

anthropogeny
tracks

a CARTA newsletter

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EXPLORING **THE ORIGINS** OF TODAY'S HUMANS

A flood of new information from ancient DNA, fossils, archeology, and population studies sheds more light on our origins

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SYMPOSIUM

FRIDAY, February 21, 2020, 1:00 - 5:30 PM (PT)
Conrad T. Prebys Auditorium, Salk Institute
FREE ADMISSION & LIVE WEBCAST!

At the time of this publication, a little less than seven years have passed since CARTA presented its symposium **Behaviorally Modern Humans: The Origin of Us** (May 2013).

Since then, a flood of new information from ancient DNA, fossils, archeology, and population studies necessitates revisiting the topic with a new symposium, **Exploring the Origins of Today's Humans** (February 21, 2020).

Exploring the Origins of Today's Humans will ask: where did we humans come from and when did we become the dominant species on the planet?

Available evidence indicates that all humans living today are derived from a relatively small population that arose in Africa beginning roughly 300,000 years ago, which then spread throughout Africa and eventually the rest of the planet.

In the course of this diaspora, our ancestors mated with other human-like species and assimilated some of their DNA, but eventually replaced all of these other close evolutionary cousins without exception - leaving only one human species today.

Exploring the Origins of Today's Humans seeks to summarize current knowledge and update conclusions since the previous symposium in 2013.

Curious about where we came from and how we got here? Consider attending one of our **FREE** symposia on anthropogeny (the study of human origins) where experts present on topics addressing the origins of the human phenomenon. Can't make it in person? We also offer a **FREE LIVE WEBCAST**. For more details, including registration, the live webcast, or for information on past and future events, please visit:

carta.anthropogeny.org

Co-Chairs and Speakers



Mark Collard (Co-Chair)
Simon Fraser University



Kristen Hawkes (Co-Chair)
University of Utah



Jean-Jacques Hublin
Max Planck Institute for Evolutionary Anthropology
Homo sapiens Origins: when "Moderns" were "Archaic"



Katerina Harvati
University of Tübingen
Homo sapiens Dispersals out of Africa



Tim Weaver
UC Davis
The Evolution of the Human Skull



John Hawks
University of Wisconsin—Madison
How Homo naledi Matters to our Origins



Sriram Sankararaman
University of California, Los Angeles
Recovering signals of ghost archaic introgression in African populations



Paola Villa
University of Colorado
The Archaeology of Ancient Tools



Teresa Steele
UC Davis
Continuity of Punctuation in the African Archaeological Record after 500,000 Years Ago



Joshua Akey
Princeton University
Tales of Human History Told by Neandertal and Denisovan DNA that Persist in Modern Humans



Iain Mathieson
University of Pennsylvania
Using Ancient DNA to Track the Evolution of Today's Humans



Anthropogeny Tracks newsletter is produced by CARTA staff and faculty

Center for Academic Research and Training in Anthropogeny

"to explore and explain the origins of the human phenomenon"

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UC San Diego

We Have Never Been Modern

Written by K. Lindsay Hunter
CARTA Community Engagement and
Advancement Director
(@Paleo_Bonegirl, @CARTAUUCSD)

Today's researchers studying the origins of our species have been inundated with new data revealed through advances in technology, refined genomic and dating methods, as well as new discoveries. However, this largess provides a challenge in integration and description that ultimately begs for reflection. CARTA Member Iain Davidson's (PhD, U of New England, emeritus) profiled chapter (see "CARTA-inspired Publications") reminds us that in our quest to identify "ourselves" in the past, our own un-recognized biases often reify cultural categories with biological data.

In contextualizing the myriad talks and speakers "Exploring the Origins of Today's Humans," on February 21, 2020, I'm reminded of philosopher Bruno Latour's assertion, "we have never been modern." With some indulgence, I ask that we take a brief look at some of the changes over the past decade within the sciences surrounding anthropogeny (with a focus on paleoanthropology), and how these altered perspectives regarding who we are today and how science is practiced impact our views of the human past.

Since we must begin somewhere, I'll begin in 2013, the time of CARTA's last symposium on this topic. In retrospect, many forces have since intervened to change our frame of reference for today's humans. For me, 2013 was the year that, as a member of an underground team composed solely of early-career women scientists (from the U.S., Canada, and Australia), I helped excavate the first remains of the then unidentified hominin now known as *Homo naledi*. These bones had recently come to light through the amateur exploration of two local South African cavers belonging to the Speleological Exploration Club (SEC). This unexpected discovery precipitated a half-decade of

further exploration into the depths of South African caves beyond the so-called "twilight zone," an area that popular wisdom had deemed the limit of hominin wandering. Post-naledi, it might be argued that field exploration has seen a resurgence, at least in some regions, and this has been rewarded by yet-undescribed discoveries deep within other caves.

Early in 2013, a now well-known survey was deployed, and in 2014, four intrepid women scientists of another kind (including CARTA Member Katie Hinde, PhD, ASU) published the "Survey of Academic Field Experiences (SAFE): Trainees report harassment and assault," which gained traction in the media as SAFE13. As the first empirical examination of scientists' experiences of harassment during fieldwork, the study exposed the dark underbelly of work in the field. SAFE13 and the later qualitative SAFE2 (2017), brought many uncomfortable but necessary conversations to the forefront of various field sciences and challenged the ways that diversity and inclusion initiatives were previously implemented.

In 2015, the mysterious Rising Star remains were first announced following a ground-breaking early-career researcher description workshop, and by 2017 began to coalesce into a broader picture of human origins, which by now included engrossing details of Denisovan and Neandertal introgression, such as that discussed by CARTA Member Joshua Akey, PhD (Princeton University) in our Winter Symposium. It seemed that a previously unknown, small-brained hominin with mosaic traits (many ancient hold-overs associated with climbing) had evidently been disposing of their dead deep within at least one South African cave in two apparently separate instances (i.e., the Dinaledi and Lesedi chambers of the Rising

Continued on the next page...

Star cave system). The fact that these strikingly human-like actions, presumably achieved without the use of artificial light, had taken place only 236-335,000 years ago, was made all the more poignant in light of new dates published for the Jebel Irhoud Middle Stone Age site (performed by a team including CARTA Member Jean-Jacque Hublin, PhD, Max Planck). These dates, at $286,000 \pm 32,000$ years ago, placed the Jebel Irhoud tools and human remains within the same date range as *Homo naledi* (albeit on the opposite end of the African continent).

In the background of these scientific events, social changes within the field began to take root and flourish. In 2016, within the American Association of Physical Anthropologists (AAPA), the Committee on Diversity (COD), chaired by CARTA Member Susan Antón, PhD (New York University), launched the IDEAS: Increasing Diversity in Evolutionary Anthropological Sciences workshop to address underrepresentation of racialized minority scholars in biological anthropology through training, mentoring, and outreach. Meanwhile, back in Africa, the Rising Star Expedition created career paths for a small cadre of South Africans, including Nompumelelo Hlophe (now a PhD candidate), Maropeng Ramalepa, Mathabela Tsikoane, Dirk van Rooyen, and original *Homo naledi* discoverers, Steven Tucker and Rick Hunter, who formed the core of a Wits Exploration Team.

In 2018, a second call for Rising Star excavators went out over social media, this time bringing South Africans Keneiloe Molopyane, PhD (now Curator of Maropeng, the Official Visitor of the Cradle of Humankind), and Kerry Warren, PhD (UCT), joined by Welsh caver-scientist Angharad Brewer Gillham. The commitment to providing opportunities to women and other groups historically disadvantaged in the field sciences has become an important part of the legacy of a small-brained human relative to its “Modern” human cousins.

To reiterate, much has changed since the last CARTA symposium on the subject of behavioral or anatomical “modernity” some six years ago, but we can also see that it is not merely with regard to a flood of new information from Ancient DNA, Fossils, Archeology and Population Studies. The face of the field of anthropogeny itself is quite

literally changing, and the hand of many CARTA Members can be detected in steering its future course. We no longer have the luxury of performing our analyses in a vacuum (if indeed, we ever did), and the future of our sciences will be made stronger and more rigorous through the introduction of different views and biases, bringing us ever closer to our illusive modern ideal.

We hope that you will join us Feb 21, 2020 as CARTA presents, “Exploring the Origins of Today’s Humans,” whether it is at the Salk or in the comfort of your own home via live webstream, as together we tackle these existential questions in the light of various lines of new evidence.

To learn more about how *this primate assimilates such knowledge, stay tuned to read my CARTA guest blog on “Twilight Beasts” (www.twilight-beasts.org, @TwilightBeasts on Twitter), which will seek to summarize this provocative symposium.*

Further reading:

Berger, L.R., et al. (2015), *Homo naledi*, a new species of the genus *Homo* from the Dinaledi Chamber, South Africa, *eLife*, 4:e09560.

Browning, S.R., Browning, B.L., Zhou, Y., Tucci, S., & Akey, J.M. (2018), Analysis of human sequence data reveals two pulses of archaic Denisovan admixture. *Cell*, 173(1), 53-61.

Clancy, K.B., Nelson, R.G., Rutherford, J.N., & Hinde, K. (2014), Survey of academic field experiences (SAFE): Trainees report harassment and assault. *PloS one*, 9(7), e102172.

Dirks, L.R., et al. (2015), ‘Geological and taphonomic context for the new hominin species *Homo naledi* from the Dinaledi Chamber, South Africa’, *eLife*, 4:e09561.

Dirks, P. H., et al. (2017), The age of *Homo naledi* and associated sediments in the Rising Star Cave, South Africa. *Elife*, 6, e24231.

Hawks, J., et al. (2017), New fossil remains of *Homo naledi* from the Lesedi Chamber, South Africa. *eLife*, 6, e24232.

Hublin, J., et al. (2017), New fossils from Jebel Irhoud, Morocco and the pan-African origin of *Homo sapiens*. *Nature* 546, 289-292.

Nelson, R.G., Rutherford, J.N., Hinde, K., & Clancy, K.B. (2017). Signaling safety: Characterizing fieldwork experiences and their implications for career trajectories. *American Anthropologist*, 119(4), 710-722.

Richter, D., et al. (2017), The age of the hominin fossils from Jebel Irhoud, Morocco, and the origins of the Middle Stone Age. *Nature* 546, 293-296.

2019 ANTHROPOGENY FIELD COURSE

INTREPID ANTHROPOGENY EXPLORERS!

During Summer 2019, a small group embarked on a journey to better understand human origins. Visiting important locations throughout the East African Rift, including parts of Ethiopia and Tanzania, our explorers studied fossils, lived with hunter-gatherers, and encountered numerous non-human primates. The following pictures give a glimpse into this journey.

Meet the cast of

characters! 1 (from left to right): **Fiona Stewart** (Liverpool John Moores University, Field Course co-faculty, Anthropology), **Vanessa Bateman** (UC San Diego PhD student, Visual Arts), **Stephan Kaufhold** (UC San Diego PhD student, Cognitive Science), **Arturs Semenuks** (UC San Diego PhD student, Cognitive Science), **Rafael Nunez** (UC San Diego Faculty), **Pascal Gagneux** (UC San Diego, Anthropology, Field Course co-faculty), **Linda Nelson** (CARTA). 2: **Arturs**. 3: "Wisdom is like a baobab tree: it takes many to grasp it" (African proverb). 4: **Stephan**. 5: **Pascal**. 6: The explorers along with their Hadza hunter-gatherer hosts. 7: **Alex Piel** (Liverpool John Moores University, Field Course co-faculty, Anthropology). 8: **Vanessa**. 9: **Rafael**.

THIS PICTURE COLLAGE:

To represent the human characters of the field course, this collage takes the shape of a recently discovered Middle Stone Age obsidian point found at the Fincha Habera rock shelter in the Ethiopian highlands dating to ~47,000 years ago.

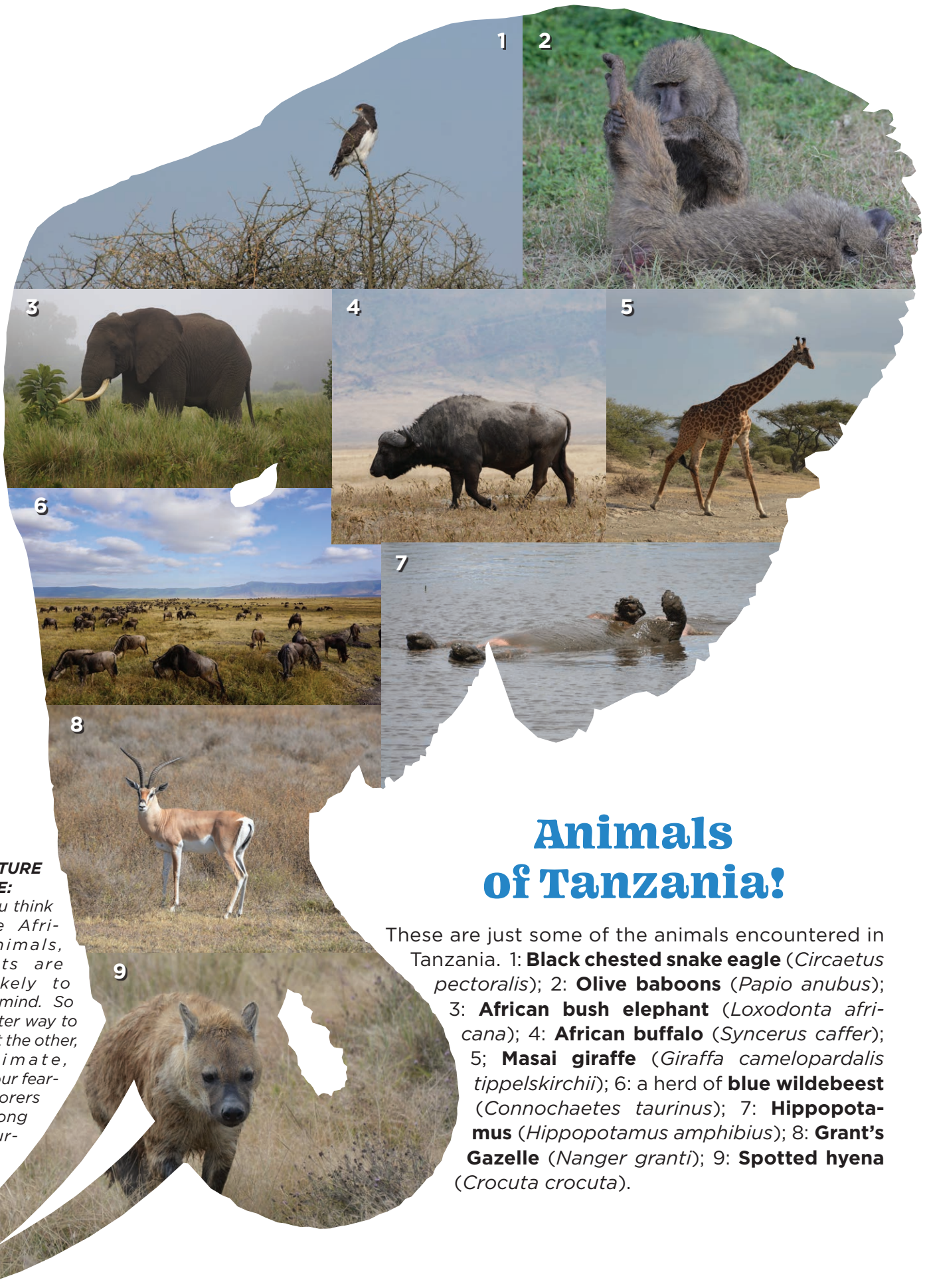




THIS PICTURE COLLAGE:
It seemed only fitting that the shape for a collage about wild chimpanzees collage should form that of a chimpanzee face.

Chimpanzees of East Africa!

These snapshots represent just some of the chimpanzees (*Pan troglodytes*) our intrepid explorers encountered. Studying the biology and behavior of our closest living cousins is valuable for their conservation and helps us to understand our ourselves.



Animals of Tanzania!

These are just some of the animals encountered in Tanzania. 1: **Black chested snake eagle** (*Circaetus pectoralis*); 2: **Olive baboons** (*Papio anubus*); 3: **African bush elephant** (*Loxodonta africana*); 4: **African buffalo** (*Syncerus caffer*); 5: **Masai giraffe** (*Giraffa camelopardalis tippelskirchii*); 6: a herd of **blue wildebeest** (*Connochaetes taurinus*); 7: **Hippopotamus** (*Hippopotamus amphibius*); 8: **Grant's Gazelle** (*Nanger granti*); 9: **Spotted hyena** (*Crocuta crocuta*).

THIS PICTURE COLLAGE:

When you think of large African animals, elephants are most likely to come to mind. So what better way to represent the other, non-primate, animals our fearless explorers found along their journey?

Landscapes of Tanzania!



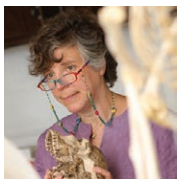
A small sampling of the ecosystems of Tanzania. 1: **Ghideru Ridge** (with smoke from burnt Datoga cattle corral); 2: **Ngoro-ngoro Crater**; 3: **Mbulu Highlands** (dense farming); 4: **Issa Valley River** (lush gallery forest); 5: **Olduvai Gorge**; 6: **Ghideru Ridge** (Acacia-Commiphora woodland overlooking Yaeda Valley); 7: **Serengeti** (grassland); 8: **Yaeda Valley** (baobab tree); 9: **Issa Valley Grassland** (as seen by a bipedal hominin); 10: **Eastern Rift Valley** (near Mto Wa Mbu); 11: **Maasai Village of Endulen**.

THIS PICTURE COLLAGE:
The skyline of Mt. Kilimanjaro.



AWARDS & HONORS

The following awards and honors were received by CARTA members during the past year.



Rachel Caspari
Central Michigan University

Elected as Fellow (Section H) of AAAS in November 2019.



Todd Preuss
Emory University

Promoted to full Professor of Pathology and Laboratory Science, 2019.



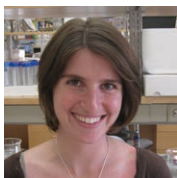
Rob Knight
UC San Diego

Received the American College of Nutrition Grace A. Goldsmith Award, 2019, and the NIH Director's Pioneer Award, 2019.



Wenda Trevathan
New Mexico State University

Elected as Fellow (Section H) of AAAS, 2019.



Amy Non
UC San Diego

Best poster award, International Association of Population Health Sciences Conference, 2019.



Polly Wiessner
Arizona State University

Awarded the Queen's Jubilee Medal, Papua New Guinea, in cultural research, preserving cultural knowledge, and cultural education, 2019.



Briana Pobiner
Smithsonian Institution

Elected as a Sinai and Synapses Fellow, 2019-2021.

It is with great sadness that CARTA recognizes the passing of pioneering stress hormone researcher, colleague, friend, and CARTA Member, **Bruce S. McEwen, PhD**, (Harold and Margaret Milliken Hatch Laboratory of Neuroendocrinology, Rockefeller University), who died on Jan. 2, 2020, aged 81.

Bruce was professionally active right up to the end of his life, and CARTA was fortunate to have him speak on October 11, 2019, when CARTA/KIBM presented, "Impact of Early Life Deprivation on Cognition: Implications for the Evolutionary Origins of the Human Mind." He presented his talk, "The Resilient Brain: Epigenetics, Stress, and the Lifecourse," via previously recorded video. This presentation may be accessed via the CARTA video archives: <https://carta.anthropogeny.org/events/sessions/resilient-brain-epigenetics-stress-and-lifecourse>.

His CARTA profile has been archived and you may continue to visit it for details on his work. A summary of his life's work is available from Rockefeller University at this link: <https://www.rockefeller.edu/news/27135-neuroscientist-bruce-mcewen-studied-impact-stress-brain-died/>.

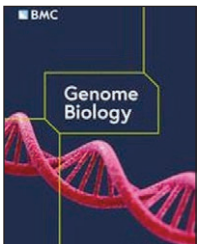
IN MEMORIAM: BRUCE MCEWEN



Credit: Rockefeller University

Transdisciplinary interaction is a core CARTA principle, and our anthropogeny symposia provide a forum for experts from different spheres of knowledge to interact and spark new research on the origins of the human phenomenon. These selected publications were inspired by such interactions. CARTA members are listed in bold. Visit carta.anthropogeny.org for the complete list.

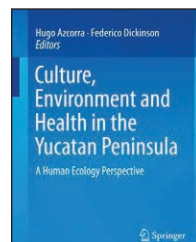
CARTA-INSPIRED PUBLICATIONS



Amato KR, et al., including **Knight R, Leigh SR**. Convergence of human and Old World monkey gut microbiomes demonstrates the importance of human ecology over phylogeny. *Genome Biol.* 2019;20(1):201.

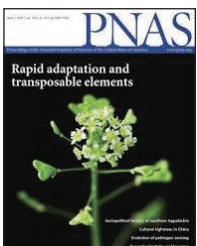
The authors compare gut microbiome composition and functional potential across a diverse same of humans and wild, non-human primates. Surprisingly, humans group more closely with cercopithecines, particularly baboons, than with African Apes, suggesting that diet, ecology, and physiological adaptations are more important than host-microbe co-diversification.

oligodendrocytes underwent greater gene-expression changes in human evolution than did neurons.



Bogin B, et al. Globalization and Children's Diets: The Case of Yucatan, Mexico. In: Azcorra H, Dickinson F, editors. *Culture, Environment and Health in the Yucatan Peninsula*. Springer, Cham; 2019.

Stunting (low height-for-age) and overweight/obesity in the Maya children of Yucatan may be attributed to poverty and nutritional transitions brought on by globalization, new forces in human evolution. In order to translate research into better child health and well-being, we must come to terms with both the social and biological effects of food globalization.



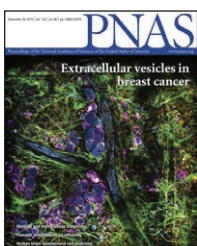
Ardesch DJ, et al., including, **Preuss TM, Rilling JK**. Evolutionary expansion of connectivity between multimodal association areas in the human brain compared with chimpanzees. *Proceedings of the National Academy of Sciences.* 2019;116(14):7101.

This study compared the cortical connectivity in humans, chimpanzees, and macaques, as determined with diffusion-tensor imaging, and found that connections associated with schizophrenia were selectively modified in human brain evolution. This accords with Crow's theory that brain changes occurring in human evolution rendered humans more vulnerable to developing psychosis.



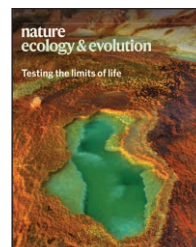
Bulbul O, et al., including **Kidd KK**. Ancestry inference of 96 population samples using microhaplotypes. *International Journal of Legal Medicine.* 2018;132(3):703-711.

Microhaplotypes have become a new type of forensic marker with a great ability to identify and deconvolute mixtures. This study shows that these loci provide clear distinctions among 6 biogeographic regions and provide some information distinguishing up to 10 clusters of populations.



Berto S, et al., including **Preuss TM, Konopka G**. Accelerated evolution of oligodendrocytes in the human brain. *Proc Natl Acad Sci USA.* 2019;116(48):24334-24342.

There is increasing appreciation of the role of oligodendrocytes in cognition and in human psychiatric diseases. This study compared gene expression in humans, chimpanzees, and macaques, and found that

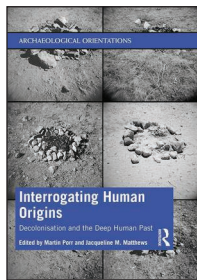


Colbran LL, et al., including **Capra JA**. Inferred divergent gene regulation in archaic hominins reveals potential phenotypic differences. *Nat Ecol Evol.* 2019;3(11):1598-1606.

This study establishes differences in gene regulatory architecture between anatomically modern humans and archaic hominins, including in genes associated with skeletal and dental morphology consistent

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with the archaeological record. Results provide an avenue for exploring phenotypic differences between archaic groups from genomic information alone.



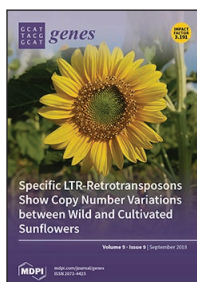
Davidson I. IMHO: inventing modern human origins. In: Matthews J, Porr M, editors. *Interrogating Human Origins. Decolonization and the Deep Human Past*. London: Routledge; 2019. p. 35-55.

Archaeohistory is necessarily an invention of scholars, necessitating rigorous and ongoing re-examination of classificatory definitions and interpretation biases relative to their own historical context. Caution is urged in adopting any archaeological classificatory system without first interrogating their inherent subjectivities and theoretical roots.



Fox K, Rallapalli KL, Komor AC. Rewriting Human History and Empowering Indigenous Communities with Genome Editing Tools. *Genes (Basel)*. 2020;11(1).

Appropriate empirical-based evidence and detailed theoretical considerations are often overlooked when associating observed phenotypic variation with evolutionary explanations. Combining population genetics with precision genome editing tools and methods has the potential to functionally investigate population-specific point mutations, holding “just-so” evolutionary explanations accountable.



Gu S, Li H, et al., including **Kidd JR.** Recent Selection on a Class I ADH Locus Distinguishes Southwest Asian Populations Including Ashkenazi Jews. *Genes (Basel)*. 2018;9(9).

The derived human alcohol dehydrogenase (ADH)1B*48His allele is one component of an East Asian specific core haplotype that underwent recent positive selection. These results indicate that this allele has also independently undergone recent rapid increases in frequency in Southwest Asia populations. The emergence of agriculture in these regions may be the reason for this convergence of a metabolic variant.



Heft IE, et al., including **Sikela JM.** The Driver of Extreme Human-Specific Olduvai Repeat Expansion Remains Highly Active in the Human Genome. *Genetics*. 2020;214(1):179-191.

Sequences encoding Olduvai protein domains have been associated with brain size, cognitive aptitude, autism, and schizophrenia in humans. The current study provides evidence of the genomic events that led to the genomic instability underlying this recent, rapid, and extreme human-specific Olduvai expansion, and which remain highly active in the human genome today.



Khan N, Kim SK, **Gagneux P,** Dugan LL, **Varki A.** Maximum reproductive lifespan correlates with CD33rS1-GLEC gene number: Implications for NADPH oxidase-derived reactive oxygen species in aging. *The FASEB Journal*. 2020; 34:1928-1938.

CD33rS1glecs are innate immune cell receptors modulating production of reactive oxygen species, which contribute to aging. We found a strong positive correlation between CD33rS1GLEC gene number and maximum lifespan. Two striking exceptions are humans and orcas, species with prolonged post-reproductive lifespans, allowing care of helpless young by elderly caregivers--The Grandmother Hypothesis.



Muotri A. Brain organoids and insights on human evolution. *F1000Res*. 2019;8(760).

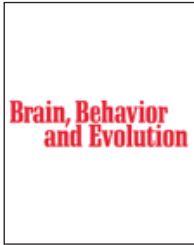
Human brain organoids have emerged as a promising technique for modeling early stages of human neurodevelopment in the lab. We review the current state of the art on the use of brain organoids from different species and the molecular and cellular insights generated from these studies. We then discuss the limitations and future perspectives of this technology.



Pembrey M. Does cross-generational epigenetic inheritance contribute to cultural continuity? *Environmental Epigenetics*. 2018;4(2).

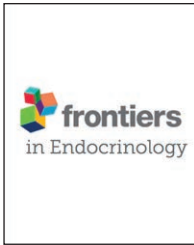
The author proposes that cultural continuity balances responsiveness

and stability in the human epigenome. Cultural tradition and institutions provide stability, allowing for increasing responsiveness, while 'runaway' responsiveness is countered by the positive selection of genetic variants that dampen responsiveness. Longitudinal multigenerational testing is required.



Preuss TM. Critique of pure marmoset. *Brain Behav Evol.* 2019;93(1):92-107.

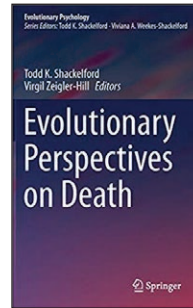
This paper reviews the merits of marmosets as a model primate relative to other models (e.g., macaques) and to more comparative approaches. The large number of evolutionary specializations in marmosets warrants special caution in extrapolating results to humans.



Stepien B, **Huttner W.** Transport, Metabolism, and Function of Thyroid Hormones in the Developing Mammalian Brain. *Frontiers in Endocrinology.* 2019;10:209.

The crucial role of thyroid hormone (TH) signaling in embryonic brain development has long been established. This

paper reviews the current knowledge of TH delivery, conversions, and function in the developing mammalian brain, and discusses their potential role in vertebrate brain evolution. Future research should be aimed at elucidating TH signaling in nervous system development.



Varki A. Did Human Reality Denial Breach the Evolutionary Psychological Barrier of Mortality Salience? A Theory that Can Explain Unusual Features of the Origin and Fate of Our Species. In: Shackelford TK, Zeigler-Hill V, editors. *Evolutionary Perspectives on Death.* Basel: Springer International Publishing; 2019. p. 109-135p.

Humans deny, ignore, corrupt or distort reality-- a feature that should have limited survival and reproduction. Our ability to read minds of others should also have been initially detrimental, by triggering fear of personal mortality. A rare combination of these two negatives may have breached this "psychological evolutionary barrier," explaining our planetary dominance and our eventual downfall.

CARTA Symposia Schedule

Exploring the Origins of Today's Humans

February 21, 2020

The Evolution of Human Physical Activity

May 15, 2020

Comparative Anthropogeny: Culture-Biology Interactions in the Cycle of Life

Fall, 2020

Altered States of the Human Mind: Implications for Anthropogeny

Winter, 2021

Find past CARTA symposia at



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What is CARTA?

The UC San Diego/Salk Institute Center for Academic Research and Training in Anthropogeny (CARTA) is dedicated to answering the age old questions "where did we come from?" and "how did we get here?" As CARTA explores the origins of humanity, we are not only answering philosophical and existential questions, but also addressing very practical issues concerning human nutrition, medicine, mental disease, the organization of society, the upbringing of our young, and the interactions of humans with one another and with our environment. Transdisciplinary interaction is at the core of CARTA's mission to advance human origins research.

For more information, please visit
<https://carta.anthropogeny.org>

Support CARTA

Your donation helps to ensure that CARTA's symposia remain free and available to all. There are three ways to donate to CARTA:

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