

References

Aktuell

EDITORIAL 2016

Fat lot of good. [nature 533 \(2016\), 8.](#)

Humans' exceptional ability to burn through calories fuels our evolution.

GANI 2016

Nahid D. Gani & M. Royhan Gani, *On the Environment of Aramis, Concerning Reply of White to Cerling et al. in August 2014.* [Current Anthropology 57 \(2016\), 219.](#)

WHITE 2016

Tim D. White, *On the Environment of Aramis, Reply to Gani and Gani.* [Current Anthropology 57 \(2016\), 220.](#)

YU 2016

Byron M. Yu, *Fault tolerance in the brain.* [nature 532 \(2016\), 449–450.](#)

If stored information is erased from neural circuits in one brain hemisphere in mice, the lost data can be recovered from the other. This finding highlights a safeguarding mechanism at work in the brain.

Anthropologie

AMALRIC 2016

Marie Amalric & Stanislas Dehaene, *Origins of the brain networks for advanced mathematics in expert mathematicians.* [PNAS 113 \(2016\), 4909–4917.](#)

The origins of human abilities for mathematics are debated: Some theories suggest that they are founded upon evolutionarily ancient brain circuits for number and space and others that they are grounded in language competence. To evaluate what brain systems underlie higher mathematics, we scanned professional mathematicians and mathematically naive subjects of equal academic standing as they evaluated the truth of advanced mathematical and non-mathematical statements. In professional mathematicians only, mathematical statements, whether in algebra, analysis, topology or geometry, activated a reproducible set of bilateral frontal, Intraparietal, and ventrolateral temporal regions. Crucially, these activations spared areas related to language and to general-knowledge semantics. Rather, mathematical judgments were related to an amplification of brain activity at sites that are activated by numbers and formulas in nonmathematicians, with a corresponding reduction in nearby face responses. The evidence suggests that high-level mathematical expertise and basic number sense share common roots in a nonlinguistic brain circuit.

Keywords: mathematical cognition | semantic judgment | functional MRI

Significance: Our work addresses the long-standing issue of the relationship between mathematics and language. By scanning professional mathematicians,

we show that high-level mathematical reasoning rests on a set of brain areas that do not overlap with the classical left-hemisphere regions involved in language processing or verbal semantics. Instead, all domains of mathematics we tested (algebra, analysis, geometry, and topology) recruit a bilateral network, of prefrontal, parietal, and inferior temporal regions, which is also activated when mathematicians or nonmathematicians recognize and manipulate numbers mentally. Our results suggest that highlevel mathematical thinking makes minimal use of language areas and instead recruits circuits initially involved in space and number. This result may explain why knowledge of number and space, during early childhood, predicts mathematical achievement.

FU 2016

Qiaomei Fu et al., *The genetic history of Ice Age Europe*. [nature \(2016\)](#), preprint, 1–6. DOI:10.1038/nature17993.
n2016-Fu-Supplement.pdf

Qiaomei Fu, Cosimo Posth, Mateja Hajdinjak, Martin Petr, Swapan Mallick, Daniel Fernandes, Anja Furtwängler, Wolfgang Haak, Matthias Meyer, Alissa Mittnik, Birgit Nickel, Alexander Peltzer, Nadin Rohland, Viviane Slon, Sahra Talamo, Iosif Lazaridis, Mark Lipson, Iain Mathieson, Stephan Schiffels, Pontus Skoglund, Anatoly P. Derevianko, Nikolai Drozdov, Vyacheslav Slavinsky, Alexander Tsybankov, Renata Grifoni Cremonesi, Francesco Mallegni, Bernard Gély, Eligio Vacca, Manuel R. González Morales, Lawrence G. Straus, Christine Neugebauer-Maresch, Maria Teschler-Nicola, Silviu Constantin, Oana Teodora Moldovan, Stefano Benazzi, Marco Peresani, Donato Coppola, Martina Lari, Stefano Ricci, Annamaria Ronchitelli, Frédérique Valentin, Corinne Thevenet, Kurt Wehrberger, Dan Grigorescu, Hélène Rougier, Isabelle Crevecoeur, Damien Flas, Patrick Semal, Marcello A. Mannino, Christophe Cupillard, Hervé Bocherens, Nicholas J. Conard, Katerina Harvati, Vyacheslav Moiseyev, Dorothee G. Drucker, Jiří Svoboda, Michael P. Richards, David Caramelli, Ron Pinhasi, Janet Kelso, Nick Patterson, Johannes Krause, Svante Pääbo & David Reich

Modern humans arrived in Europe $\approx 45,000$ years ago, but little is known about their genetic composition before the start of farming $\approx 8,500$ years ago. Here we analyse genome-wide data from 51 Eurasians from $\approx 45,000$ –7,000 years ago. Over this time, the proportion of Neanderthal DNA decreased from 3–6% to around 2%, consistent with natural selection against Neanderthal variants in modern humans. Whereas there is no evidence of the earliest modern humans in Europe contributing to the genetic composition of present-day Europeans, all individuals between $\approx 37,000$ and $\approx 14,000$ years ago descended from a single founder population which forms part of the ancestry of present-day Europeans. An $\approx 35,000$ -year-old individual from northwest Europe represents an early branch of this founder population which was then displaced across a broad region, before reappearing in southwest Europe at the height of the last Ice Age $\approx 19,000$ years ago. During the major warming period after $\approx 14,000$ years ago, a genetic component related to present-day Near Easterners became widespread in Europe. These results document how population turnover and migration have been recurring themes of European prehistory.

HUSEYNOV 2016

Alik Huseynov et al., *Developmental evidence for obstetric adaptation of the human female pelvis*. [PNAS 113 \(2016\)](#), 5227–5232.

pnas113-05227-Supplement1.mp4, pnas113-05227-Supplement2.mp4, pnas113-05227-Supplement3.mp4, pnas113-05227-Supplement4.mp4, pnas113-05227-Supplement5.mp4, pnas113-05227-Supplement6.mp4

Alik Huseynov, Christoph P. E. Zollikofer, Walter Coudyzer, Dominic Gascho, Christian Kellenberger, Ricarda Hinzpeter & Marcia S. Ponce de León

The bony pelvis of adult humans exhibits marked sexual dimorphism, which is traditionally interpreted in the framework of the “obstetrical dilemma” hypothesis: Giving birth to large-brained/ large-bodied babies requires a wide pelvis, whereas efficient bipedal locomotion requires a narrow pelvis. This hypothesis has been challenged recently on biomechanical, metabolic, and biocultural grounds, so that it remains unclear which factors are responsible for sex-specific differences in adult pelvic morphology. Here we address this issue from a developmental perspective. We use methods of biomedical imaging and geometric morphometrics to analyze changes in pelvic morphology from late fetal stages to adulthood in a known-age/known-sex forensic/clinical sample. Results show that, until puberty, female and male pelves exhibit only moderate sexual dimorphism and follow largely similar developmental trajectories. With the onset of puberty, however, the female trajectory diverges substantially from the common course, resulting in rapid expansion of obstetrically relevant pelvic dimensions up to the age of 25–30 y. From 40 y onward females resume a mode of pelvic development similar to males, resulting in significant reduction of obstetric dimensions. This complex developmental trajectory is likely linked to the pubertal rise and premenopausal fall of estradiol levels and results in the obstetrically most adequate pelvic morphology during the time of maximum female fertility. The evidence that hormones mediate female pelvic development and morphology supports the view that solutions of the obstetrical dilemma depend not only on selection and adaptation but also on developmental plasticity as a response to ecological/nutritional factors during a female’s lifetime.

Keywords: pelvis | development | evolution | obstetrical dilemma | sex steroids

Significance: The obstetrical dilemma hypothesis states that the human female pelvis represents a compromise between designs most suitable for childbirth and bipedal locomotion, respectively. This hypothesis has been challenged recently on biomechanical, metabolic, and biocultural grounds. Here we provide evidence for the pelvis’ developmental adaptation to the problem of birthing large-headed/large-bodied babies. We show that the female pelvis reaches its obstetrically most adequate morphology around the time of maximum fertility but later reverts to a mode of development similar to that of males, which significantly reduces the dimensions of the birth canal. These developmental changes are likely mediated by hormonal changes during puberty and menopause, indicating “on-demand” adjustment of pelvic shape to the needs of childbirth.

PONTZER 2016

Herman Pontzer et al., *Metabolic acceleration and the evolution of human brain size and life history*. [nature \(2016\), preprint, 1–3](#). DOI:10.1038/nature17654.

n2016-Pontzer-Supplement.pdf

Herman Pontzer, Mary H. Brown, David A. Raichlen, Holly Dunsworth, Brian Hare, Kara Walker, Amy Luke, Lara R. Dugas, Ramon Durazo-Arvizu, Dale Schoeller, Jacob Plange-Rhule, Pascal Bovet, Terrence E. Forrester, Estelle V. Lambert, Melissa Emery Thompson, Robert W. Shumaker & Stephen R. Ross

Humans are distinguished from the other living apes in having larger brains and an unusual life history that combines high reproductive output with slow childhood growth and exceptional longevity¹. This suite of derived traits suggests major changes in energy expenditure and allocation in the human lineage, but direct measures of human and ape metabolism are needed to compare evolved energy strategies among hominoids. Here we used doubly labelled water measurements of total energy expenditure (TEE; kcal day⁻¹) in humans, chimpanzees, bonobos,

gorillas and orangutans to test the hypothesis that the human lineage has experienced an acceleration in metabolic rate, providing energy for larger brains and faster reproduction without sacrificing maintenance and longevity. In multivariate regressions including body size and physical activity, human TEE exceeded that of chimpanzees and bonobos, gorillas and orangutans by approximately 400, 635 and 820 kcal day⁻¹, respectively, readily accommodating the cost of humans' greater brain size and reproductive output. Much of the increase in TEE is attributable to humans' greater basal metabolic rate (kcal day⁻¹), indicating increased organ metabolic activity. Humans also had the greatest body fat percentage. An increased metabolic rate, along with changes in energy allocation, was crucial in the evolution of human brain size and life history.

ROEBROEKS 2007

WIL ROEBROEKS (Hrsg.), *Guts and Brains, An Integrative Approach to the Hominin Record*. (Leiden 2007).

The volume brings together researchers from a wide range of disciplines dealing with the evolution of the human niche in an attempt to chart where different lines of evidence lead to comparable conclusions and where discrepancies (and hence learning opportunities) exist. The book consists of a diverse collection of papers, and it is no easy a task to draw together some conclusions and pointers for it, but this has not deterred us from at least making an attempt at integrating the various approaches to the study of palaeolithic subsistence (Anwar et al., this volume). In its diversity this volume constitutes only a beginning, a rough layout of an emerging field. When this volume went to press, an important symposium on the very same “integration” issue was being organized at the Max Planck Institute for Evolutionary Anthropology at Leipzig: The Evolution of Hominid Diets: Integrating approaches to the study of Palaeolithic subsistence (Hublin & Richards, in prep). In integration lies the future of the past.

Bibel

BIETAK 2016

Manfred Bietak, *Exodus Evidence, An Egyptologist Looks at Biblical History*. *Biblical Archaeology Review* 42 (2016), iii, 31–37.

The question of elements of historicity in the Biblical account of the Egyptian enslavement of the Israelites and their subsequent Exodus from Egypt is an extremely complicated matter with many uncertainties. But a number of aspects of the account can be reliably—that is, historically—traced back to the late 13th–12th century B.C.E., the time when proto-Israelites appear both in Egypt and Canaan and in what would become Israel. In short, although the Biblical text was undoubtedly composed later, it draws in some particulars on accurate memories from the time of the enslavement and Exodus that it describes.

FRAHM 2016

Eckart Frahm, “*And His Brothers Were Jealous of Him*”, *Surprising Parallels Between Joseph and King Esarhaddon*. *Biblical Archaeology Review* 42 (2016), iii, 43–50, 63–64.

We will probably never be able to determine with certainty how many versions of the Joseph story there were, who composed them and when. What we can say, however, with some confidence is that the author(s) of the tale drew central motifs from a variety of sources, some of Egyptian and others possibly of Mesopotamian origin. The story of the rise to power of the Assyrian king Esarhaddon may well

have served as a particularly important model for the Biblical authors' treatment of Joseph's conflict with his brothers.

If so, Esarhaddon was not the only Mesopotamian ruler who left his mark on a central figure of the Hebrew Bible. The episode of Moses's birth and upbringing may have been modeled on the birth legend of King Sargon of Akkad, and the story of Jonah on legends about the Assyrian queen Sammu-râmât -Semiramis, who like the Biblical prophet had close ties with doves and fish. In all these cases, however, the Biblical authors thoroughly transformed their models. Stripping them of their royal prerogatives, they turned them into characters with complex psyches and unique qualities—characters who have deeply shaped the religious and literary imagination of East and West to this day.

Biologie

DRUCKER 2014

Dorothee G. Drucker, Hervé Bocherens & Stéphane Péan, *Stable carbon (^{13}C) and nitrogen (^{15}N) isotope abundances in collagen of the mammoth of Mezhyrich (Epigravettian, Ukraine): Palaeoecological implications*. *L'anthropologie* **118** (2014), 504–517.

The mammoth steppe ecosystem was characterized by a high diversity in large mammals species distributed on a vast geographical range. The isotopic analyses of the collagen of the faunal remains from this context testified the niche partitioning among large herbivores with a specialization in the types of consumed plants. In the case of the mammoth (*Mammuthus primigenius*), systematic higher abundances in ^{15}N are found for this species compared to those of other grazers in Eurasia and Alaska during the Upper Palaeolithic. This distinct isotopic signature reflects a specific ecological niche. The analyses of mammoth remains at the Epigravettian site of Mezhyrich (15,000–14,300 conv BP) reveal low abundances in ^{15}N that are equivalent to those of the associated horses. Thus, the mammoth of Mezhyrich experienced a significant change in their environment and diet that probably led to the loss of their ecological niche. A likely direct competition with other large herbivores and the possible predation by wolves and human populations should be considered for the mammoth of the Ukrainian plains, long before their extirpation from the region.

Keywords: *Mammuthus primigenius* | Collagen | Carbon-13 | Nitrogen-15 | Mezhyrich | Epigravettian

DRUCKER 2015

Dorothee G. Drucker et al., *Tracking possible decline of woolly mammoth during the Gravettian in Dordogne (France) and the Ach Valley (Germany) using multi-isotope tracking (^{13}C , ^{14}C , ^{15}N , ^{34}S , ^{18}O)*. *Quaternary International* **359** (2015), 304–317.

Dorothee G. Drucker, Carole Vercoûtère, Laurent Chiotti, Roland Nespoulet, Laurent Crépin, Nicholas J. Conard, Susanne C. Münzel, Thomas Higham, Johannes van der Plicht, Martina Lázničková-Galetová & Hervé Bocherens

The woolly mammoth (*Mammuthus primigenius*) was an emblematic and key species of the so-called mammoth steppe ecosystem between ca. 110,000 and 12,000 years ago. Its contribution to human subsistence during the Gravettian period as source of raw material was documented in southwestern France and southwestern Germany, with some evidence of active hunting in the latter region. However, decreasing genetic diversity and increasing indications of nutritional

stress point to a likely decline of this megaherbivore. The specificity of the ecological niche occupied by the woolly mammoth is clearly reflected by their collagen ^{13}C and ^{15}N abundances ($\text{d}^{13}\text{C}_{\text{coll}}$ and $\text{d}^{15}\text{N}_{\text{coll}}$), measured on skeletal remains of the typical mammoth steppe. The abundances of carbon-13 in mammoth collagen are comparable to those of other grazers like horse (*Equus* sp.), while the nitrogen-15 abundances are significantly higher (about 3‰) than in the other herbivores, either horse or reindeer (*Rangifer tarandus*). During the Aurignacian and Gravettian occupation at Geißenklösterle in the Ach Valley (Germany), the mammoths had the expected stable isotope signature, but the nitrogen-15 of horses showed an unexpected overlap with those of the mammoth. This unusual pattern was already occurring during the Aurignacian, while the oxygen-18 abundances in bone phosphate ($\text{d}^{18}\text{O}_{\text{bp}}$) of horse and reindeer were unchanged between Aurignacian and Gravettian periods, which rules out significant change in environmental and climatic conditions. Thus, we hypothesize that during the Aurignacian and Gravettian, the ecological niche of mammoth was intact but not occupied intensively by mammoths due to a decline in their population. This decline could be tentatively explained by human pressure through hunting. In Dordogne (France), decreasing horse and reindeer $\text{d}^{15}\text{N}_{\text{coll}}$ values coeval to decreasing horse $\text{d}^{18}\text{O}_{\text{bp}}$ values between the Aurignacian and the Early Gravettian periods reflected a clear change in the environment, while no contrast in $\text{d}^{15}\text{N}_{\text{coll}}$ values was observed between the Early and Final Gravettian at the Abri Pataud. The mammoth of Dordogne yielded slightly higher $\text{d}^{15}\text{N}_{\text{coll}}$ values than expected, probably as a consequence of the nursing effect since all the analyzed samples were ivory instead of bone. The direct dating and sulphur-34 measurement on the ivory of the Early Gravettian at Pataud showed that almost all of them were of contemporaneous and local origin. Significant contrasts in $\text{d}^{34}\text{S}_{\text{coll}}$ values were found between the Dordogne and the Ach Valley for the same herbivores species, which confirms the potential of sulphur-34 in collagen as a mobility tracker.

Keywords: Gravettian | Aurignacian | Ach Valley | Dordogne | Mammoth | Stable isotopes

Isotope

NAITO 2016

Yuichi I. Naito et al., *Ecological niche of Neanderthals from Spy Cave revealed by nitrogen isotopes of individual amino acids in collagen*. [Journal of Human Evolution](#) **93** (2016), 82–90.

Yuichi I. Naito, Yoshito Chikaraishi, Dorothee G. Drucker, Naohiko Ohkouchi, Patrick Semal, Christoph Wißing & Hervé Bocherens

This study provides a refined view on the diet and ecological niche of Neanderthals. The traditional view is that Neanderthals obtained most of their dietary protein from terrestrial animals, especially from large herbivores that roamed the open landscapes. Evidence based on the conventional carbon and nitrogen isotopic composition of bulk collagen has supported this view, although recent findings based on plant remains in the tooth calculus, microwear analyses, and small game and marine animal remains from archaeological sites have raised some questions regarding this assumption. However, the lack of a protein source other than meat in the Neanderthal diet may be due to methodological difficulties in defining the isotopic composition of plants. Based on the nitrogen isotopic composition of glutamic acid and phenylalanine in collagen for Neanderthals from Spy Cave (Belgium), we show that i) there was an interindividual dietary heterogeneity even within one archaeological site that has not been evident in bulk collagen

isotopic compositions, ii) they occupied an ecological niche different from those of hyenas, and iii) they could rely on plants for up to $\approx 20\%$ of their protein source. These results are consistent with the evidence found of plant consumption by the Spy Neanderthals, suggesting a broader subsistence strategy than previously considered.

Keywords: Neanderthal | Nitrogen isotope | Amino acid | Ecological niche | Subsistence strategy | Plant diet

Klima

JAGOUTZ 2016

Oliver Jagoutz, Francis A. Macdonald & Leigh Royden, *Low-latitude arc-continent collision as a driver for global cooling*. [PNAS 113 \(2016\), 4935–4940](#).

New constraints on the tectonic evolution of the Neo-Tethys Ocean indicate that at ≈ 90 – 70 Ma and at ≈ 50 – 40 Ma, vast quantities of mafic and ultramafic rocks were emplaced at low latitude onto continental crust within the tropical humid belt. These emplacement events correspond temporally with, and are potential agents for, the global climatic cooling events that terminated the Cretaceous Thermal Maximum and the Early Eocene Climatic Optimum. We model the temporal effects of CO₂ drawdown from the atmosphere due to chemical weathering of these obducted ophiolites, and of CO₂ addition to the atmosphere from arc volcanism in the Neo-Tethys, between 100 and 40 Ma. Modeled variations in net CO₂-drawdown rates are in excellent agreement with contemporaneous variation of ocean bottom water temperatures over this time interval, indicating that ophiolite emplacement may have played a major role in changing global climate. We demonstrate that both the lithology of the obducted rocks (mafic/ultramafic) and a tropical humid climate with high precipitation rate are needed to produce significant consumption of CO₂. Based on these results, we suggest that the low-latitude closure of ocean basins along east–west trending plate boundaries may also have initiated other long-term global cooling events, such as Middle to Late Ordovician cooling and glaciation associated with the closure of the Iapetus Ocean.

Keywords: climate change | climate–tectonic connection | arc–continent collision

Significance: This manuscript provides a mechanism for triggering cooling events following the Cretaceous Thermal Maximum and the Early Eocene Climate optimum that ultimately resulted in the Cenozoic glaciation. We present a quantitative model of changes in CO₂ sources and sinks during the closure of the NeoTethys Ocean. Our results suggest that long-term cooling was predominantly due to obduction of highly weatherable mafic and ultramafic Ca- and Mg-rich rocks (ophiolites) in the wet tropics. Our model accounts for both the two episodes of cooling and also the partial recovery in temperatures between ≈ 70 and 50 Ma.

Kultur

OVERMANN 2016

Karenleigh A. Overmann, *Beyond Writing, The Development of Literacy in the Ancient Near East*. [Cambridge Archaeological Journal 26 \(2016\), 285–303](#).

Previous discussions of the origins of writing in the Ancient Near East have not incorporated the neuroscience of literacy, which suggests that when southern

Mesopotamians wrote marks on clay in the late fourth millennium, they inadvertently reorganized their neural activity, a factor in manipulating the writing system to reflect language, yielding literacy through a combination of neurofunctional change and increased script fidelity to language. Such a development appears to take place only with a sufficient demand for writing and reading, such as that posed by a state-level bureaucracy; the use of a material with suitable characteristics; and the production of marks that are conventionalized, handwritten, simple and non-numerical. From the perspective of Material Engagement Theory (MET), writing and reading represent the interactivity of bodies, materiality and brains: movements of hands, arms and eyes; clay and the implements used to mark it and form characters; and vision, motor planning, object recognition and language. Literacy is a cognitive change that emerges from and depends upon the nexus of interactivity of the components.