



anthropogeny tracks

a CARTA newsletter

Volume 5, Issue 1 - March 2017

Awareness of Death and Personal Mortality: Implications for Anthropogeny



Life is a beautiful and paradoxical thing: the wondrous and seemingly impossible existence of living organisms comes packaged with guaranteed impermanence.

Humans are no exception. Yet here we are, able to discuss, write, philosophize, and study our own and others' mortality, and even rationalize and understand how the fragility of life may have shaped our species' evolution.

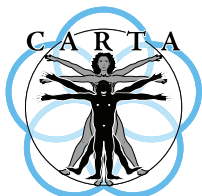
While certain warm-blooded social animals and birds appear to react selectively and specifically to the death of other members of their group, we humans seem to be unusual in the quality and extent of our responses to death and ability to translate experiences into an understanding of our own personal mortality.

When during childhood do these levels of understanding emerge? What is the underlying neurobiological basis for fears of death and mortality? When during human evolution did these fears emerge, and how did our ancestors tolerate them without sinking into an evolutionary dead end of depression or hopelessness?

Assuming we found a solution to this dilemma, why are we still the only mammals that commit suicide? What does the archaeological, historical and cross-cultural record tell us about these matters? And what are the consequences for our current human condition, ranging from self-esteem to social organization, to political leanings?

CARTA's March 3, 2017 symposium, [Awareness of Death and Personal Mortality: Implications for Anthropogeny](#), will bring together expert speakers from a wide range of different disciplines that are relevant to seeking answers to these questions. In the process, we will gain a better understanding of how increasing awareness of death and personal mortality shaped the origin of humans.

This symposium is made possible by **The G. Harold and Leila Y. Mathers Charitable Foundation**.



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

CARTA • University of California, San Diego • 9500 Gilman Drive, MC# 0060 • La Jolla, CA 92093

The outstanding lineup of speakers for **Awareness of Death and Personal Mortality: Implications for Anthropony** features:



Dora Biro
University of Oxford
Responses to Death in Chimpanzees and Other Mammals



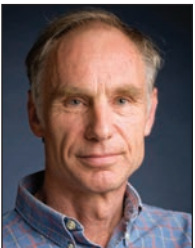
Colin Renfrew
University of Cambridge
The Archaeology of Immortality in the Ancient World



John M. Marzluff
University of Washington
Why Do Corvid Birds Gather Around Their Dead?



Rita Astuti
London School of Economics and Political Science
Death as Celebration: CrossCultural Perspectives



Paul Harris
Harvard University
Understanding of Death and Mortality by Children



Sheldon Solomon
Skidmore College
Human Mortality Denial and Terror Management Theory



Joseph LeDoux
New York University
What is Fear? And is Fear of Death Really a "Fear"?



Ajit Varki
UC San Diego (Co-Chair)
"Mind Over Reality Transition": The Evolution of Human Mortality Denial



Nicholas Humphrey
University of Cambridge (Co-Chair)
The Lure of Death: Suicide as a Uniquely Human Phenomenon

Symposium Details

- Friday, March 3, 1:00 - 5:30 p.m., 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.anthropony.org/symposia/upcoming>

Excerpts from Student Essays: *Implications of Anthropogeny for Medicine and Health*

Students enrolled in the Graduate Specialization in Anthropogeny at UC San Diego have the unique opportunity to engage with the expert scientists who speak at CARTA's human origins symposia. At each symposium, students "host" the internationally renowned speakers, creating important scholastic and research connections and gaining valuable knowledge in the process. As part of the curriculum requirement, each student summarizes their assigned speaker's presentation and ensuing discussions in a written essay, which is vetted by the speaker and the Faculty of Anthropogeny (who administer the Specialization). The following excerpts were taken from those essays written by students who participated in the October 2016 CARTA symposium, [Implications of Anthropogeny for Medicine and Health](#).

Alison Caldwell, Neuroscience

Speaker: [David Haig](#), Harvard University

Talk: [The Divided Child](#)



The most recent CARTA Symposium, "Implications of Anthropogeny for Medicine and Health," provided a glimpse of how evolutionary biology can be used to understand human health and disease. Many topics were discussed, from adaptations to high altitude to the evolution of mother's milk. Of particular interest was Dr. David Haig's talk, "The Divided Child," with a fascinating discussion about the conflicting fitness values in maternal and paternal genes, and how differences

in maternal and paternal gene expression can result in unique developmental disorders with interesting implications for human behavior.

Human mothers possess unique relationships with their offspring; unlike other Great Apes, we maintain multiple dependent offspring at a time. This results in unique relationships between siblings, and by necessity, competition among offspring for maternal care and attention. Reproductive fitness is therefore a delicate balance between the maternal costs of reproduction and maximizing the number of offspring who can go on to pass on our genes. Because of this, maternal genes and paternal genes are frequently in conflict. Paternally derived genes are predicted to demand more than maternal genes - it is in the reproductive interest of the father's genes to grow the biggest, strongest baby they can, while maternal genes tend to silence growth, leading to smaller, less demanding babies so mothers have more resources to spread across offspring. In simple terms, the paternal genes are the "accelerator;" the maternal genes are the "brake." The conflicting values of these genes are balanced in the offspring.

Landon Klein, Neuroscience

Speaker: [Barbara Natterson-Horowitz](#), UCLA

Talk: [Zoobiquity and "One Medicine"](#)

In her lecture, Dr. Natterson-Horowitz outlined the trajectory leading to her current interest in comparative medicine, provided numerous examples of similarities in pathologies found in humans and other animal species, and touched on the value of recognizing the relative ubiquity of "human" pathologies across species.

Dr. Natterson-Horowitz worked exclusively with human patients until she was asked by the Los Angeles Zoo to image the heart of a chimpanzee that had woken up with a facial droop indicative of a possible stroke. Upon examination, Dr. Natterson-Horowitz noticed that the heart, remarkably similar to a human heart, had developed blood clots



and enlarged atria that were nearly identical to those seen in human patients. She was surprised to see that both a human and a chimpanzee had spontaneously developed the same infiltrative heart failure that she had treated for years, sparking her interest in how human and veterinary medicine can inform one another. Over the following months, she was asked to examine the hearts of lions, gorillas, condors, and sea lions for various reasons, and found that their pathologies and effective treatments were nearly identical to humans, suggesting that vulnerability to these conditions may be quite ancient, preceding the evolutionary split between these disparate species.

Emily Little, Psychology

Speaker: [Cynthia Beall](#), Case Western Reserve University

Talk: [Adaptations to High Altitude](#)

Defining high altitude as 8,000 feet or higher, Dr. Beall began her talk with a broad overview of why functioning at high altitude is relevant to us in modern society, citing examples of "rugged mountaineers" training for selected high altitude adventures and athletes who need to adjust their bodies to play soccer at 12,000 feet in Bolivia. In contrast to these people who train for athletic events, there are also communities of people who have been living in high altitude for thousands of years: Andean populations living at 14,000 feet for 14,000 years and Tibetan populations living on high altitude plateaus for 20-30,000 years, to name a couple.



The unique thing about these populations is that they are unaffected by the severe bodily stress induced by high altitude in almost all other humans, due to the decreased levels of oxygen at high altitude, referred to as hypoxia. Hypoxia occurs when barometric pressure falls and there are fewer molecules of oxygen per volume of air. For example, at Pike's Peak, a lungful of air only consists of 58% oxygen molecules. The oxygen processing pathway includes exchanging oxygen molecules in our blood, transporting them through the heart and getting them to the mitochondrial system where they are used. The question is: what does the mitochondrial system do when there are not enough oxygen molecules?

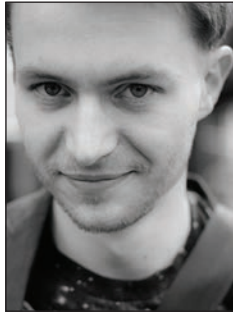
Dr. Beall explained one of the broad questions of her work in the context of human origins: Why are we able to acclimatize? The simple answer is that we are descended from ancestors that lived at different percentages of oxygen. One of the interesting ways that Dr. Beall investigates the questions of human adaptation to high altitude is by examining genetic variation among different high altitude populations. Interestingly, she has found differences among Tibetan and Andean highlanders on the gene ENGL1, which is known as the oxygen sensor gene. Specifically, Tibetans have mutations in HIF2A, implicated in the oxygen transport pathway, that result in a dampened response to high altitude stress.

Sascha Pohflepp, Visual Arts

Speaker: **Michael Gurven**, UC Santa Barbara

Talk: **Heart Disease in Hunter-Gatherers?**

Dr Michael Gurven's presentation focused on the question whether arteriosclerosis is a universal process and whether it universally affects our mortality. In the developed world, one of every four deaths is due to heart disease. Some work, such as Eaton et al., proposes that hunter-gatherers haven't had those problems, suggesting a mismatch between our genetic make-up and our contemporary lifestyle. Furthermore, it is significantly harder to obtain a direct assessment, especially assuming that risk factors might work differently in different populations. A good example for this kind of error is the common myth that the Inuit of Alaska do not have heart disease—which was originally attributed to high levels of consumption of omega-3 oils—based on Bang and Dyerberg's 1976 study. It turned out, however, that those were based on unreliable mortality statistics and ultrasound imaging analysis eventually showed fairly significant arteriosclerosis in those populations. In contrast, the "Horus study of four ancient populations" assessed mummified individuals across four geographic regions, using whole body CT scans. What Thompson et al. found was evidence of calcification across all arterial beds across all populations, concluding that "heart disease is a serial killer that has been stalking mankind for thousands of years." The presence of arteriosclerosis in premodern humans thus suggests that the disease is an inherent component of human aging and not characteristic of any specific diet or lifestyle, such as arterial stiffening, declines in systolic and diastolic function.



Catie Profaci, Neuroscience

Speaker: **Katie Hinde**, Arizona State University

Talk: **Evolving Milk**



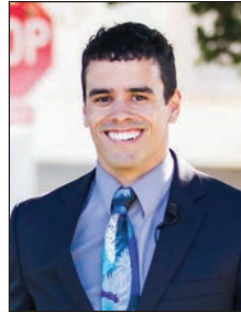
In her talk, Dr. Katie Hinde made a strong case for further research into the specific components of breast milk that make it the gold standard for infant care. With a better understanding of exactly what is in milk, how this composition varies naturally, and how this variation affects offspring, doctors might be able to achieve better NICU outcomes and improve available care for infants without the option of breast feeding.

Dr. Hinde painted a picture of the incredible variation inherent in milk. Species variation might be expected, and population variation is somewhat intuitive given varying diets and immune challenges, but variations at the individual level are more surprising. Even more astonishing are the differences found within individuals depending on parity, the duration of lactation, the hour of day, and the gender of the child. These factors, as well as other aspects of the mother's life history, can influence milk's yield, fat and protein content, fatty acid ratios, hormones, glycans, and immune factors. Unfortunately, the quest for the golden standard of milk is complicated by the fact that each of these components must be viewed through the lens of a trade-off system. Some of these variations might favor the mother's health rather than the infant's. In choosing an ideal milk donor or creating an ideal formula, it will be necessary to disassociate these factors and identify what is best for the growth and development of the infant. Importantly, milk has also been shown to significantly influence behavioral phenotypes. For example, glucocorticoid levels in milk are predictive of a more nervous temperament in rhesus macaques, and cortisol concentrations were positively associated with growth (Hinde et al., 2015). These data show a link between milk composition and offspring behavioral phenotype, and it also highlights what seems to be a trade-off between growth and behaviors such as play. Ideal formulas would need to take both of these factors into account.

Sequoyah Reynoso, Neuroscience

Speaker: **Randolph Nesse**, Arizona State University

Talk: **Why Genes that Harm Health Persist**



Sometimes long-accepted theories turn out to be wrong. Take the perception of Earth's flatness, for example. From most people's perspective, our planet does seem flat. A more accurate model of reality can emerge only when people take a few steps back and examine all of the available evidence. At the recent CARTA symposium, **Implications of Anthropogeny for Medicine and Health**, Dr. Randy Nesse urged this kind of perspective shift on evolutionary thinking.

Nesse presents his case by highlighting the persistence of genes that harm health. For instance, humans have spines that are easily susceptible to damage, narrow arteries that tend to get clogged, and a birth canal that jeopardizes the lives of both mother and child. Why doesn't evolution weed out these problems? Shouldn't natural selection have fixed Achilles' heel by now? Nesse offers six reasons for the persistence of vulnerabilities: 1) natural selection is not strong enough, 2) there is a mismatch between our evolved environment and our current environment, 3) pathogens evolve faster than we do, 4) our traits inherently have trade-offs, 5) we acquire genetic success at the cost of health, and 6) our bodies' defenses are useful but costly.

Camille Toarmino, Psychology

Speaker: **Charles Nunn**, Professor of Evolutionary Anthropology and Global Health, Duke University

Talk: **Shining Evolutionary Light on Human Sleep and Health**

Dr. Nunn wanted to know if humans were an 'evolutionary outlier' when it comes to sleeping habits. An evolutionary outlier is 'a trait that is more extreme than predicted based on modeling trait evolution on a phylogenetic tree'. In other words, he can use social and ecological factors of other primates to predict what human sleep should look like. The phylogenetic models he created encompassed variables such as activity period, body mass, brain size, diet, inter-birth-interval, group size, and phylogeny. A phylogenetic prediction model incorporates these factors to create a probability distribution of what that aspect of human sleep should look like, and then he can compare what the actual value of that facet of human sleep is to determine whether or not humans are an evolutionary outlier.



Dr. Nunn found that humans sleep less and spend a greater percentage of time in REM sleep than predicted by the model, making humans outliers in both cases. According to the model, humans should be sleeping about 10.3 hours, but in fact are sleeping around 7 hours in Western populations. In the Hadza hunter-gatherers and Malagasy agriculturists, sleep duration is about 6.2 and 6.5 hours, respectively, which suggests that it is not the advent of electricity driving our short sleep. Compared to other primate species, humans are the shortest sleepers, and spend the greatest proportion of time in REM sleep. Furthermore, humans seem to be highly flexible when it comes to sleep. The Piraha hunter-gatherers take short naps during the day and through the night. There are historical references to a first and second sleep with a period of nighttime activity, which suggest at some point there was a biphasic sleep. In the Hadza and Malagasy populations, sleep was found to be much more fragmented and less efficient compared to Western populations.

Dr. Nunn theorized about why humans are such short sleepers. According to him, our ancestors had better things to do than sleep.

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There were selective forces at play, such as increased predation risk due to ground sleeping that likely influenced the duration of sleep. Sleep also comes with opportunity costs like socialization and social learning which were likely crucial to human survival. Humans could be short sleepers, because what made us successful as a species favored less sleep. But that may come with consequences, as 10% of the US population has some kind of insomnia. This evolutionary approach of examining short sleep might also be able to help us understand disease. Dr. Nunn suggested that the glymphatic system - the system that removes metabolic byproducts including amyloid beta, may help us understand diseases like Alzheimer's. Alzheimer's is marked by increased amyloid beta build up in the brain, and because the glymphatic system functions most effectively during sleep, there could be some link between this disease and our shortened, fragmented sleep. This evolutionary approach to disease is likely to be quite fruitful in years to come.

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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CARTA posts relevant and informative anthropogeny articles on Facebook and Twitter every day? Stay up-to-date on anthropogeny by visiting:



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CARTA Member Awards and Honors

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



Francisco Ayala (UC Irvine):

Awarded Doctor Honoris Causa, Universidad Pontificia Comillas, Madrid, Spain.

Received Medal of Honor, Real Academia Nacional de Medicina, Spain.

Received Medal of the Lección Magistral Andrés Laguna, Universidad of Alcalá and the Fundación Lilly, Spain.

Named Honorary Fellow, International Society for Science and Religion (ISSR), United Kingdom.



Ursula Bellugi (Salk Institute):

As of 2017, retired as Distinguished Professor Emerita, Salk Institute.

The Williams Syndrome Association is holding a celebration in Bellugi's honor called, "White Nights," in NYC in March, 2017.



Christopher Boehm (USC):

Named Senior Scholar, Center for Humans and Nature, Chicago.



Jean-Pierre Changeux (Baylor College of Medicine):

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



Bernard Comrie (UC Santa Barbara):

Elected a Foreign Member of the Russian Academy of Sciences, October 2016.



Aniruddh Patel (Tufts University):

Appointed a Senior Fellow, Canadian Institute for Advanced Research (CIFAR), Azrieli Program in Brain, Mind, & Consciousness.



Katherine Pollard (UC San Francisco):

Selected as a Chan-Zuckerberg BioHub Investigator.



Palmer Taylor (UC San Diego):

Recipient of the Reville Medal, UC San Diego.

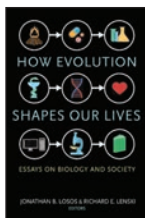
Anthropogeny as an Introduction to the Medical Curriculum

A major curriculum re-organization was recently achieved at UC San Diego's medical school. The first lecture that students now hear is entitled "Understanding Human Evolution: Implications for the Theory & Practice of Medicine." In September 2016, this lecture, delivered by Dr. Ajit Varki, CARTA's Executive Co-Director, was video recorded and permanently archived on the CARTA website for all to learn from and enjoy. Here's the link:

<https://carta.anthropogeny.org/mediaplayer/play/311302/299688>

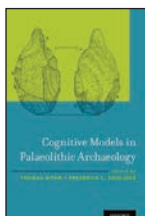
CARTA-Inspired Publications

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.)



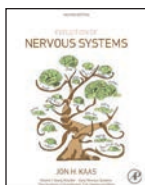
Ayala, FJ. Evolution and Religion: Conflict and Dialogue. In: Losos, JB, Lenski, RE, eds. *How Evolution Shapes Our Lives: Essays on Biology and Society*. Princeton University Press; 2016:255-283.

According to religious authors, humans have been designed by God. Darwin's theory of natural selection accounts for the evolution of species, including humans. Science and religious faith need not be in contradiction. Science concerns the processes that account for the natural world. Religion concerns the meaning and purpose of the world, humans' relation to their Creator and moral values.



Barnard, P, **Davidson, I**, Byrne, RW. Toward a Richer Theoretical Scaffolding for Interpreting Archaeological Evidence Concerning Cognitive Evolution. In: Wynn, T, Coolidge, F, eds. *Cognitive Models in Palaeolithic Archaeology*. Oxford Scholarship Online; 2016:45-68.

In the explosion of interest in the evolution of human minds, insufficient attention has been paid to different levels of relevant theory, or the construction of a model of mental architecture that can evolve. In this paper we attempt both, grounding arguments in our knowledge of animal cognition, cognitive theory and archaeological evidence indicative of nutrition, medicine use and tool-making.



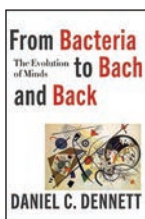
Bogin, BA, Varea, C. Evolution of Human Life History. In: **Kass, JH**, ed. *Evolution of Nervous Systems*. Academic Press; 2016:37-50.

Monkeys and apes pass through three stages of development after birth: infant, juvenile, and adult. Humans add childhood and adolescence stages. The new human stages entail a large investment of energy and time by older members of the social group in order to achieve healthy brain and body growth. These investments are achieved via a new type of family organization called biocultural reproduction.



Colchero, F, et al. including **Pusey, AE**, and **Stoinski, TS**. The emergence of longevous populations. *Proc Natl Acad Sci U S A*. 2016;113(48):E7681-E7690.

This study of mortality patterns in humans, monkeys and apes reveals the remarkable rise in life expectancy and lifespan equality over the last few generations of humans. Across populations, female lives tend to be longer and less variable than male lives, suggesting deep evolutionary roots to the male disadvantage. The findings open new directions for research on inequality, sociality, and aging.



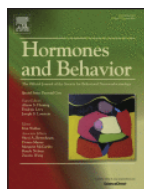
Dennett, DC. *From Bacteria to Bach and Back*. New York, NY: W.W. Norton and Company; 2017.

The evolution of the human mind, from the origin of life to the present and projecting into the immediate future, is the focus of this book. Natural selection is obviously the key, but there is a puzzle: How could a slow, mindless process build a thing that could build a thing that a slow mindless process couldn't build on its own? The solution is a process of cultural evolution, which created intelligent designers: us.



Hewlett, BS. Evolutionary Cultural Anthropology: Containing Ebola Outbreaks and Explaining Hunter-Gatherer Childhoods. *Current Anthropology*. 2016; 57(S13):S27-S37.

This paper outlines an integrated framework for the study of culture, called evolutionary cultural anthropology, that highlights culture and its interactions with biology and ecology. Applied research during Ebola outbreaks and several decades of research with hunter-gatherer children of the Congo Basin are utilized to illustrate evolutionary cultural anthropology.



Hrdy, SB. Variable postpartum responsiveness among humans and other primates with "cooperative breeding": A comparative and evolutionary perspective. *Hormones and Behavior*. 2016;77:272-283.

Why do postpartum responses of mothers in our own species vary so much more than in other apes, ranging from attentive to rejecting, or even infanticidal? And why are even experienced mothers so peculiarly sensitive to cues of social support? Explanations need to take into account both the genus *Homo*'s long legacy of cooperative breeding and neural overrides that may have co-evolved with it.



Murray, CM, et al. including **Pusey, AE**. Chimpanzee fathers bias their behaviour towards their offspring. *R Soc Open Sci*. 2016;3(11):160441.

In promiscuously mating species, recognition of offspring by fathers is not expected. However, chimpanzee fathers were found to associate and interact more with their own infants. These patterns suggest that a capacity for paternal care existed early in hominin evolution.



Nesse, RM, Finch, CE, and **Nunn, CL**. Does selection for short sleep duration explain human vulnerability to Alzheimer's disease? *Evol Med Public Health*. 2017

Compared with other primates, humans sleep less and have a much higher prevalence of Alzheimer's disease (AD) pathology. This article reviews evidence relevant to the hypothesis that natural selection for shorter sleep time in humans has compromised the efficacy of physiological mechanisms that protect against AD during sleep. Our hypothesis highlights possible long-term side effects of medications that reduce sleep, and may lead to potential new strategies for preventing and treating AD.



Parker, CH, et al. including **Hawkes, K**. The pyrophilic primate hypothesis. *Evol Anthropol*. 2016;25(2):54-63.

Only genus *Homo* creates and controls fire, but how our pyrotechnic abilities evolved remains unknown. Using recent paleoenvironmental reconstructions, we link human fire dependence to ancestral foraging habits that evolved in the progressively fire-prone tropical African Pliocene, turning our ancestors into active pyrophiles whose fire dependence contributed to their rapid expansion out of Africa.



Patel, AD. Using music to study the evolution of cognitive mechanisms relevant to language. *Psychon Bull Rev.* 2016

Music and language share certain cognitive processes, so studying how other species process human music can yield insight into the evolution of mechanisms relevant to language. Can other species acquire implicit knowledge of musical structure through extended exposure (vs. through explicit training)? I suggest that domestic dogs would be a good species to study in addressing this question.



Pollard, KS. Decoding Human Accelerated Regions. *The Scientist.* 2016;30(8).

This article reviews the topic of Human Accelerated Regions (HARs) for a general audience. It discusses the use of ancient DNA and diverse human genomes to understand the evolution of HARs, as well as emerging genomics and stem cell technologies for testing HAR function.



Samson, DR, et al. including **Crittenden, AN,** and **Nunn, CL.** Hadza sleep biology: Evidence for flexible sleep-wake patterns in hunter-gatherers. *Am J Phys Anthropol.* 2017.

This study showed that circadian rhythms in small-scale foraging populations are more entrained to their ecological environments than Western populations. Additionally, Hadza sleep is characterized as flexible, with a consistent early morning sleep period yet reliance upon opportunistic daytime napping. We propose that plasticity in sleep-wake patterns has been a target of natural selection in human evolution.



Smith, CM, et al. including **Denton, DA.** Endogenous central amygdala mu-opioid receptor signaling promotes sodium appetite in mice. *Proc Natl Acad Sci U S A.* 2016;113(48):13893–13898.

Sodium appetite is an important instinctive behavior with high survival value. Although a role of opioid signaling in salt appetite has been identified in rats,

the exact contribution made by different opioid receptor subtypes within specific brain regions is not fully characterized. Here, we report that mu-opioid receptor (MOR) signalling is intrinsically responsible for opioid-dependent sodium appetite. During gratification of sodium appetite, the central amygdala is activated. Endogenous MOR promotes sodium intake in sodium-depleted mice. Accordingly, we reveal a key nucleus within the endogenous opioid circuit that is likely to be conserved across primates and important in the control of dietary sodium consumption.



Stringer, C. The origin and evolution of *Homo sapiens*. *Philos Trans R Soc Lond B Biol Sci.* 2016;371(1698).

Many experts consider that the species *Homo sapiens* goes back to about 200,000 years, based on modern-looking fossils from Omo Kibish and Herto in Ethiopia. In this paper, I argue that the *sapiens* lineage in Africa should be extended back to the branch point of the last common ancestor with the Neanderthals and Denisovans, at least 500,000 years ago.



Trevathan, WR, Rosenberg, KR. *Costly and cute: Helpless Infants and Human Evolution.* University of New Mexico Press in Association with the School for Advanced Research Press; 2016.

We examine the costs and benefits of immature offspring who are highly dependent on parents and alloparents for the first several years of their lives but who are also socially and emotionally engaged, an unprecedented developmental pattern among primates. Helpless infants are as important to understanding human evolution and adaptation as their parents, “man the hunter” and “woman the gatherer.”

CARTA members who authored chapters in the book are Wenda Trevathan, Jeremy deSilva, Katerina Semendeferi, Sarah Hrdy, and Jim McKenna.

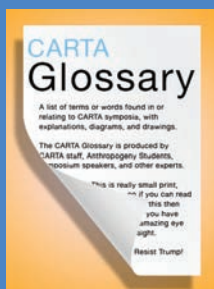


Trumble, BC, et al. including **Finch, CE,** **Gurven, M,** and **Kaplan, H.** Apolipoprotein E4 is associated with improved cognitive function in Amazonian forager-horticulturalists with a high parasite burden. *FASEB J.* 2016

Being an apolipoprotein E4 allele carrier is the strongest risk factor to date of Alzheimer’s disease (AD) and cognitive decline in industrial populations; it is associated with greater cognitive performance in individuals facing a high parasite and pathogen load, suggesting advantages to the E4 allele under certain environmental conditions. The current mismatch between postindustrial hygienic lifestyles and active parasite-rich environs may be critical for understanding genetic risk for cognitive aging.



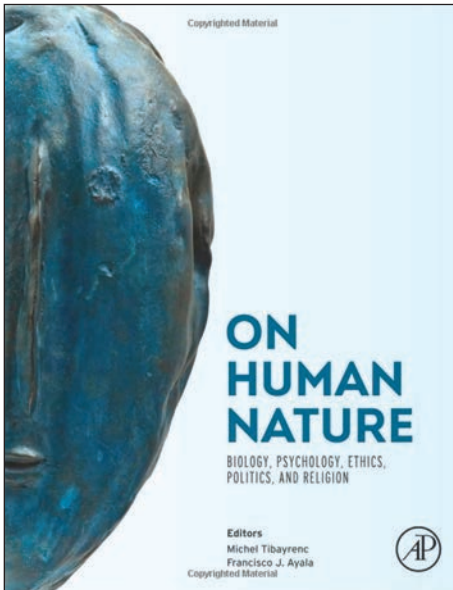
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Did you know that CARTA prepares a glossary for each symposium that defines the key terms used in the presentations? Symposium-specific glossaries can be found on the individual event pages and a combined glossary of all terms can be found here:

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

An Encyclopedia for Every Anthropogenist's Bookshelf



Tibayrenc, M, and Ayala, FJ. *On Human Nature: Biology, Psychology, Ethics, Politics, and Religion*. Academic Press; 2016.

From the Publisher: *On Human Nature* is a thought-provoking book covering the present state of knowledge on human diversity and its adaptive significance through a broad and eclectic selection of representative chapters. This transdisciplinary work brings together specialists from various fields who rarely interact, including geneticists, evolutionists, physicians, ethologists, psychoanalysts, anthropologists, sociologists, theologians, historians, linguists, and philosophers.

As one would expect, many CARTA members have contributed to this transdisciplinary work, including the following chapters:

1. The Advent of Biological Evolution and Humankind: Chance or Necessity? (Camilo Cela-Conde and **Francisco J. Ayala**)
4. The Contribution of Genetic Ancestry From Archaic Humans to Modern Humans (**Mark Stoneking**)
8. The Human Brain: Evolution and Distinctive Features (**Todd M. Preuss**)
9. How Different Are Humans and "Great Apes"? A Matrix of Comparative Anthropogeny (**Ajit Varki** and **Pascal Gagneux**)
14. Human Life History Evolution: New Perspectives on Body and Brain Growth (Steven N. Austad and **Caleb E. Finch**)
18. Gene-Culture Models for the Evolution of Altruistic Teaching (Kenichi Aoki, Joe Yuichiro Wakano, and **Marcus W. Feldman**)
19. Multiple Origins of Agriculture in Eurasia and Africa (**Ofer Bar-Yosef**)
32. Human Variability and the Origins and Evolution of Language (**Terrence W. Deacon**)
33. Human Evolution and Progress (**Francisco J. Ayala**)
35. Adaptive Significance of Ethics and Aesthetics (**Francisco J. Ayala**)
44. Science and Technology in Human Societies: From Tool Making to Technology (Camilo Cela-Conde and **Francisco J. Ayala**)

CARTA Symposia Schedule

**Awareness of Death and Personal Mortality:
Implications for Anthropogeny**
March 3, 2017, Salk Institute

**Extraordinary Variations of the Human Mind:
Lessons for Anthropogeny**
May 5, 2017, Salk Institute

**Cellular and Molecular Explorations of
Anthropogeny**
September 29, 2017, Salk Institute

For more information, please visit
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CARTA on the Web



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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.

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