

**WE ARE WHAT WE ATE: THE DIETS THAT FUELED HUMAN EVOLUTION**

Public Symposium · Friday, October 30, 2026

Co-chairs:**Erica Sonnenburg**, Stanford University School of Medicine**Pascal Gagneux**, University of California San Diego**Sponsored by:**

Center for Academic Research and Training in Anthropogeny (CARTA)

ABSTRACTS***The diets of early hominins*****Matthew Sponheimer**, University of Colorado Boulder

The story of becoming human is, to a significant extent, the story of how our ancestors adapted to a changing world. Dietary transitions, linked to environmental change, have been especially important in this regard. Bipedal locomotion, tool use, and increased brain size have been offered as causes and/or consequences of hominin dietary change. Any such claims, however, are limited by the difficulty of inferring dietary behavior at millions of years' remove. In this talk, we examine the methods used to explore hominin dietary ecology, their strengths and limitations, and the ways they inform current questions in early hominin dietary research. The enigmatic taxon *Paranthropus boisei*, better known publicly as "Nutcracker Man," will receive special attention, as it presents an ideal case study of the problems and prospects of studying early hominin diet, and of how diet may have shaped the rise and fall of hominin species.

The human predatory pattern**Jessica Thompson**, Yale University

Humans consume more meat than any other primate. We are also the only primate to regularly eat animals larger than ourselves. This is the human predatory pattern, but how, when, and why did this happen? What were the ecological and evolutionary circumstances that positioned our ancestors to become the first primate intruders into the carnivore guild? New fossil and archaeological discoveries dating between 4 – 2 million years ago continue to pull back the curtain on these questions, and new theoretical framing draws from nutritional and ecological literature to examine its consequences even today. The human predatory pattern had impacts across hominin anatomy, technology, and social behavior, starting with the first blow of stone on bone to access the marrow inside. This talk will summarize this new evidence and how it contributes to the changing story of human omnivory.

From sugar to starch: Detecting diet shifts during human evolution**Nathaniel Dominy**, Dartmouth College

What did our ancestors eat? It is a challenging question because feeding behaviors seldom fossilize. How, then, do we identify the foods and dietary preferences that fueled the origin and evolution of our human lineage? Here I evaluate three complementary methods and their inferential limits. First, mechanical testing of edible plant tissues—including rainforest fruits and underground storage organs—is useful for establishing the processing (chewing) abilities of hominin teeth and jaws. Second, stable isotope analyses of modern and fossil ecological analogs can distinguish between diets premised on below- or above-ground plant tissues, especially those in savanna-woodlands. Third, comparative genomics, exemplified by copy-number variation of the salivary amylase gene (AMY1), can detect signatures of dietary starch adaptation that persist in human populations today. No single method is decisive, but their convergence provides a rigorous, testable framework for reconstructing pivotal dietary transitions during human evolution.

The role of red meat: From a blessing to a curse?
Ajit Varki, University of California San Diego School of Medicine

We humans are unusual in comparison to our primate cousins, regarding our penchant for consuming meat from large animals. Archaeological evidence of stone tools useful for butchery and cut marks on bone fossils indicate that this dietary shift predated the origin of the genus *Homo* about 2 million years ago. Such foods are also rich in essential amino acids, certain vitamins like B12 (not made by plants) and trace elements. Iron is essential for almost all life forms, but it is also toxic in excess. However, Iron is particularly important for women of child-bearing age, and the demands are even greater during pregnancy and lactation. Elemental iron and iron present in plants are poorly absorbed. In contrast “red meat”, eponymously defined by its rich content of heme iron associated with myoglobin, is much more efficiently utilized, because of the presence of specific heme receptors in the gut—increasing the likelihood of successful pregnancies and breast-feeding in ancestral populations. However, with the onset of agriculture, animal domestication and major increase in production and consumption, red meat is associated with major diseases such as cancer, atherosclerotic cardiovascular disease, obesity, and type 2 diabetes. Given that red meat is now sought after as prestigious food in most societies, its increasing large-scale production contributes substantially to environmental degradation and climate destabilization. This presentation (including some of our own work) discusses how “red meat”, once a valuable resource—has, in modern times, been partially transformed from “blessing” to a ‘curse”.

The evolutionary significance of cooked food
Rachel Carmody, Harvard University

Cooking is a uniquely human behavior that transforms food through physical and chemical processes, making it easier to consume and digest while increasing the energy we can extract from it. Cooking may also have broadened the human dietary niche by detoxifying foods and reducing foodborne pathogens, while the control of fire may have made otherwise difficult-to-obtain foods, such as honey, more accessible. By increasing the net energetic returns and diversity of the diet, cooking and fire use may have contributed to a suite of adaptations consistent with higher dietary quality that emerged in our lineage approximately 2 million years ago, including energetically costly increases in body size and relative brain size accompanied by reductions in digestive structures. Although the archaeological record of early fire use has long shaped debates about when cooking became evolutionarily important, recent evidence from South Africa and Kenya supports the plausibility of cooking during this critical evolutionary transition. In this talk, I will examine cooking as a major evolutionary innovation and its broader role in shaping human dietary adaptation.

Adaptation of the microbiome to changing diets
Justin Sonnenburg, Stanford University School of Medicine
& **Erica Sonnenburg**, Symposium Co-Chair, Stanford University School of Medicine

The human gut houses trillions of microbes from hundreds of species forming an ecosystem called the microbiome. This ecosystem not only aids digestion and gut health, but is wired into diverse physiological processes including immune system regulation, metabolism, and central nervous system function. Unlike our human genome, our microbiome can adapt to changes in its environment on a timescale ranging from days to weeks with diet being one of the most powerful influences on the microbiome. This plasticity enables adaptations to dietary changes, such as those associated with seasons or migrating into new environments; however, it also represents a vulnerability. Extreme or prolonged dietary change can drive microbial extinctions in the gut microbiome, as well as changes in composition and function that are deleterious to human health. Recent evidence has revealed that humans living an industrialized lifestyle harbor a gut microbiome that is radically different from that of our paleolithic ancestors. Adaptation of the gut microbiome to industrial, highly processed foods has resulted in a deteriorated ecosystem that may be causing and contributing to many chronic metabolic and inflammatory diseases.

Fermentation and human brain expansion

Erin Hecht, Harvard University

The expansion of the human brain represents a metabolic paradox: how did our ancestors fuel such an energetically expensive organ while reducing the size of the digestive tract? While the "Cooking Hypothesis" suggests fire was the primary driver, the transition likely began much earlier. This talk will explore the External Fermentation Hypothesis, proposing that the intentional or accidental fermentation of foods could have provided a crucial "external stomach." By outsourcing the work of digestion to microbes, early hominids could access higher caloric density and more bioavailable nutrients. We will discuss how this shift in food technology may have predated fire, served as a catalyst for the initial surge in brain volume, and what it suggests about the unique evolutionary trajectory of the human lineage.

Human evolution, spit by spit

Stefan Ruhl, State University of New York at Buffalo

Saliva is needed for the pre-processing of food in the mouth, the maintenance of tooth mineralization, and protection from microbial pathogens. What is known to date about the functions of salivary proteins has largely been deduced from conventional in vitro experiments or by analogy to distantly related animal models that only incompletely represent the human condition with respect to saliva. This gap in knowledge also poses an impediment to harnessing saliva as a diagnostic fluid for dental and systemic diseases. An alternative approach to gaining insights into the functions and disease associations of salivary proteins is to conduct comparative studies of globally distinct human populations or with closely related primate species. When we compared the proteomes of human saliva and the saliva of our closest extant evolutionary relatives, chimpanzees and gorillas, we found that humans produce a waterier saliva, containing less than half the total protein of great apes and Old-World monkeys. We also discovered unique protein profiles in human saliva that were distinct from those of nonhuman primates. By analyzing the evolution of genes encoding key saliva proteins across the mammalian lineage, we found that saliva-related genes have undergone frequent duplications, losses, and regulatory changes, with these patterns becoming particularly evident in the primate lineage. These findings open up the possibility that dietary differences and pathogenic pressures may have shaped a uniquely distinct salivary proteome in the human lineage. Overall, our work highlights the evolutionary malleability of saliva-related genes and provides new insights into how adaptations to diet and disease may have influenced primate biology. Discovering such variations will allow future studies to elucidate adaptations to human-specific dietary changes and to new pathogen challenges that emerged with increased meat consumption beginning over 2 million years ago, and more recently with agriculture, animal husbandry, and sedentarism.

The diets of children past and present

Lora Iannotti, Washington University in St. Louis, Bursky School of Public Health

Greater than half of the world's children are malnourished, experiencing micronutrient deficiencies, stunted growth and development, or overweight/obesity. If malnutrition occurs during the first 1,000 days of life, there will be life-long consequences. Many populations globally no longer have access to critical elements of evolutionary dietary patterns such as animal source foods or diet diversity giving rise to these problems. We describe the empirical evidence highlighting the disconnect in child dietary patterns past and present and report findings from our study in Ecuador showing the benefits of mimicking ancestral diets on early brain and bone development.