

anthropogeny
tracks

a CARTA newsletter

vol. 7/2 - may 2019



ANTHROPOGENY:
THE
PERSPECTIVE
FROM
AFRICA

CARTA sets its sights on the
“cradle of humanity” with this
May 2019 symposium

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CARTA SYMPOSIUM

Anthropogeny: The Perspective from Africa features a cast of scientists and scholars who live and work in Africa and who will share their perspective on human origins.

It is therefore probable that Africa was formerly inhabited by extinct apes closely allied to the gorilla and chimpanzee; and as these two species are now man's nearest allies, it is somewhat more probable that our early progenitors lived on the African continent than elsewhere. [p. 199]

Darwin, Charles.
The Descent of Man, and Selection in Relation to Sex.
London: John Murray; 1871.

We are nearing 150 years since Charles Darwin and Thomas Huxley each published conclusions that humans shared a common ancestor with the African great apes, with Darwin having gone as far as to mark Africa as the birthplace of *Homo sapiens*.

Darwin's and Huxley's interpretation of available evidence in the face of prevailing racial sentiment is truly profound as neither was aided by modern archaeology, primatology, climatology, sociocultural anthropology, or advancements in genomics (the discovery of DNA was still 70-some-odd years away!), and both lived in the age of European exceptionalism and the "great chain of being."

The, at the time, non-prosaic conclusions of Darwin and Huxley have been validated in the

following years by global efforts of scholarly and systematic research.

No matter how complicated the story of human origins becomes, and it is very complex, the evidence is clear that Darwin and Huxley were correct in surmising that Africa was the "cradle of humanity."

We know that multiple waves of hominin species arose on the African continent and some left Africa and spread across the old world. All were eventually displaced, replaced, and in limited amounts, genetically assimilated by our own species, which also originated in Africa.

As Svante Pääbo put it, "We are all Africans, either living in Africa or in recent exile from Africa."

Continued on the next page...

Africa (orthographic projection) from Wikimedia Commons, authored by Martin23230 and licensed under the Creative Commons Attribution-Share Alike 3.0 Unported license. No alterations to image. [https://en.wikipedia.org/wiki/Africa#/media/File:Africa_\(orthographic_projection\).svg](https://en.wikipedia.org/wiki/Africa#/media/File:Africa_(orthographic_projection).svg)



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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<https://carta.anthropogeny.org>



UC San Diego

Continued from the previous page

Given all of this, it is not surprising that Africa holds a strong focus for anthropogeny, the study of human origins.

CARTA's May 2019 symposium, **Anthropogeny: The Perspective from Africa**, highlights this focus with an entirely African view on the epicenter of our species' origin, a continent that not only incubated us, but also our closest living and extinct relatives.

To do this, we've assembled a lineup of scientists and scholars who *live and work* in Africa to provide "boots-on-the-ground" context, as well as to share their contributions to the field of anthropogeny (*see below for more details*).

We hope you will consider joining us for this free event. Attend in person or watch the proceedings on the live webcast, all times listed in Pacific.

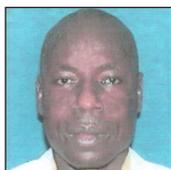
FRIDAY, MAY 31, 2019, 1:00 - 5:30 PM (PT)
Conrad T. Prebys Auditorium, Salk Institute
FREE ADMISSION & LIVE WEBCAST!



Job Kibii, National Museums of Kenya
Australopithecus in East and South Africa



Berhane Asfaw (Co-Chair), Rift Valley Research Service (Ethiopia)
Assessing claims for the "earliest" Homo sapiens



Andossa Likius, University of Moundou (Chad)
The Chad Basin



Sarah Wurz, University of the Witwatersrand (South Africa)
Klasies River as a 120,000-year-old archive of human behavior in South Africa



Yonas Beyene, Association for the Conservation of Culture & CFEE (Ethiopia)
The archaeology of Konso-Gardula



Abdoulaye Camara, Cheikh Anta Diop University of Dakar (Senegal)
The view from West Africa



Lyn Wadley (Co-Chair), University of the Witwatersrand (South Africa)
The origin and development of fire technology in Africa



Judith Sealy, University of Cape Town (South Africa)
Behavior and settlement patterns in coastal stone age communities - evidence from stable isotopes



Himla Soodyall, University of the Witwatersrand (South Africa) & Academy of Science of South Africa (ASSAf)
So, where do we come from?

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 about this CARTA symposium, including registration, the live webcast, or for information on past and future events, please visit:

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



**CENTER FOR ACADEMIC RESEARCH
AND TRAINING IN ANTHROPOGENY**
"To explore and explain the origins of the human phenomenon"

THE G. HAROLD AND LEILA Y.
MATHERS
FOUNDATION
Special thanks to CARTA's supporters and many generous friends



UC San Diego

A SALUTE TO CARTA's 10-YEAR HISTORY

Earlier this year, CARTA celebrated its 10th anniversary with a whirlwind tour of anthropogeny. Kicking off the event were several key leaders at UC San Diego who offered high praise and congratulations to this unique organization. Sixteen speakers, all CARTA members, followed with their “30-thousand-foot view” of anthropogeny as it relates to their field - from genomics to neuroscience to anthropology and beyond - keeping in mind these key questions:

What do we know for certain? What do we think we know? What do we need to know? How do we proceed?

The talks were delivered to a packed auditorium, and streamed live to interested viewers across the globe. Greeting attendees as they entered the auditorium were several large posters offering a succinct overview of CARTA's history, Graduate Specialization in Anthropogeny, and supporters and visionaries. We thought it only fitting to share that information with the readers of *Anthropogeny Tracks*, so they too, can learn about, and marvel at, CARTA's growth and development over the past 10 years.

EVOLUTION OF CARTA BANNER:

In this banner, we detail how this unique endeavour originated, give due credit to its brains, drivers, and supporters, and share what CARTA accomplished over the last 10 years.



10th ANNIVERSARY
REVISITING THE AGENDA

EVOLUTION OF CARTA

1990 - 1995

Local researchers begin informal meetings to inquire about human uniqueness from the perspective of their specialties:

- Kurt Benirschke (Comparative Pathology)
- Floyd Bloom (Neuroscience)
- Ted Bullock (Neuroscience)
- Patricia Churchland (Philosophy)
- Roy D'Andrade (Anthropology)
- Russell Doolittle (Biology)
- Fred “Rusty” Gage (Neuroscience)
- Bob Katzman (Neurology)
- Jim Moore (Biological Anthropology)
- David Perlmutter (Linguistics)
- Terry Sejnowski (Neuroscience)
- Ajit Varki (Medicine and Cellular & Molecular Medicine; Meetings Coordinator)

1996 - 1997

January 11, 1996: First formal organization of these meetings under the name, The La Jolla Group for Explaining the Origin of Humans (LOH).

LOH conversations expand globally with the advent of email and expert visitors begin to attend LOH meetings.

Jim Handelman, Executive Director of the Mathers Foundation, meets with Varki and discusses a shared interest in human origins. Handelman asks to be included in the LOH email list.

Peter Preuss, a prominent UC San Diego alumnus, offers Varki financial support for a meeting consisting of the global list of LOH participants.

1998 - 2000

February 6, 1998: First formal LOH meeting, *Explaining Humans*, with support from the Preuss Family Foundation. In attendance:

- Margaret J. Schoeninger, future CARTA Co-Director
- Pascal Gagneux, future CARTA Associate Director
- Jim Handelman

The Mathers Foundation offers support for the continuation of this unusual activity.

2001 - 2003

LOH transforms into the formal, UC San Diego-recognized, Project for Explaining the Origins of Humans (POH).

The POH website launches with help from Chaitan Baru, San Diego Supercomputer Center.

POH launches the first iteration of the online resource, the Matrix of Comparative Anthropogeny (MOCA), with help from Vishu Nandigam, San Diego Supercomputer Center.

2004 - 2007

March 12, 2004: First POH public symposium, with support from The Mathers Foundation, *Sequencing the Chimpanzee Genome: What Have We Learned?*

The Mathers Foundation offers to fund more POH public symposia.

The Primate Foundation of Arizona (PFA) donates a collection of chimpanzee skeletons, other samples, and records to POH, which creates the Museum of Primatology (MOP) at UC San Diego to organize the collections.

POH applies to become a formal UC San Diego Organized Research Unit (ORU).

2008 - 2009

January 25, 2008: POH becomes the Center for Academic Research and Training in Anthropogeny (CARTA), an official ORU at UC San Diego.

September 19, 2008: First CARTA public symposium, *Anthropogeny: Defining the Agenda*.

Annette C. Merle-Smith begins support of CARTA public symposia.

2010 - 2012

March, 2010: Formal approval for the Graduate Specialization in Anthropogeny and formation of the Faculty of Anthropogeny to administer the Specialization at UC San Diego.

Initial cohort of Specialization Students enroll and begin course work in Anthropogeny.

MOP initiates a digitization project of the PFA chimpanzee skeletons as a virtual resource for research and comparative primatology. Annette C. Merle-Smith provides major funding for this project.

2013 - 2018

Completion of the MOP digitization project culminates with the rollout of online access to the digitized PFA chimpanzee skeletons to researchers worldwide.

Annette C. Merle-Smith begins support of the Specialization students with the Annette C. Merle-Smith Fellowship, named in her honor.

October 14, 2016: CARTA partners with Arizona State University to co-sponsor the symposium, *Implications of Anthropogeny for Medicine and Health*.

May 5, 2017: CARTA partners with the KAVLI Institute for Brain and Mind to co-sponsor the symposium, *Extraordinary Variations of the Human Mind: Lessons for Anthropogeny*.

June 1, 2018: The Paul G. Allen Frontiers Group co-supports the symposium, *Imagination and Human Origins*.

October 12, 2018: CARTA partners with the KAVLI Institute for Brain and Mind to co-sponsor the symposium, *Impact of Tool Use and Technology on the Evolution of the Human Mind*.

CARTA TODAY

360+ Members: CARTA's global scientific membership.

32 Symposia: CARTA's anthropogeny talks unite experts and a curious, global audience.

46 Countries: The global reach of CARTA's live-streamed symposia.

35+ Million Views: Online viewership of CARTA Symposia videos, available free to the public.

10,117 Website Users: Individuals with active CARTA accounts.

45 Graduate Students: Enrollment in the Graduate Specialization in Anthropogeny since 2011.

7 Field Courses in East Africa: The Anthropogeny Field Course consists of sessions at key sites throughout Ethiopia and Tanzania.

\$1.5M in CARTA Fellowship Funding: Thanks to generous donors, CARTA has offered financial support for students enrolled in the Graduate Specialization in Anthropogeny.

52 Digitized PFA Chimpanzee Skeletons: Available as an online resource for research through MOP.

Comparative Anthropogeny: The National Center for Biotechnology Information (NCBI) of the National Library of Medicine (NLM) has agreed to publish completed MOCA entries as a free online book.



10th ANNIVERSARY
REVISITING THE AGENDA

CARTA'S ENDEAVORS WOULD NOT BE POSSIBLE WITHOUT THE SUPPORT OF MANY GENEROUS FOUNDATIONS AND FRIENDS

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Terrence Deacon	Donald MacLeod	Lawrence J. Schneiderman	Geary Zern
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CARTA SUPPORTERS BANNER:
In honor of the financial contributions by CARTA's wonderful supporters and friends, we proudly displayed all those whose generosity has made, and continues to make, CARTA possible. If you would like to support CARTA's anthropogeny efforts, please visit:

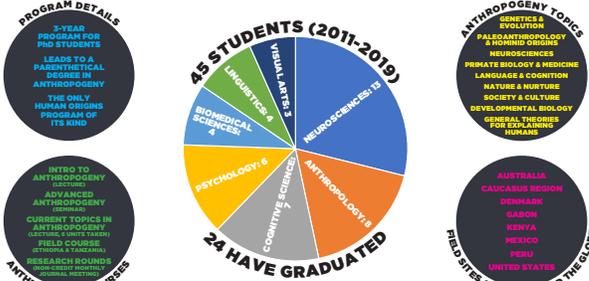
<https://carta.anthropogeny.org/support>



10th ANNIVERSARY
REVISITING THE AGENDA

GRADUATE SPECIALIZATION IN ANTHROPOGENY

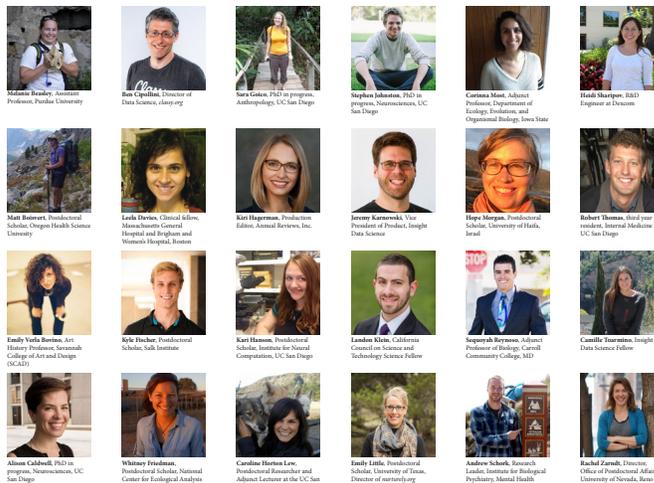
CARTA supports a unique anthropogeny graduate specialization available to PhD students in participating programs at UC San Diego. The program's curriculum trains a new generation of transdisciplinary thinkers who can advance the study of anthropogeny while gaining valuable training in mediating between multiple knowledge bases.



CURRENT AND PAST SPECIALIZATION STUDENTS

Jason Adams, Neurosciences	Sara Goico, Anthropology, '18	Sequoyah Reynoso, Neurosciences, '17
Julia Adrian, Cognitive Science	Kiri Hagerman, Anthropology, '16	Marley Rossa, Neurosciences
Vanessa Bateman, Visual Arts	Karl Hanson, Anthropology, '14	Tim Sainburg, Psychology
Melanie Beasley, Anthropology, '14	Caroline Horton, Anthropology, '16	Andrew Schorff, Cognitive Science, '16
Matthew Boisvert, Neurosciences, '18	Javier How, Neurosciences	Arturs Semenuks, Cognitive Science
Emily Verla Bovino, Visual Arts, '18	Stephen Johnston, Neurosciences, '18	Nina Semushina, Linguistics
Alison Caldwell, Neuroscience, '18	Jeremy Karnowski, Cognitive Science, '16	Heidi Sharipov, Neurosciences, '14
Ben Cipolini, Cognitive Science, '12	Stephan Kaulhold, Cognitive Science	Robert Thomas, Biomedical Sciences, '14
Elizabeth Clausing, Anthropology	Megan Kirchgessner, Neurosciences	Camille Toarmino, Psychology, '17
Sean Coflinger, Psychology	Landon Klein, Neurosciences, '18	Katie Van Alstyne, Psychology
Leela Davies, Biomedical Sciences, '13	Emily Little, Psychology, '17	Linnea Wilder, Anthropology
Emily Davis, Linguistics	Hope Morgan, Linguistics, '13	Haleh Yazdi, Psychology
Kyle Fischer, Neurosciences, '18	Corinna Most, Anthropology, '16	Rachel Zarnett, Biomedical Science, '14
Whitney Friedman, Cognitive Science, '16	Sascha Pohlhepp, Visual Arts	Matthew Zaslanski, Linguistics
Anupam Garg, Neurosciences	Catie Profaci, Neurosciences	

WHAT OUR GRADUATES ARE DOING NOW



ANTHROPOGENY SPECIALIZATION BANNER:
CARTA supports a unique Graduate Specialization in Anthropogeny at UC San Diego. Over the past ten years, many brilliant and hard-working graduate students have participated in the Specialization. This banner pays tribute to these students and their achievements.



10th ANNIVERSARY
REVISITING THE AGENDA

IN MEMORIAM: VISIONARIES WHO SHAPED CARTA



On February 27, 2016, CARTA lost our original supporter and champion, **James H. Handman** (born 1954), Director of the Mathers Foundation of New York.

Modest and humble to a fault, Jim always insisted on keeping a low profile, and brushed off any attempt to give himself due credit for jump-starting the entire CARTA enterprise. Without Jim, the heart and soul of CARTA's efforts – the symposia on human origins and the Anthropogeny Graduate Specialization program – would not exist today.



Roy Opland (November 6, 1931–October 20, 2016) was Emeritus Professor of Anthropology at the UC San Diego and the University of Connecticut. Opland was a cultural anthropologist and a founder of cognitive anthropology. His research interests included African-American family structure, personality color perception, and mathematical models for reconstructing mitochondrial lineages.



Franz Ruedler (September 16, 1928–October 5, 2008) served as Professor and Chairman of the Department of Molecular and Experimental Medicine at the Scripps Research Institute. Ruedler made important discoveries relating to the molecular basis of hemoglobin deficiency, X-chromosome inactivation in female mammals, and the male fundamental contribution to the understanding of Tay-Sachs disease, galactosemia, and sickle cell and other hemolytic anemias. He played a major role in pioneering new therapies for hemophilia, bone marrow transplantation in acute leukemia and T-cell-leukodystrophies in myeloid malignancies.



Gerald Holman (July 1, 1930–May 17, 2014) was a Professor of Neurobiology at The Scripps Research Institute. A pre-eminent biologist, Holman's focus on the Scripps Research Institute led to a Nobel Prize in Physiology or Medicine, which he shared with Herbert Boyer in 1972.



Andrew Hill (June 6, 1946–September 12, 2015) was the 11th Clayton Stephenson Professor of Anthropology at Yale University and Curator and Head of the Division of Natural History at the Peabody Museum of Natural History. A renowned paleoanthropologist, Hill published many important contributions related to African studies, human evolution, environment, ecology, evolutionary theory, anthropology and archaeology. He discovered many important sites, including a trail of hominid footprints dating to about 10 million years old at Ledi, an archaeological site in Tanzania.



Leslie B. Orgel (January 02, 1927–October 18, 2015) was UC San Diego School of Medicine's first Dean for Scientific Affairs, whom he created as one of the prominent cell biology programs in the nation, and served as a Professor of Medicine, Nobel Laureate, Consultant to the Editor of modern cell biology. Orgel was awarded the Nobel Prize in Physiology and Medicine, along with Albert Claude and Christian de Duve, in 1974. UC San Diego established the George E. Palade Endowed Chair in his honor.



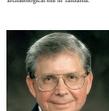
Elizabeth Bates (July 26, 1947–December 13, 2015) was a Professor of Cognitive Science at UC San Diego. Bates was an authority in the sciences of how the brain is organized to process language acquisition. She was one of the founding members of the UC San Diego Department of Cognitive Science, the first such academic department created in the United States.



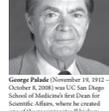
Theodore Balfanz (May 16, 1915–December 10, 2015) was Professor Emeritus of Neuroscience and served as the Director of the Scripps Institution of Oceanography. He was the founding father of neurophysiology and a recognized leader in the field of neurophysiology. His pioneering investigations included studies of sensory systems, especially in fish, neurophysiology of nerve cells, and electrical activity and emission of the brain.



Jeffrey L. Elman (January 22, 1948–June 28, 2015) was a founding member and Distinguished Professor of Cognitive Science at UC San Diego. Elman was a pioneer in artificial neural networks and an internationally recognized scholar in the field of language processing and learning. He was the Chair of the Division of Social Sciences from 2008 to 2015 and was a founding Co-Director of the Center for Research in Language. He was the Director of the University's Kavli Institute for Brain and Mind, and the University's first Director of Online and Technology Enhanced Education to support the expansion of educational access at UC San Diego.



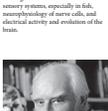
Lewis Judd (February 10, 1930–December 16, 2015) was the Chair of the Department of Psychiatry in the UC San Diego School of Medicine from 1977 to 2013, leading the Department to become a leader in leading psychiatric research. He also served as Director of the Center for the Study of Mental Health (NSM) from 1988 to 1992 and was a Vice President of the American Psychiatric Association. Judd was an expert in biological psychiatry and clinical psychopharmacology.



George Palade (November 18, 1912–October 18, 2015) was Scripps Institution of Oceanography's first Dean for Scientific Affairs, whom he created as one of the prominent cell biology programs in the nation, and served as a Professor of Medicine, Nobel Laureate, Consultant to the Editor of modern cell biology. Orgel was awarded the Nobel Prize in Physiology and Medicine, along with Albert Claude and Christian de Duve, in 1974. UC San Diego established the George E. Palade Endowed Chair in his honor.



Kurt Beneshki (May 26, 1924–September 10, 2015) was among the earliest faculty at the UC San Diego School of Medicine where he served for nearly a quarter of a century as a noted pathologist, geneticist, and expert on the genetic and reproductive systems of human and several mammalian species. He became internationally known for his successful efforts to create the world's first "transgenic" or "knock-in" mice to preserve the eggs, sperm and other tissues of endangered species.



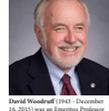
Francis Harry Compton Crick (June 8, 1916–July 28, 2004) was British molecular biologist, biophysicist, and neuroscientist and half of the pair of UK molecular biologists who discovered the structure of DNA. He was the founding father of Biological Studies. Famously Crick and Watson proposed the double-helical structure of DNA in 1953. Crick and Watson subsequently suggested a general theory for the structure of small proteins. Crick, Watson, and Maurice Wilkins were jointly awarded the 1962 Nobel Prize in Physiology or Medicine "for their discoveries concerning the molecular structure of nucleic acids and its significance for information transfer in living material."



Marvin Goodman (November 15, 1920–November 15, 2015) was Distinguished Professor of Anatomy and Cell Biology at Wayne State University and a Professor in the Center for Molecular Medicine and Genetics. Goodman is known worldwide for his research in molecular evolution and molecular systematics.



Bob Kistman (November 29, 1923–September 16, 2015) Professor Emeritus and was the Florence Hibel Chair for Research in Alzheimer's Disease at UC San Diego, and he was the founding Director of the Shirley Mazon Alzheimer's Disease Research Center at the UC San Diego. Kistman played a major role in making UC San Diego one of the major centers for Alzheimer's research in the United States. It is the only leading primate non-invasive and repair leading to a program that has had many prominent scientists before him in 1984.



David Woodruff (1941–November 16, 2015) was an Emeritus Professor of Biology and founding Chair of the Section of Ecology, Behavior and Evolution in UC San Diego's Division of Biological Sciences. Woodruff was a world-renowned conservation geneticist and biogeographer who championed UC San Diego's role in conservation science for 35 years.



Wolfgang "Wolf" Berger (October 9, 1937–August 6, 2017) was a Professor and former Director of the Scripps Institution of Oceanography at UC San Diego. Berger was one of the pioneers in paleoneurology and mainly integrated all branches of neuroanatomy, sensory, physical, chemical, biological and geological. His research included investigations of glaucoma, the carbon cycle, the history of climate, and the productivity of the ocean.



Steve Heinemann (February 11, 1939–August 2, 2015) was a Professor of Neuroscience at the Salk Institute for Biological Studies where he focused his research on the molecular mechanisms by which nerve cells communicate with each other at specialized connections known as "synapses." His pioneering research on neurotransmitter receptors in the brain helped lay the groundwork for understanding diseases of the brain. Heinemann established the Salk Institute's Molecular Neurobiology Laboratory.



Ernest May (July 5, 1904–February 3, 2007) was the Alexander Agassiz Professor of Zoology, Entomology, and Harvard University. May was one of the 20th century's leading evolutionary biologists and his work has contributed to the conceptual evolution that led to the synthesis of Mendelian genetics and Darwinian evolution, and to the development of the biological species concept. His theory of peripatric speciation has become widely accepted as one of the standard modes of speciation and is the basis of the theory of punctuated equilibria.



John Wooley (1945–April 20, 2015) was the long-time Associate Vice Chancellor for Research and Professor of Pharmacology at the UC San Diego. Wooley was also an Adjunct Professor in Pharmacology and in Chemistry and Biochemistry and a Strategic Advisor and Senior Fellow at the San Diego Supercomputer Center.

ASK AN ANTHROPOGENY EXPERT

Are you chewing on a particular and ponderous problem related to anthropogeny? Perhaps you're cogitating on where we came from and how we got here. Propose your question to us and we'll recruit experts to weigh in with answers. Selected questions will be featured in a future CARTA newsletter.



Modern humans outside of Africa have ~2% Neanderthal DNA, modern Melanesians and some other Asian populations also have additional contributions of Denisovan DNA, and modern African populations have traces of yet another unknown archaic species in their genomes. What do these genomic contributions from archaic humans tell us about our "modernness" and "humanness," and what does it really mean to be "modern human"?

Submitted by L.B., San Diego, CA



The multiple documented admixture events between archaic and modern humans illustrate that our understanding of evolution as "neat series of bifurcations" might be too simplistic.

On the other hand, humans on different continents do not all share the same archaic DNA: Most Africans did not inherit Neanderthal DNA and most Europeans and Asians did not inherit any Denisovan DNA. These admixture events were not at the root of modern humans.

Anatomically modern humans date back to over 200,000 years in Africa and archaeological evidence in Africa for modern behavior is older than 100,000 years (includes the use of pigments, shell beads, and projectile weapons).

Given the enrichment of archaic DNA away from functional regions of the modern human genome, there appears to be the distinct possibility that most archaic DNA was purged from the genome of our ancestors even after numerous interbreeding events.

However, archaic DNA from Neanderthals and Denisovans has provided novel adaptations to climate (high elevation), diet (lipid metabolism) and immunity (HLA variants) to certain modern human populations.

Answered by Pascal Gagneux, CARTA Associate Director, Professor of Pathology and Anthropology, UC San Diego

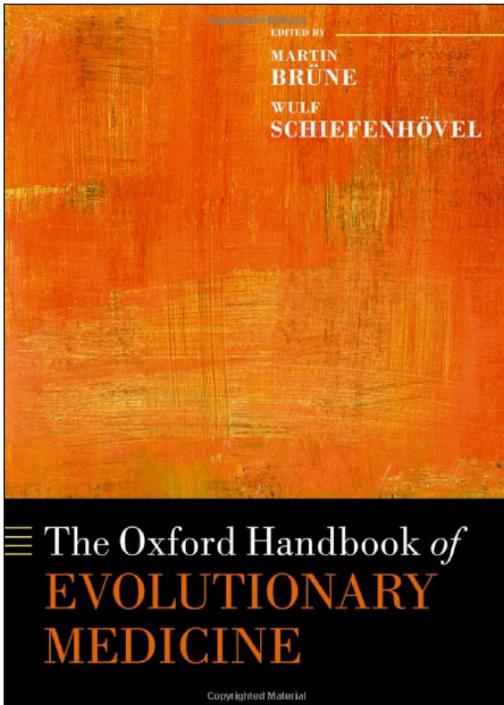
IN MEMORIAM BANNER:

This was the most difficult, yet impressive, banner CARTA displayed at the 10th Anniversary symposium. While we remember and honor the brilliant minds we've lost, we also pay homage to their contributions to CARTA, which may never have come to fruition if not for these luminaries.

A new textbook on Evolutionary Medicine featuring contributions by CARTA members.

RECOMMENDED RESOURCE

THE OXFORD HANDBOOK OF EVOLUTIONARY MEDICINE, 1ST ED.



From the publisher:

“*The Oxford Handbook of Evolutionary Medicine* is a compilation of up-to-date insights into the evolutionary history of ourselves as a species, and how and why our evolved design may convey vulnerability to disease. Written in a classic textbook style, emphasizing the physiology and pathophysiology of all major organ systems, the book addresses students as well as scholars in the fields of medicine, biology, anthropology, and psychology.”

The Oxford Handbook of Evolutionary Medicine is edited by Martin Brüne (Professor of Psychiatry, Department of Psychiatry, Psychotherapy and Preventive Medicine Division of Cognitive Neuropsychiatry, Ruhr-University Bochum) and Wulf Schiefenhövel (Professor of Medical Psychology and Ethnomedicine, Max-Planck-Institute for Ornithology).

Below and on the following pages are the chapters contributed by CARTA members, in bold. Each listing also includes the chapter abstract for your reference.

Core Principles for Evolutionary Medicine

- **Randolph M. Nesse** (Foundation Professor of Life Sciences and Founding Director, Center for Evolution and Medicine, Arizona State University)

New interest in evolution and medicine arose late in the twentieth century from the recognition that there are several possible kinds of evolutionary explanation for aspects of the body that leave it vulnerable to disease, in addition to the inevitability of mutations. Investigations of related hypotheses have led to rapid growth of evolutionary medicine, and its expansion to integrate demographic,

phylogenetic, and population genetic methods. Evolutionary approaches to understanding disease are part of a major transition in biology, from viewing the body as a designed machine to a fully biological view of the body's organic complexity as fundamentally different from that of designed machines.

Growth and Development

- Robin M. Bernstein (Associate Professor of Anthropology, Health and Society Program, Institute of Behavioral Science, University of Colorado, Boulder)
- **Barry Bogin** (Professor of Biological Anthropology, School of Sport, Exercise and Health Sciences, Loughborough University)

An evolutionary and biocultural approach is taken to the study of human growth and development. The evolutionary perspective focuses on the unusual process of human postnatal growth and development, a process that takes two decades to complete and traverses the stages of

infancy, childhood, juvenility, and adolescence. Human childhood and adolescence are highly unusual even compared to our closest living relatives, perhaps unique. The biocultural perspective of human development focuses on the constant interaction taking place during all phases of

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human development between genes and hormones within the body and the sociocultural environment that surrounds the body. While humans are often considered to be cooperative breeders, depending on social group helpers

to successfully rear offspring, it may be more accurate to understand humans as practicing biocultural reproduction as an adaptation to minimise risks to health.

Nutrition, Energy Expenditure, Physical Activity, and Body Composition

- Ann E. Caldwell (Instructor/Fellow, Division of Endocrinology, Metabolism, and Diabetes, Anschutz Health and Wellness Center, University of Colorado Denver)
- **Stanley Boyd Eaton** (Associate Professor of Anthropology and Radiology, Emeritus, Emory University and Emory School of Medicine)
- **Melvin Konner** (Samuel Candler Dobbs Professor, Department of Anthropology, Program in Neuroscience and Behavioral Biology, Emory University)

An imbalance of energy intake, expenditure, and storage substantially increases the risk of chronic, deadly conditions, including heart disease, stroke, type 2 diabetes mellitus (T2DM), certain cancers, and depression. Our understanding of the physiological, lifestyle, and environmental factors that contribute to poor energy regulation and balance can be informed in meaningful ways in the context of evolutionary medicine. There is a substantial mismatch, or discordance, between ancestral environments (environments of evolutionary adaptedness, EEAs) and most modern environments with regards to the availability and accessibility of food, and the connection between physical activity energy expenditure and energy

acquisition. Evolutionary medicine can inform research and approaches to reduce the disease burden associated with an imbalance of energy based on the discordance model for diet and activity, and further applying life history theory to understand physical activity. Challenges to the evolutionary approach to chronic disease are thought-provoking, but they do not negate its value. Novel approaches incorporating insights that consider human evolutionary history and integrate across Tinbergen's levels of analysis can lead to the development of interventions that are more compatible with evolved physiology and psychology and environments that are more conducive to lifestyles that reduce the risks of chronic diseases.

Cardiovascular System

- Kevin S. Shah (Cardiology Fellow, University of California, Los Angeles)
- Kalyanam Shivkumar (Professor of Medicine and Radiology, UCLA Cardiac Arrhythmia Center and EP Programs, Adult Cardiac Catheterization Laboratories, RR UCLA Medical Center, UCLA Health System)
- Mehdi Nojumi (Medical Student, University of California, San Diego School of Medicine)
- **Barbara Natterson-Horowitz** (Visiting Professor, Department of Human Evolutionary Biology, Harvard University; David Geffen School of Medicine at University of California, Los Angeles; Adjunct Professor, University of California, Los Angeles Department of Ecology and Evolutionary Biology)

Cardiovascular (CV) disease is the leading killer of our species. Various evolutionary lenses can be applied to better understand human vulnerability to CV disorders. The evolutionary origins of a healthy human heart—its myocardial, electrophysiologic, valvular and vascular systems—offers a history of the selective pressures, trade-offs and adaptations leading to the normal mammalian CV systems. Beyond these evolutionary-developmental perspectives, the application of a framework based on

Tinbergen's four questions offers a novel evolutionary lens for understanding our species' vulnerability to CV pathology. This is done by a consideration of comparative information about non-human animals who spontaneously develop the same CV diseases. This phylogenetic information can then be used to develop trade-off-based adaptive hypotheses to explain the nature and origins of vulnerability to a range of CV pathologies including atherosclerosis, heart failure, valvular heart disease and arrhythmias.

Sexuality, Reproduction, and Birth

- Wulf Schiefenhövel (Professor of Psychiatry, LWL University Hospital Bochum, Department of Psychiatry, Psychotherapy and Preventive Medicine, Division of Cognitive Neuropsychiatry, Ruhr-University Bochum)
- **Wenda Trevathan** (Regents Professor of Anthropology, Emerita, New Mexico State University)

The chapter extends discussion of the human reproductive life course by providing a focus on male and female sexuality and the common result of that sexuality, the production of offspring via childbirth. It begins with an overview of sexuality in non-human primates, with emphasis on variability, considering ways in which sexual behaviors of our closest relatives are both different

and similar to sexual behaviors of humans. The chapter addresses sperm competition, male and female orgasmic response, and homosexuality. The approach includes both evolutionary medicine and evolutionary psychology. The chapter considers the hours that surround the production of offspring, beginning with labour and delivery and concluding with the early postpartum treatment of

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the new-born infant. Topics covered include the role of the hormone oxytocin, the stages and phases of labor, posture in labor and delivery, surgical delivery, postpartum hemorrhage, neonatal hyperbilirubinaemia, treatment of the new-born, mother-infant bonding, postpartum

depression, and breastfeeding. Although there are aspects of labor and delivery that benefit from clinical assistance and consideration by evolutionary medicine, most of the time the process progresses with little or no intervention as it has for thousands of generations.

AWARDS & HONORS

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



Matt Cartmill (Boston University):

Received the American Association of Physical Anthropologists Charles R. Darwin Lifetime Achievement Award, 2019.



Ajit Varki (UC San Diego):

Reappointed Distinguished Visiting Professor at the Indian Institute of Technology, Madras and at the National Center for Biological Sciences in Bangalore, two of the most prestigious institutions of higher learning in India.



Antonio Damasio (University of Southern California):

Received the Paul MacLean Award for Outstanding Neuroscience Research in Psychosomatic Medicine at the annual meeting of the American Psychosomatic Society, March 2019.

Awarded Doctor Honoris Causa (honorary Ph.D.) by the University of San Martin in Buenos Aires, Argentina.

CARTA Member and President of the American Society of Human Genetics (ASHG), David Nelson (Baylor College of Medicine), took inspiration from CARTA and organized a symposium for the annual ASHG meeting, October 2018, “with an eye toward educating human geneticists about human origins.”

CARTA- INSPIRED SYMPOSIUM



**Presidential Symposium:
Origins of Our Species: Advances
in Our Understanding of Ancient
Humans in Africa**

This exciting session focused on recent advances in our understanding of human origins, migration, and health, with a focus on findings in ancient and modern Africa. The speakers discussed current understanding of early hominins, including anthropological and genetic evidence that points to earlier emergence of modern humans and apparent genetic contributions from prior species. The recognition of this deep and braided history of our species in Africa has consequences for understanding genetic variation in modern human populations and their influence on health and disease. Each speaker was given time for audience Q&A, and the session ended with a moderated panel discussion with the moderators and speakers.

Talks available on YouTube:

Current status and future directions

John Hawks (University Wisconsin Madison)

<https://www.youtube.com/watch?v=Cr6JmXpRgTk&t=>

Reconstructing the prehistory of Africa: The narrative of the genes

Himla Soodyall (University of the Witwatersrand, South Africa)

<https://www.youtube.com/watch?v=xLaVR32HfE&t=>

Genetic medicine research in Africa: Promise, problems, prospects

Ambroise Wonkam (University of Cape Town, South Africa)

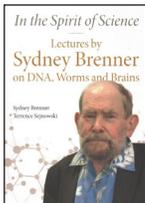
<https://www.youtube.com/watch?v=CKWAYzvNOpQ&t=>

Moderated Panel Discussion

<https://www.youtube.com/watch?v=OxqI9m1EcLQ&t=>

CARTA - INSPIRED PUBLICATIONS

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.



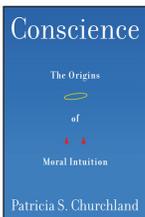
Brenner, S, Sejnowski, T. *In the Spirit of Science: Lectures by Sydney Brenner on DNA, Worms and Brains.* Singapore: *World Scientific*; 2018.

In October 2017, Nobel laureate Sydney Brenner gave four lectures on the history of molecular biology, its impact on neuroscience and the great scientific questions that lie ahead. The recorded lectures, full of anecdotes on other leading scientists from the past 60 years, are the basis for this book. Terry Sejnowski serves as Sydney's interlocutor for the last two lectures. The two share many stories and memories.



Chen, F, et al., **Hublin, J-J.** A late Middle Pleistocene Denisovan mandible from the Tibetan Plateau. *Nature*. 2019;569(7756):409-412.

The Xiahe (Gansu, China) mandible is the first rather complete fossil identified as Denisovan. Its discovery 2,500 km from the Denisova Cave (Altai, Russia) demonstrates that this sister group of the Neanderthals adapted to the high altitude of the Tibetan Plateau. Its features help to relate other Chinese fossil hominins to the Denisovans, confirming this group lived on a large portion of mainland Asia.



Churchland, P. *Conscience: The Origins of Moral Intuition.* New York: W. W. Norton; In Press.

In *Conscience*, Churchland explores how moral systems arose from our physical selves in combination with environmental demands. All social groups have ideals for behavior, even though they vary among different cultures. In trying to understand why, she looks to evolution to elucidate how, from birth, our brains are configured to form powerful bonds, to cooperate, and to care. Caring also motivates us to learn and modify the norms and values of the group.



Florio, M, et al., **Huttner, WB.** Evolution and cell-type specificity of human-specific genes preferentially expressed in progenitors of fetal neocortex. *eLife*. 2018;7:e32332.

The expansion of the neocortex during human evolution, which is one of the foundations of our cognitive abilities, is largely driven by an increase in the proliferative capacity of the neural stem and progenitor cells in the fetal human neocortex. This study identifies 15 human-specific protein-encoding genes that have been shown (*ARHGAP11B*, *NOTCH2NL*), or are candidates, to promote this capacity.



Jaouen, K, et al., **Hublin, JJ.** Exceptionally high $\delta^{15}\text{N}$ values in collagen single amino acids confirm Neanderthals as high-trophic level carnivores. *Proc Natl Acad Sci USA* 2019;116(11):4928-4933.

The level of carnivory in Neanderthals is much debated and several other explanations have been provided for their high nitrogen isotope values. Nitrogen and carbon isotopic values in bone collagen single amino acids rather than in the bulk collagen provide a much better assessment of the diet. This technique, when applied to two Neanderthal individuals confirms their essentially carnivorous diet.



Jeste, DV, et al., **Caspari, R, Gagneux, P, Miller, BL, Semendeferi, K.** *New Science of Practical Wisdom.* *Perspect Biol Med.* In Press.

Wisdom is a complex human trait composed of psychological processes ranging from prosociality, to acceptance of uncertainty, and spirituality, all processes involving fronto-limbic circuitry of the brain. Wisdom is associated with positive life outcomes and can increase with age. Post-reproductive adults can help enhance the fitness of younger kin. Wisdom has important implications at individual and societal levels, and is a major contributor to human thriving.



Kim, PS, McQueen, JS, **Hawkes, K**. Why does women's fertility end in mid-life? Grandmothering and age at last birth. *J Theor Biol*. 2019;461(14):84-91.

Agent-based models of the grandmother hypothesis that kept female fertility below age 50, as observed in living humans and great apes, showed grandmothers' subsidies for dependent youngsters could evolve human-like postmenopausal longevity from ancestral great ape-like life histories. Here the end of female fertility evolves as well, and grandmothers' subsidies *not only* drive the evolution of increased longevity *but also* maintain the end of female fertility below 50.



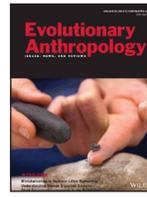
O'Donnell, C, Goncalves, JT, Portera-Cailliau, C, **Sejnowski, TJ**. Beyond excitation/inhibition imbalance in multidimensional models of neural circuit changes in brain disorders. *eLife*. 2017;6:e26724.

A leading theory holds that neurodevelopmental brain disorders arise from imbalances in excitatory and inhibitory (E/I) brain circuitry. However, it is unclear whether this one-dimensional model is rich enough to capture the multiple neural circuit alterations underlying brain disorders. The findings in this paper suggest that the basic E/I imbalance model should be updated to higher dimensional models that can better capture the multidimensional computational functions of neural circuits.



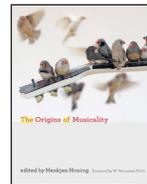
Okerblom, JJ, et al., including **Varki, A**, Breen, EC. Human-like *Cmah* inactivation in mice increases running endurance and decreases muscle fatigability: Implications for human evolution. *Proc R Soc Lond B Biol Sci*. 2018;285(1886).

Compared to other primates and most mammals, humans are exceptional long-distance runners, a selective advantage for human ancestors, allowing increased resource exploration, hunter/gatherer behavior in the savannah, and persistence hunting. This feature appeared ~2 million years ago, coincident with emergence of the genus *Homo*, a process also likely facilitated by loss of the *CMAH* gene. Indeed, human-like *Cmah* null mice showed enhanced endurance running performance and muscle fatigue resistance.



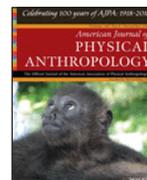
Pargeter, J, **Shea, JJ**. Going big versus going small: Lithic miniaturization in hominin lithic technology. *Evol Anthropol*. 2019;28(2):72-85.

Systematic production and use of small, sharp-edged cutting tools is among the most distinctive ways human lithic technology differs from other primate stone tool use. Archaeologists equate "lithic miniaturization" with microliths, and as a result, view lithic miniaturization as a recent evolutionary phenomenon. This paper argues that lithic miniaturization takes many other forms, and it shows that such evidence appears from Early Pleistocene times onwards.



Patel, AD. Music as a transformative technology of the mind: An update. In: Honing, H, ed. *The Origins of Musicality*. Cambridge, MA: MIT Press; 2018:113-126.

This chapter proposes that musical behavior may be a human cultural invention that triggered processes of gene-culture coevolution, resulting in evolved neural specializations for music processing. The chapter also discusses specific aspects of music cognition which could be studied to investigate this idea. The chapter is in a new edited volume called *The Origins of Musicality* (MIT Press).



Rightmire, GP, Margvelashvili, A, Lordkipanidze, D. Variation among the Dmanisi hominins: Multiple taxa or one species? *Phys Anthropol*; 2019;168(3):481-495.

To determine the number of taxa documented at Dmanisi, we assess sources of variation in brain size, craniofacial morphology, and the expression of characters related to aging and sex dimorphism. Growth anticipated in skull 3, age-related remodeling affecting the D2600 mandible, pathology, and sex differences can account for much of the inter-individual variation observed. The Dmanisi hominins likely represent a single paleospecies of *Homo*.



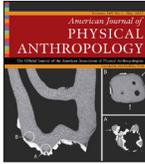
Rogers, CN, et al., including **Rilling, JK, Preuss, TM**. Oxytocin- and arginine vasopressin-containing fibers in the cortex of humans, chimpanzees, and rhesus macaques. *Am J Primatol*. 2018;80(10):e22875.

Oxytocin (OT) and arginine vasopressin (AVP) are peptides expressed by hypothalamic nuclei, nuclei that project strongly to nearby basal forebrain structures. However, OT and AVP receptors are present in large parts of the cerebral cortex. This study demonstrates

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peptide-containing fibers in the cortex in these three species, which may account in part for their known effects on social cognition.



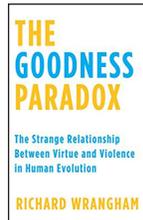
Ungar, PS, Livengood, SV, **Crittenden, AN**. Dental Microwear of Living Hadza Foragers. *Phys Anthropol*. 2019;169(2):356-367.

Analysis of dental microwear can be used to assess the diet of contemporary hunter-gatherers. Here occlusal surface microwear texture data for the Hadza are presented, suggesting that despite earlier data on dietary differences between the sexes, men and women currently have similar modal diets across seasons, likely associated with increased domesticated cultigens in the diet.



Wiessner, P. Collective Action for War and for Peace: A Case Study among the Enga of Papua New Guinea. *Curr Anthropol*. 2019;60(2):224-244.

This paper explores the challenges of collective action for both war and peace-making in small-scale societies, drawing on a study from Papua New Guinea. The role of pragmatic considerations, emotional appeals, and ritual means to unite individuals with different interests and agendas are considered. The juxtaposition of war and peacemaking is an effective strategy for the evolution of social complexity.



Wrangham, RW. *The Goodness Paradox: The Strange Relationship Between Virtue and Violence in Human Evolution*. New York: Pantheon; 2019.

Humans' daily interactions are characteristically tolerant, and for about 300,000 years our ancestors' anatomy has looked like that of a domesticated animal. Yet we also exhibit exceptional levels of violence. *The Goodness Paradox* explains why tolerant and violent tendencies evolved in parallel, and in doing so, presents a specific theory of the origin and self-domestication of *Homo sapiens*.



Xu, S, et al., including **Fisher, SE**. *Foxp2* regulates anatomical features that may be relevant for vocal behaviors and bipedal locomotion. *Proc Natl Acad Sci USA*. 2018;115(35):8799-8804.

FOXP2 mutations cause a rare speech/language disorder. The gene affects brain circuits linked to motor skills and spoken language, but is also active in skeletal tissue. Analysis of skeletal-specific knockouts of mouse *Foxp2* revealed roles in skull shaping and bone remodeling. Thus, the gene may have been well placed to contribute to coevolution of neural and anatomical traits related to speech and bipedal locomotion.

CARTA Symposia Schedule

Impact of Early Life Deprivation on Cognition: Implications for the Evolutionary Origins of the Human Mind

Friday, October 11, 2019, The Salk Institute

Exploring the Origins of Today's Humans

Winter 2020

The Evolution of Human Physical Activity

Spring 2020

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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>

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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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