



# AnthroQuest

The Newsletter of The Leakey Foundation

## Humans, the High Energy Ape

HERMAN PONTZER, LEAKEY FOUNDATION GRANTEE, CITY UNIVERSITY OF NEW YORK

For over a century, paleo-anthropologists have been scouring the globe for human fossils, assembling the evolutionary history of our lineage bone by bone. As Darwin predicted, the human lineage began in Africa around 6 million years ago. The earliest hominins were bipedal but otherwise quite apelike. Then, about 2 million years ago, things began to change. Brain sizes increased, tool technology became more sophisticated, teeth and diets shifted to include more meat, body size and proportions became more like modern humans. Our lineage crossed some critical, if indistinct, threshold: the dawn of the genus *Homo*.

The origin of our genus presents some of the most vexing questions in human evolution. Humans have the biggest brains, biggest babies, most offspring, longest lives, and most physically demanding lifestyles (until the advent of cities, anyhow) of any living ape, changes that are thought to have their beginnings in early *Homo*. Each of these traits cost energy, calories that we must wrest from the environment and process in our cells. Evolving all of them together seems to violate a fundamental law in biology. In other species, evolving one costly trait



An adult male gorilla. Gorillas are the largest ape, but expend less energy for their size than humans or chimpanzees. Photo: Lincoln Park Zoo

inevitably means reducing investment somewhere else; trade-offs are the rule, because energy is limited. How did our lineage escape the energetic constraints limiting brain size, reproduction, longevity, and activity in other apes?

For the past six years, with support from The Leakey Foundation, I've led a study tackling these questions by measuring daily energy expenditures across all of the living apes – chimpanzees, bonobos, gorillas, and orangutans. Working with zoos and sanctuaries around the U.S. and across the globe, my colleagues and I used the “doubly labeled water” method,

a technique borrowed from human nutrition science, to measure the calories these apes burn each day. The apes in our study drank a small dose of water enriched with stable, harmless isotopes of hydrogen and oxygen. We mixed the water with fruit juice and gave it as a treat. We then collected urine samples every couple of days for two weeks to track how quickly their bodies flushed out the isotopes. This allowed us to calculate each ape's daily production of carbon dioxide, providing a direct, physiological measure of calories burned. This approach has become the gold standard for measuring daily energy expenditure

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The mission of The Leakey Foundation is to increase scientific knowledge, education, and public understanding of human origins, evolution, behavior, and survival.

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# Letter from the President

The Leakey Foundation had a busy year. Our Friends and Fellows matched our two major donors' million dollar challenge grant for the fiscal year 2015-16. In fact we more than matched the challenge. So, we were able to fund more research grants and have a robust education outreach program. We gave 18 lectures, 29 school outreach visits, rebuilt our website and increased our social media following. Our podcast, *Origin Stories*, was one of four nominated for an award for best podcast by the Science Media Awards Summit and Hub held at Harvard University in September. We were in great company with NPR, *Science Friday* and *The Boston Globe*. One of our podcast episodes on evolution and tuberculosis was shared by the World Health Organization on its social media channels and website.



French countryside at the Grottes de Cougnac.

We set up a symposium on the theme of survival in collaboration with Harvard University, NOVA, NOVA Labs, SMASH, and WGBH where we discussed how to confront the threatening problems we *Homo sapiens* face by examining these issues through the lens of evolution. The goal of the symposium was to better understand how we got in this predicament and therefore what solutions might work to end the threats of pollution, over-population, global warming, lack of species diversity, violence, and chronic disease. Seven internationally respected scientists helped us see our way through the current and building crisis.

Please join us to help continue this work. We have a \$1 million challenge grant again this year! Any dollar you donate to support The Leakey Foundation will be matched 1:1, so becoming a Fellow at \$1,000 will bring us \$2,000. With your donations, we can fund more researchers and share their research with more of the public.

Camilla Smith  
President, The Leakey Foundation



Camilla Smith and her niece Jane Minor outside the Musée de l'Homme, Paris.

## MILLION DOLLAR CHALLENGE

*Your support makes a difference!*

For a limited time, your donation will be doubled up to one million dollars! Help us increase our funding for scientific research and educational outreach. See page 11 to join the challenge or visit [leakeyfoundation.org/donate](http://leakeyfoundation.org/donate)



# Humans, the High Energy Ape (continued from front page)



A mother chimpanzee and young offspring. Chimpanzees expend less energy each day than humans but more than other apes. Photo: Mary H. Brown

in public health but is relatively new in human evolution and primatology.

Our work led to the discovery that humans have evolved faster metabolic rates than other apes, providing the




Photo: Mary H. Brown

extra energy needed to fuel the costly traits that make us unique. The difference is substantial. Humans burn about 400 more calories each day than chimpanzees and bonobos, and nearly 1,000 more calories each day than orangutans, even after accounting for differences in body size (larger individuals tend to burn more calories) and activity level among species (we used a sedentary human sample to match the activity levels of our zoo apes). Our results also showed that humans are by far the fattest apes, carrying more body fat than our pot-bellied evolutionary kin. Alongside big brains and bipedalism, we can now add faster metabolisms and fatter bodies to the list of unique human traits.

As others have pointed to before, humans also have smaller guts and walk more efficiently than other apes, saving energy that we can channel toward brains and reproduction. Our diet has evolved as well, with meat, tubers, and the advent of cooking leading to big increases in the energy density of our food relative to other primates'. Our new findings on daily energy expenditure show that these crucial changes are all part of a wholesale evolutionary shift in hominin metabolism. Rather than simply working within a constrained ape-like energy budget or trying to force more calories through an ape-like metabolism, hominins fundamentally altered their physiology to fuel the big changes that make humans distinct.

Greater energy requirements also carry an increased risk of starvation, which likely explains humans' greater propensity to add body fat – our body's reserve fuel tank when food is scarce. Humans also share food and provision those in need, unlike other apes. We think food sharing likely coevolved early in the genus *Homo*, with our increasing metabolic rates.

Louis Leakey's work with Mary, Richard, and others at Olduvai Gorge in the 1960's established *Homo habilis*, still among the earliest and most controversial members of our genus. He also recognized the need to study living apes to answer fundamental questions in human evolution,

launching the field of ape ecology with Jane Goodall, Dian Fossey, and Birute Galdikas. Today, that effort continues to expand, uncovering new dimensions of our evolved biology through new approaches and techniques in ape research. Integrating the ever-expanding fossil record with new discoveries in ape ecology and physiology will continue to provide powerful insights into human and ape evolution. 



An adult female orangutan. Orangutans expend the least energy of any ape, nearly 900 kilocalories per day fewer than humans. Photo: Mary H. Brown

Read more about  
Leakey Foundation funded  
research at  
[leakeyfoundation.org/blog](https://leakeyfoundation.org/blog)



# Awarded Grants

## Fall 2016



## Behavioral

**Ekwoge Abwe, Drexel University**

*Behavioral diversity with genetic and ecological variation in chimpanzees, Cameroon*

**Abigail Bigham, The University of Michigan**

*Evolutionary consequence of adaptive genetic change among high-altitude Andeans*

**Katharine Burke, University at Buffalo**

*Social network, personality and physiological stress levels in juvenile rhesus macaques*



Kristin Sabbi in Kibale National Park, Uganda.

**Alecia Carter, University of Cambridge**

*Constraints on the evolution of culture: Social information in Namibian baboons*

**Erica Dunayer, University at Buffalo, SUNY**

*Influence of stress for market exchanges in Cayo Santiago macaques*

**Nicole Herzog, University of Utah**

*Chimpanzees in fire-altered landscapes: Investigating foundations for hominin fire exploitation*



Thomas Kraft with Batek children and a wreathed hornbill in a forest camp in Malaysia. Photo: Thomas Kraft

**James Higham, New York University**

*Living outside of groups: Pathology, social-exclusion, or adaptive strategy?*

**Thomas Kraft, Dartmouth College**

*Shifting co-residence and interaction patterns in a transitioning hunter-gatherer society*

**Amy Lu, Stony Brook University**

*Understanding weaning trajectories in a wild primate - the gelada (*Theropithecus gelada*)*

**Stephanie Musgrave, Washington University in St. Louis**

*Ontogeny of complex tool use among Goualougo triangle chimpanzees*

**Evelyn Pain, Stony Brook University**

*Functions of male woolly monkey morphological variation in Yasuni, Ecuador*

**Rachel Perlman, Stony Brook University**

*The energetics of male reproductive strategies in geladas (*Theropithecus gelada*)*

**Rachna Reddy, University of Michigan**

*The development of male reproductive strategies in wild chimpanzees*

**Kristin Sabbi, University of New Mexico**

*The ontogeny of sex-typed social behavior among East African chimpanzees*

**Nicole Thompson, Columbia University**

*The benefits of social connections during development in blue monkeys in Kakamega, Kenya*

## Paleoanthropology

**Todd Disotell, New York University**

*Exome sequencing of the *Cercocebus-Mandrillus* clade*

**Laurence Dumouchel, The George Washington University**

*The environments of the earliest obligate biped, *Australopithecus anamensis**



Kathryn McGrath collecting impressions of orangutan teeth.

**John Fleagle, Stony Brook University**  
*Earliest fossil platyrrhines from Santa Rosa, Peru*

**Mathew Fox, University of Arizona**  
*Paleoenvironments of *Homo erectus* occupations in the Luonan Basin, China.*

**Sonia Harmand, Stony Brook University, Turkana Basin Institute**  
*The missing Oldowan: 2.3-2.0 Ma sites from West Turkana, Kenya*

**Israel Hershkovitz, Tel Aviv University**  
*New perspectives on modern human origins: Hominid remains from the Manot Cave, Israel*

**Radu Iovita, New York University**  
*Innovators in the foothills: New excavations at early Upper Paleolithic Maibulak (Kazakhstan)*

**Rutger Jansma, University of Minnesota**  
*A phylogenetically informed analysis of the catarrhine adaptive radiation*

**David Katz, University of California, Davis**  
*Morphological consequences of admixture in human and non-human primates*

**Abigale Koppa, Stony Brook University**  
*Nutritional and mechanical properties of Kenyan savanna and wetland plants*

**Jason Lewis, Stony Brook University, Turkana Basin Institute**  
*Pleistocene & Holocene archaeological assemblages from Kisele II Shelter, Tanzania*

**Kathryn McGrath, The George Washington University**  
*Understanding stress-related enamel defects in wild mountain gorillas*

**Rebecca Miller, University of Liege**  
*The Middle-Upper Paleolithic transition at Trou Al'Wesse (Belgium)*

**Marie-helene Moncel, CNRS-MNHN**  
*Early evidence of Acheulean bifacial technology in Europe. New fieldwork at Notarchirico (Italy).*

**Kelsey Pugh, City University of New York**  
*Mid-Late miocene hominoid phylogeny: Implications for ape and human evolution*

**Christina Rogers, Emory University**  
*Evolution of oxytocin and vasopressin systems in the hominoid brain*

**Nancy Stevens, Ohio University**  
*Primate diversification in the late Oligocene Nsungwe Formation of Tanzania*

## Baldwin Fellows

*The Franklin Mosher Baldwin Memorial Fellowships help students from developing countries get advanced education and training in paleoanthropology and primatology.*

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*Ethiopia*

**Ainash Childebayeva, University of Michigan**  
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**Abebe Taffere, University of Florida**  
*Ethiopia*

**Kennedy Oginga, Baylor University**  
*Kenya*

**Terry Mwanache, Colorado State University**  
*Tanzania*

**Vidrige Kandza, Max Planck**  
*Republic of Congo*



Baldwin Fellow Kennedy Oginga studies the paleoenvironment in western Kenya.



# Director's Diary: The Leakey Foundation

When I stood in the dimly lit overhang at Abri de Cap Blanc in the Dordogne region of France and my eyes beheld the carved horse in sandstone (15,000ya) I was reminded that the capabilities to imagine and create lie deep in our species' DNA.

The Dordogne region of France is famous the world-over for housing some of the most spectacular and earliest evidence of creativity. For a few weeks in May 2016, a group of nineteen Leakey Foundation Trustees and Fellows visited many of these sites and met the people studying this area of prehistory. Following our visit in France, a group of eight intrepid travelers continued on to Leipzig, Germany, for an indepth look at the research being conducted at the Max Planck Institute for Evolutionary Anthropology, with excursions to an archeological site, a museum, and a zoo, with cultural activities too.

One of the most thrilling aspects of both tours was the time spent with the experts whose life work provides insight and evidence about our earliest ancestors. The roster of bright minds is too long to list, but a few provided a generous amount of time and energy to give our group a truly memorable experience. Rock art specialist Jean Clottes, archaeologist Harold Dibble, and paleoanthropologist Jean-Jacques Hublin hosted us throughout our tours of France and Germany. They provided behind the scenes access as well as new (often unpublished) information about their research.

At Rouffignac Cave, Font-de-Gaume, Abri du Cap Blanc, Cougnac Cave and Pech-Merle, we were encouraged to think about those who would have made their way into these seemingly magical spaces. From the astonishing amount of mammoths depicted at Rouffignac (158 or 70% of all animals represented) to the various schematic human figures at Cougnac, almost identical to ones found at Pech Merle. In some examples from Font-de-Gaume, the paleolithic artists only needed to draw two or three lines to connect natural forms and turn them into animals; a frieze depicting bison reflects remarkable artistic skill. At Pech Merle there are footprints preserved in the ground, and on the "Spotted Horse Panel" (29,000ya) a horse practically gallops off the side of a



Caverne du Pont d'Arc, site of Chauvet with Jean Clottes.



Susan Reynolds, Sharon Metzler-Dow and Élizabeth Daynès, Atelier Daynès, Paris.

cave wall. Its head is perfectly made from the shape of the jagged rock.

Museums provided opportunities to see priceless collections up close and to ask curators questions. The group visited l'Institut de Paléontologie Humaine with Professor Henry de Lumley and spent time in the laboratories of the newly re-opened (2015) Musée de l'Homme in Paris. There was a private visit (the museum was closed) at the Musée National de Préhistoire in Les Eyzies-de-Tayac where we saw the bones of the Neanderthal child discovered in 1961 at Roc de Marsal,



# France & Germany



Frank Huffman, Victoria Fong, Camilla Smith with Henry de Lumley, l'Institut de Paléontologie Humaine, Paris.



Roc de Marsal with Harold Dibble.

as well as the artistic reconstruction of that child by paleo-artist Élisabeth Daynès. (That exhibit would bring us full circle since we also visited Daynès' art studio in Paris and the archaeological site of Roc de Marsal with lead investigator Harold Dibble.)

In Halle, Germany, we joined Dr. Jean Jacques-Hublin for a tour of the incomparable Halle State Museum of Prehistory. Such unique, artistically refined exhibits provoked awe as we gazed at the Nebra Sky Disc, contemplated the ritualistic burial of an infant with its puppy and a hoofless horse (extraordinary), and stepped backwards as a life sized elephant burst thru a wall.

Creativity was not only to be found on dark cave walls and in museum exhibits but also in the remarkable atelier of Ms. Daynès, where we saw the painstaking work of adding hairs, one by one, onto a reconstruction of a hominid. Then there was also the engineered and artistic reconstructions of Lascuax and Chauvet.

Across the border in Germany, the Wolfgang Köhler Primate Research Center at the Leipzig Zoo and the Schöningen site were two excursions that demonstrated the breadth of research funded by The Leakey Foundation. The primate research center focuses on the behavior and cognition of the four great apes, while the Schöningen site provides evidence of the earliest specialized tool kit, including wooden spears, 300,000 years old.

A day was spent at the Max Planck Institute for Evolutionary Anthropology in Leipzig where researchers investigate humankind's history from an interdisciplinary perspective. They are testing their hypotheses with imaginative, cutting



Jean Clottes and Anne Maggioncalda.

edge projects, many funded by The Leakey Foundation, including 35 grants totalling almost half a million dollars, mostly in small seed grants to young scientists.

At the MPI, we met an early career scholar and Leakey Foundation grantee Kathryn Fitzsimmons, who took us into her pitch-dark lab to teach us about luminescence dating. Director Svante Pääbo spoke to our small group about the

tantalizing possibility that Neanderthals had language, and he is using genetic evidence to test his idea. In the Department of Human Evolution, Jean-Jacques Hublin has assembled a diverse group of thought leaders, including 32 people who joined our group for lunch to break bread and talk about human origins. This was a captivating experience for paleo-enthusiasts like those traveling with The Leakey Foundation.

While strolling through the museum in Halle, I asked Jean-Jacques Hublin why he has dedicated his life to studying our earliest ancestors. He paused and then said in almost a whisper, "It connects us with people we have forgotten. It resuscitates those people. It is a fight against oblivion." A truly eloquent and creative way indeed to explain why human origins research matters. 🦷🦷🦷

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***Travel with The Leakey Foundation is a benefit for donors at the Fellows level. Are you interested in joining our 2017 Fellow's Tour to India? (Please email Sharal Camisa at [travel@leakeyfoundation.org](mailto:travel@leakeyfoundation.org))***

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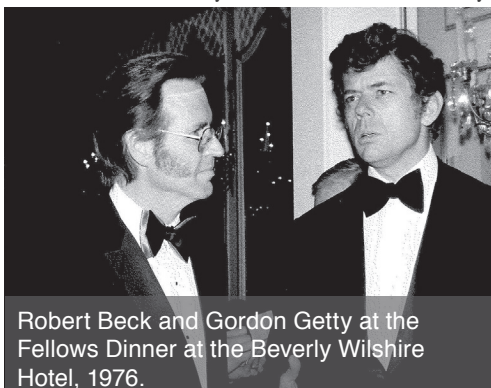
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# From the Archive: 1976

MEREDITH JOHNSON, COMMUNICATIONS MANAGER

*The Leakey Foundation archive holds a rich record of our organization's history and the history of science. This installment of "From the Archive" takes a look at the year 1976.*

In 1976 a gallon of gas cost 59 cents, Jimmy Carter was elected president, and The Leakey Foundation was only eight years old. The young organization had just raised its first million dollars, thanks to a matching challenge grant offered by founding trustee Robert Beck in 1975.



Robert Beck and Gordon Getty at the Fellows Dinner at the Beverly Wilshire Hotel, 1976.

The Leakey Foundation awarded many important grants in 1976, including Donald Johanson's continued study of the Hadar region of Ethiopia after the discovery of Lucy in 1974. Elizabeth Meyerhoff, who was studying the West Pokot in Kenya, wrote to the Foundation with a plea for emergency funding, "I have finally exhausted the initial \$1000---the last few shillings were spent on a back tire for the Piki-Piki. I live more and more Pokot-like, eating the weeds which I gather, or on very special occasion, just after the evening rain, on flying termites." The Leakey Foundation was able to help, thanks to the generous donors who helped meet Beck's million dollar challenge. The Foundation's archive contains comprehensive records on these grants, including photographs, correspondence, research reports, and the original applications. These documents provide fascinating insight into the history of the science.

The Foundation's 1976 speaker series featured legends in primatology and archaeology, such as Dian Fossey, Jane



Dr. J. Desmond Clark presenting a private workshop for Leakey Foundation Fellows at the Getty Museum, 1976.

Goodall, Robert Hinde, Mary Leakey, and Richard Leakey along with talks from luminaries in other fields, including Joseph Campbell, Buckminster Fuller, Jonas Salk, and Carl Sagan. The Leakey Foundation archive contains audio recordings, photographs, illustrations, posters, and press clippings from the lectures. We also have notes and telegrams from prominent researchers and detailed records of planning and budgets related to the lecture series.

The Fellows Dinner that year was a grand affair held at the Beverly Wilshire Hotel with guest speaker Sir Peter Scott of the World Wildlife Fund and Master of Ceremonies Jimmy Stewart. There was also a Fellows Day Conference at the Getty Museum where Fellows could engage in dialogue with scientists like Desmond Clark and Clark Howell. The cost of becoming a Leakey Foundation Fellow in 1976 was a thousand dollars, the same as it is today.



A woman taking a photograph with Elizabeth Meyerhoff (r). Kenya, 1976. Photo: Murray Roberts

The Leakey Foundation is working to digitize and preserve our complete archive, and with the renewed million dollar matching grant challenge we have the opportunity to move more quickly and preserve this important collection for the future. We need your support. Please donate or become a Leakey Foundation Fellow today.



**Help preserve the history of science.**  
[leakeyfoundation.org/donate](https://leakeyfoundation.org/donate)





# Science Speakeasy

ARIELLE JOHNSON, OUTREACH COORDINATOR

The Leakey Foundation is thrilled to announce our new event series, *Science Speakeasy* for intellectually curious adults ages 21+ at Public Works in San Francisco. These events will mix talks from up-and-coming scientists with cocktails, interactive science and storytelling. This season's roster of scientists includes Dr. Nathan Young, as well as Leakey Foundation grantees Dr. Alia Gurtov and Dr. Stephanie Meredith.

*Science Speakeasy* will take place on **March 14, May 23, and June 20, 2017**. These events will pair speakers focused on one aspect of human evolution, examining everything from our ancient origins to our modern lives. These events will also integrate the latest in technology from our partner Meeting Pulse, a company which creates cutting-edge live event software. Before and in between talks, attendees can further explore human origins at interactive stations curated by The Leakey Foundation, featuring local universities and

event partners. Guests will also be able to enjoy food from local vendors, thematic cocktails, as well as a fully-stocked bar.

We're especially excited to launch *Science Speakeasy* after the success of our 2015-2016 event series *Being Human*, which we presented in partnership with the Baumann Foundation. We held nine *Being Human* events with a cumulative attendance of over 1,500 people. Recordings of these events are now available on The Leakey Foundation's YouTube channel. The Baumann Foundation will continue *Being Human* as a smaller, private event series, and we wish them great success.

***Tickets for Science Speakeasy will go sale in January 2017. Don't miss a Science Speakeasy event!***

***Get your season pass at a 15% discount (\$25 for all three events 3/14, 5/23 and 6/20). Visit [leakeyfoundation.org](http://leakeyfoundation.org) this January to get your tickets!***

## MILLION DOLLAR CHALLENGE

**Yes! I WANT MY DONATION DOUBLED!**

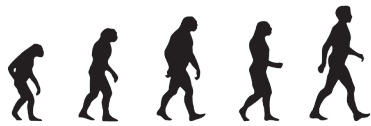
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All contributions are tax deductible, as provided by law.  
Please consider The Leakey Foundation during the planning of your estate.

### The challenge is now, and every dollar counts!

For a limited time, your donation will be doubled up to one million dollars!  
Help us increase our funding for scientific research and educational outreach.  
Have your donation doubled online at [leakeyfoundation.org/donate](http://leakeyfoundation.org/donate)





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# LEAKEY FOUNDATION EVENTS AND PROGRAMS

*New Event Series!*



**03/14**  
**05/23**  
**06/20**

## **SAN FRANCISCO**

### ***Science Speakeasy***

Public Works  
[leakeyfoundation.org](http://leakeyfoundation.org)



**03/01**

## **HOUSTON**

### ***Erin Vogel***

Houston Museum of Natural Science  
[hmns.org](http://hmns.org)



**04/05**

## **NEW YORK CITY**

### ***Zaneta Thayer***

American Museum of Natural History  
[amnh.org](http://amnh.org)



## **PODCAST**

### ***Origin Stories***

Check out our award-nominated  
podcast *Origin Stories*!  
Subscribe on iTunes or listen online:  
[leakeyfoundation.org/origin-stories](http://leakeyfoundation.org/origin-stories)

**TICKETS FOR  
SCIENCE SPEAKEASY WILL GO  
ON SALE IN JANUARY**

**See all of The Leakey Foundation's upcoming  
events at [leakeyfoundation.org/events](http://leakeyfoundation.org/events)**

