

Travel and Learn



with the Institute of Human Origins

After thirty years of traveling all over the globe, we thought that we should have an adventure in our own backyard! IHO's rafting trip in May 2019 hosted 27 travelers and two geologists who spent a week floating down one of the most beautiful places on Earth—the Grand Canyon! Cruising the Colorado River with IHO's Chris Campisano and ASU School of Earth and Space

Exploration's Ramon Arrowsmith gave our travelers a deeper understanding of the development of the Earth than could any classroom lecture. Interested in joining us for Grand Canyon trip number two? We have requested the same week—May 30 to June 5, 2021, for the next trip. Email Julie Russ at jruss@asu.edu to get on the travelers list.

Awards and Recognition

Joan Silk, IHO Research Affiliate and Professor in ASU's School of Human Evolution and Social Change, was named a new **Regents Professor**—the highest honor that ASU bestows on its faculty in recognition of top experts in their field. Professor Silk joined IHO and SHESC in 2012, after a long career at UCLA. She studies the social lives of baboons in Botswana to explore the origins of prosocial behavior in humans.



Institute of Human Origins

2019 Highlights

Dear Friend of the Institute of Human Origins,

As I review the depth and breadth of IHO's scientific activity during the last year, I am proud of the ways we've grown and expanded our research portfolio. **Building on IHO's core strengths in ancient fossils and artifacts, we now include research on diverse subjects that promise to provide a truly holistic account of how we became human**—including the social behavior of our nonhuman primate relatives, the large-scale cooperative behavior of modern humans, and ancient DNA and genetics.

Public interest in who we are as a species and how we came to inhabit virtually every terrestrial biome on the planet is expanding as well. And well it should. **Understanding our past is a vital source of insight on our future on a changeable planet Earth.**

IHO is ambitious in pursuit of new discoveries, thought-provoking investigations, and the creation of public knowledge about human origins. **We need visionary partners who will invest** in our forward-thinking explorations to understand how we became human.

We are grateful to all of you who have helped support IHO's programs during the past year, through gifts to our operating fund, direct support of our research, investment in our long-term success through endowment gifts and bequests, or participation in one of our tour programs. **The broad support from many sources enables IHO scientists to produce the exciting research and discovery**—whether in the field or in the lab—that drives our field forward.

We appreciate ASU's long-term support of our faculty, but our research, student training, and outreach programs rely more than ever on the generosity of donors whose passion for the study of human origins creates the **strong "public-private partnership" that we enjoy with the university.**

Please consider the opportunities that your end-of-year investment will provide for future research and discovery and then join the quest for our origins by supporting IHO with your generous charitable gift. Enclosed you will find the Gift/Pledge form for your convenience. Or you can go to **IHO's website at iho.asu.edu/support/supportIHO** to give securely online.

I thank you in advance for your support and look forward to hearing from you.

Best wishes for the New Year,

William H. Kimbel, PhD

Director
Virginia M. Ullman Professor of Natural History and the Environment

Connecting the human past to the global future

Though much of the Institute of Human Origins' research focuses on our human past, its science advances our **understanding of how evolutionary pressures shaped human adaptations and what those transformations imply for the global future of humanity.**

IHO's research is—

- Seeking an understanding of the **evolution of ancient hominin populations** and environments on local to regional scales
- Addressing **gaps in our knowledge** of key places and time periods on the **human species' part of the Tree of Life**
- Exploring the pathways and timing of **critical population migrations through the fossil and archaeological records** between the earliest Out-of-Africa migration (after 1.8 million years ago) and the appearance/spread of modern humans (300,000 to 60,000 years ago)
- Creating a timeline and explanation for the **evolution of technology, social learning, cumulative culture, and cooperation** in the context of ancient environmental change
- Shaping a **comparative primate context** for understanding the origins of human adaptations (social structure, cooperation, population interactions)
- Understanding the **causes and consequences of extinction**—not only of our hominin relatives (such as the Neandertals) but also of the enormous array of animal species that lived alongside ancient humans over the last several hundred thousand years

One of the most important roles IHO plays is in **education and outreach about human origins science**, connecting the lessons from the human past to the prospects for humanity's global future and creating innovative ways of disseminating knowledge about our origins with practical consequences for society.



Tracks from researchers cross beaches that had been inhabited during a long volcanic winter 74,000 years ago by early modern humans at Vleesbaai, South Africa.

Image Curtis Marean

Excavation site at Bokol Dora 1

Image David Braun

Education and Outreach

In November, IHO hosted its **6th annual premier science event in New York City**. The evening's featured presentation was by Carol Ward PhD, Curators' Distinguished Professor at the University of Missouri, who engaged the audience with tales of field work and fossil discoveries west of Lake Turkana, Kenya, that are refining our understanding of the origin and early evolution of the human lineage. Closing the evening was IHO Founding Director Don Johanson, who gave a fascinating review of the progress of human origins research since the discovery of Lucy. Thank you to Harmonie Club member Migs Woodside for hosting IHO and to Gerry Ohmstrom for supporting this event.

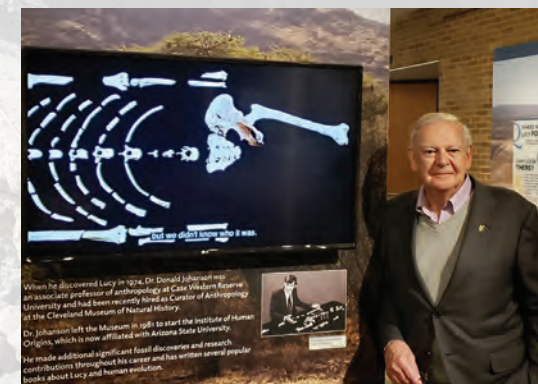
before she was returned to her home in the National Museum of Ethiopia in Addis Ababa. Johanson was treated to a standing ovation from a packed house for the lecture. If you would like to view the lecture, you can see it online at <https://www.youtube.com/watch?v=v3nKefnql4>.

The Arizona PBS science show Catalyst interviewed Don Johanson about the "Lucy Mission"—a NASA mission to send a small spacecraft to a series of "Trojan" asteroids that revolve around the planet Jupiter. **The scientists believe that these asteroids may hold clues to the origins of the solar system, like "Lucy," who helped humans understand our origins.** Watch the interview here <https://azpbs.org/catalyst/2019/06/catalyst-nasa-satellite-images-of-our-solar-system/>.

Finally, Don Johanson's first popular book published in 1981, *Lucy: The Beginnings of Humankind*, is available for the first time as an **audiobook—read by Johanson**. Find it on Audible.com.



Professor Carol Ward engages the audience at the Harmonie Club in New York City



Don Johanson next to an exhibit for the 45th anniversary of the discovery of Lucy at the Cleveland Museum of Natural History

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

Neysa Grider-Potter advised by William Kimbel. Dissertation: Form and function of the primate cervical vertebral column.

Dominique Garello advised by Ramon Arrowsmith and Chris Campisano. Dissertation: Tephrostratigraphy of Pliocene drill cores from Kenya and Ethiopia, and Pleistocene exposures in the Ledi-Geraru Research Project Area, Ethiopia: Geological context for the evolution of *Australopithecus* and *Homo*.

Jacob A. Harris advised by Curtis Marean. Dissertation: Probability models of bone surface modification and application to fossil evidence from Ledi-Geraru (2.82 Ma) and Dikika (3.9 Ma) Afar, Ethiopia.

Learn more about IHO and get involved!

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

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t @humanoriginsASU

y youtube.com/user/LucyASUIHO

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And don't forget about visiting 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

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

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Arizona State University

A research center of The College of Liberal Arts and Sciences



iho.asu.edu

Early fossil and archaeological records

A new archaeological site known as Bokol Dora 1 in Ethiopia's Ledi-Geraru research area, was discovered by an international team of scientists—including IHO researchers Kaye Reed and Chris Campisano. New discoveries at the site, published in the *Proceedings of the National Academy of Sciences*, show that the origin of Oldowan stone-tool production is older than 2.58 million years. The excavation site is geographically close to the 2013 discovery site of the oldest fossil attributed to *Homo*, also discovered by the IHO team. The fossil, a jawbone, dates to about 2.78 million years ago. The earliest known occurrences of Oldowan tools and the genus *Homo* are being pushed back in time, raising the possibility of a still more ancient evolutionary link between the two.

A group of 20 geologists and paleoanthropologists with the African Rift Valley Research Consortium (ARVRC) met in Ethiopia in January for a geological tour of fossil-bearing sites in the Lower Awash River Valley of Ethiopia. The trip, organized by IHO's Chris Campisano and funded by a grant from the National Science Foundation, is part of an ARVRC effort to broaden scientific collaboration among research groups working in the East African Rift Valley. The trip resulted in planned research proposals to more fully understand the geological evolution of the Lower Awash Valley in relation to ancient environments in which early hominins lived.

Building on the importance of the geologic laboratory work for recent research, Curtis Marean and Chris Campisano are creating a new cryptotephra lab at ASU. Marean's discovery of glass shards from Mt. Toba at sites in South Africa, originally deposited from over 9,000 kilometers, 74,000 years ago, pinpointed sediments within a two-week window, unheard of in geologic dating. With the collaboration of colleagues at UNLV, who processed the original Mt. Toba materials and with NSF funding, the lab will begin processing samples from archaeological sites in Europe, Africa, and possibly North America at ASU.

Left: Excavations continue at the open-air site at Vleesbaai, South Africa, one of the locations where the Mt. Toba shards were discovered.

Image Curtis Marean

Emergence of modern humans in Africa

The newest member of the IHO research team—Kathryn Ranhorn—joined IHO and the School of Human Evolution and Social Change (SHESC) in the fall. Her research focuses on the origins and dispersals of early *Homo sapiens*, and she is an expert in stone artifact technology and analysis. Ranhorn uses stone tools as a proxy for understanding behavioral evolution and population dispersal. Her approach to understanding lithic technology involves both experimental archaeology, where she replicates how stone tool processes were learned and reproduced, and archaeological field work in both Kenya and Tanzania. And she is fluent in Swahili!

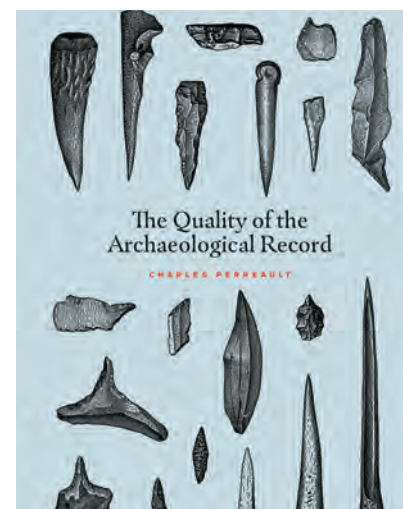
As field work continues at Curtis Marean's field sites near Mossel Bay, South Africa, Marean is building the infrastructure for the HOMER—Human Origins, Migration, and Evolution Research—project. This integrated network of field projects includes sites in South Africa, North Africa, and Italy, all led by young, rising scientists, trained in the same field methods and committed to working in a cooperative manner on a well-defined set of research goals. The goal of the project is to document when in the evolutionary record we first find evidence of extreme cooperation. The second group of nine HOMER students, including students from ASU and other universities, participated in field research this year, traveling to both South Africa and Malawi.

Curtis Marean and his team have completed the first phase of their reconstruction of the Paleo-Agulhas Plain, a now submerged extinct ecosystem off the coast of South Africa. This is described in a special issue of *Quaternary Science Reviews*—which focuses on the last 2.6 million years—with 22 articles from this international team of collaborators.



Left: In collaboration with colleagues at La Trobe University (Australia), Washington University (USA), and the University of Johannesburg (S. Africa), Gary Schwartz is collecting hominin and mammal fossils from the 2.6 to 2.0-million-year-old paleocave site of Drimolen, South Africa, where a nearly complete skull of *Paranthropus robustus* was discovered in the 1990s.

Image Gary Schwartz

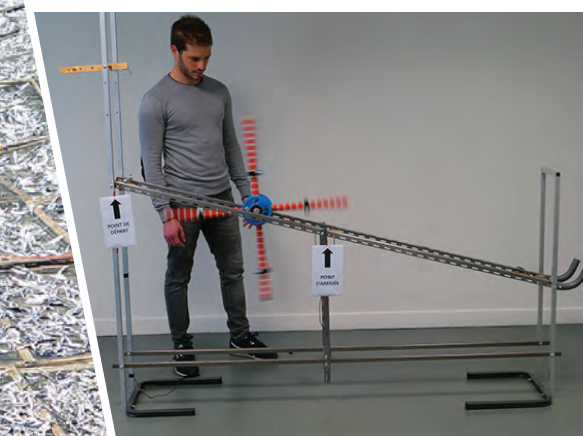


In his new book *The Quality of the Archaeological Record* (University of Chicago Press), Charles Perreault argues that archaeologists routinely face a problem in attempting to discern details of past behavior that existed on the scale of human lifetimes from data that are spread across timescales that span thousands of years and expansive geographical regions. This disjunction between the goals of archaeology and the information preserved in ancient records presents profound problems for interpreting the past, Perreault suggests, leading him to propose that archaeologists develop a true "macroarchaeology" program, which he argues, can finally "unleash the full contributive value of their discipline."

Cooperation and cognition

High levels of cooperation are one of the unique features that sets humans apart from other apes. Previously, researchers have focused on food sharing in traditional communities, but Kim Hill's team has been collecting daily information at a coastal village of Samal in the Philippines to understand the holistic economic exchange of goods and services between households—childcare, cooking, firewood, tools, medicine, and food. Hill is examining the relationships between givers and receivers, what social norms are at work, and the nature of kin and nonkin reciprocity. Imagine recording the exchange of all goods and services between households every day for four and a half years! The findings will have implications for the evolution of more extensive forms of human cooperation.

It is easy to understand how people began and continue to cooperate with each other on a small scale, as observed in Kim Hill's research. But how did people—on cultural and societal levels—evolve to cooperate at large scales when kin or close relationship networks are not pressuring individuals to participate in cooperative actions? Research on the emergence of large-scale cooperation was published in the *Proceedings of the Royal Society B* and conducted by Sarah Mathew and former IHO postdoctoral researcher Carla Handley, with international collaborators. The research participants included foragers, pastoralists, horticulturalists, and wage laborers from across 15 diverse populations including in Brazil, Tanzania, Fiji, India, and Kenya. Research results show that culturally evolved beliefs in potentially punitive and morally disapproving "gods" may facilitate cooperation with strangers.



Even in traditional societies, human technology is often too complex to be the product of human ingenuity alone. New experimental work by a research team led by Rob Boyd and published in *Nature Human Behavior*, suggests that group-level cultural evolution can generate new adaptive knowledge even though individuals don't always understand what they are doing. To test the researchers' hypothesis, the team studied cultural evolution in the laboratory with an exercise to simulate "generations" of improvements. After the experiment, each participant was tested on their causal understanding of the task. Over generations, participants got better at the task even though their understanding of it did not improve. The uniquely human ability to learn from each other makes possible the cumulative cultural evolution of highly refined adaptations—that are at best only partially understood. This powerful tool may have allowed our species to adapt and spread.

Thomas Morgan's research on the evolution of human collective behavior can reach thousands of experimental participants through "Dallinger," an open-source, online, experimental platform that he created. A key goal of "Dallinger" is to improve the efficiency and reliability of experimental behavioral science. To this end, this year he was challenged by a funder to use "Dallinger" to design, create, and execute a large-scale experiment within six weeks, and once the data were collected, to replicate the entire study in under 24 hours. Morgan's experiment explored human prestige bias, asking whether human psychology is biased towards egalitarian or elitist societies. It involved 300 participants working together in groups of 10 to solve problems. The experiment was completed within the six-week target and was replicated successfully in under seven hours. The results show that human psychology tends to produce oligarchic to autocratic social structures.

There is a shared window of learned cooperative behavior when children across societies begin learning the cooperative social norms of the adults around them. Joan Silk and former IHO postdoc Bailey House led an international team of collaborators working in eight societies around the globe in a cross-cultural study the development of

prosocial and cooperative behavior in children and adults. The participating groups differ widely in the size of their communities, their subsistence strategies, and locations. Variation in "generous" choices did not emerge until children reached middle childhood (around 8 to 10 years of age), as children's choices began to converge on the behavior of adults within their own societies. At about the same age, children in all societies also began to more strongly respond to social norms. The results, published in *Nature Human Behavior*, suggest that children, like adults, are influenced by social norms—and that this influence increases substantially during middle childhood.

Genetic inquiry

Building on Sarah Mathew's research among the Turkana people in Kenya, geneticists Melissa Wilson and Anne Stone are collaborating with her to ask whether genetic relatedness faithfully mirrors cultural relatedness. Initial comparisons between diverse populations of indigenous Africans show that relationships between clans are more about geography than language groups. In addition, much of this research is breaking ground in looking at African populations in a similar way that researchers have scrutinized European populations in the past—not as one homogenous group but as unique and identifiable groups. To that end, Mathew, Wilson, and Stone are working with the African groups to make sure there is permission to use any DNA has been collected outside of the original use request for additional research.

The evolution of differences between women and men when it comes to human disease may hinge on the fact that women's immune system evolved to facilitate their survival during pregnancy. Though this may make them more susceptible to autoimmune disease, women have a smaller risk of getting nonreproductive cancers. Colleagues have coined this new hypothesis the Pregnancy Compensation Hypothesis or the "pregnancy pickle," and it may help researchers better understand the mechanisms and pieces of the immune system they can target for new therapies.

Anne Stone, with colleagues including Ian Gilby, have new analyses of dental calculus sampled from deceased chimpanzees at Gombe National Park, Tanzania, to gather data about health and disease in this close human relative. There have been many surveys of past human populations but no studies that have focused on the oral microbial ecosystem in other primates. Dental calculus is among the richest known sources of ancient DNA in the archaeological record and has been used to answer biological and anthropological questions such as Neanderthal diet and behavior, the evolution of antibiotic resistance genes in oral pathogens, and the bacterial composition of precontact human dental calculus. With more than 50 years of observation history of chimpanzees at Gombe, this research will help to identify if these methods are useful for inferring lifestyle in other primate populations.

Indigenous peoples have occupied the island of Puerto Rico since at least 3000 BCE. Due to the demographic shifts that occurred after European contact, the origin(s) of these ancient populations, and their genetic relationship to present-day islanders, are unclear. Anne Stone and colleagues used ancient DNA from precontact Indigenous communities to obtain complete mitochondrial genomes from 45 individuals and genotypes from two individuals. Their findings have contributed to a more complete reconstruction of precontact Caribbean population history and explore the roles of Indigenous peoples in shaping the biocultural diversity of present-day Puerto Ricans and other Caribbean islanders.

Non-human primates

Long-term male-female bonds and parental investment in offspring are the hallmarks of human society. Joan Silk studies baboon behavior to see how those behaviors may have developed in our primate cousins. Her recent research finds that female baboons form special relationships with males after they give birth and that their preferred partners

are often the fathers of their offspring. These special relationships function as a joint parenting effort. The development of stable breeding bonds and paternal investment seem to be grounded in the formation of close ties between males and females, but other factors such as male dominance rank also influence paternity success and may preclude stability of these bonds to the extent found in human societies.

In an article covered widely by the press, a group of researchers, including Kevin Langergraber, found that bonobo moms play an active role in helping their sons find a mate. Using genetic and demographic data from multiple populations in the wild, they found that bonobo males whose mother lived in their group at the time of conception were more than three times as likely to father offspring than males whose moms had died. In contrast, a mother's presence or absence from the group had no relationship to paternity success in male chimpanzees. As bonobos and chimpanzees are our closest living relatives, these results offer insight into the evolution our own species, where menopausal mothers and grandmothers forego their own reproduction to assist the reproduction of relatives.

Much of the variation in the behavior among wild chimpanzee groups may be akin to "cultural" variation in humans. Kevin Langergraber and graduate student Kevin Lee were part of a large research team that showed that chimpanzees that live in areas of high negative human impact have lower levels of behavior and cultural diversity. Much of the empirical work and debate surrounding the loss of biodiversity has focused on declines in genetic diversity or population size. However, behavioral diversity is also a facet of biodiversity, but it has not been considered as an additional concern until recently. Several international conservation organizations now call for the protection of biological diversity in its entirety, including the behavioral diversity of culturally rich wildlife.

Left: Over five decades of detailed behavioral, ecological, and demographic data are captured in the Gombe Chimpanzee Database, begun by Jane Goodall and added to by hundreds of researchers over the past years. Primatologist Ian Gilby is the co-director of the database and is working with students at ASU to scan and convert thousands of handwritten observations to digital records.

Image Ian Gilby

Katie Ranhorn has been excavating in a remote region of the Turkana Basin for over five years.

Image Kathryn Ranhorn