have a digestive tract nearly 16 times the length of their bodies. For comparison, the fruit-eating red ruffed lemurs (*Varecia rubra*) have guts approximately five times their body length.

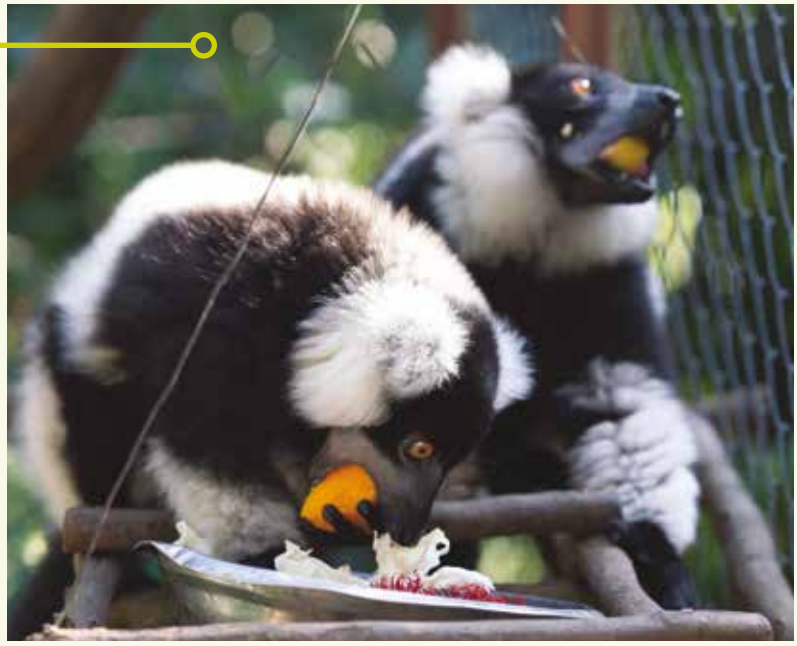
While a longer gut allows sifakas to digest complex plant matter efficiently, it also means that consuming excessively sugary fruit can upset the sifaka's delicate gut system, making them extremely (and sometimes fatally) sick. Fruits from the forests of Madagascar, which make up a regular part of wild sifakas' diets, have the approximate sugar content of an American-grown cucumber; whereas in the United States, many fruits and veggies are cultivated to maximize their sugar content. As a result, for the DLC's sifakas, fruit is off the menu entirely. This is why it's crucial to individualize diet plans—a healthy snack for a ruffed lemur could send a sifaka straight to the vet!

A longer gut also means more time to digest. Food can take up to 36 hours to pass through a Coquerel's sifaka, while red ruffed lemurs go from eating to excreting in under two hours. Beyond allowing ruffed lemurs to enjoy more sugary produce, this allows whole seeds to pass through their digestive systems. Everywhere red ruffed lemurs travel, they drop seeds in their own little piles of fertilizer (aka poop), helping to disperse seeds for a variety of plant species across Madagascar's tropical rainforests.

Because of their sensitive digestive systems, sifakas at the DLC are fed multiple times daily. This mimics the feeding bouts that wild sifakas have throughout the day and keeps the lemurs' GI tracts operating similar to those of wild populations. *Photo by Sara Nicholson.*



Gastrointestinal tract from a Coquerel's sifaka.



Black and white ruffed lemurs feast on fruits at Parc Ivoloina in Tamatave, Madagascar. *Photo by Sara Sorraia.*

Gastrointestinal tract from a red ruffed lemur.

Diagrams reproduced from Campbell et al. 2000. "Description of the gastrointestinal tract of five lemur species: *Propithecus tattersalli*, *Propithecus verreauxi coquereli*, *Varecia variegata*, *Hapalemur griseus*, and *Lemur catta*." *American Journal of Primatology*. 52: 133-142.

Tapping into Nature

With Ehsan Dehghan-Niri, Ph.D.
Associate Professor, School of Manufacturing Systems and Networks, Arizona State University

By **MATTHEW BURKHART**,
Communications and Education Assistant
Undergraduate, North Carolina State University

RESEARCHER SPOTLIGHT

Ehsan's enthusiasm for the aye-aye shines through his work. "If I had to focus on one topic and wasn't allowed to do anything else, I would pick studying aye-ayes. That's it," he says. "For the rest of my life, I can do that." Pictured: Ehsan at the Duke Lemur Center, feeding a mealworm to an aye-aye. *Photo courtesy of Ehsan Dehgan-Niri.*

THE AYE-AYE, a nocturnal lemur known for its distinctive tap-foraging technique, has become the unlikely muse for cutting-edge engineering research.

Over millions of years, the aye-aye has evolved a unique foraging behavior known as percussive or tap-foraging. This remarkable technique involves the aye-aye tapping on tree bark while bending its large, cupped pinnae (external ear structures)—the largest among all primates—forward to detect acoustic cues that reveal hidden cavities beneath the bark's surface. Once a cavity is located, the aye-aye gnaws into the wood using its specialized rodent-like teeth and inserts its long, slender middle finger to extract grubs from inside.

Ehsan Dehghan-Niri has been studying aye-ayes to unlock insights that could revolutionize non-destructive testing technologies used to inspect aging infrastructure like pipelines and aircraft composites.

Ehsan first became aware of the aye-aye when watching the National Geographic channel with his four-year-old son. He was instantly captivated by aye-ayes' unique foraging technique, especially their

Non-destructive testing (NDT) is a technique for evaluating the structural integrity of a component or product without impairing its functionality. NDT enables the inspection of machines and structures that are currently in use, such as oil pipelines and airplanes, by allowing for routine maintenance and safety assurance over time without disrupting their service.

ability to tap through nearly an inch of wood to hear echoes from cavities that indicate the presence of insects inside.

"I knew that the wood structure is very similar to composites, and I knew finding deep cavities in such a complex material and geometry is extremely difficult," says Ehsan. "And we are talking about thicknesses of half an inch, one inch. How can they do it?"

In engineering, non-destructive testing (NDT) allows inspectors to test materials without damaging them, often using ultrasound, sound waves, and tapping to detect cavities, cracks, or flaws.

Inspired by the aye-aye's percussive foraging, Ehsan's research uses biomimicry, simulation tools, and behavioral studies—learning from biology to innovate technology—to advance acoustic-based NDT techniques.

At the Duke Lemur Center, he and his team have developed a specialized observation box equipped with high-tech acoustic, video, and thermal imaging systems to capture aye-ayes' movements during their nocturnal foraging. Using CT scans, they also created 3D-printed models of the aye-aye's head, external ear structures, and hand for detailed mechanical and acoustic analysis.

Their comprehensive data revealed that the aye-aye's foraging behavior is more complex than simple tapping. In addition to drumming on wood with its elongated middle finger, the lemur performs rubbing and gliding motions that generate distinct acoustic signals.

"Now we know that aye-ayes do not just tap," Ehsan says. "They perform both tapping and rubbing. When they perform rubbing, they generate another acoustic field, another frequency."

"That's so important for them," he explains. "For smooth versus rough surfaces, for example, you need to use a different type of friction, a different angle of attack."

This insight led Ehsan to develop and patent a new method for inspecting composite materials in engineering. Inspired by the friction-based signals created by the aye-aye, his team's approach improves the sensitivity and resolution for detecting flaws.

"The aye-aye is a natural non-destructive testing specialist," says Ehsan.

"This is the value of looking at nature for engineering. The aye-aye's tapping system has evolved and been optimized over tens of millions of years. It would be very difficult, if not impossible, for us to design a system like this from scratch in our lifetime.

"You can see a story from biology, how humanity can be helped."

Elphaba, an aye-aye born at the Duke Lemur Center, graces the cover of the journal *Materials Evaluation* in April 2025. Ehsan sees the aye-aye as an ambassador for both technological innovation and nature's genius. *Photo by David Haring.*

The significance of Ehsan's research extends beyond engineering. The aye-aye is an endangered species with only a few thousand individuals estimated in the wild. Ehsan hopes his research can raise awareness and aid conservation efforts. His research team is exploring ways to facilitate aye-aye communication and breeding in fragmented rainforest habitats in Madagascar, and he routinely mentions the aye-aye when presenting to students. "Any time I mention the aye-aye, students start asking questions. They immediately become more engaged." *Photo by David Haring.*

PLAYING *the* LONG GAME

By **DUKE LEMUR CENTER STAFF**

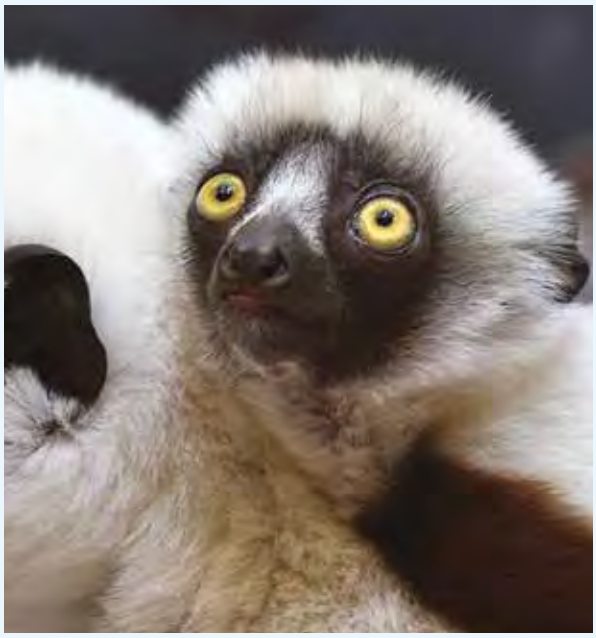
Sydonie is the second successful birth to parents Beatrice and Elliot, who traveled from the DLC to Chester Zoo in Cheshire, England, in 2021 and were the first members of their species ever to set foot on European soil. Sydonie joins her big sister Sofena to form a family of four. *Photo courtesy of Chester Zoo.*

The beautiful and iconic Coquerel's sifaka, the "dancing lemur of Madagascar," was first brought to the Lemur Center in 1962, when little was known about its natural history and health and dietary needs. "It became one of the DLC's missions to conserve this species and help these lemurs thrive in the United States," says Colony Curator Britt Keith, M.Sc. "We knew we needed to establish a genetically diverse breeding colony as a safeguard against the rapidly declining population of their wild counterparts in Madagascar."

While the DLC made unprecedented progress in the care and breeding of Coquerel's sifakas, this highly endangered species was underrepresented elsewhere. "It became clear that forming a second colony in Europe was paramount for this species' long-term survival," says Britt. "Having the entire safety net population living in the USA, with half at the DLC, was risky. What if a disease swept through?"

Coquerel's sifakas are also delicate. Their extraordinarily long intestines are prone to deadly kinks, obstructions, and infections. "There was a chance that they would do better in Europe," Britt adds.

In 2021, the DLC relocated four breeding pairs of Coquerel's sifakas to zoos in Germany and the United Kingdom. 18 months later, Sofena was born at Chester Zoo in Cheshire, England—the first-ever successful Coquerel's sifaka birth outside Madagascar and the USA. "The birth of a Coquerel's sifaka in Europe is a real landmark moment



Ando is the first male Coquerel's sifaka born in the EU. His mother, Euphemia, was a wonderful dam at the Lemur Center before moving to Germany, and she's proving an excellent mother to Ando. Ando's father, Hercules, is a first-time dad and is also doing a great job. *Photo by Rolf Schlosser, Kölner Zoo.*

for conservation," said Mike Jordan, Chester Zoo's Director of Animals and Plants, in a press release in 2023.

In 2025, the European population celebrated the births of two more infants: Ando, a male, at Kölner Zoo (Cologne, Germany) and Sydonie, Sofena's new sister, at Chester Zoo.

"A growing European population is a tremendous victory for this species," says Britt. "We're thrilled that the European conservation breeding program has now resulted in three successful births."

Today, 10 Coquerel's sifakas reside in Europe and 53 reside in the USA. In addition, 34 Coquerel's sifakas live in four private parks in Madagascar. "For the last four years, the DLC has been collaborating with these parks and Madagascar's Ministry of the Environment and Sustainable Development to develop a studbook and Species Survival Plan for these sifakas," Britt says.

Coquerel's sifakas are among the most endangered primates on Earth, with wild populations declining 80% over the last 30 years due to habitat loss. Breeding programs in the USA and Europe form a safety net that guards against the species' total extinction, should wild populations continue to crash. And breeding programs in Madagascar, combined with protecting forests and studying wild populations, will play a crucial role in recovery and reintroduction programs.

This year, the first-ever Madagascar studbook and conservation breeding program for any species will be launched for the Coquerel's sifaka. This, plus the births of three European sifaka infants, is a testament to the long-term relationships, trust, and capacity-building that the DLC and its European and Malagasy partners have created in the name of lemur conservation.

"This triangle of cooperation and dedication between Europe, Madagascar, and the USA—all in the name of the Coquerel's sifaka—builds on the hope that we can save these incredible, fragile animals," Britt says. "We will not let this species be lost from the incredible biodiversity found nowhere on Earth but Madagascar."

Only three zoos in Europe care for Coquerel's sifakas, having worked with the Lemur Center to expand the conservation breeding program for this critically endangered species. "We're extremely grateful to our partners and collaborators at Tierpark Berlin, Kölner Zoo, and Chester Zoo," says Britt. *Photo courtesy of Chester Zoo.*

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