Institute of Human Origins

2024 Research Review

Dear Friends and Supporters of IHO,

The year 2024 has been a year of celebration for the Institute of Human Origins (IHO). **Lucy ("Dinknesh")** – one of the most iconic human ancestor fossil discoveries in paleoanthropology – was discovered 50 years ago by IHO's Founding Director Donald Johanson. **Lucy's 50th anniversary once again re-ignited a world-wide interest in human origins science.** Her story is as fascinating now as it was 50 years ago, gracing the covers of prominent scientific journals and magazines in various languages across the globe. This year-long celebration gave IHO the platform to reach and engage with new audiences through our monthly lecture series, special research symposium, public events, K-12 programming, and social media outlets. It also spurred new collaborations that will advance the research and education mission of IHO. These successes would not have been possible without your support – thank you.

As a friend, member, or supporter of IHO, I invite you to read this annual review to have a glimpse of the cutting-edge research that IHO's scientists have been conducting to understand how we became who we are today. This research is more critical and urgent than ever – as the dominant species, our actions determine the fate of all living beings on earth, including our own. Knowledge about the evolutionary foundations of our biology and behavior is crucial for understanding how we can and will adapt to a rapidly changing and increasingly unstable world and the impact that our actions have. **We have to use the momentum that Lucy's 50th anniversary has provided us to break new ground in research, education, and engagement.** Together with you, I envision a new era of multidisciplinary and collaborative innovation and transformation in human origins research, public engagement, and training of the next generation of scientists that will **connect our past to the present and to a sustainable future for the human species.**

IHO relies, more than ever, on generous donors like you, whose passion for the study of human origins creates the strong public/private partnership that IHO enjoys with Arizona State University. I am grateful to all of you who have supported IHO's research, student training, public outreach, and Lucy 50 related programs this year. I hope that you will continue to support IHO's mission to **connect the deep past to our shared global future on this precious, but fragile, planet.**

I invite you to join me in creating a sustainable future for us and all those that share this earth with us by investing in research on our evolutionary past, and education and outreach for new generations of students who will transform our future.

Enclosed you will find the Gift/Pledge form for your convenience. Or you can go to IHO's secure giving website at **https://iho.asu.edu/support-iho.**

Thank you in advance for your support, and I look forward to sharing our progress and new initiatives with you. Let's work together for a better future.

Best wishes for the New Year,

Yohannes Haile-Selassie PhD
Director and Professor

ASU Institute of Human Origins
Arizona State University
A research center of The College of Liberal Arts and Sciences

A Year for Human Origins
Lucy 50
iho.asu.edu

Full flesh "Lucy" reconstruction by paleoartist John Gurche.

IHO research scientist and Hadar Research Project Director Chris Campisano with Irene Smail, an ASU anthropology PhD graduate (2021), now at West Virginia School of Osteopathic Medicine, and IHO Postdoctoral Researcher Blade Radae in the field in Hadar during a short field season, January 2024.

A complete jaw of *Australopithecus deyiremeda* from Woranso-Mille, Ethiopia. This species lived contemporaneously with Lucy's species *Australopithecus afarensis.*

Early Fossil and Archaeological Records

Comparing hominins at Hadar and Woranso-Mille

The collaborative project funded by the W.M. Keck Foundation has made significant progress this year with fieldwork both at Hadar and Woranso-Mille—two IHO-led sites in Ethiopia and laboratory research at the National Museum of Ethiopia. This project involves nine institutions from the US, Europe, and Africa at Hadar and Woranso-Mille. For the first time in over a decade, Hadar Project Director **Chris Campisano** returned to the field, leading a group of geologists, paleontologists, IHO postdoctoral fellows, and local scholars. As part of the Keck project, IHO Director **Yohannes Haile-Selassie** also conducted fieldwork this year at Woranso-Mille and recovered significant fossil hominins that are relevant to the questions asked by the Keck project.

The goal of the research is to compare the sites of Hadar and Woranso-Mille—locations that are only about 21 miles apart. Multiple hominin species have been identified at Woranso-Mille, while at Hadar, there was only one hominin species found, *Australopithecus afarensis,* to which Lucy belonged and lived in the area and walked on two feet 3.2 million years ago. At Woranso-Mille there are two and potentially three different hominin species—*Australopithecus afarensis, Australopithecus deyiremeda,* and possibly another species of currently unknown affinity. **Haile-Selassie** and his colleagues have been working on the latter group to figure out what species they belong to, and they are currently revising a manuscript they submitted to the journal *Nature.*

The question scientists at IHO—and around the world—are trying to answer is, are environmental differences the cause of a single species in one area and multiple species nearby? Was there more habitat heterogeneity in a diverse landscape 3.3 to 3.4 million years ago at Woranso-Mille versus at Hadar? IHO scientists and their collaborators are trying to answer these questions by comparatively analyzing types of soils, animal fossils, and pollen and plant proxies at each site. Initial results from this year's field seasons are being generated in various laboratories around the world, and the project is currently working on a short synthesis manuscript to share the preliminary results with the rest of the scientific community. A complete analysis of the samples from both Hadar and Woranso-Mille will continue for the next few years.

UNESCO World Heritage designation

At the edge of the south coast of South Africa, **Curtis Marean** and his research team have been teasing out the secrets of our earliest modern human ancestors in caves at Pinnacle Point, South Africa, for over 25 years. In late July, the site was declared a UNESCO World Heritage Site—the Olympic gold medal of heritage—which is only given to sites of "outstanding universal value" to all of humanity.

In 1999, Marean was conducting reconnaissance on the south coast of South Africa, looking for a new field site to investigate ideas he had about the origins of modern humans. He explored a series of caves and rock-shelters at the base of a 50-meter-tall coastal cliff at Pinnacle Point. Marean saw high scientific potential in those sites, though they had never been excavated. When he joined ASU and IHO in 2001, Marean and his team did the first test excavations and commenced a research project that continues to reveal new and surprising clues about people living at the edge of the ocean around 160,000 to 50,000 years ago. After successive breakthrough discoveries were published in *Nature* and *Science,* Marean wondered how his team could use their scientific discoveries to give back to the local community that had so warmly welcomed and supported the researchers over the years. He decided to see if there was any opportunity for a World Heritage Site recognition, since that designation can be a potent driver of tourism and job creation. He met with the mayor of the local town, Mossel Bay, and various stakeholders and members of the communities and began the process of surveys and information gathering. The group engaged the government of the Western Cape Province, which eventually took over the process and appointed a full-time "champion" to run it. The application was submitted to UNESCO in March 2023, and subsequently accepted on the first submission. The formal announcement was made by UNESCO on July 26, from their meeting at New Delhi, India.

Looking out to the ocean from one of the cave sites at the new World Heritage site at Pinnacle Point. Image credit SACP4.

Six million years of African mammal fossil history

The East African Rift Valley is a fossil-rich area, reaching across Ethiopia, Kenya, and Tanzania, that preserves the most complete record of human evolution anywhere in the world—including the 3.2-million-year-old fossil skeleton "Lucy," discovered 50 years ago in Hadar, Ethiopia. Over the past six million years, the valley has been home to vast numbers of mammals, whose fossils have been collected and catalogued, and who have many modern analogues living on the African plains today. Mammals comprise the bulk of fossils discovered in the valley. However, we have little knowledge of how long-term changes or trends in the diversity, size, and migration of these animals may have influenced hominin diversity and distribution.

This research began in the IHO Paleoecology Lab led by **Kaye Reed** and a cohort of ASU graduate students, now doctoral graduates, along with **Chris Campisano** and collaborated across several years to build a database of fossil and modern mammal bone collections that was used in this analysis. The researchers examined the presence and absence of species over six million years to reveal that, at various times, endemic animals—those that were found in only one region—disappeared from the fossil record, a long trend that likely resulted from some mammals being able to travel to new regions as immigrants rather than evolving there.

Over the course of six million years, environmental changes occurred, shifting the valley from woody habitats that supported a wide variety of mammals—including carnivores, omnivores like pigs and suids, browsers and frugivores including monkeys and other primates, hooved grazers, and larger mixed feeders like elephants—to a drier, more open landscape, and more grazing animals figured prominently. Groups of migrating mammals may have outcompeted the established species in resource acquisition, which then led to their extinction. The researchers observed that our ancestors were surely influenced by the same environmental factors as other mammals. When the early hominin fossil record is thin or puzzling—and this is the case more often than not—it is useful to draw on the fossil records of other mammal groups for comparison and for contextual clues. The research shows that climate change, paleoenvironments, and mammal evolution have intertwined in eastern Africa over the last six million years. This research is a solid example of how researchers can leverage a wealth of geographic and temporal data to generate novel insights into the evolution of humans and the mammals that lived alongside us in Africa.

Replicability in stone tool analysis

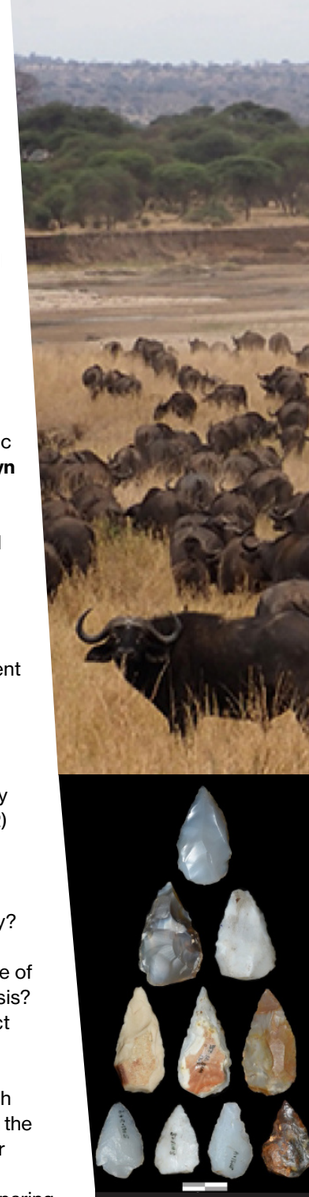
Data comparability is particularly acute in the analysis of lithic (stone) artifacts in the Paleolithic record. A group of researchers, including **Kathryn Ranhorn**, created the most extensive study yet on replicability in lithic analysis based on a total of 11 analysts, 100 lithics, 38 attributes, and hundreds of hours of collaborative conversation and writing. Although initially geared toward the African Middle Stone Age record, this study has broad applicability to analyzing stone tools across all regions and periods. The most pertinent finding of the study is that the 11 international expert lithic analysts closely matched across many of the attributes tested in the study, which asked the following questions: (1) Which lithic attributes are analysts able to code more reliably and which are they able to code less reliably? (2) Does limiting the number of possible attribute states impact interanalyst replicability? (3) Do specific flake characteristics (i.e., differences in flake shape, etc.) impact interanalyst replicability? (4) Does the inclusion of images in definitions impact interanalyst replicability? (5) What degree of measurement precision is realistic in lithic analysis? (6) Do differences in lithic flaking systems impact interanalyst replicability? (7) Do the analyst's experience and training impact inter-analyst replicability? The researchers concluded that high replicability in lithic analysis is possible, providing the baseline for any comparative study, at least under specific methodological designs. This finding is important given the project's original goal of comparing lithic assemblages across the MSA of Africa.

Genetic Inquiry

Kenyan population history and genomic ethics

In collaboration with **Sarah Mathew** and **Melissa Wilson**, **Anne Stone** is examining how genetic and cultural population structures correspond with each other in Rendille, Borana, Samburu, and Turkana communities of Northern Kenya. Their results show that genetic structure in this region is shaped primarily by geography rather than by culture.

This research also provides a better understanding of genetic diversity in Africa. They currently have National Institutes of Health funding to examine how Western methodological and ethical practices used in genetic studies accurately align with the understandings, attitudes, and perceptions of the Turkana, Borana, Rendille, and Samburu. In particular, **Rebecca Siford,** an IHO-affiliated graduate student, will assess the effectiveness of dissemination efforts by determining the level of understanding of genetics research using pre- and post-dissemination assessments and identify and compare attitudes towards genetic research.



Images above: (top) Wildebeest in a mixed environment. Kaye Reed image. (bottom) An array of stone tool points show infinite variation for analysis. Image from *Nature,* Kappelman et al, "Adaptive foraging behaviors in the Horn of Africa during Toba."

Denise Su, stuck in the mud, on site at Shuitangba. Jay Kelley image.

Reconstructing Paleoclimate

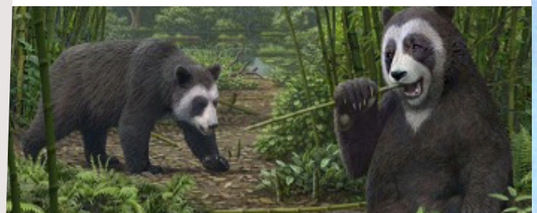
Six-million-year-old Chinese animal fossils

A fossil site in southwestern China gives scientists new information about the environment and ecology of the Late Miocene period. Scientists believe that reconstructing what it was like millions of years ago can help us understand the relationships between climate change and how different species responded and evolved. In the Yunnan Province, there is a lignite mine—a form of coal—in Shuitangba, full of old compressed trees and fossils from about six million years ago. Paleoecologist **Denise Su** and a team of scientists started a project in 2007 in the Zhaotong Basin that would last nearly two decades and provide a unique look into past environments.

After four excavations over the years, the team found 2,400 vertebrate animals, including a new species of apex otter the size of a wolf and evidence of the earliest bamboo-eating ancestral panda to have a false thumb. Of the vertebrates found, 60% of the bones were water birds, an uncommon find at any excavation site. The team also found three elephant skulls, including a baby.

Another unexpected find, according to IHO affiliate researcher and paleoanthropologist **Jay Kelley** was a baby Lufengpithecus (ape) skull. Kelley has worked at the site since the beginning and said apes were long gone from Europe, South Asia, and most of East Asia by this time. Throughout nearly all of Eurasia, monkeys only show up after apes become extinct. Shuitangba is the first Eurasian site where fossil apes and monkeys have been reliably shown to have coexisted outside of the parts of Southeast Asia where they coexist today.

Part of the reason why researchers are interested in understanding environments in these critical transition periods is because it gives us a sense of how animals, plants, and ecosystems shifted, adapted, and changed to respond to those factors. By analyzing the sediment, animal remains, and plant remains, the team was able to reconstruct the paleoenvironment at Shuitangba. Fieldwork is complete, however, analysis continues on the discoveries.



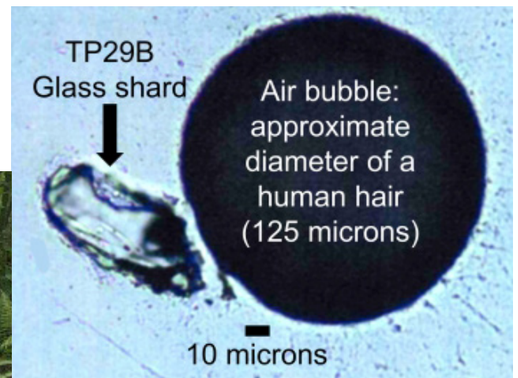
(Above) Six million years ago, giant otters may have lived in the lush swamps of what is now China, and coexisted with tapir. **(Right)** An artist reconstruction of Ailurarctos from Shuitangba. The grasping function of its false thumb has reached the level of modern pandas, whereas the radial sesamoid may have protruded slightly more than its modern counterpart during walking. Illustrations by Mauricio Anton.

Cryptotephra research

The Toba super-eruption occurred during the main occupation of archaeological site Shinfa-Metema 1 (SM1) in Ethiopia and is documented by tiny glass shards—cryptotephra—thoughout its deposits. Cryptotephra are volcanic glass shards that can range from 80–20 microns in size, which is smaller than the diameter of a human hair. Extracting these microscopic shards from archaeological sediment requires patience and great attention to detail. Searching for cryptotephra at these archaeological sites is like looking for a needle in a haystack, but without knowing if there is even a needle. However, the presence of this dating method leads to the ability to correlate sites 5,000 miles apart, and even potentially further, and define dates to within weeks instead of thousands of years.

The methods for identifying low-abundance cryptotephra were first developed for research at Pinnacle Point, South Africa, at a University of Nevada Las Vegas lab and are now carried on at IHO's Sediment and TEphra Preparation (STEP) Lab. Graduate student **Jayde Hirniak** led IHO's effort to create its own cryptotephra lab, working with **Chris Campisano** and building on methods developed at UNLV. Hirniak's primary expertise is in tephrochronology, which involves the use of volcanic ash to link archaeological and paleoenvironmental records and place them on the same timeline.

The research at SM1 testing the "blue highways" hypothesis (see the next section) highlights the importance of the UNLV-ASU team pushing the limits for successfully using cryptotephra to date and correlate archaeological sites across Africa. The lab at ASU was built to process extremely low-abundance cryptotephra (less than 10 shards per gram) using a highly specialized technique. There are only a few labs in the world with these capabilities. One of the groundbreaking implications of this research is that these cryptotephra methods developed for the prior study in South Africa and now applied to a research site in Ethiopia, proves that researchers can correlate sites across Africa, and perhaps the world, at a resolution of several weeks of time.



Adaptation to a Changeable Planet

Toba super-eruption unveils new insights into early human migration

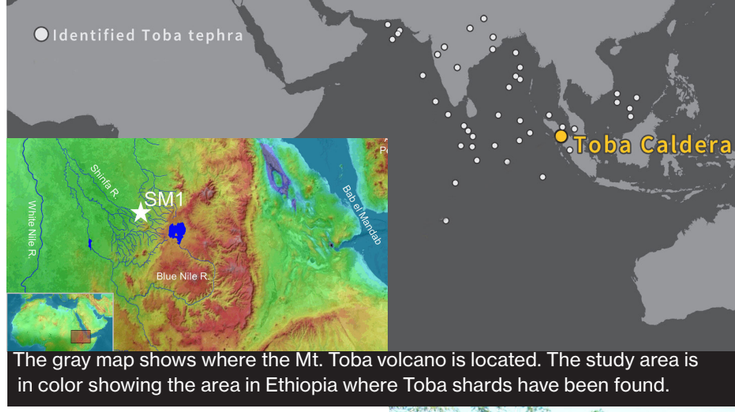
Modern humans dispersed from Africa multiple times, but the event that led to global expansion occurred less than 100,000 years ago. Previous researchers speculated that dispersals were restricted to "green corridors" formed during humid intervals when food was abundant and human populations expanded in lockstep with their environments. But a new study in *Nature* by researchers **Curtis Marean**, **Christopher Campisano**, **Jayde Hirniak,** and their colleagues suggests that humans also may have dispersed during arid intervals along "blue highways" created by seasonal rivers.

Working in the Horn of Africa (see map above right), the researchers uncovered evidence showing how early modern humans survived in the wake of the eruption of Toba, one of the largest super-volcanoes in history, some 74,000 years ago. The behavioral flexibility of these people not only helped them live through the super-eruption but may have facilitated the later dispersal of modern humans out of Africa and across the rest of the world.

The team investigated the Shinfa-Metema 1 site in the lowlands of present-day northwestern Ethiopia along the Shinfa River, a tributary of the Blue Nile River. Based on isotope geochemistry of the teeth of fossil mammals and ostrich eggshells, they concluded that the site was occupied by humans during a time with long dry seasons on par with some of the most seasonally arid habitats in eastern Africa today. Additional findings suggest that when river flows stopped during dry periods, people adapted by hunting animals that came to the remaining waterholes to drink. As waterholes continued to shrink, it became easier to capture fish without any special equipment, and diets shifted more heavily to fish.

Toba's climatic effects appear to have produced a longer dry season, causing people in the area to rely even more on fish. The shrinking of the waterholes may also have pushed humans to migrate outward in search of more food. Seasonal rivers thus functioned as "pumps" that siphoned populations out along the channels from one waterhole to another, potentially driving the most recent out-of-Africa dispersal.

The humans who lived at Shinfa-Metema 1 are unlikely to have been members of the group that left Africa. However, the behavioral flexibility that helped them adapt to challenging climatic conditions such as the Toba super-eruption was probably a key trait of Middle Stone Age humans that allowed our species to ultimately disperse from Africa and expand across the globe.



The gray map shows where the Mt. Toba volcano is located. The study area is in color showing the area in Ethiopia where Toba shards have been found.

Life History and Adaptation

Poor oral health affects the heart, brain

Healthy teeth or tooth loss, cavities, and damaged teeth can provide doctors and scientists with important information about the health of other parts of our body. That's what recent research by **Ben Tumble** and colleagues confirmed in a study focusing on the Tsimane people, an Indigenous population in the Bolivian Amazon. This study by evolutionary anthropologists and bioarchaeologists discovered that poor oral health is associated with higher levels of inflammation, decline in mental ability (dementia), and aortic valve calcification (cardiovascular disease). But how does poor oral health affect our hearts and brains exactly? Trumble and colleagues believe that there could be bacteria entering the bloodstream causing the inflammation, which can lead to trouble chewing and poor nutrition.

Three generations of Tsimane women. Paul Hooper image.

Trumble notes that in the US, people living in low socioeconomic status conditions often are at higher risk for both chronic diseases of aging and of not having access to dental insurance or good dental care. These structural barriers make it more likely for individuals to have both high rates of chronic diseases, like cardiovascular disease, compared to the rest of the population, but also to have poor dental health. In the US, it is difficult to disentangle the role of oral health in chronic disease. However, the Tsimane have far less of a socioeconomic gradient and very little access to modern dentistry. This makes it possible to examine associations between oral health and chronic disease without confounding social factors.

Trumble and his colleagues at the Tsimane Health and Life History Project have worked with the Tsimane for over 20 years and have brought access to health care to this subsistence population, which have led to numerous discoveries about heart health, dementia, brain volume, and now oral health. The research on oral health actually came from a request by the Tsimane to get access to dental care. In order to apply for future grants, and to ask the various Bolivian health agencies for help, the researchers had to first collect preliminary data to show that there is a major unmet need for dental care in

Above: Ben Trumble in his lab.

Below: Stone tools that become increasingly more complex over the course of three million years. Top: First time period studied—Old-owan core, Koobi Fora, Kenya. Second: Second time period studied—Acheulean cleaver, Algeria. Third: Char-acteristic of 600,000 year ago technology —Levallois core, late Pleistocene Algeria. Fourth: Hopewell period microblade core, Ohio. Image credits found at https://iho.asu.edu/publications/annual-research-review.

this population and that it has important impacts for health. Because of this study, there is now increased awareness of the associations between oral health and chronic disease in the U.S., and they also started working with local Bolivian dentists to provide dental care to the Tsimane in the coming months.

Trumble worked with dental researchers **Gary Schwartz** and **Christopher Stojanowski**, a bioarchaeologist in the School of Human Evolution and Social Change. This project revealed connections among oral health, cardiac health, and cognitive health that hold true even in a population that are known to have minimal levels of cardiovascular disease and dementia.

Human Uniqueness—Cooperation and Cognition

Origin of cumulative culture in human evolution

Each of us individually is the accumulated product of thousands of generations that have come before us in an unbroken line. Our culture and technology today are also the result of thousands of years of accumulated and remixed cultural knowledge. But when did our earliest ancestors begin to make connections and start to build on the knowledge of others, setting us apart from other primates? Cumulative culture—the accumulation of technological modifications and improvements over generations—allowed humans to adapt to a diversity of environments and challenges. It is unclear, however, when cumulative culture first developed during hominin evolution. Research by **Charles Perreault** and ASU doctoral graduate **Jonathan Paige** concludes that humans began to rapidly accumulate technological knowledge through social learning around 600,000 years ago. Perreault says that our species, *Homo sapiens,* has been successful at adapting to ecological conditions—from tropical forests to arctic tundra—that require different kinds of problems to be solved. Cumulative culture is key because it allows human populations to build on and recombine the solutions of prior generations and to develop new complex solutions to problems very quickly. The result is that our cultures—from technological problems and solutions to how we organize our institutions—are too complex for individuals to invent on their own.

To investigate when this technological turn may have begun and to explore the origin of cumulative culture, Paige and Perreault analyzed changes in the complexity of stone tool manufacturing techniques across the past 3.3 million years of the archaeological record. The researchers broke down the complexity of the stone tool technologies by the number of steps that each tool-making sequence involved. The results suggested that after around 600,000 years ago, the complexity of manufacturing sequences rapidly increased and hominin populations started relying on unusually complex technologies. There are only rapid increases in complexity after that time as well. Both of those findings match what we expect to see among hominins who rely on cumulative culture.

While other forms of social learning may have influenced tool-making, it is only in the Middle Pleistocene when there is evidence for rapid increases in technological complexity and the development of other kinds of new technologies like consistent evidence of controlled use of fire, hearths, and domestic spaces, likely essential components of the development of cumulative culture. Other kinds of complex technologies also developed including wooden structures constructed with logs hewn using hafted tools, which all suggest that cumulative culture arose near the beginning of the Middle Pleistocene epoch, possibly predating the divergence of Neandertals and modern humans.

Influences for mate choice

As humans, we socially learn from others. We learn—or copy—how to talk from our parents and friends; we learn from teachers when we go to school. And, according to research, people also tend to copy what others find attractive in partners. This mate-choice copying is said to save us time and energy when trying to find a match. We probably all do this—ask friends and family members for advice, discuss relationships with each other, and learn from our friends' successes and failures. Animals do it too. Female bowerbirds flock together and collectively inspect males; female fish watch where other females lay their eggs and follow suit. Some scientists believe our brains evolved a context-specific system for picking a date. However, new research by **Thomas Morgan** shows different results.

Morgan, whose research encompasses the evolution of the human mind and intelligence, evolutionary anthropology, and psychology and biology fields, ran a study that suggests the human brain is actually a flexible and adaptable broad-context social learning tool and not a collection of task-specific solutions programmed by evolution. Morgan uses the metaphor of a Swiss-Army knife versus a crowbar to explain narrow and broad context copying mechanisms. Morgan believes that not only are humans cognitively sophisticated, but we also have complex cultures, which themselves evolve and interact with genetic evolution. He said that when we talk about the evolution of the mind, we need to know what evolution has done exactly, which gets to the heart of questions about human nature. Has natural selection given us a hardwired brain with dedicated circuits to solve a variety of common problems? Or has it given us a flexible, general-purpose learning system and then it's up to us to figure things out? This is what this project helps us to understand, and its conclusion is the latter: Our brain is a flexible, general-purpose tool.

Stepparenting in traditional societies

Kim Hill and graduate student **Julia Phelps** published new research stemming from Hill's 45 years of fieldwork with the Ache, an indigenous hunter-gatherer group in Paraguay. The study highlights that many Ache children lived with stepparents, extended kin, or adoptive parents at some point in their lives. This was particularly common due to the high mortality rate and extremely high divorce rates in the forest. The data imply that stepparenting and alloparenting were extremely common throughout human ancestral history. Hill and Phelps also address why nonbiological caregivers—"alloparents"—invest time and resources in children who are not their own and what the social effects of such relationships are.

Three possible explanations for this behavior are proposed: (1) Kinship ties—Alloparents are often related to the children they care for and their actions may be driven by inclusive fitness, meaning they benefit by helping relatives; (2) Social alliances—Some alloparents invest in children as a way to strengthen social ties with the child's biological parents or to build future alliances with the children themselves; (3) Cultural norms and signaling—Helping children may signal generosity and cooperative traits, improving the helper's social standing. This could also be driven by biological factors, like the positive feelings that come with caring for others. As Hill and Phelps state in the article, "The widely repeated proverb really seems consistent with the results of this study: 'It takes a village to raise a child.'"

Third-party arbitration and forgiving strategies increase cooperation when perception errors are common

Humans cooperate in groups in which mutual monitoring—keeping an eye on each other's behavior—is common. This provides the possibility of third-party arbitration, which is not just a way to solve disputes in the legal world. It is also a way that humans negotiate life. As we interact with one another, third-party arbitration, like the viewpoint of a mutual friend, can stabilize reciprocity, or equal exchanges, in a relationship, in at least two ways: first, when it is accurate, it reduces the frequency of misunderstandings resulting from errors in perception between two people. Second, even when it is inaccurate, it provides a public signal that allows pairs to align their expectations about how to behave after errors occur. Many times this happens among coworkers, friends, and family without these parties even noticing what has occurred.

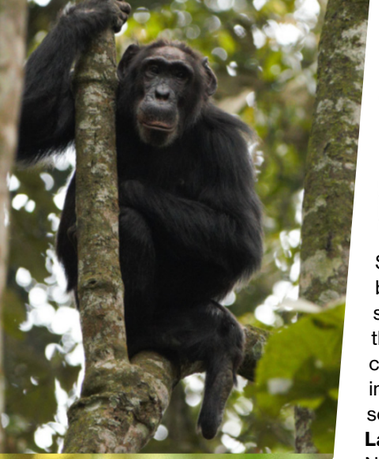
Researchers, including **Rob Boyd, Sarah Mathew**, and **Hillary Lenfesty**, created experiments that test for these two effects. The experiments were conducted with individuals participating through an online Prisoner's Dilemma "game." The prisoner's dilemma is a game theory involving two rational agents, each of whom can either cooperate for mutual benefit or betray their partner for individual gain. The dilemma arises from the fact that while defecting is rational for each agent, cooperation yields a higher payoff for each. Players with the highest average payoffs are those who make use of third-party arbitration and who also employ forgiving strategies. The combination of these two behaviors reduces the detrimental effects of errors on reciprocity, resulting in more cooperation.

Their results suggest that third-party arbitration plays an important role in sustaining direct reciprocity when perception errors are frequent. Almost all participants made use of the third-party arbitrator in conditions in which arbitration was optional, and individuals who used the arbitrator more often had higher average payoffs.

Above: These two images show how Ache children are integrated into the life of the community, first in fishing (top image) and in hanging out with a group of men, regardless of whether a biological parent is present. Kim Hill images.

Perceived value of education in hunter-gatherer communities

Universal formal education is a major global development goal. Yet hunter-gatherer communities have extremely low participation rates in formal schooling, even in comparison with other marginalized groups. Recent research by **Helen Elizabeth Davis** and a colleague reviewed existing literature to identify common challenges faced by hunter-gatherer children in formal education systems in the Global South. They find that hunter-gatherer children are often granted extensive personal autonomy, which is at odds with the hierarchical culture of school. Hunter-gatherer children face economic, infrastructural, social, cultural, and structural barriers that negatively affect their school participation. While schools have been identified as a risk to the transmission of hunter-gatherer values, languages, and traditional knowledge, they are also viewed by hunter-gatherer communities as a source of economic and cultural empowerment. These observations highlight the need for hunter-gatherer communities to decide for themselves the purpose school serves and whether children should be compelled to attend.



Chimpanzees caught in snares lose and injure their fingers, toes, hands, and feet. Lita (top), an adult female chimpanzee, lost her foot. Photo by Kevin Langergraber. Peterson (bottom), an adult male, was the only chimpanzee snared at Ngogo after ASU primatologist Kevin Langergraber and his team started the snare removal program in 2011. With the help of the Uganda Wildlife Authority, they successfully removed his wire snare. Photo by Kevin Lee

Nonhuman primates

Snare removal program supports chimpanzee conservation

Snares are a common tool often used by hunters in Uganda looking to catch small, wild game meat. Unfortunately, the snares are also capable of catching wild chimpanzees, resulting in injured fingers, toes, hands, feet—and sometimes complete amputation. **Kevin Langergraber** has been studying the Ngogo community of chimpanzees in Kibale National Park in Uganda for over two decades and serves as director of the Ngogo Chimpanzee Project, where he and a team of scientists study, research, and work to protect the primates through conservation efforts.

After witnessing and helping chimpanzees who were getting injured in snares, Langergraber and his team decided to implement a snare removal program in 2011. Their report is the first to statistically show how snare removal helps conservation efforts. The report compares the number of times chimpanzees were snared during the 12.75 years after the start of this project with the number of times individuals were snared during the previous 14 years. Only one chimpanzee was snared after they began removing snares, compared with 12 individuals caught during the period before. This showed a 79% reduction in the number of victims after implementing the snare removal program. The researchers also explained that snared chimpanzees have more intestinal parasites, are not able to run fast—putting them in danger of being attacked by other chimpanzees—and have decreased locomotor skills, making it difficult to safely be in the canopy of the forest. Since the start of the snare removal program, there are now eight two-person snare removal teams that patrol Kibale National Park in cooperation with the Uganda Wildlife Authority. Langergraber encourages people who want to learn more about chimpanzees and conservation in Ngogo to watch "Chimp Empire, the four-part Netflix series launched in 2023 that gives a never-before-seen account of the chimpanzees scientists and Langergraber study.

Modernizing data collection at Gombe

Ian Gilby studies the behavioral ecology of wild chimpanzees and coordinates long-term research on the chimpanzees of Gombe National Park, Tanzania. As Convener of the Gombe Research Consortium, Gilby is concentrating on laying the groundwork for future research at Gombe by focusing on data collection and accessibility. Working closely with a database designer with extensive experience with primate data, Gilby is working to modernize the Gombe chimpanzee database. The archive, begun by Jane Goodall, contains data from 60+ years of data collected each day by researchers and field assistants. The ultimate result will be a resource that is accessible through a web-based interface, allowing users (with tiered levels of access) to use the database management software of their choice to run their analyses from anywhere in the world. As such, errors will be minimized and the scope for collaboration will be greatly increased. To ensure continuity after this work is done, a Research Data Manager in ASU's Global Institute of Sustainability has been managing the technical logistics and will continue to do so.

Baboon behavior research

Joan Silk along with collaborator **Jacob Feder**, an NSF postdoctoral fellow at IHO, are working on comparative analyses of the structure of social networks in papionin baboon species. They have established relationships with researchers studying five of the six species of baboons (yellow olive, chacma, guinea, kinda, geladas, mandrills), and two species of mangabeys (sooty, grey-cheeked) to contribute grooming data. They have data in hand from about half of these projects and have begun exploring the properties of their social networks.

Silk and Feder have also begun exploring the social dynamics that preceded and followed the fission in a group of olive baboons (Papio anubis) that Silk studied in collaboration with the Uaso Ngiro Baboon Project in Laikipia, Kenya. The fission began when a high-ranking male transferred from his natal group into a neighboring group, triggering the parallel dispersal of his closest female grooming partners. Several of these females were members of a single matriline and had close social ties. The dispersing females did not integrate into their new group, and they and the male eventually budded off and formed a new daughter group. Aggression rates in the original group rose prior to the fission and returned to baseline levels once the new group had formed. However, there was no indication that the dispersing females were "evicted" by their original groupmates. Indeed, grooming between the founder group and the daughter group persisted at low levels, suggesting that within-group vs. between-group distinctions were blurred. This fission appears to have been a product of female mate choice, selective social decisions, and elevated female-female competition.

Left: IHO Director Yohannes Haile-Selassie, Jane Goodall Institute Executive Director Anna Rathmann, Jane Goodall Institute Archive and Database Director Ian Gilby, and The College of Liberal Arts and Sciences Dean Kenro Kusumi stand in front of a new plaque in the Institute of Human Origins offices honoring Jane Goodall for her contributions to science. Image by Samantha Chow.

Awards and Recognitions

Evolutionary Anthropologist Robert Boyd elected to American Academy of Arts and Sciences

IHO Research Scientist and School of Human Evolution and Social Change Professor Robert Boyd was elected to the American Academy of Arts and Sciences, one of the oldest learned societies in the United States.

Boyd is considered a forerunner in the field of cultural evolution. Specifically, his research focuses on the evolutionary psychology of the mechanisms that give rise to—and influence—human culture, and how these mechanisms interact with population dynamic processes to shape human cultural variation. Boyd is also an affiliated professor with the ASU-Santa Fe Institute Center for Biosocial Complex Systems and the ASU Center for Social Dynamics and Complexity.

His work is summarized in three books, two coauthored with P. J. Richerson—*Culture and the Evolutionary Process,* and *Not by Genes Alone: How Culture Transformed Human Evolution*—and by Boyd individually, *A Different Kind of Animal.* Boyd, along with his wife, ASU primatologist Joan Silk, coauthored *How Humans Evolved,* considered the gold-standard textbook for introduction to biological anthropology courses.

Baboon mom and baby being groomed by another female. Image courtesy Joan Silk.

ASU professor named AAAS Fellow

The American Association for the Advancement of Science (AAAS), the world's largest general scientific society and publisher of the *Science* family of journals, elected **Kaye E. Reed** to the newest class of AAAS Fellows, which is among the most distinguished honors within the scientific community.

Election as an AAAS Fellow is an honor bestowed upon AAAS members by their peers for their scientifically or socially distinguished efforts to advance science.

Reed, formerly an ASU President's Professor in the School of Human Evolution and Social Change and research scientist with the Institute of Human Origins, currently an Emeritus Professor after retiring in spring 2024, was cited for her "distinguished contributions to the study of human evolution, particularly for groundbreaking work in reconstructing early hominin paleoecology and fossil discoveries related to the origins of the genus *Homo*."

Working for over 20 years as director of the Ledi-Geraru Research Project in Ethiopia and as a member of the research team at Hadar, Ethiopia—the site where the famous "Lucy" fossil skeleton was discovered—Reed's research has mainly focused on understanding the paleoenvironment, or what the ancient plant, animal, and climate environments were millions of years ago. Her research has also taken her to South Africa, Morocco, and Spain.

In 2013, her research team in Ledi-Geraru discovered a 2.8-million-year-old jawbone that pushed back the first known appearance date of our own genus *Homo* by approximately 400,000 years.

"I am very excited and honored to be named an AAAS Fellow," said Reed.

Friend of IHO

ASU Institute of Human Origins
Arizona State University

Are you a Friend of IHO?

Are you a "Friend of IHO"? The Institute of Human Origins has a membership program where your level of giving will receive benefits and opportunities for you to become engaged with IHO events, gain special access to IHO scientists, and receive various thank you gifts to show off your support of the Institute of Human Origins!

If you are currently a donor, you should have received some special mailings about your level of benefits and how to raise your benefits to the next level!

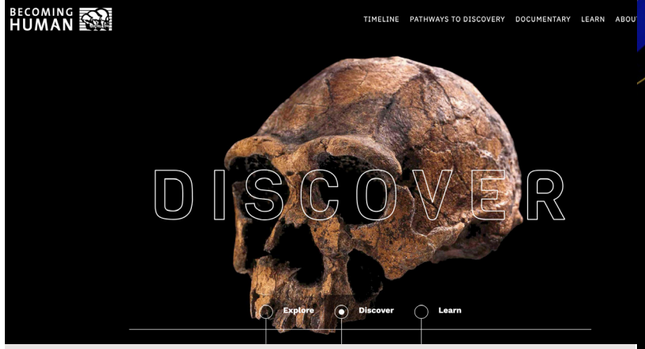
If you are not a donor, in this celebration year for the 50th anniversary of the Lucy discovery, consider making a year-end gift to support this incredible year of education outreach about human evolution and our human past—and future—on the planet!

Learn more about the IHO Membership Program at **iho.asu.edu/support/membership-program**

Ask An Anthropologist!

AskAnAnthropologist.asu.edu is a resource for middle and high school students and their teachers to learn about anthropology from stone tools to big brains and from climate change to teeth. The lively website has activities for students and short quizzes for teachers to use for assessment of learning. Please alert your students and teachers to this terrific resource that is a companion to ASU's wildly popular **AskABiologist.asu.edu.**

Future development will include interviews and podcasts with IHO scientists, articles keyed to national science standards, and more activities and games.



BecomingHuman.org—An incredible learning resource!

In summer 2023, a completely refreshed version of **BecomingHuman.org** was launched to enlighten and educate thousands of **teachers, students, and the community of life-long learners** about the science of how human life developed on Earth. It includes a **Timeline of Human Evolution** that is focused on the biological and technological changes of human ancestor species for the last seven million years and the environmental changes that these species were adapting to. Its mission is to provide a wide spectrum of information on discoveries in the field, the emergence of modern humans in Africa and subsequent migrations, human adaptation to a changeable planet, human uniqueness and cumulative culture, genetic inquiry, and what studying nonhuman primates helps us to understand how our cooperative behaviors developed.

The very popular **Documentary** continues to be a centerpiece of the offerings of this robust and engaging website!

For the past 24 years, BecomingHuman.org has been supported by the IHO Executive Board and partners with the scientific community of experts across the spectrum of human origins scientists affiliated with ASU's Institute of Human Origins to ensure the highest level of scientific understanding presented within this website.

Explore the website at BecomingHuman.org

Find the online version of this publication and links to research and news at https://iho.asu.edu/publications/annual-research-review

Thank You for Your Support!

ASU Institute of Human Origins
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A research center of The College of Liberal Arts and Sciences

A Year for Human Origins
50 Lucy
iho.asu.edu

What an amazing year it has been celebrating the 50th anniversary of the discovery of Lucy! The goal of the Institute of Human Origins (IHO) during this year was to engage and reignite a worldwide interest in human origins, like Lucy did 50 years ago.

Engaging our community of Friends and Supporters

This year was full of events and public lectures beginning with the Second Annual Billl Kimbel Impact Lecture at the Mesa Arts Center by Donald Johanson and a Gala Dinner Lakeside at the Phoenix Zoo hosted by the IHO Executive Board, which received nearly 300 people to celebrate the golden anniversary of the Lucy discovery and make new friends in the community. A monthly lecture series began in February with each of the IHO scientists giving a 20-minute "masterclass" lecture on their scientific focus. In November, IHO welcomed Nobel Laureate Svante Pääbo to give a lecture on "Archaic Genomics," which was well attended. All of these lectures are on IHO's YouTube channel **(@ASUInstituteofHumanOrigins).**

Engaging an international academic audience

In April 2024, IHO invited 20 human origins science international experts, including 11 international experts and 9 IHO scientists for a day-long symposium about the impact of Lucy on human origins science over the last 50 years. That symposium was open to the public and online, which reached an audience of 1,500 people from around the world. The symposium talks are available to watch on IHO's YouTube channel.

Engaging with the Ethiopian Community

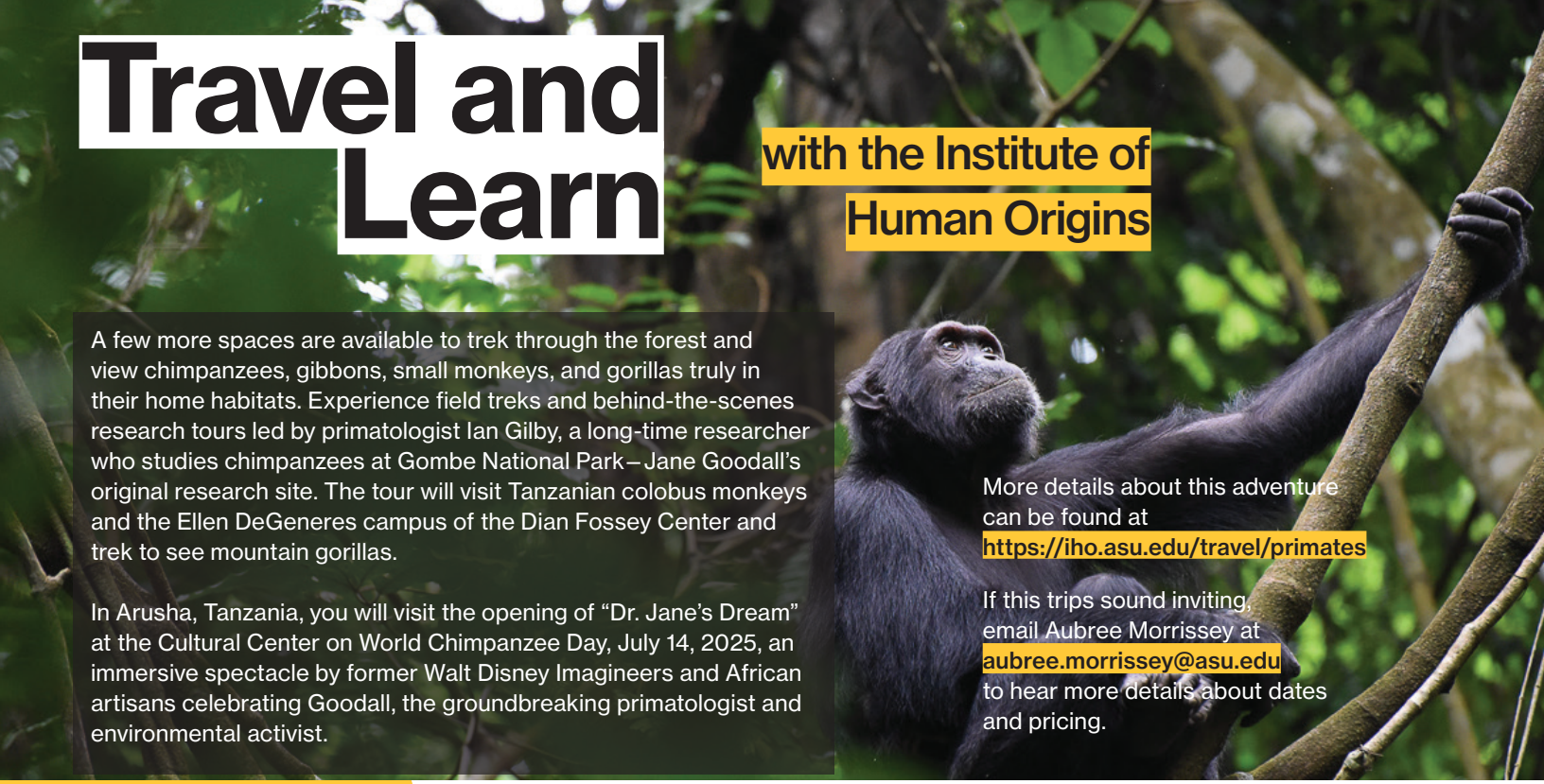
The 2024 year began with Donald Johanson leading an IHO donor trip to Ethiopia to visit the National Museum of Ethiopia labs where the original "Lucy" fossil skeleton is stored and curated (left image, IHO Director Yohannes Haile-Selassie co-led the trip with Johanson) and return to the site where Lucy was discovered (right image). Later in the year, the East African Association of Paleoanthropology and Paleontology had their biennial conference in Addis Ababa, Ethiopia's capital, to honor the "Golden Anniversary" of the discovery of Lucy. The conference was organized in part by Haile-Selassie and attended by Johanson and several IHO scientists.

Engaging Media and the Global Community

The "Grand Finale" of the year was Donald Johanson on stage at the famed 92nd Street Y in New York City with author and New York Times columnist Carl Zimmer. Media coverage of the continuing importance of the Lucy discovery was covered by top scientific journals and media, including *Science* and *Scientific American,* and by popular outlets like the *Washington Post* and *New Scientist*. For more media coverage, including a link to a half-hour program on Arizona PBS, go to **https://news.asu.edu/spotlight/lucy-at-50**

Travel and Learn

with the Institute of Human Origins



A few more spaces are available to trek through the forest and view chimpanzees, gibbons, small monkeys, and gorillas truly in their home habitats. Experience field treks and behind-the-scenes research tours led by primatologist Ian Gilby, a long-time researcher who studies chimpanzees at Gombe National Park—Jane Goodall's original research site. The tour will visit Tanzanian colobus monkeys and the Ellen DeGeneres campus of the Dian Fossey Center and trek to see mountain gorillas.

In Arusha, Tanzania, you will visit the opening of "Dr. Jane's Dream" at the Cultural Center on World Chimpanzee Day, July 14, 2025, an immersive spectacle by former Walt Disney Imagineers and African artisans celebrating Goodall, the groundbreaking primatologist and environmental activist.

More details about this adventure can be found at **https://iho.asu.edu/travel/primates**

If this trips sound inviting, email Aubree Morrissey at **aubree.morrissey@asu.edu** to hear more details about dates and pricing.

During the past year, these IHO-affiliated students received their PhDs

Kevin C. Lee

Advised by Kevin Langergraber, Joan Silk, Ian Gilby

Dissertation: Chimpanzees as a model for evaluating the evolution of human hyper-sociality

Lee is an adjunct professor in Public Health at the University of Puget Sound.

Adele Crane

Advised by Anne Stone, Keolu Fox, Arvind Varsani, Melissa Wilson

Dissertation: Phylogenomics and zoonotic spillover of mycobacterium leprae in the Pacific Islands and Brazil

Crane is a posdoctoral fellow at Colorado State University.

Learn more about IHO and get involved!

Stay in touch with breaking science, news, and events by following IHO on Instagram, Facebook, YouTube, and Twitter.

- Lucy and ASU Institute of Human Origins
- @humanoriginsASU
- youtube.com/@ASUInstituteofHumanOrigins
- @human_origins_asu

And visit IHO's website for school-aged students—**Ask An Anthropologist**—and connect with the Facebook page for "Dr. Anthropology"!

- **askananthropologist.asu.edu**
- facebook.com/dranthropology

Don't miss announcements, discoveries, or IHO outreach events in our latest e-newsletter. To keep abreast of IHO research as it occurs, please update your email contact information online. **iho.asu.edu/subscribe**

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