anthropogeny tracks
a CARTA newsletter
Volume 3, Issue 3 - October 2015

Skin Evolution Goes Beyond the Surface Level

Skin is the major interface between the human body and its environment. It supports diverse and complex functions, such as protection, vitamin photosynthesis, thermoregulation, and communication. Although the structure and function of human skin have been well characterized, its evolution remains inadequately understood. While great strides have been realized in the study of skin pigmentation, the evolution of functional nakedness, humans' prodigious ability to sweat, and the origins of the human breast (the body's largest modified sweat gland) are still largely matters of conjecture. The skin's microbiome is emerging as one of the most important factors in maintaining barrier functions, but there is much to be discovered about its diversity and roles in health and disease.

How can the many gaps in our knowledge of the evolution of human skin be adressed? For one, CARTA's October 16, 2015 public symposium, **Unique Features of Human Skin**, will bring together scientists representing evolutionary biology, genetics, dermatology, anthropology, and physiology to share their knowledge and answer questions about human skin in an explicitly evolutionary framework.

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

Symposium Details

- Friday, October 16, 1:00 - 5:30 p.m., Pacific
- Conrad T. Prebys Auditorium, Salk Institute
- Free and open to the public, however registration is required
- Live webcast
- For more information or to register, visit: http://carta.anthropogeny.org/events/unique-features-human-skin

The fantastic lineup of speakers includes:

Skin, a Window into the Evolution of the Human Super-Organism
Richard Gallo, UC San Diego

The Genetics of Skin Pigmentation
Mark Shriver, Pennsylvania State University

The Skin and Ultraviolet Radiation: Effects on DNA and Carcinogenesis
James Cleaver, UC San Francisco

Human Skin: Sweating, Thermoregulation, and Water Balance
Michael Sawka, Georgia Institute of Technology

Ecology and Evolution of the Skin Microbiome
Rob Knight, UC San Diego

Of Lice and Men: The Molecular Evolution of Human Lice
Mark Stoneking, Max Planck Institute for Evolutionary Anthropology

Subcutaneous Fat in Humans
Chris Kuzawa, Northwestern University

Evolution of Hair Follicles, Mammary Glands, and Sweat Glands in Humans and Other Mammals
Sarah E. Millar, University of Pennsylvania

Naked, Colorful Skin and Its Role in Human Social Interactions
Nina Jablonski, Pennsylvania State University

Center for Academic Research and Training in Anthropogeny
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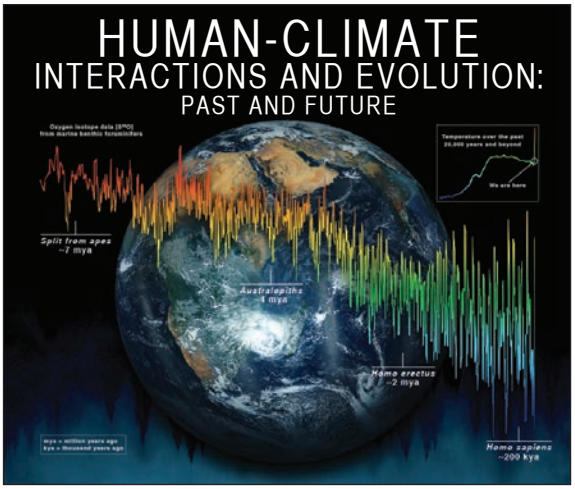
Excerpts From Student Essays: CARTA Climate Symposium



Student engagement with the expert scientists who speak at CARTA's human origins symposia is an important part of our endeavour. At each symposium, graduate students enrolled in the Graduate Specialization in Anthropogeny have the unique opportunity to "host" these internationally renowned speakers. Participating in the symposia proceedings provides a great opportunity for students to create important scholastic and research connections, as well as to gain valuable knowledge from the brightest minds representing diverse fields of inquiry. As part of the curriculum requirement, each participating 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 by a number of the students who participated in the May 2015 CARTA symposium, **Human-Climate Interactions and Evolution: Past and Future**.

Kiri Hagerman, Anthropology

Speaker: Jean-Jacques Hublin, Professor and Director of Human Evolution at the Max Planck Institute for Evolutionary Anthropology

Talk: *The Climatic Framework of Neandertal Evolution*

Neanderthals are an important species to study in relation to climatic influences given the short separation time between them and modern humans. Dr. Hublin discussed the current timeline for the estimated divergence between these two species and concluded that this event probably occurred around 600 thousand years ago (ka), with a distinct Neanderthal phenotype emerging around 450 ka.

The main effect of climatic changes on Neanderthal evolution might well result from the succession of demographic crashes and subsequent genetic bottlenecks their populations suffered. This likely resulted in episodes of rapid genetic drift. Indeed, during the Middle Pleistocene, a spectacular increase in the amplitude of climatic cycles had a major impact on the habitability of the Middle latitudes of Eurasia.

The general body proportions of Neanderthals are a possible indicator of an adaptation to the cold. Body proportions in modern humans are known to vary according to climatic conditions, with colder conditions producing a stockier build in the population. Neanderthals fit this stockier phenotype, which could be a sign that they evolved in harsher conditions. Dr. Hublin raised the counterargument, however, that this could also be the result of primitive retention in Neanderthals. Unfortunately, there are not enough Middle Pleistocene specimens from sufficiently disparate areas to determine the effect of climate on body proportions at this time.

In his concluding remarks, Dr. Hublin discussed the main question at hand: whether climate was a factor in Neanderthal extinction. Perhaps in certain areas of Europe local climate change did play a role and cleared the path for modern human expansion. But the fact is, modern human expansion was irresistible all over the planet and not just in places where Neanderthals lived. In this scenario, humans are the more important factor, and not climate—in other words, climate was probably not the main cause for Neanderthal extinction.

Corinna Landig, Biomedical Sciences

Speaker: Veerabhadran Ramanathan, Distinguished Professor of Atmospheric and Climate Sciences at Scripps Institution of Oceanography, UC San Diego

Talk: *Climate Change Mitigation: In Pursuit of the Common Good*

Dr. Ramanathan described how he went from studying the quantum mechanics of the atmosphere of Venus to mitigation of climate pollutants and interacting with the world's religious leaders. In his early career, around 1975, it was generally thought that carbon dioxide (CO_2) was the main greenhouse gas, but then he found that chlorofluorocarbons (HFC) heavily contribute to the greenhouse effect as well. In fact, one molecule of HFCs contributes 10,000-15,000 times more to the greenhouse effect than CO_2. The greenhouse gases form a "blanket" that traps the solar energy underneath and keeps the planet surface warmer than normal. In 1980, he and his colleague, R. Madden, predicted we would be able to detect human-induced climate change due to the increase in CO_2 emission by the year 2000. Their prediction came true – human-induced climate change is now undisputable. How do we slow down the ongoing climate change and global warming? Dr. Ramanathan agrees that mitigation of CO_2 emission is very important, however, the reduction of other climate pollutants is essential as well. Carbon dioxide has a long lifetime compared to other pollutants like HFCs or black carbon. Therefore, the effect of mitigation will be seen later compared to the mitigation of short-lived climate pollutants (SLCPs), which can be seen in a few weeks.

Although mainly induced by the upper one billion, the people with access to fossil fuel, the worst consequences of the climate change will affect the bottom three billion. Dr. Ramanathan suggests that from a moral point of view, the top one billion must intervene, including the world's religious leaders who have to agree on human-induced climate change and foment interventions. In 2014, as a member of the Pontifical Academy of Sciences, he co-organized a Vatican meeting on "Sustainable Humanity, Sustainable Nature" and in this meeting, they came to the conclusion that a "sustainable relationship with nature requires change in attitude toward nature and towards each other and therefore requires moral leadership." As a result of this meeting, Pope Francis and other religious leaders signed a statement on climate change.

Emily Little, Psychology

Speaker: William Ruddiman, Professor Emeritus of Environmental Sciences, University of Virginia

Talk: *How Humans Took Control of Climate*

In his talk, *How humans took control of climate*, Dr. William Ruddiman defined his argument for the development of the anthropocene, or the era of human domination of the planet, being a long, slow and time-transgressive process.

While this time period is generally dated back to the start of the industrial revolution, Dr. Ruddiman and his colleagues have been collecting evidence that points to human environmental domination starting much earlier. Specifically, he argued that we should be focusing on human-driven domestication and agriculture as the real time point for the start of anthropogenic climate change, which occured before the explosion of industrialization and urbanization. He presented data showing the natural cycles of methane and carbon dioxide, both major culprits in global temperature change. Around 10,000 years ago (ya), both methane and carbon dioxide had leveled off and started to decrease. This decrease should have led the planet into a phase of glaciation as part of the normal cycle of environmental fluctuation. However, an atypical rise around 6,000 ya prevented the onset of glaciation, and just so happened to coincide with the explosion of agriculture.

Dr. Ruddiman's research demonstrates that this was far from coincidental. Plant domestication dates back to more than 10,000 ya in the fertile crescent of South-Western Asia (Mesopotamia). At around 5,000 ya, domesticated rice began to spread across Asia, and the process was completed by around 1,000 ya. Given that rice paddies are essentially methane-releasing swamps, this seems to have been a key player in the sudden and unexpected rise in methane levels.

In fact, models from Dr. Ruddiman's colleague, Dorian Fuller, suggest that rice paddies can account for over 70% of the atypical methane levels during that time period. At 4,000 ya, rice and other early agriculture began spreading exponentially, with livestock spreading across the rest of Asia and India, as well as into Africa. Though estimates for the methane contribution of the increase in livestock agriculture are still being developed, it is likely that this will represent a significant contribution, given the methane these animals release.

In addition, livestock and farming contributed to the rise in carbon dioxide levels via deforestation, as land-clearing required for agriculture releases huge amounts of the gas. Meanwhile, large-scale deforestation by pre-agriculturalists wasn't necessary due to their hunter-gather, non-settled, way of life. With agriculure, settled living becomes possible, and the need for wood for dwellings and fuel also increases, causing further deforestation. Sharp flint axes were used to clear land during the earliest phase of farming. But, by 4,500 ya, bronze axes came into use in many regions, which is well after the start of large-scale clearance and CO_2 emissions increase 6,000 ya.

The take-home message of Dr. Ruddiman's presentation was that humans have a long history of affecting the climate before the start of the industrial revolution.

Camille Toarmino, Psychology

Speaker: Rick Potts, Director of the Human Origins Program at the Smithsonian Institution

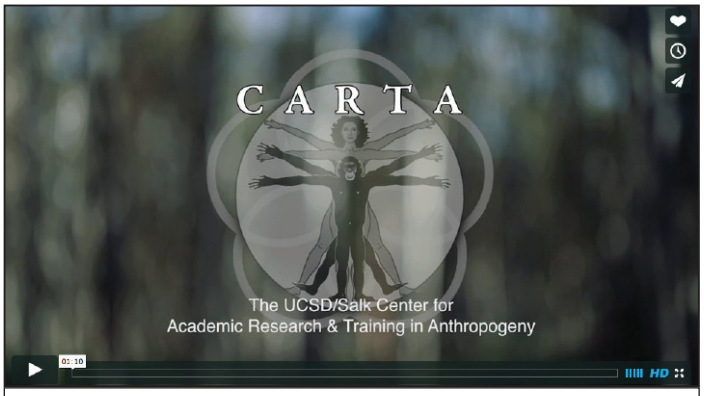
Talk: *Climate Instability and the Evolution of Human Adaptability*

"The entire planet has become our archaeological site," Dr. Potts stated during his talk. The truth in this statement is in part what makes our species so unique – we have accumulated many adaptations that have allowed us to thrive in numerous varying environments and climates. We have quite literally made the world our home.

But, records show that there was strong instability in the climate for millions of years, alternating between periods of aridity and moistness, as well as coolness and warmth. These alternations can be attributed to orbital dynamics, and Potts focused on the interaction between two variables in particular: eccentricity (the shape of the earth's orbit around the sun) and orbital precession. Examining these two variables shows that there were alternating high and low phases of variability in Africa.

What did these fluctuations mean for the evolution of *Homo sapiens*? Potts presented an interesting trend speaking to this very question. His work in southern Kenya showed vast changes in the landscape there, where early humans lived. During periods of prolonged high climate variability intervals, many interesting 'firsts' emerged. These firsts are called FADS (first datum appearance) of a particular behavior, species, tool, etc.

For instance, during these intervals, the genera *Australopithecus*, *Homo*, and *Paranthropus* all made their first appearances. The origins of other major technological and behavioral advances, such as wider social networks, trade, complex symbolic activity, and planning, were also rooted in these times. Indeed, even Oldowan stone tool technology, which emerged and proliferated during dynamic climate instability, increased the range of accessible foods, which in turn helped offset habitat and resource instability.



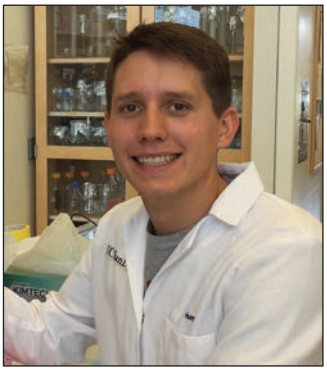
Check out the CARTA bumper video!

http://carta.anthropogeny.org/donate

Michael Vaill, Biomedical Sciences

Speaker: Jeff Severinghaus, Professor of Geosciences at Scripps Institution of Oceanography, UC San Diego

Talk: *Abrupt Climate Transitions and Humans*



Dr. Severinghaus began his talk, *Abrupt Climate Transitions and Humans*, by clarifying a commonly misunderstood bit of climate information. The public is well aware of the relationship between greenhouse gases, including carbon dioxide and methane, and global temperatures. However, the mechanism by which they interact over geological history seems to have largely eluded public understanding.

Basic physics explains that greenhouse gases trap heat in the atmosphere and can produce increased global temperatures. The historical correlation between atmospheric greenhouse gas levels and global temperatures, as measured by ice core scientists such as Severinghaus, is not, in fact, due to this greenhouse effect. It is instead due to a mechanism that operates in reverse of the greenhouse effect.

As the eccentricity, axial tilt, and precession of the earth's orbit change, changes in the average distance between the earth and the sun produce variations in the earth's global temperature. These orbit-induced temperature variations then alter atmospheric composition by shifting the equilibrium of gases between the atmosphere and the ocean. As the earth cools, gases are dissolved into the ocean; as the earth warms, gases are released into the atmosphere. This effect is clearly illustrated in the ice core record by a lag of several hundred years between changes in temperature and subsequent changes in gas equilibrium.

The greenhouse effect plays a role in global warming periods by amplifying the temperature increases until the average distance from the sun and temperature coordinately begin to decrease, a scenario Severinghaus likened to compounding credit card interest. So while it may be tempting to draw an analogy between previous ice ages and the current situation, it is not valid. Human burning of fossil fuels has altered the magnitude of the greenhouse amplifier. As a result, our planet is now facing a situation that it has never encountered before.

Haleh Yazdi, Psychology

Speaker: Peter deMenocal, Professor of Earth and Environmental Sciences, Columbia University

Talk: *African Climate Change and Human Evolution*

As the African climate underwent a series of gradual changes, human evolution responded accordingly. Shifts in climate resulted in changes in the resources available to primates, thus forcing them to become flexible with the foods that they ate and the places they sheltered.

As mentioned in Dr. Peter deMenocal's talk and papers (deMenocal, 2011; 2014), changes in African climate and the trajectory of human evolution coincide with two major events. The first occurred between 2.9-2.4 million years ago when the lineage of "Lucy" (*Australopithecus afarensis*) became extinct and the *Paranthropus* group appeared and disappeared. The second event occurred between 1.9 and 1.6 million years ago when *Homo erectus* appeared.

By investigating changes in carbon isotope ratios from ocean and land sediments, scientists were able to estimate what percentage of African landscapes contained woody plants (indicative of wet climates), and those which contained grassy plants (indicative of grasslands) at a given time. They discovered that during the first event, East Africa was mostly comprised of wet landscapes, such as shrubs and forests. Slowly, these wet landscapes dried and converted to grasslands during the *Paranthropus* era. However, a sudden, dramatic expansion of grasslands occured during the second event.

Carbon samples of *Paranthropus* and *Homo erectus* teeth reflect these changes— only *Homo erectus* teeth indicate consumption of a mixed diet, which was feasible through migration amid expanding grasslands. These findings show that the shift from wet to dry climates determined the survival and extinction of certain traits over others, eventually leading to the adaptation and evolution of our species.

Did you know?

***Anthropogeny* is the study of the origin of humans (Oxford English Dictionary, 2006). The term was first used in the 1839 edition of Hooper's Medical Dictionary and was defined as "the study of the generation of man."**

Curious to learn more?

Each day, CARTA posts relevant and informative anthropogeny articles on Facebook and Twitter. Stay up-to-date on anthropogeny by visiting:

facebook.com/ucsdcarta
twitter.com/cartaucsd

Announcing the 2015-16 Anthropogeny Fellows

To support participation in the Graduate Specialization in Anthropogeny, CARTA offers fellowships to the most highly motivated students. This program is offered to UC San Diego gradutate students from eight different disciplines, including anthropology, biology, biomedical sciences, cognitive science, linguistics, neurosciences, psychology, and visual arts. This year, nine anthropogeny students were awarded fellowships, including two recipients of the the inaugural Merle-Smith Fellowship in Anthropogeny.

Honoring Annette Merle-Smith, who has been a supporter of CARTA from the beginning, the Merle-Smith Fellowship was established to support the participation of those students who demonstrate the most involvement in, and commitment to, the Graduate Specialization in Anthropogeny. CARTA is pleased to introduce the first two recipients of the Merle-Smith Fellowship Award, Whitney Friedman and Andrew Schork, both from the Cognitive Science department. Whitney studies the social interactions of male bottlenose dolphins and what their interactions can tell us about ourselves, and Andrew probes for genetic factors that contribute to variability in the adolescent brain and mind.

Also deserving of recognition are seven other students who received CARTA fellowship awards for 2015-16: Emily Bovino (Visual Arts), Kiri Hagerman (Anthropology), Caroline Horton (Anthropology), Emily Little (Psychology), Corinna Most (Anthropology), Hans Peterson (Psychology), and Camille Toarmino (Psychology).

Each student in the Anthropogeny program has performed to an exceptionally high standard and we wish to extend our sincere congratulations to everyone for their hard work.

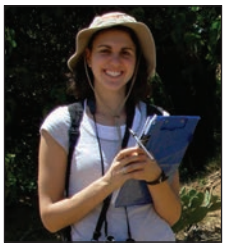

Emily Bovino


Whitney Friedman


Kiri Hagerman


Caroline Horton


Emily Little


Corinna Most


Hans Peterson


Andrew Schork


Camille Toarmino

Anthropogeny in Action: A Paleolithic Culinary Celebration

At the conclusion of each academic year, the Anthropogeny Specialization students, along with Anthropogeny Faculty, gather to celebrate their accomplishments with a human origins-themed gastronomic feast.

This year's theme included paleolithic cooking techniques and tools, such as slowcooking a suckling pig with a ground fire and spit, and crafting stone blades. Of course, a few exceptions were made and neolithic implements were used, when necessary.

Wood was first hand-split for the double-sided ground fire. The suckling pig, stuffed with garlic, lemongrass, and basil, was then loaded onto a sturdy spit constructed from green bamboo and lashed together with New Zealand flax. Flax is a tough, yet pliable leaf that makes excellent rope. Meanwhile, off to the side, several cakes and homemade bread were baked in cast iron pans.

Then, while turns were taken to rotate the pig, Dr. Pascal Gagneux gave the students a session on stone knapping, the results of which were used to carve the perfectly roasted pig.

All-in-all, students were treated to a delicioius Paleolithic tour of our culinary history spanning millions of years of human evolution.

A special thanks to Suncoast Farms in Imperial Beach, CA, for hosting this event.

Top: Anthropogeny students gathered for the celebration.

Bottom Left: Pascal demonstrates how to spin dough.

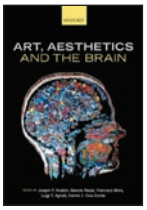
Bottom Right: Using an obsidian blade, a piece of volcanic glass knapped into a cutting tool, Pascal carves the roasted pig.

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.)

Berger, L.R., et al. including **Churchill, S.E.**, **DeSilva, J.M.**, **Bogin, B.**, and **Tocheri, M.W.** *Homo naledi*, a new species of the genus *Homo* from the Dinaledi Chamber, South Africa. *eLife*. 2015; 4:e09560.

The fossils combine both ape-like and human-like traits. *Homo naledi* has a human-like hand, wrist, foot and lower leg, coupled with more primitive trunk, shoulder, pelvis, upper leg, and brain size. Representing at least 15 individuals, from infants to older adults, this is the largest assemblage of a single species of hominins yet discovered in Africa.



Cela-Conde, C.J., and **Ayala, F.A.** Art and Brain Coevolution. In: Huston, J.P., Nadal, M., Mora, F., Agnati, L.F., and Cela-Conde, C.J., eds. *Art, Aesthetics, and the Brain*. New York: Oxford University Press; 2014:408-425.

The capacity for *producing* aesthetic items is universal: painters, dancers, and musicians are not restricted to any culture or historical epoch. The capacity for *appreciating* "beauty," aesthetic qualities in objects, movements and sounds is also universal, and it goes beyond producing them. How to establish the phylogenetic appearance of the human competence for appreciating beauty?

Costantini, T.W., Dang, X., Coimbra, R., Eliceiri, B.P., **Baird, A.** CHRFAM7A, a human-specific and partially duplicated α7-nicotinic acetylcholine receptor gene with the potential to specify a human-specific inflammatory response to injury. *J of Leukoc Biol*. 2015; 97(2):247-257.

New behaviors are coincident with new kinds of injury: bipedal movement leads to new forms of trauma, harnessing fire leads to increased smoke inhalation and the cooking of foods increases burn injury. We posit that the appearance of CHRFAM7A in the human genome modified the human neuro-inflammatory response and as such, helped specify a uniquely human vagus nerve response to injury and infection.

Hilton, H.G., et al. including **Parham, P.** Loss and Gain of Natural Killer Cell Receptor Function in an African Hunter-Gatherer Population. *PLoS Genet*. 2015; 11(8):e1005439.

The genes that control human immune responses vary enormously between individuals. Understanding the evolution of these genetic differences and how they personalize the immune response is key to understanding how the immune system works in health and disease. Our study of the genetically diverse hunter-gatherer KhoeSan of southern Africa uncovered two immune gene variants with unusual function.

Humphrey, N. Consciousness as Art. *Scientific American Mind*. 2015; 26(3):64-69.

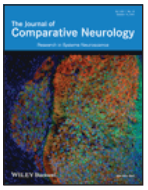
Debate rages as to whether the qualities of conscious experience which, we set such store on can be explained simply as the workings of the physical brain, or whether there must be an additional ingredient of a non-physical kind. Considering consciousness to be an illusion – a mere trick of the physical brain – offends people, so perhaps we should think of it as art instead. While people resent being duped by illusions, they are proud to be art-lovers. If our brains have evolved to create masterpieces of consciousness for our private enjoyment, scientists will want to know what the evolutionary pay-off is. Is the purpose of this brain-art to make people fall in love with themselves – and other people too?

Järvinen, A., Ng, R., Crivelli, D., Neumann, D., Grichanik, M., Arnold, A.J., Lai, P., Trauner, D., **Bellugi, U.** Patterns of Sensitivity to Emotion in Children with Williams Syndrome and Autism: Relations Between Autonomic Nervous System Reactivity and Social Functioning. *J Autism Dev Disord*. 2015; 45(8):2594-2612.

Williams syndrome (WS) and autism spectrum disorder (ASD) are associated with atypical social-emotional functioning. Affective visual stimuli were used to assess autonomic reactivity and emotion identification, and the social responsiveness scale was used to determine the level social functioning in children with WS and ASD contrasted with typical development (TD), to examine syndrome-specific and syndrome-general features.

Lieberman, P. Language Did Not Spring Forth 100,000 Years Ago. *PLoS Biol*. 2015; 13(2):e1002064.

Chomsky claims that no form of language existed before 100,000 years ago when the syntactic features of every language that then or will ever exist were preloaded into every human brain. Supposedly, children do not learn their native language. Instead, they activate this implausible innate knowledge. Some aspects of speech and language go back millions of years, others evolved in the last 500,000 years.

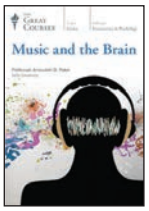


Lipovich, L., et al. including **Sherwood, C.C.**, **Hof, P.R.**, **Grossman, L.I.**, and **Goodman, M.** High-throughput RNA sequencing reveals structural differences of orthologous brain-expressed genes between western lowland gorillas and humans. *J Comp Neurol*. 2015. (doi: 10.1002/cne.23843)

Human cognitive abilities are strikingly different from other great apes' despite relatively modest genome sequence divergence. We analyzed the brain transcriptome of the western lowland gorilla, phylogenetically closely related to humans but with a brain approximately one-third the size. We provide a unique repository of sequences and structures of thousands of genes transcribed in the gorilla brain.

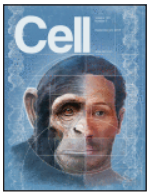
Osada, N., Hettiarachchi, N., Adeyemi Babarinde, I., **Saitou, N.**, Blancher, A. Whole-Genome Sequencing of Six Mauritian Cynomolgus Macaques (*Macaca fascicularis*) Reveals a Genome-Wide Pattern of Polymorphisms under Extreme Population Bottleneck. *Genome Biol Evol*. 2015; 7(3):821-830.

A small number of Cynomolgus macaques were introduced to Mauritius from Southeast Asia around the 16th century. We sequenced the whole genomes of six Mauritian cynomolgus macaques and found a mild reduction of overall level of nucleotide diversity and a strong reduction of low-frequency polymorphisms. This is compatible with their history of introduction to that island.



Patel, A.D. Music and the Brain. 2015. The Great Courses, Course No. 1181. http://www.thegreatcourses.com/courses/music-and-the-brain.html

Music is an integral part of humanity. Every culture has music, from the largest society to the smallest tribe. Yet we still struggle to understand the origin of our musical behavior. In this 18-lecture video, we explore topics such as the evolution of musicality, the neurological sources of music's emotional power, and the impact of regular engagement with music on brain structure and function.



Prescott, S.L., et al. including **Gage, F.H.** Enhancer Divergence and *cis*-Regulatory Evolution in the Human and Chimp Neural Crest. *Cell*. 2015; 163(1):68-83.

The genetic differences between humans and chimpanzees are surprisingly small, yet our craniofacial complexes have diverged significantly since our common ancestor. These changes are mediated by mutations affecting developmental gene expression patterns. This study uses epigenomics and a cellular model system to compare functional mutations important for recent human-chimp craniofacial evolution.

Samraj, A.N., et al. including **Crittenden, A.N.**, **Varki, N.M.**, and **Varki, A.** A red meat-derived glycan promotes inflammation and cancer progression. *Proc Natl Acad Sci U S A*. 2015; 112(2):542-547.

The first molecular difference discovered between humans and chimps was human-specific loss of the sialic acid Neu5Gc. This nonhuman molecule incorporates into human tissues from dietary red meats, despite antibody responses against it. The resulting inflammation may explain the human-specific propensity for red meat-associated cancer risk. This process promoted cancers in a humanlike mouse model.

Schwarz, F., et al. including **Varki, N.**, **Varki, A.**, and **Gagneux, P.** Siglec receptors impact mammalian lifespan by modulating oxidative stress. *eLIFE*. 2015; 4:e06184.

A major factor in aging is damage by reactive oxygen species generated by white blood cells. Siglec receptors on such cells modulate production of these free radicals. We found a strong correlation between the number of Siglec genes in mammalian species and their maximum lifespan. Deleting a Siglec gene in mice caused accelerated aging. Surprisingly, humans may be an exception to this correlation.

Sejnowski, T.J. Summary: Cognition in 2014. *Cold Spring Harb Symp Quant Biol*. 2014; 79:237-241.

The goal of the 79th CSH Symposia on Quantitative Biology on Cognition held in the summer of 2014 was to survey recent advances in cognitive neuroscience and assess future prospects. Participants were treated to an extraordinarily rich feast of 58 long talks, 6 short talks, and 137 posters. The sense that emerged from the symposium was that a threshold had been crossed and a new era in the study of cognition was underway. In this summary, Terry Sejnowski attempts to capture that sense of awakening, to trace the strands that gave rise to it, and to access its implications for future discoveries.

Smith, C.M., Walker, L.L., Chua, B.E., McKinley, M.J., Gundlach, A.L., **Denton, D.A.**, Lawrence, A.J. Involvement of central relaxin-3 signalling in sodium (salt) appetite. *Exp Physiol*. 2015; 100(9):1064-1072.

Vast areas of the interior of the planet, jungles, mountains and savannah are severely sodium deficient. Salt appetite would be an important survival advantage during primate evolution. Our Institute discovered Relaxin 3. ICV infusion of Relaxin 3 can stimulate sodium appetite, and the antagonist R3 (B1-22) R of the receptor (RXFP3) will substantially abolish sodium appetite, but not thirst.

Tibayrenc, M., Avise, J.C., **Ayala, F.J.** In the Light of Evolution IX: Clonal Reproduction: Alternatives to Sex. *Proc Natl Acad Sci U S A*. 2015; 112(29):8824-8826.

Clonal reproduction prevails in virus, bacteria and parasitic protozoa. Asexual reproduction is also common in insects, pathogenic helminthes, crustacea and plants, and is found even in vertebrates. The study of clonal reproduction raises many theoretical and technological challenges that may yield considerable payoffs in microbiology, parasitology, artificial cloning, and the study of cancer.

Waismeyer, A., **Meltzoff, A.N.**, Gopnik, A. Causal learning from probabilistic events in 24-month-olds: an action measure. *Dev Sci*. 2015; 18(1):175-182.

24-month-old infants observed an adult produce a probabilistic pattern of causal evidence. They were provided no motor involvement with the objects. When given a chance to respond, the infants immediately recreated the cause-effect event without trial-and-error or linguistic instruction. We argue that such *observational causal learning* from probabilistic displays supports human children's rapid cultural learning.

Wroblewski, E.E., et al. including **Pusey, A.E.**, and **Parham, P.** Signature Patterns of MHC Diversity in Three Gombe Communities of Wild Chimpanzees Reflect Fitness in Reproduction and Immune Defense against SIVcpz. *PLoS Biol*. 2015; 13(5):e1002144.

Small, wild chimpanzee populations have many major histocompatibility complex (MHC) class I variants, like indigenous human populations. A variant enriched among chimpanzees infected with simian immunodeficiency virus (SIV) has similarities to the human variant that most resists HIV progression. Selection unusually maintained these related variants despite the rapid evolution of the hominid MHC.

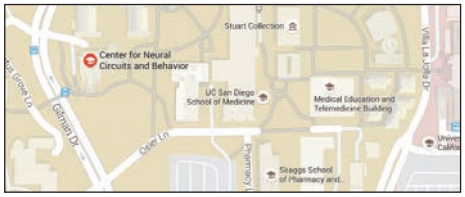
anthropogeny tracks

CARTA

Special Lecture Featuring Dr. Francisco Ayala of UC Irvine, CARTA 2015 Visiting Professor

"Guernica" by Pablo Picasso, color added

Dr. Francisco J. Ayala is the Donald Bren Professor of Biological Sciences at UC Irvine. His scientific research focuses on population and evolutionary genetics, including the origin of species, genetic diversity of populations, the origin of malaria, the population structure of parasitic protozoa, and the molecular clock of evolution. He also writes about the interface between religion and science, and on philosophical issues concerning epistemology, ethics, education, and the philosophy of biology.



Evolution of Ethical Behavior and Moral Values: Biology? Culture?

- Monday, December 7, 2015
- 4:00 - 5:00 pm
- Center for Neural Circuits and Behavior, Marilyn G. Farquhar Seminar Room, UC San Diego

CARTA Symposia Schedule

Unique Features of Human Skin
October 16, 2015, Salk Institute

Origins of Genus *Homo*
February 5, 2016, Salk Institute

Ancient DNA and Human Evolution
April 29, 2016, Salk Institute

Implications of Anthropogeny for Medicine and Public Health
October 14, 2016, UC San Diego

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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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