



anthropogeny tracks

a CARTA newsletter

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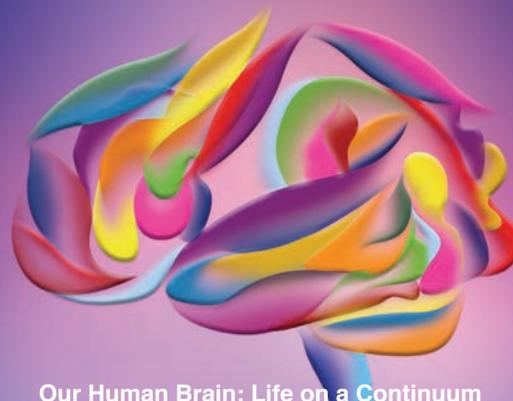
Savantism to Synaesthesia: The Human Mind's Many Variations and Their Relevance for Understanding Our Evolution

Beyond the neurotypical human brain are incredible variations that equip their possessors with unique mental abilities (autobiographical memory and extreme musicality) or cognitive dissonance (Autism spectrum disorders and Williams syndrome). Often, these super-human abilities exist in trade-offs with limitations in other cognitive/social areas.

The goal of **Extraordinary Variations of the Human Mind: Lessons for Anthropogeny** is to explore some of these variations with experts who have pursued them in depth as an avenue for understanding how evolutionary processes, both genetic and cultural, have shaped our mental facilities.

- May 5, 2017, 1:00 - 5:30 pm Pacific
- Conrad T. Prebys Auditorium, Salk Institute
- Free and open to the public (registration is required)
- Live webcast
- For more information or to register, visit:
<https://carta.anthropogeny.org/symposia/upcoming>
- Co-sponsored by the *Center for Academic Research and Training in Anthropogeny (CARTA)* and the *KAVLI Institute for Brain and Mind (KIBM)*
- This symposium is made possible by The G. Harold and Leila Y. Mathers Charitable Foundation

Extraordinary Variations of the Human Mind Lessons for Anthropogeny



Our Human Brain: Life on a Continuum
Daniel Geschwind, UCLA (Co-Chair)

**Williams Syndrome: Clues to Links Across Levels
from Gene to Cognition**

Karen Berman, National Institutes of Health, NIMH

Language at the Extremes

Simon Fisher, Max Planck Institute for Psycholinguistics

Highly Superior Autobiographical Memory

James McGaugh, UC Irvine

The Incredible Savant Syndrome

Darold Treffert, The Treffert Center

Acquired Savantism in Neurological Conditions

Bruce Miller, UC San Francisco

**Born to be Musical: What We can Learn
from Congenital Anomalies**

Isabelle Peretz, Université de Montréal (Co-Chair)

Fragments of Genius: Mapping the Mind of a Musical Savant

Adam Ockelford, University of Roehampton

**Synaesthesia: From Extraordinary Experiences to
Enhanced Abilities**

Jamie Ward, University of Sussex



Center for Academic Research and Training in Anthropogeny
"to explore and explain the origins of the human phenomenon"

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Excerpts from the 2016 Anthropogeny Field Course

Understanding the context of the ecology in which our species evolved is critical to the study of anthropogeny. And although there is a plethora of informative books and journal articles on the subject, nothing can compare to experiencing firsthand the landscapes our ancestors may have encountered in Africa. Learning directly from researchers who have discovered fossils, interacting with one of the last remaining hunter-gatherer tribes, and observing a variety of primates in their natural habitat, are further examples of experiences that simply cannot be duplicated with mere words. They have to be lived, felt, and savored. In July 2016, five Anthropogeny Specialization Track students traveled to Ethiopia and Tanzania to participate in the Anthropogeny Field Course, and did just that. At times it seemed like a dream. Every twist and turn, every hill and valley, was different and uniquely magical. The following excerpts from the students' experiences in Africa will convey some of the magic they encountered in the field.

Kyle Fischer, Neuroscience

While in Africa, I was lucky enough to observe twelve primate species: greater galago, lesser galago, vervet monkeys, red-tailed monkeys, blue monkeys, red colobus, black-and-white colobus, olive baboons, yellow baboons, chimpanzees, mountain gorillas, and humans. The social organizations and behaviors of these groups are highly diverse, even, as we saw, between populations of the same species in different ecosystems. This can make comparison between species difficult, but nonetheless revealing.



Whitney Friedman, Cognitive Science



We are walking with a Hadza hunter. Soundlessly, swiftly, he moves behind the trees and up over the rocks, a bushbuck in sight. Arrow drawn, he takes aim at the briefly still prey. Suddenly the tinny sound of a cowbell rings and the bushbuck takes off. A Datoga herder passes behind us, walking alongside his herd of 50 cattle, hooves shuffling, bells clanging. A bit further down

the valley they stop to graze the remaining bits of green grass emanating from the hard, dry earth. Over the course of our hunt, we pass over countless cow patties and a handful of pastoralists grazing their cattle.

The least seen of the group, and perhaps the outlier in terms of behavior, were the galagos. Nocturnal and largely solitary foragers, beside the religious hermit, it would be hard to find comparison in human populations (though the call of the greater galago would be appropriate for a horror film). However, it is interesting to compare the galagos to similar species amongst other primate populations. The galagos seem to fit a niche that is commonly exploited — in the Amazon there are night monkeys, and in Madagascar the aye aye, and in Southeast Asia the tarsier — very similar in many ways to the galagos nocturnal habits and behavior. While not directly comparable to humans, it makes one wonder what ecological niche was left available amongst the ancient primate population that humans eventually filled.

My favorite species to watch, behaviorally, were the red-tailed monkeys. Moving in large groups of 20 to 50 individuals comprised largely of females, juveniles, and a few large adult males, they are constantly active and vocal. Watching these groups move like a wave along the narrow evergreen gallery forests lining the streambed, one of the most remarkable parts of their behaviors I saw was the rate at which the intrepid jump would fell a rotten branch or tree. Adroit and fast, the soft chattering and sound of moving leaves reminded one of a marching column of army ants methodically moving through the forest.



Red-tailed monkey in Ugalla, Tanzania. Photo credit: K. Fischer

“Do you like the Datoga?” we asked Gongga, the leader of the Hadza camp. Gongga’s reply was simple, honest, factual, “No, we hate them. But we need them to trade honey.”

The Datoga are a pastoralist group with what Pascal Gagneux (Associate Professor of Pathology and Anthropology, UC San Diego) points out is a deadly successful cultural combination: cattle, and metallurgy to make a very effective suite of weapons, among other things. This way of life has enabled the Datoga’s migration across Africa and has afforded them great success in the Serengeti Plains, a region that scholars believe the Hadza have occupied continuously for some 90,000 years, if not more. Given the proximity of Hadzaland to paleontological sites where discoveries of hominid remains have been dated to over 2 million years, it is indeed possible that Hadzaland has been used by hominids through much of our species evolutionary history. Today, however, the Datoga as well as the Maasai and Bantu societies are fast encroaching on Hadzaland, bringing with them large herds of cattle that are over-grazing the land, leaving little for the natural populations of grazing species to consume and contributing to the decline of Hadza prey. The Hadza are not a warring people. It is not in their culture to defend land boundaries, as they do not believe that land can be owned, nor do they have warriors who they train in combat (Marlowe, 2010). Gongga tells us that they do not want to, nor think it wise to war with their neighbors.

The Hadza lifestyle is incredibly symbiotic with their environment, more so than any modern group of people I have ever encountered. This symbiosis, together with their ability to adapt, and their intricate knowledge of the ecosystem, have allowed them to survive through periods of ecological disturbance such as extreme drought - an insurmountable challenge for their pastoralist neighbors. The Hadza take advantage of at least four very critical resources: tubers that hold water and starch (18% of kcals), calorie-rich honey provides as much as 14% of caloric intake, hunting provides protein (31% of kcals), and the baobab tree provides fruit, seeds, leaves, and flowers (18% kcals), holds water, houses honey bees, and can even be used by the Hadza for shelter or protection from predation.

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Yet, despite this incredible symbiosis, the Hadza are being out-competed in their ecological niche by their pastoralist neighbors. Without land protection and the corridor proposed by those like Daudi Peterson (owner/operator of Dorobo Safaris, an ecotourism company devoted to protecting and giving a voice to the Hadza), the Hadzaland ecosystem will continue its decline. Over-grazing (much helped by the recent introduction of veterinary drugs for preventing bovine sleeping sickness and babesiosis) will continue to eliminate resources critical for maintaining sustainable levels of the avian and mammalian species the Hadza rely on. At present, the Hadza tell us that it has become much harder to hunt, both due to lack of prey and to the disruption caused by loud and hungry cattle. In the near future, one of two things will happen: the Hadza will win land rights, perhaps even a sort of statehood or official recognition by the government to continue their lifestyle, or their way of life will disappear — more likely through gradual dissipation than warfare.

Landon Klein, Neuroscience

We spoke softly, as if we'd wake the bones. My knees buckled under the weight of 2 million years. We have 14 strata of hominid fossils, he said, ranging from 6 million to 80 thousand years old. 'If anyone ever doubts evolution, bring them here.'

The above passage from my journal reflects the profundity of my experience visiting the National Museum in Ethiopia. Prior to embarking on this trip, I was aware that we would have the unique opportunity to view ancient hominid skeletons, an honor apparently bestowed only upon us and President Barack Obama. Consequently, my excitement that morning, admittedly exacerbated by a heaping dose of delicious Ethiopian coffee, was entirely for viewing our ancient cousins.



What struck me most upon reflection, however, was that the highlight of this day for me wasn't viewing the actual skeletons of "Ardi" (*Ardipithecus ramidus*) and "The Nutcracker Man" (*Australopithecus boisei*), though this was, of course, absolutely incredible. Rather, the most visceral part of the day was our exploration of the extensive fossil collection in the basement of the National Museum, which played host to thousands of fossils dating back millions of years, organized first by age, then by class, then by species.

The collection seemed comprehensive, taking on an almost literary nature by constituting an orderly documentation of the history of modern life, human and otherwise. In literature, I often consider the words, events, characters, and exposition omitted to be as much a part of the story as the pages themselves. In the same sense, the absence of certain fossils added to the poetry of experience, and made the experience even more enlightening. While this collection of fossils was unbelievably vast and unprecedentedly comprehensive, the blank pages, so to speak, shed light on fossils as they relate to our understanding of human history - that there are massive blind spots inherent in the fossil record; that, like human history itself, the fossils telling our story are imperfect, biased, incomplete.

First and foremost, however, I was astounded by the contrast between the tangibility of this form of "data," and the way data are represented in my own line of research. While my own work tends



Cattle herder in Hadzaland, Tanzania. Photo credit: P. Gagneux

to provide data that are abstract, nebulous, and fragile, the data provided by these fossils is robust and tangible. When we first began our tour of the National Museum, we entered a room where a student was cleaning fossils in order to produce casts. Using a drill-like buffer, the student was grinding away hardened material (matrix) that was extraneous to the desired bone. My immediate gut reaction was to cringe at this. Such a valuable sample should require a far gentler touch, I thought, and any slight tremor could potentially destroy a priceless resource for understanding some of the most profound questions of humanity.

This innate anxious response reemerged twice more during our visit to the museum, and yet I soon realized that these samples had survived the harsh climatic shifts and physical demands of hundreds of thousands or even millions of years. That the robustness of these remains, proven by their timelessness, far out matched the otherwise incredible potency of human carelessness. While much of our understanding of early hominid life is speculative, these bones stand as unequivocal, graspable testaments to this mysterious period in our history. In this sense, fossils are indispensable to our understanding of early human life. They provide physical grounding upon which theories of behavior and development can be mapped.



Baboon fossils at the National Museum, Ethiopia. Photo credit: P. Gagneux

Emily Little, Psychology



Ngorongoro Crater safari adventure was next. Breathtaking does not even begin to describe the never ending wildlife sightings in this pristine crater valley. My face hurt from the excitement muscles being fully engaged throughout the hours and hours of driving through the crater. Leopards, buffalo, elephants, zebra, hippos, flamingos, lions, rhinos, hyenas, and so many birds! What did wildlife viewing have to do with human origins? Well, a lot.

I have spent most of my life interested in human connection to nature. In the Advanced Anthropogeny course that I took through the Anthropogeny specialization track last year, one of the topics that I addressed in our contributions to MOCA (the Matrix of Comparative Anthropogeny, <https://carta.anthropogeny.org/moca>) was human modification of the environment, which brought my interest in human-environment interaction into perspective from an evolutionary standpoint. As was brought up in the closing ceremony at the sunrise Ugalla hike, the Ngorongoro Crater experience was a perfect example of the incredible biodiversity of our planet when civilization is not allowed to overtake the environments of other species. Yes, there are protected areas in the US where wildlife still roams, but nowhere in the world is mammalian biodiversity so prevalent and apparent than in these protected areas of Africa. How would current society be different if we still lived in harmony with this degree of biodiversity? At what point in our history did we make the transition from using the valuable resources of nature to exploiting them to the point of extinction? Despite my childlike glee at the pure beauty and excitement of our safari experience, these were all questions going through my mind that I believe are integral to understanding our “human uniqueness” given that exploiting environments to the degree that human beings have is unmatched by any other species. Douglas’s (our guide from Dorobo Safaris) knowledge was never ending and the best part was that his enthusiasm was on par with ours, despite him having visited this area and seen these animals countless times.

Next stop: Olduvai Gorge. I had visited another Camp Leakey during personal travels in Borneo, so seeing the original site of Leakey discoveries as they pertain to human origins was definitely special. I was especially struck by the preservation methods that were taken to ensure that Mary Leakey’s Laetoli Footprints were buried and preserved. This was an excellent time for some “walking in their shoes” type of perspective-taking, imagining what it must have been like to have been a bipedal hominin walking through that rocky valley landscape, and thinking about the relationship between bipedalism and other neural and cognitive advancements.



Ngorongoro Crater, Tanzania. Photo credit: E. Little

Camille Toarmino, Psychology



Pascal Gagneux and I woke early and met Benji at our camp for a quick breakfast before we started our hunt. It was the first and only hunt I had ever been on and I was looking forward to learning how the Hadza track animals.

We were quiet as we lurked in Benji’s shadow, following his lead on when to stop moving and talking. I had no sense of where we were, trusting only Benji’s sense of direction. He knew the landmarks and must have walked that path a thousand times. His steps were shorter than mine, his body more in tune with the environment, as I clumsily made my way through the bush. He had learned the crevices and rocks, moving efficiently and swiftly towards his hunting spots. It was as if his body was made to navigate this terrain.

We stopped at a boulder with large rocks surrounding it - local hyrax territory — a common meat amongst the Hadza. The first day we met the Hadza we sat with them watching the sunset as Douglas explained how the next few days would go, and one of the men stood up and fired an arrow off into the distance, just missing a hyrax we were totally unaware of. It seemed as if they had a keen sense of everything in their immediate environment, whereas we had no idea what sights, sounds, or smells were clues to the presence of a potential dinner.

We climbed the boulder to the top of the hyrax territory, also python territory, overlooking the dry and arid land. We sat on top of the boulder and watched a group of baboons in the distance, too far for an arrow to reach, but not far enough so that we couldn’t hear their distinct vocalizations. It was amazing that animals could survive in this climate, even thrive, with all its harshness and perils. But you could find food if you knew where to look. There were animals to be hunted, but only for those with the ability of discreteness, knowledge of the land, and excellent archery skills.

The baobab trees produced seeds surrounded by fruit, delicious and tart, tasting just like candy. Fibrous tubers were just below the ground, found by listening for hollow spots in the earth. Honey was hidden away by different types of bees, but could be uncovered if you knew where to look and had a friend to help you find it.

And while we were unlucky in the hunt for the hyrax, we ended up with a much richer and belly-filling experience. As we explored the earth for meat, we began to hear bird chatter whistling from above, and Benji began whistling back. It was a greater honeyguide bird, here to lead us to a bounty of honey. They whistled on and on with each other, and we followed the bird without fully understanding the magic that was taking place between bird and human. An elaborate form of interspecies communication emerged, as Benji and the bird kept track of one another through their own songs. We arrived at the bird’s final destination - a massive baobab tree with a large hollow space full of buzzing and lively African honeybees. I still wasn’t sure what Benji was going to do. I knew he wanted the honey, but we had no fire to smoke the bees out of the tree.

Then, out of seemingly pure coincidence, a man from the neighboring Datoga tribe arrived with the fire that we needed. Perhaps Benji called for him and I didn’t understand the language, but we saw not a single other person on our hunt until now.

Benji took the fire and planted it at the base of the tree. He used some other dried plants in the area for kindling. Smoke started to billow from the bottom of the tree and Benji stayed there with his arm reached inside the tree searching for honeycombs. I couldn’t believe what I was seeing. He stayed as the bees drunkenly swarmed out of

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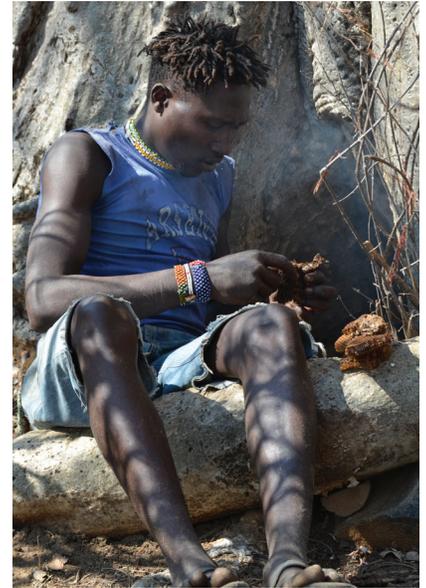
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the tree and began stinging him all over of his face and neck. He did not budge and barely winced in pain. And I was feeling silly for standing so far away, afraid to be stung, when Benji was enduring sting after sting. I imagine that Benji had learned obtaining honey not only to eat, but also to trade with others, and that this was more important for the survival of his people than the temporary pain of bee stings. Still, I was impressed by what I viewed as courage, and even more when he emerged with a feast of honeycombs for all to share.

I had never eaten honey straight out of the honeycomb, but the dark colored viscous substance was so delicious. We sat and shared the honey, even with the Datoga man that brought the fire and whose cattle herds are increasingly degrading the land where the Hadza live and forage, and Benji shared some wax combs with the bird that led us to our feast. It became clear just what a symbiotic relationship the Hadza and the greater honeyguide had. The bird led Benji to a great source of honey, and in return Benji shared the bounty with it. I don't know about the bird, but we ate until we felt sick. We must have consumed 1,000 calories just in honey. I quickly realized how the Hadza sustained themselves on this energy rich substance.



Benji stokes the fire to smoke the bees. Photo credit: P. Gagneux



The reward for enduring angry honey bees: precious calories from honey and larvae. Photo credit: P. Gagneux

CARTA Member Awards and Honors

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



Francisco J Ayala (UC Irvine):

2017 Blaise Pascal Medal for Life Sciences, European Academy of Sciences.

Fellow, European Academy of Sciences.



Philip Lieberman (Brown University):

Keynote speaker and "honoured scientist," XIIIth International Symposium of Psycholinguistics, at the University of Minho, Braga Portugal, April, 2017.



Jean-Pierre Changeux (Institut Pasteur and College de France):

Received Doctor Honoris Causa, Weizmann Institute, November, 2016.



Terry Sejnowski (Salk Institute):

Honorary doctorate, University of Zurich, 2017



Alyssa Crittenden (University of Nevada, Las Vegas):

UNLV Rising Researcher of the Year, 2017.



Palmer Taylor (UC San Diego):

2017 recipient of Volwiler Research Achievement Award from the American Association of Colleges of Pharmacy.



Sarah Hrdy (UC Davis):

Honorary doctorate, Emory University, 2017.

Interested in learning more about human origins?

All past CARTA symposia are viewable online at: https://carta.anthropogeny.org/symposia/past_list

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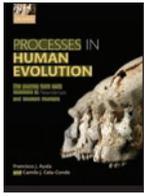


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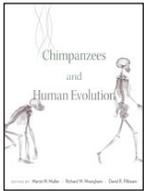
CARTA-Inspired Publications

Transdisciplinary interaction is at the core of CARTA's mission to advance human origins research. CARTA symposia provide a forum for experts from vastly different fields to share knowledge and work together to spark new research. The following is a selection of publications inspired by interactions amongst CARTA members (**in bold**) and facilitated by CARTA. (Complete list at the CARTA website.)



Ayala, FJ, Cela-Conde, CJ. *Processes in Human Evolution: The Journey from Early Hominins to Neandertals and Modern Humans*. Oxford University Press: 2017.

The numerous human fossils discovered during the last decade, as well as advances in genetics, paleontology, ecology, archaeology, geography, and climate science, have considerably impacted the interpretations of human phylogeny. *Processes in Human Evolution* is intended as a primary textbook for university courses on human evolution, and also as supplementary reading in advanced undergraduate and graduate courses.



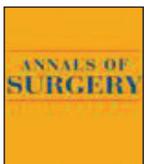
Boehm, C. Ancestral Precursors for Moral Evolution. In: Muller, MN, **Wrangham, RW**, Pilbeam, DR, eds. *Chimpanzees and Human Evolution*. Harvard University Press; 2017.

A behavioral reconstruction for the Last Common Ancestor is used to discuss the evolutionary background for moral evolution. Of interest are 14 intracommunity attacks of chimpanzees and bonobos, where large coalitions attack certain high ranking males. The similarity to human hunter-gatherers when they moralistically put down bullies suggests that this ancestral behavior served as a preadaptive building block for the evolution of moral sanctioning in the human line.



Changeux, JP. Climbing Brain Levels of Organisation from Genes to Consciousness. *Trends Cogn Sci*. 2017;21(3):168–181.

To elucidate the 'astonishing evolutionary parsimony' that relates few genetic changes to the dramatic increase of human brain organisation, a strategy is suggested that dynamically links - through intrinsic variation-selection mechanisms - nested structural levels that include the genes; networks of transcription factors; synaptic epigenesis; long-range connectivity up to consciousness.



Costantini, TW, et al., including **Baird, A**. The Response to Burn Injury in Mice With Human Hematolymphoid Systems. *Ann Surg*. 2016;263(1):199–204.

These experiments are the first to demonstrate the suitability of humanized mice for injury research and offer the possibility to address very specific research questions that are not amenable to traditional mouse models of injury, for example, the emerging role of certain human-specific genes that are totally absent from the mouse genome. We demonstrate that the trafficking of immune cells after burn injury mimics the trafficking observed in humans and that the engrafted cells express genes that are unique to the human genome.



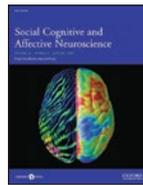
Crittenden, AN, Sorrentino, J, Moonie, SA, Peterson, M, Mabulla, A, **Ungar, PS**. Oral health in transition: The Hadza foragers of Tanzania. *PLoS One*. 2017;12(3):e0172197. <https://doi.org/10.1371/journal.pone.0172197>

Working among Hadza foragers, we tested the hypothesis that the transition to agriculture results in a decline in oral health. Our data show that men in the bush and women in the village have more tooth and gum disease than the converse. These differences are linked to diet and smoking, and highlight the complexity of effects of the transition from foraging to farming on human biology.



Hawkes, K. Ethnoarchaeology and Plio-Pleistocene sites: Some lessons from the Hadza. *J Anthropol Archaeol*. 2016;44(B):158–165.

Early sites were declared home bases where hunters brought meat to their families. But bone assemblages left by modern Hadza show aggressive scavenging better explains those sites, a claim strengthened as archaeologists find key sites at Olduvai were near a permanent spring. Hadza data also show limits on access to meat absent bow and arrow, so a much larger role for other foods in human evolution.



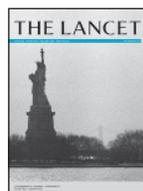
Hecht, EE, et al., including **Preuss, TM, Hopkins, WD**. A neuroanatomical predictor of mirror self-recognition in chimpanzees. *Soc Cogn Affect Neurosci*. 2017;12(1):37–48.

In humans, mirror self-recognition (MSR) involves a right-lateralized parieto-frontal system. The MSR ability varies markedly among chimpanzees. This study showed that in chimpanzees, MSR ability is related to the degree to which connections between the parietal and frontal lobes are human-like in being stronger on the right and showing greater prefrontal connectivity.

Hilton, HG, et al., including **Parham, P**. Resurrecting KIR2DP1: A Key Intermediate in the Evolution of Human Inhibitory NK Cell Receptors That Recognize HLA-C. *J Immunol*. 2017;198(5):1961–1973.

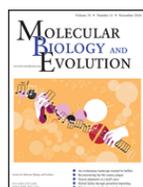


Interactions between HLA-C and NK cell receptors influence human reproduction and immunity. Only great apes have a comparable system. On separation from the common ancestor, chimpanzees retained greater receptor diversity than humans. On resurrecting KIR2DP1, a dead human receptor, we found evidence for an initial solution to the lost diversity, and its later replacement by a better one.



Kaplan, H, et al., including **Finch, CE, Gurven, M**. Coronary atherosclerosis in indigenous South American Tsimane: a cross-sectional cohort study. *Lancet*. 2017;pii: S0140-6736(17)30752-3.

Are heart attacks a modern disease? The answer was sought in the Amazonian Tsimane, where heart attacks are almost unknown. Teams of cardiologists and anthropologists analyzed older Tsimane by x-ray (CT) and showed their arterial calcium accumulates 25 years more slowly than in the U.S. Future studies will identify if genes and life style factors protect Tsimane from a curse of modern aging.



Mendizabal, I, et al, including **Konopka, G, Preuss, TM**. Comparative Methylome Analyses Identify Epigenetic Regulatory Loci of Human Brain Evolution. *Mol Biol Evol*. 2016;33(11):2947–2959.

Phenotypic differences between humans and other primates largely reflect differences in gene expression. Expression differences are regulated in part by the number and location of DNA methylation sites. Using a new technique for surveying the entire genome, this comparative study of humans, chimpanzees, and macaques identified a large set of human-specific methylation sites.



Rightmire, GP, Ponce de León, MS, Lordkipanidze, D, Margvelashvili, A, Zollikofer, CP. Skull 5 from Dmanisi: Descriptive anatomy, comparative studies, and evolutionary significance. *J Hum Evol.* 2017;104:50–79.

Dmanisi tracks the earliest dispersal of humans out of Africa. Five skulls display variation but document a single population. There is a continuum of forms. Skull 5 is primitive, but skull 1 resembles *Homo erectus*. We argue that *Homo habilis*, the Dmanisi sample, and *Homo erectus* are segments of one evolutionary lineage. Human phylogeny may have been less “bushy” than is commonly claimed.



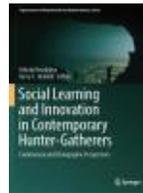
Rodríguez, JA, et al., including **Navarro, A**. Antagonistic pleiotropy and mutation accumulation influence human senescence and disease. *Nat Ecol Evol.* 2017;1(3).

Human aging has long been a public health issue as well as a fascinating evolutionary problem. This paper gives support, at a genome-wide level, to two of the most well known theories of aging: The Mutation Accumulation (MA) and the Antagonistic Pleiotropy (AP). As theoretically predicted by MA, we observe higher risk allele frequencies combined with large effect sizes for late-onset diseases. Also, and in concordance with AP, we found that human genomes carry a significant excess of variants increasing reproductive fitness at early age periods, but at the cost of an increased risk for some age related diseases later on, when humans are not fertile anymore.



Schwarz, F, et al., including **Varki, N, Varki, A**. Paired Siglec receptors generate opposite inflammatory responses to a human-specific pathogen. *EMBO J.* 2017;36(6):751–760.

Humans uniquely display a protein called Siglec-11 on microglia, a brain cell type that recognizes polysialic acid on neurons, but also kills invaders. Human infant brains are uniquely infected by a rare *E. coli* type that cloaks itself in polysialic acid and mimics neurons. This confuses microglia and allows lethal invasion, perhaps causing population bottlenecks in human origins. But some humans also display Siglec-16 on microglia, countering the *E. coli* attack.



Terashima, H, **Hewlett, BS** eds. *Social Learning and Innovation in Contemporary Hunter-Gatherers*. Tokyo: Springer Japan; 2016.

This is the first book to examine social learning and innovation in hunter-gatherers, the way of life that characterized most of human history. The book considers how common forager cultural norms, e.g., egalitarianism, high value on autonomy, and extensive sharing, influence from whom and how children learn. Particular attention is given to the debate as to whether teaching exists in foragers, the contexts of observation and imitation, and the roles of play in social learning.



Walker, KK, et al., including **Pusey, AE**. Chimpanzees breed with genetically dissimilar mates. *Roy Soc Open Sci.* 2017

Inbreeding negatively affects fitness while heterozygosity often has positive effects. Among the Gombe chimpanzees, mothers are more genetically dissimilar than expected to the sires of their offspring, suggesting active mate selection and/or post-copulatory processes. The effect is not just due to natal females avoiding close relatives but is also true for immigrant females.



Check out the CARTA bumper video!
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Student News

As of this printing, three anthropogeny students have successfully defended their theses and have been bestowed the title of Doctor of Philosophy in 2017: Whitney Friedman, Emily Little, and Camille Toarmino. The years of hard work and sacrifice that went into these incredible achievements can't be understated, especially given that they also have successfully completed the Anthropogeny Specialization requirements (Whitney in 2016, Emily and Camille in 2017). In addition to their Ph.D.s, they will receive a parenthetical degree in Anthropogeny, joining a growing list of transdisciplinary scholars who have been trained in human origins. Please give a hearty congratulations to Drs. Whitney Friedman, Emily Little, and Camille Toarmino!



Whitney Friedman received her Ph.D. in cognitive science at UC San Diego this Winter. Whitney's work utilized methods from cognitive science and ethology to study the process of cognition in non-humans as it emerges through interaction. Her dissertation research focused on social interactions among male bottlenose dolphins in Shark Bay, Western Australia, as they negotiate a nested structure

of alliances critical for reproductive success. Dolphins are an important but often overlooked model species for understanding the evolution of complex cognition.



Emily Little defended her thesis this spring. Her studies in psychology at UC San Diego involved cultural variation in parent-infant interaction and the related implications for early social and cognitive development. Emily's research employed ethnographic and observational methods to investigate culture-specific infant-caregiver interaction patterns, which she combined with structured observation and experimental

paradigms to measure differences in the development of social cognition skills in infancy.

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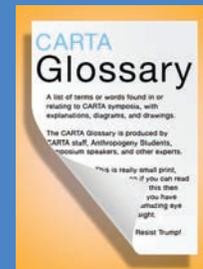
Camille Toarmino also defended her thesis this spring. Her research focused on the social rules that govern nonhuman primate communication systems, in particular how perturbations to those rules effect ongoing vocal signaling. Another aspect of her research involves examining communication in a naturalistic network of individuals, and determining what prompts an individual to vocalize in these settings.

Camille will continue her education in veterinary science, leading to a Doctorate in Veterinary Medicine.

For more CARTA-related news, please visit <https://carta.anthropogeny.org>

Did you know that CARTA prepares a glossary for each symposium that defines the key terms used in the presentations? Symposium-specific glossaries can be found on the individual event pages and a combined glossary of all terms can be found here:

<https://carta.anthropogeny.org/glossary>



CARTA Symposia Schedule

Cellular and Molecular Explorations of Anthropogeny

September 29, 2017, Salk Institute

The Role of Hunting in Anthropogeny

Winter 2018

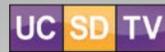
Imagination and Human Origins

Spring 2018

Impact of Tools and Technology on the Evolution of the Human Mind

Fall 2018

CARTA on the Web



Want to re-watch a CARTA symposium? All symposia, including “**Implications of Anthropogeny for Medicine and Health**” (October 2016), are available at the above websites.



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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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