

THE PAPER TRAIL
by Dr. Sarah Zehr, Research Coordinator

Not only do we have hundreds of lemurs in our current colony, we have had hundreds more who have lived here over the 40 plus years of our existence. The fact that we collect and keep animal medical and husbandry records on all of our animals makes the DLC uniquely set up to support research into the life histories of our species. One of the factors we use to monitor the health of young infants is their weight, and they are weighed every few days for the first month, and then weekly for the next two. An infant's weight at any given age will of course be dependent on how much the infant weighed when it was born and the rate at which it is gaining. So while there will be a range of weights that are acceptable for an infant of a given age, we need to be sure that it is growing at the appropriate rate. One of our recent arrivals, a sifaka infant named Rupert, was one of the smallest sifaka ever born here to survive; he weighed a mere 86g. When Rupert was just over a month old, the technicians who care for him noticed that he didn't seem to be moving about on his mother as much as he should be. He was weighed and found to be gaining, but only a few grams at a time. "How little gain is too little?," We wanted to know. And how much would he need to gain each day for us to be sure that although he was small, he was healthy? While we are quick to interfere and provide medical care when an animal is clearly sick, handling the animals in order to treat them can cause additional stress (but see Meg Dye's report on our Animal Training Program for a description of how we are addressing this problem!). In any case, information that will help us assess the situation without handling the animal is extremely helpful.

As we observed Rupert and monitored his weight over several days, we were able to look at the growth rates of other infants born here, and compare Rupert's growth curve to theirs. We can see that even though Rupert was born small, early on he was gaining

"I am sick to death of you people."
says Rupert as he is weighed yet again.



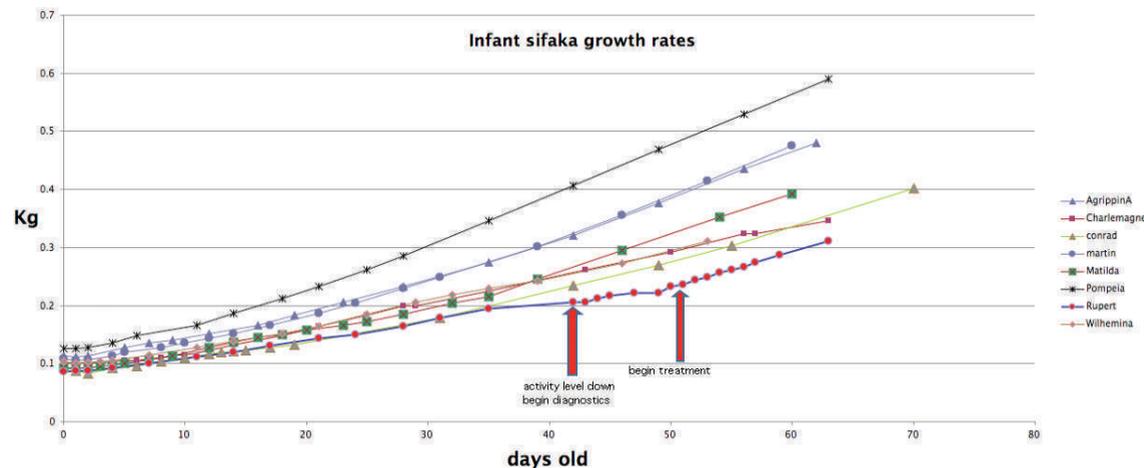
weight on par with the other healthy infants we have observed. A closer look allows us to pinpoint exactly where he started to veer off the normal curve; it was clear there was an underlying problem and Rupert would have to be caught and treated. Blood work indicated a bacterial infection, so he was started on a daily dose of antibiotics. As we continued to monitor his weight during his treatment, we saw him jump back up onto the normal growth curve so we feel confident that the treatment was effective. We will continue to keep a close eye on Rupert's weight so we can chart his progress. Another example of how the research conducted at the DLC has a directly positive effect on animal care!

conservation • education • research
Duke Lemur Center
March 2010



lemur.duke.edu

Lari Hatley, Editor • David Haring, Photographer • Design work donated by Heath Murray Designs
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Weights of several healthy infants born at the DLC. Arrows indicate where Rupert's weight starts to veer off the curve, and where he starts resuming healthy weight gain.

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RAFTING TO MADAGASCAR

Dr. Anne D. Yoder, Director

I love science. For the curious mind, it is a never-ending quest for answers to questions that may seem impossible to answer. One such question is “How in the world did lemurs get to Madagascar?” As you may recall from the most recent DLC newsletter, I spent my allotted page space giving you a mini-review of Madagascar’s geological history and its relationship to lemur evolution. I made the bold statement “When all of the available scientific evidence is marshaled from sources as disparate as fossils and DNA, we can say with near certainty that lemurs arrived in Madagascar by sheer accident, after having traveled hundreds of miles across the ocean barrier that separates Africa and Madagascar.” --- end of story. Indeed, virtually any time that I have given a public seminar on lemurs and Madagascar, I have ended with that conclusion. Inevitably, however, some smarter-than-average audience member will raise his or her hand and ask “but how did they make such a journey? Wouldn’t it have taken a long time, and wouldn’t these proto-lemurs have needed food and water during the journey?” Over the course of many years now, I have had to waive my hands by saying, well, we have rejected the possibility that they were already on Madagascar when it separated from Africa and India, and we have also rejected the possibility that there were any land bridges joining Madagascar to other landmasses, so, overwater dispersal is the only remaining solution. Right?

Yes, right!

But I too have always wondered exactly what were the mechanisms by which lemurs and most (if not all) of the other terrestrial vertebrates made the journey. It does seem more than a little crazy to think of an ancestral lemur, clinging to a log or small raft of vegetation, as it made its way leisurely across the Mozambique Channel. Surely that lemur (or lemurs) would have expired from hunger and thirst during the many weeks or months that such a journey might have taken.

David Krause, the renowned paleontologist, has offered at least one distinctly plausible explanation. David points out that in the present-day Indian Ocean storm system, enormous cyclones can blow from the east to

the west, passing over Madagascar, then pull U-turns as they hit the thermal inertia of Africa, only to hit Madagascar again, this time from the west. One consequence of the sweeping pattern and destructive force of these storms is that they can potentially tear out huge chunks of African riverbanks, resulting in the appearance of chunks of earth, that have been described as “floating islands of vegetation, oftentimes with tall trees and sometimes supporting animals (including mammals), that were tracked or seen drifting in oceans, tens and hundreds of kilometers from land.” This certainly sounds plausible, but there has always been the niggling fact that the prevailing currents of today’s Indian Ocean system flow from east to west, flowing southward along Madagascar’s western coast. In other words, although the floating islands that we can observe today seem like ideal life rafts, the prevailing currents make it unlikely that they would ever end up washing up on Madagascar’s shores.

Enter Ali & Huber, Nature, January 2010. This groundbreaking study may have solved the mystery once and for all. In a computer simulation that took nearly three years to complete, Ali & Huber demonstrate that with the continental configurations of the deep past, ocean currents would actually have moved from the west to the east, making for ideal transoceanic transport from Africa to Madagascar. And here’s the best part: approximately every 100 years, for a nearly 40 million year period (indeed, the very period within which all of Madagascar’s terrestrial mammals have been estimated to have arrived), there were episodic storm systems that would have resulted in high-velocity transport across the Mozambique Channel. As Jason Ali told me in personal communication, “if we throw in a ‘correctly configured’ cyclone, we might [see velocities of] ~1 meter/second for a few days within the transit.” Now that’s a fast track to Madagascar! And I, for one, believe that the mystery has been solved, at long last.

And so, this series of questions, and rejected hypotheses, and plausible scenarios has culminated with solid data that seem to provide a conclusive answer to an impossible question. How did lemurs get to Madagascar? Answer: by a freak accident of nature, deep in earth’s history, and never to be repeated. My satisfaction as a scientist couldn’t be greater, but my viewpoint as a conservation biologist has reached a sense of even greater urgency. How can we even contemplate a world without lemurs? We can’t. It is simply unthinkable.

Anne D. Yoder



MADAGASCAR UPDATE

by Charlie Welch, Conservation Coordinator

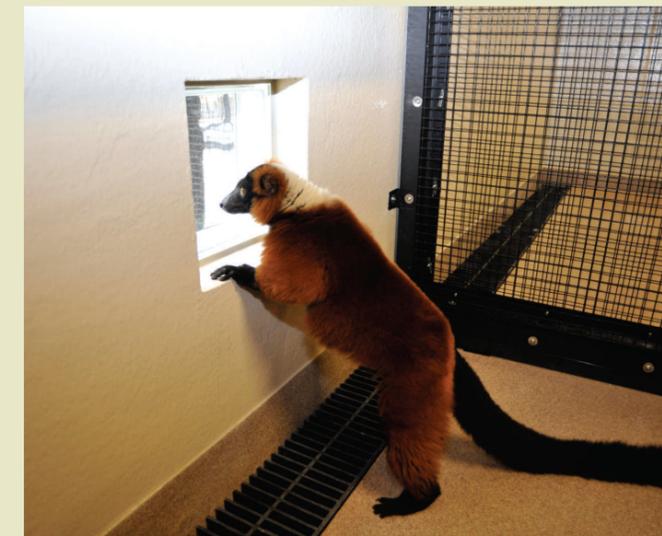
Madagascar has a global heritage, which means we must continue to do all that we can from here to preserve.

There is not much good news coming out of Madagascar these days. The leader of the transition government, Andry Rajoelina remains in power, and all attempts at ‘power sharing’ have failed. As a result, Madagascar continues to be chastised by the international community, including most African countries and organizations. The US has withdrawn Madagascar’s preferred tax status through the AGOA program, which means that Malagasy exported products will have much more difficulty competing with those of other developing countries. Ultimately that will mean loss of precious jobs, of which Madagascar already has so few.

The worst news is that in January the Madagascar government lifted the ban on export of rosewood. That will almost certainly mean an increase in rosewood and other precious woods being illegally removed from national parks and other protected areas. The piles of rosewood and ebony logs waiting in mostly northeastern ports will quickly disappear into shipping containers, then onto ships bound primarily for Asia. Much of that wood was illegally gotten.

Government instability is always bad news for conservation. Add to that, human desperation caused by a failing economy and it becomes quite difficult to be optimistic about the future of Madagascar’s unique natural heritage. But it is also a global heritage, which means we must continue to do all that we can from here to preserve - and hope that the political situation in Madagascar improves.

See <http://dukelemurcenter.blogspot.com> for updates on Charlie’s travels in Madagascar.



Red-ruffed lemur enjoys a lemur-sized window designed to mimic the dappled sunlight of the forest

LEMURS ENJOY NEW BUILDING

The Releasable Building (RB) is open for business! Since January 20th, groups have slowly been moving from their old cages to brand spanking new digs in the RB, and the lemurs seem to love it! Five breeding groups now call the building home: a large family group of red-ruffed lemurs (Pyxis’ group), a family group of black and white ruffed lemurs (Kizzy’s group), a large family of ring-tailed lemurs (Sprite’s), a smaller group of ring-tailed lemurs (Shroeder’s) and a pair of blue eyed lemurs (Foster’s). All these animals are breeding groups and all will be released out into one of the adjoining four natural habitat enclosures this spring and summer!



“I was greatly impressed by this new complex where sanitizable housing is combined with excellent outdoor access for each group. It was particularly interesting how adjacent rooms can be interconnected in order to hold larger groups. We have waited many years for this replacement of the temporarily rigged cages that clustered around the original building.”
Dr. Elwyn Simons

BUILDING TRUST

by Meg Dye, Animal Trainer

The animal training program at the Duke Lemur Center was initiated in the spring of 2007. One of the primary reasons for the training program is to assist in the advancement of lemur husbandry. The training program teaches the lemurs to participate in their own health care. Lemurs are taught a variety of behaviors including how to walk on to a scale, into a kennel, and take liquid from a syringe in case they ever need medicine.

With the confirmed pregnancy of four sifaka females who were currently participating in the training program, we added another goal; voluntary infant removal. With this goal we would need to overcome a few challenges. First, unlike a gorilla mom who cradles her infant in her arms and can be trained to hand her infant to a keeper for a delicious reward, lemur infants cling extremely tight to their mothers abdomen for the first three to four weeks after being born. Second, voluntarily removing a baby from a mom during a training session has never been conditioned with lemurs so we would need to modify our training plan as we went. Finally, we needed to remain conscious of the first fact that lemur infants cling extremely tightly to their mother. Thus, when a baby is removed from its mom so are two small handfuls (not to mention two small foot-fuls) of hair!

On December 15, 2009 Antonia gave birth to Rupert. On Rupert's first day, Antonia's primary trainer, Sarah Zehr, conducted a training session with Antonia and her new infant. Upon hearing the cue for the start of the training session, Antonia came down from the top of her heat box and sat in front of Sarah just as she had for the last two years. As Sarah and Antonia went through behaviors they regularly do during a train-



ing session, we all eagerly waited and watched as Sarah removed Rupert from Antonia for his first weighing! For the next two weeks, Rupert was removed every other day to be weighed and then put back with mom.

We realized that a lofty goal such as voluntary infant removal would add to the advancement of husbandry care for lemur infants and greatly reduce any stress for both mom and baby when a temporary separation was needed. What we did not realize was how the behavior would be needed beyond the taking of Rupert's weight. With his regular weighing, the staff became concerned that Rupert's weight was not where it should be for an infant of his

age (see Sarah Zehr's article on Monitoring Rupert's Weight). When Rupert was 50 days old, he was examined by the vet staff and put on a seven day dose of antibiotics that would need to be given orally. In order to do this, Rupert would need to be removed from his mom once a day for one week. Amazingly, Antonia and Rupert both exceeded our expectations! Rupert never missed a day and received his full dose of antibiotics while Antonia waited for his return while calmly eating a peanut in front of Sarah.

If your children have outgrown their hard plastic playhouse, or you have hard plastic milk cartons, tubes, or crawls-through toys, our technicians would love to turn these into lemur enrichment: easy to clean and hours of fun.



Training reduces stress for both mom and baby.

BOOKS SAILING TO MADAGASCAR!

by Charlie Welch, Conservation Coordinator



In discussions with our Malagasy veterinarian trainees, Haja and Hery several months back, it became clear that there was a real need for veterinary medicine reference books at the recently opened (and only) College of Veterinary Medicine in Antananarivo. There is a library at the college, but not yet many books. Dr. Randy Junge, vet at the St. Louis Zoo travels often to Madagascar, and has taken some books with him to donate to the college library, but there is always a limit on what one can carry in air travel baggage. Books are heavy!

Lemur Center veterinarians Dr. Cathy Williams, and Dr. Bobby Schopler put out a call for donations of used vet reference books through veterinary journals and the NCSU Vet School. The books began to trickle in, then to flood in, but we still had no way to get the books to Madagascar in an affordable fashion. Enter Peter Balasky, to the rescue. Peter is a palm enthusiast who lives in south Florida. He became interested in the diversity of palm species in Madagascar, and has traveled there repeatedly. As so often seems to happen, Peter fell in love with Madagascar and its people, and wanted to do something to help the many poor. He started a humanitarian NGO which donates clothes, education materials, medical supplies, and other needs to the people of Madagascar. Peter sends a shipping container full of supplies and materials for donation to Madagascar every year or so. Fortunately for us, Peter has a container boarding a ship in Miami in March, and even more fortunately, he agreed to take on our vet books at no charge! Not only is Peter seeing to the book transport, but his team in Madagascar will clear the books from the port along with the other container contents! That circuitous process can be very expensive.

Peter fell in love with Madagascar and its people, and wanted to do something to help the many poor.

Cathy retrieved the last of the vet books from NCSU, and we began packing them into 35 lb boxes to send to Miami by postal delivery. But before the books were packed, DLC volunteer Vicki Willard inventoried the books by title and author, and placed DLC donation stickers inside the covers. In total 120 books at about 350 lbs were mailed to Peter in Miami, for delivery to Madagascar! And in addition, Bobby was able to put together a box of badly needed surgical instruments to send over for the vet school as well! Now we are faced with an additional wave of donated books, which Peter has also agreed to give container space for, so it is back to inventory and packing!

There are many people to thank for helping to make this book donation to the Vet College in Madagascar become a reality. Thanks to many various donors for giving the books, and thanks to the NCSU vet school for facilitating collection of the books. Thanks to Bobby and Cathy for coordinating the book donation, and to vet tech Vivian for helping to pack the books. Thanks go to volunteer Vicki for inventorying the books, and of course an enormous thanks to Peter for offering transport to Madagascar for the books. It most definitely takes a team.

Watch for a follow up article in an upcoming news-letter for an update on the book donation - arrival in Madagascar!

BIRTH DAYS

by David Haring, Registrar and Photographer

The first phase of the Lemur Center's 2010 birth season (sifakas) is winding down, with phase two (the remaining diurnal lemurs), set to begin in March, and continue on through May. Actually the first births of what we consider to be our 2010 birth season took place in December, 2009 with two infants born at the Lemur Center, and two at other institutions, a record for December. This includes one infant to first time mother, Antonia (the adorable male Rupert born December 15th) and one to Pia, her fifth (a female named Wilhelmena, born on Christmas day). The other two December births occurred to Duke Lemur Center animals but on loan to other institutions (we have 27 sifakas on loan at eight AZA zoos scattered around the US), one at the Houston Zoo (to Zenobia on 16 December) and the other at Bronx Zoo (to Chris on 29 December).

There were zero births in January, but then things picked up again in February when Rupillia gave birth to her fifth infant (sex unknown) on 3 February. This was especially important because it is the result of Rupi's first mating with Tiberius, a male born at the Lemur Center in 1988 who was shipped to the LA zoo in 1996, returning here only in December, 2008 for the express purpose of breeding her (as mandated by the sifaka Species Survival Plan (SSP). Due to Rupi's extremely high strung nature, all of her infants are raised "hands off". This means that we drop our normal, intensive infant management practices, in which sifaka newborns are removed from their mothers and weighed two to three times a week for the first month of life, then once a week afterwards. This regular weighing of infants assures us that a slight decline in infant's health is caught quickly and can be brought to the immediate attention of our Vet Dept. Luckily, so far all of Rupi's infants have thrived under this "hands off" policy, let's hope she keeps up the good work!

The only sad note in this year's sifaka season occurred on February 1st when Drusilla delivered a



stillborn male. This is actually more shocking than sad, since Drusilla, born April 1993, is one of the most successful female sifakas ever, at least from a breeding standpoint. Over the years since she delivered her first infant in 1998, she has been virtually flawless in the birthing department, producing without a hitch ten strapping infants, one each year (except for 2006 when the Vet Dept insisted she take a year off). All ten of these infants survived for at least one year, and seven are still thriving, an excellent survival record unmatched in the annals of sifaka husbandry. It's always sad to lose an infant, but given the fact that the infant was male, and given the current troublesome skewed sex ratio of captive sifaka, (of the 50 Coquerel's sifaka in captivity, 33 are male, with only 16 females and one unknown) it is not a great tragedy.

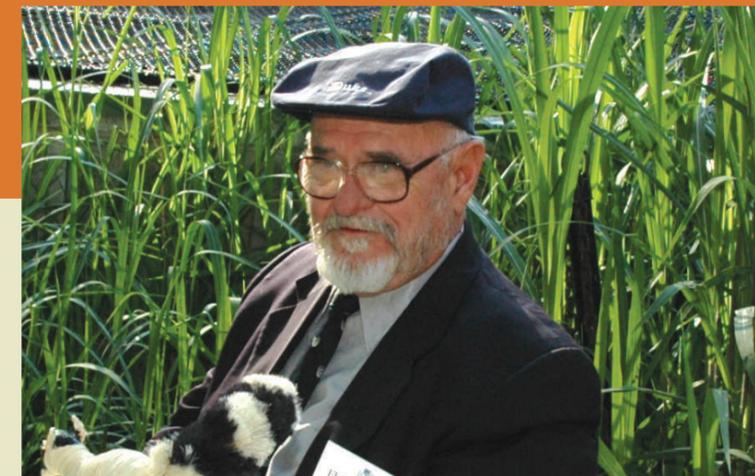
It might seem strange, but all varieties of sifaka give birth in mid winter (whether they live in NC or Madagascar), while the rest of the diurnal, seasonally

breeding lemurs give birth in what seems a much more reasonable time of year, the Spring. While mid winter in Madagascar is not as cold and miserable as it is in NC, it still is a season of scarcity, when food is at its lowest availability and poorest quality. Hence it seems a questionable time for a sifaka female to give birth, but Primatologists feel that the point of a mid-winter birth is actually to give the newborns the greatest chance of survival possible. During the winter birth season, when food is scarce, the sifaka infants remain safe and sated with 100 percent of their food and shelter needs taken care of by

their mothers. Then, a few months down the road, when infants are starting to feed a significant amount on their own, spring is in full bloom. In short, food is at its most abundant just when sifaka infants are starting to really gobble it down.

When you are trying to wrap your head around the out of synch with the rest of the lemur world sifaka calendar of midsummer breeding and mid winter births, it might be helpful to think of sifaka breeding and birthing season in terms of our own holiday calendar. Roughly speaking, sifakas breed between the Fourth of July and Labor Day (while most diurnal lemurs breed in the fall), and give birth between Christmas and April Fool's Day, with birth peak occurring around Valentine's Day (while most diurnal lemurs give birth in the Spring). Actual distribution of sifaka births at the Lemur Center (and elsewhere where our animals have been on loan) since 1987 look like this: 21 births have occurred in December, 21 in January, 36 in February, 14 in March and 5 in April.

Next newsletter Andrea Katz will be giving you a summary of phase two of the Lemur Center's birthing season. Not to spoil Andrea's surprise, but this year's Eulemur/Varecia/Lemur birthing season promises to be one of the most exciting and diverse in years, so stay tuned!



DIVISION OF FOSSIL PRIMATES - AN UPDATE

By Dr. Elwyn Simons

The Lemur Center houses both a collection of early primate fossils and a collection of sub-fossil lemurs from Madagascar. These collections make it possible to compare the fossils to the living primates most similar to them, the living lemurs, sometimes called living fossils, housed at the Lemur Center. Although the fossil collections are now kept at 1013 Broad St. in Durham, their return to the Duke Forest center is planned.

The collections disclose not only information about lemurs but about the origins of our own group of primates and their history through time. We are all interested in where we came from, and clues are revealed by these fossils. Our collections in these areas have continued to grow since the late 1970's and include many fossils of interest that were found along with the primates.

Due to this field research, the Center now holds major collections of primates and other fossils not only from Madagascar but from ancient times in Egypt and Wyoming. This makes it the principal original collection of primate fossils from a wide span of geological ages and of taxonomic diversity in the US. This collection is supplemented by a small comparative primate skeletal collection. The fossil collection is open to tours by special appointment. To arrange a tour, contact Catherine Riddle at 919.416.8420 x 21.

A resource for researchers (and other interested parties)

Whales in Egypt? Giant Lemurs in Madagascar? Believe it or not these and many other different types of fossils have been found. Our specimens number well over 24,000 and growing by the year. We are in the process of cataloging our data electronically with over 18,000 records currently in place. Our new database will house not only individual data on each specimen but will be able to run specialized reports, track publications, researcher loans, and give a quick access view of all data available. If you are interested in studying our specimens or would like additional information on what our new system will be able to do please contact our office at 919.416.8420 x 21 and speak to Catherine Riddle for more information.