

## References

### Aktuell

#### ABBOTT 2016

Alison Abbott, *How the brain reacts to orders*. [nature](#) **530** (2016), 394–395.

Modern spin on iconic Milgram experiments suggests that people obeying commands feel less responsible for actions.

The study may feed into a long-running legal debate about the balance of personal responsibility between someone acting under instruction and their instructor, says Patrick Haggard, a cognitive neuroscientist at University College London, who led the work.

#### ALMÉCIJA 2016

Sergio Almécija, *Pitfalls reconstructing the last common ancestor of chimpanzees and humans*. [PNAS](#) **113** (2016), E943–E944.

#### BONGAARTS 2016

John Bongaarts, *Slow down population growth*. [nature](#) **530** (2016), 409–412.

Within a decade, women everywhere should have access to quality contraceptive services, argues John Bongaarts.

#### CASPAR 2016

Emilie A. Caspar, Julia F. Christensen, Axel Cleeremans & Patrick Haggard, *Coercion Changes the Sense of Agency in the Human Brain*. [Current Biology](#) (2016), preprint, 1–8. DOI:10.1016/j.cub.2015.12.067.

People may deny responsibility for negative consequences of their actions by claiming that they were “only obeying orders.” The “Nuremberg defense” offers one extreme example, though it is often dismissed as merely an attempt to avoid responsibility. Milgram’s classic laboratory studies reported widespread obedience to an instruction to harm, suggesting that social coercion may alter mechanisms of voluntary agency, and hence abolish the normal experience of being in control of one’s own actions. However, Milgram’s and other studies relied on dissembling and on explicit measures of agency, which are known to be biased by social norms. Here, we combined coercive instructions to administer harm to a co-participant, with implicit measures of sense of agency, based on perceived compression of time intervals between voluntary actions and their outcomes, and with electrophysiological recordings. In two experiments, an experimenter ordered a volunteer to make a key-press action that caused either financial penalty or demonstrably painful electric shock to their co-participant, thereby increasing their own financial gain. Coercion increased the perceived interval between action and outcome, relative to a situation where participants freely chose to inflict the same harms. Interestingly, coercion also reduced the neural processing of the outcomes of one’s own action. Thus, people who obey orders may subjectively experience their actions as closer to passive movements than fully voluntary actions. Our results highlight the complex relation between the brain mechanisms that generate the subjective experience of voluntary actions and social constructs, such as responsibility.

- Responsibility for action is a key feature of human societies
- It depends on association between actions and outcomes in the brain
- Claims of reduced responsibility are sometimes based on “only obeying orders”
- Two experiments suggest coercion can reduce implicit measures of sense of agency

#### CHARBONNEAU 2016

Mark R. Charbonneau et al., *Sialylated Milk Oligosaccharides Promote Microbiota-Dependent Growth in Models of Infant Undernutrition*. *Cell* (2016), preprint, 1–13. DOI:10.1016/j.cell.2016.01.024.

Mark R. Charbonneau, David O’Donnell, Laura V. Blanton, Sarah M. Totten, Jasmine C. C. Davis, Michael J. Barratt, Jiye Cheng, Janaki Guruge, Michael Talcott, James R. Bain, Michael J. Muehlbauer, Olga Ilkayeva, Chao Wu, Tedd Struckmeyer, Daniela Barile, Charles Mangani, Josh Jorgensen, Yue-mei Fan, Kenneth Maleta, Kathryn G. Dewey, Per Ashorn, Christopher B. Newgard, Carlito Lebrilla, David A. Mills & Jeffrey I. Gordon

Identifying interventions that more effectively promote healthy growth of children with undernutrition is a pressing global health goal. Analysis of human milk oligosaccharides (HMOs) from 6-month-postpartum mothers in two Malawian birth cohorts revealed that sialylated HMOs are significantly less abundant in those with severely stunted infants. To explore this association, we colonized young germ-free mice with a consortium of bacterial strains cultured from the fecal microbiota of a 6-month-old stunted Malawian infant and fed recipient animals a prototypic Malawian diet with or without purified sialylated bovine milk oligosaccharides (S-BMO). S-BMO produced a microbiotadependent augmentation of lean body mass gain, changed bone morphology, and altered liver, muscle, and brain metabolism in ways indicative of a greater ability to utilize nutrients for anabolism. These effects were also documented in gnotobiotic piglets using the same consortium and Malawian diet. These preclinical models indicate a causal, microbiotadependent relationship between S-BMO and growth promotion.

- Malawian mothers with undernourished infants have decreased milk oligosaccharides
- Sialylated milk sugars promote growth of animals colonized with infant microbiota
- Growth promotion does not occur with provision of inulin or in germ-free mice
- Sialylated oligosaccharides impact liver, muscle, and brain metabolism

#### DEVKOTA 2016

Suzanne Devkota, *Prescription drugs obscure microbiome analyses*. *science* **351** (2016), 452–453.

Patient populations should be stratified for medications when looking for gut microbial signatures of disease.

#### FREND A 2016

Steven J. Frenda, Shari R. Berkowitz, Elizabeth F. Loftus & Kimberly M. Fenn, *Sleep deprivation and false confessions*. *PNAS* **113** (2016), 2047–2050.

False confession is a major contributor to the problem of wrongful convictions in the United States. Here, we provide direct evidence linking sleep deprivation and false confessions. In a procedure adapted from Kassin and Kiechel [(1996) *Psychol Sci* 7(3):125–128], participants completed computer tasks across multiple sessions and repeatedly received warnings that pressing the “Escape” key on their keyboard would cause the loss of study data. In their final session, participants either slept

all night in laboratory bedrooms or remained awake all night. In the morning, all participants were asked to sign a statement, which summarized their activities in the laboratory and falsely alleged that they pressed the Escape key during an earlier session. After a single request, the odds of signing were 4.5 times higher for the sleep-deprived participants than for the rested participants. These findings have important implications and highlight the need for further research on factors affecting true and false confessions.

**Keywords:** false confession | sleep deprivation | sleep

**Significance:** False confessions occur surprisingly frequently in the context of interrogations and criminal investigations. Indeed, false confessions are thought to account for approximately 15–25% of wrongful convictions in the United States. Here we demonstrate that sleep deprivation increases the likelihood that a person will falsely confess to wrongdoing that never occurred. Furthermore, our data suggest that it may be possible to identify certain individuals who are especially likely to falsely confess while sleep deprived. The present research is a crucial step toward understanding the role of sleep deprivation in the problem of false confession and, in turn, raises complex questions about the use of sleep deprivation in the interrogation of innocent and guilty suspects.

#### ILYINA 2016

Tatiana Ilyina, *Hidden trends in the ocean carbon sink*. [nature](#) **530** (2016), 426–427.

Simulations of the flux of atmospheric carbon dioxide into the ocean show that changes in flux associated with human activities are currently masked by natural climate variations, but will be evident in the near future.

Nevertheless, the current study makes a valuable contribution to the quantification of internal variability in the rates of change of the ocean carbon sink. Changes driven by human activities are undoubtedly there, but may be concealed by natural variations in many ocean regions because of the slow timescales on which ocean processes occur.

#### JOHANSSON 2016

Jörgen Johansson, *Battling the bureaucracy hydra*. [science](#) **351** (2016), 530.

Eight weeks later, my team at Umeå and ERC officers in Brussels had exchanged many emails and documents, 15 people had been mobilized, and I had sacrificed a large part of my vacation, but the contract was signed.

#### KAISER 2016

Jocelyn Kaiser, *Calling all failed replication experiments*. [science](#) **351** (2016), 548.

New journal will publish methods, data, and results.

Like other F1000Research “channels,” the new journal will first post the raw manuscripts, then invite peer reviews that will be added with the reviewers’ names. F1000Research charges author fees of \$150–\$1000 per paper depending on length. If the papers are accepted after peer review, they will be indexed in PubMed and “become part of the record,” Alberts says.

#### MERVIS 2016

Jeffrey Mervis, *What Makes Darpa Tick?* [science](#) **351** (2016), 549–553.

The stellar reputation of this small but mighty defense agency rests on the unparalleled clout of its program managers.

Such efforts inevitably raise a core question: What makes DARPA tick? The answer, say dozens of people who have worked for or with DARPA, is its cadre of program managers—people like Ben Mann—who enjoy a combination of autonomy, authority, and ample resources that is rare in government.

#### NAUDTS 2016

Kim Naudts, Yiying Chen, Matthew J. McGrath, James Ryder, Aude Valade, Juliane Otto & Sebastiaan Luyssaert, *Europe's forest management did not mitigate climate warming*. [science](#) **351** (2016), 597–600. [s351-0597-Supplement.pdf](#)

Afforestation and forest management are considered to be key instruments in mitigating climate change. Here we show that since 1750, in spite of considerable afforestation, wood extraction has led to Europe's forests accumulating a carbon debt of 3.1 petagrams of carbon. We found that afforestation is responsible for an increase of 0.12 watts per square meter in the radiative imbalance at the top of the atmosphere, whereas an increase of 0.12 kelvin in summertime atmospheric boundary layer temperature was mainly caused by species conversion. Thus, two and a half centuries of forest management in Europe have not cooled the climate. The political imperative to mitigate climate change through afforestation and forest management therefore risks failure, unless it is recognized that not all forestry contributes to climate change mitigation.

#### QIU 2016

Jane Qiu, *Tibet's Primeval Ice*. [science](#) **351** (2016), 436–439.

The quest for the world's oldest ice could yield a Rosetta Stone for how Asia responds to a changing climate

#### WILKES 2016

Rima Wilkes, *Retire the letter of reference*. [science](#) **351** (2016), 630.

In the past, there were fewer universities than today, and networks were smaller. A letter of reference mattered because it was written by someone the letter reader knew. Now, we are reading hundreds of letters of reference, most by people we don't know. Indeed, now that I have served on committees faced with hundreds of letters, each describing said candidate as “outstanding” or some other superlative, I find myself paying less and less attention to them.

#### YOUNG 2016

Nathan M. Young, Terence D. Capellini, Neil T. Roach & Zeresenay Alemseged, *A new direction for reconstructing our last common ancestor with chimpanzees, Reply to Almécija*. [PNAS](#) **113** (2016), E945.

Finally, the most relevant message of our study is that because fossil evidence for the LCA will always be rare and difficult to identify, novel multidisciplinary approaches are needed to reconstruct its phenotype. Our work demonstrates how alternative models of the LCA make explicit and testable predictions about evolutionary trajectories and phenotypic transformations in the shoulder, which in turn point to differences in the underlying morphogenetic programs that may be directly testable in genomic datasets and model species.

## Anthropologie

JORDAN 2016

Jillian J. Jordan, Moshe Hoffman, Paul Bloom & David G. Rand, *Third-party punishment as a costly signal of trustworthiness*. [nature 530 \(2016\), 473–476](#).

n530-0473-Supplement.pdf

Third-party punishment (TPP)<sup>1–7</sup>, in which unaffected observers punish selfishness, promotes cooperation by deterring defection. But why should individuals choose to bear the costs of punishing? We present a game theoretic model of TPP as a costly signal<sup>8–10</sup> of trustworthiness. Our model is based on individual differences in the costs and/or benefits of being trustworthy. We argue that individuals for whom trustworthiness is payoff-maximizing will find TPP to be less net costly (for example, because mechanisms<sup>11</sup> that incentivize some individuals to be trustworthy also create benefits for deterring selfishness via TPP). We show that because of this relationship, it can be advantageous for individuals to punish selfishness in order to signal that they are not selfish themselves. We then empirically validate our model using economic game experiments. We show that TPP is indeed a signal of trustworthiness: third-party punishers are trusted more, and actually behave in a more trustworthy way, than non-punishers. Furthermore, as predicted by our model, introducing a more informative signal—the opportunity to help directly—attenuates these signalling effects. When potential punishers have the chance to help, they are less likely to punish, and punishment is perceived as, and actually is, a weaker signal of trustworthiness. Costly helping, in contrast, is a strong and highly used signal even when TPP is also possible. Together, our model and experiments provide a formal reputational account of TPP, and demonstrate how the costs of punishing may be recouped by the long-run benefits of signalling one’s trustworthiness.

KUHLWILM 2016

Martin Kuhlwilm et al., *Ancient gene flow from early modern humans into Eastern Neanderthals*. [nature 530 \(2016\), 429–433](#).

n530-0429-Supplement.pdf

Martin Kuhlwilm, Ilan Gronau, Melissa J. Hubisz, Cesare de Filippo, Javier Prado-Martinez, Martin Kircher, Qiaomei Fu, Hernán A. Burbano, Carles Lalueza-Fox, Marco de la Rasilla, Antonio Rosas, Pavao Rudan, Dejana Brajkovic, Āeljko Kucan, Ivan Gušić, Tomas Marques-Bonet, Aida M. Andrés, Bence Viola, Svante Pääbo, Matthias Meyer, Adam Siepel & Sergi Castellano

It has been shown that Neanderthals contributed genetically to modern humans outside Africa 47,000–65,000 years ago. Here we analyse the genomes of a Neanderthal and a Denisovan from the Altai Mountains in Siberia together with the sequences of chromosome 21 of two Neanderthals from Spain and Croatia. We find that a population that diverged early from other modern humans in Africa contributed genetically to the ancestors of Neanderthals from the Altai Mountains roughly 100,000 years ago. By contrast, we do not detect such a genetic contribution in the Denisovan or the two European Neanderthals. We conclude that in addition to later interbreeding events, the ancestors of Neanderthals from the Altai Mountains and early modern humans met and interbred, possibly in the Near East, many thousands of years earlier than previously thought.

## Bibel

HAWKINS 2016

Ralph K. Hawkins, *Israelite Footprints*. [Biblical Archaeology Review 42 \(2016\), ii, 44–49, 68.](#)

Has Adam Zertal Found the Biblical Altar on Mt. Ebal and the Footprints of the Israelites Settling the Promised Land?

LEITH 2016

Mary Joan Winn Leith, *Creating Woman*. [Biblical Archaeology Review 42 \(2016\), ii, 58–61, 66.](#)

A primary function of is etiology, that is, explaining the origins of things: living things, farming, clothing (and the necessity for wearing clothes), pain in childbirth, weeds, patriarchy, death and even why humans don't (mostly) like snakes. [...] Given the many etiologies in the Garden story, the male body ought to display evidence of the woman's creation in some osteologically relevant way! In fact, this "etiological logic" was so compelling that it generated the longstanding popular assumption that this story explained "why men have one less rib than women"—I remember hearing it myself as a child.

SHANKS 2016

Hershel Shanks, *Ivory Pomegranate, Under the Microscope at the Israel Museum*. [Biblical Archaeology Review 42 \(2016\), ii, 50–57.](#)

With this in hand, there is no paleographer of note who maintains that the inscription is a forgery. Shmuel Ahituv and Aaron Demsky have remained silent. Robert Deutsch has offered to accompany them to the museum. They have not responded to requests to reexamine the inscription.

## Biologie

DAUGÉ 2016

Valérie Daugé, Mathilde Jaglin, Laurent Naudon & Sylvie Rabot, *Wenn der Bauch das Gehirn krank macht*. [Spektrum der Wissenschaft 2016, iii, 20–26.](#)

Manche psychischen und neurologischen Störungen gehen mit einer abweichenden Zusammensetzung der Darmbakterien einher. Das eröffnet einen ungewöhnlichen Behandlungsweg.

**1** Die Darmflora beeinflusst Verhalten und Stimmung, indem ihre Bakterien über die Blutbahn und das Nervensystem mit dem Gehirn kommunizieren.

**2** Einige psychische Erkrankungen und Entwicklungsstörungen von Hirnfunktionen könnten mit einer abweichenden Zusammensetzung dieser Mikrobiota zusammenhängen. Der Verdacht besteht etwa für bestimmte Formen von Autismus, Depression und Angsterkrankungen.

**3** Eine Reihe von Studien, bisher meist an Tieren, lassen hoffen, dass manche dieser Krankheiten und Defekte gemildert werden können, wenn man das mikrobielle Gleichgewicht im Darm normalisiert.

EVANS 2016

Alistair R. Evans et al., *A simple rule governs the evolution and development of hominin tooth size*. [nature 530 \(2016\), 477–480.](#)

n530-0477-Supplement.pdf

Alistair R. Evans, E. Susanne Daly, Kierstin K. Catlett, Kathleen S. Paul, Stephen J. King, Matthew M. Skinner, Hans P. Nesse, Jean-Jacques Hublin, Grant C. Townsend, Gary T. Schwartz & Jukka Jernvall

The variation in molar tooth size in humans and our closest relatives (hominins) has strongly influenced our view of human evolution. The reduction in overall size and disproportionate decrease in third molar size have been noted for over a century, and have been attributed to reduced selection for large dentitions owing to changes in diet or the acquisition of cooking<sup>1,2</sup>. The systematic pattern of size variation along the tooth row has been described as a ‘morphogenetic gradient’ in mammal, and more specifically hominin, teeth since Butler<sup>3</sup> and Dahlberg<sup>4</sup>. However, the underlying controls of tooth size have not been well understood, with hypotheses ranging from morphogenetic fields<sup>3</sup> to the clone theory<sup>5</sup>. In this study we address the following question: are there rules that govern how hominin tooth size evolves? Here we propose that the inhibitory cascade, an activator–inhibitor mechanism that affects relative tooth size in mammals<sup>6</sup>, produces the default pattern of tooth sizes for all lower primary postcanine teeth (deciduous premolars and permanent molars) in hominins. This configuration is also equivalent to a morphogenetic gradient, finally pointing to a mechanism that can generate this gradient. The pattern of tooth size remains constant with absolute size in australopiths (including *Ardipithecus*, *Australopithecus* and *Paranthropus*). However, in species of *Homo*, including modern humans, there is a tight link between tooth proportions and absolute size such that a single developmental parameter can explain both the relative and absolute sizes of primary postcanine teeth. On the basis of the relationship of inhibitory cascade patterning with size, we can use the size at one tooth position to predict the sizes of the remaining four primary postcanine teeth in the row for hominins. Our study provides a development-based expectation to examine the evolution of the unique proportions of human teeth.

#### GÓMEZ-ROBLES 2016

Aida Gómez-Robles, *What teeth tell us.* [nature](#) **530** (2016), 425–426.

Models based on developmental mechanisms described in mice and shared by most mammals are shown to accurately predict tooth size in extinct hominins, and can explain the small third molars in our species.

More importantly, Evans and colleagues’ results are relevant beyond the study of fossil teeth. Many of the developmental constraints that influence dental evolution are shared by other systems formed by the repetition of serially homologous components, such as vertebrae, ribs, limbs and digits. Teeth can therefore be useful in identifying developmental mechanisms operating in these other systems<sup>9</sup>. By extension, the authors’ model has the potential to help us understand the evolution of human traits that are associated with serially homologous structures, including our upright posture (which is influenced by vertebral anatomy), bipedal locomotion (which is linked to limb anatomy) and precision grip (which depends on the anatomy of digits). As with third-molar reduction, we tend to consider these traits the result of human-specific selective pressures, but their evolution is also fundamentally channelled by general developmental rules that humans have not escaped.

#### VILLARINO 2016

Nicolas F. Villarino et al., *Composition of the gut microbiota modulates the severity of malaria.* [PNAS](#) **113** (2016), 2235–2240.

Nicolas F. Villarino, Gary R. LeClerc, Joshua E. Denny, Stephen P. Dearth, Christopher L. Harding, Sarah S. Sloan, Jennifer L. Gribble, Shawn R. Campagna, Steven W. Wilhelm & Nathan W. Schmidt

Plasmodium infections result in clinical presentations that range from asymptomatic to severe malaria, resulting in  $\approx 1$  million deaths annually. Despite this toll on humanity, the factors that determine disease severity remain poorly understood. Here, we show that the gut microbiota of mice influences the pathogenesis of malaria. Genetically similar mice from different commercial vendors, which exhibited differences in their gut bacterial community, had significant differences in parasite burden and mortality after infection with multiple Plasmodium species. Germfree mice that received cecal content transplants from “resistant” or “susceptible” mice had low and high parasite burdens, respectively, demonstrating the gut microbiota shaped the severity of malaria. Among differences in the gut flora were increased abundances of Lactobacillus and Bifidobacterium in resistant mice. Susceptible mice treated with antibiotics followed by yogurt made from these bacterial genera displayed a decreased parasite burden. Consistent with differences in parasite burden, resistant mice exhibited an elevated humoral immune response compared with susceptible mice. Collectively, these results identify the composition of the gut microbiota as a previously unidentified risk factor for severe malaria and modulation of the gut microbiota (e.g., probiotics) as a potential treatment to decrease parasite burden.

**Keywords:** Plasmodium | gut microbiome | severe malaria

**Significance:** Plasmodium infections cause >200 million cases of malaria and  $\approx 1$  million deaths annually. Although these infections result in disease states that range from asymptomatic to life-threatening, factors that contribute to disease severity remain poorly defined. This report demonstrates that the assemblage of microbes in the gut can modulate the severity of malaria. Mice from different vendors with differences in their gut microbiome showed significant differences in pathology after infection with Plasmodium. Among the bacterial populations that were different between “resistant” and “susceptible” mice were Lactobacillus and Bifidobacterium, and treatment of mice with Lactobacillus and Bifidobacterium resulted in decreased Plasmodium burden. These results identify both a previously unidentified risk factor for severe malaria and a potential new avenue of treatment.

## ZEEVI 2015

David Zeevi et al., *Personalized Nutrition by Prediction of Glycemic Responses*. *Cell* **163** (2015), 1079–1094.

David Zeevi, Tal Korem, Niv Zmora, David Israeli, Daphna Rothschild, Adina Weinberger, Orly Ben-Yacov, Dar Lador, Tali Avnit-Sagi, Maya Lotan-Pompan, Jotham Suez, Jemal Ali Mahdi, Elad Matot, Gal Malka, Noa Kosower, Michal Rein, Gili Zilberman-Schapira, Lenka Dohnalová, Meirav Pevsner-Fischer, Rony Bikovsky, Zamir Halpern, Eran Elinav, & Eran Segal

Elevated postprandial blood glucose levels constitute a global epidemic and a major risk factor for prediabetes and type II diabetes, but existing dietary methods for controlling them have limited efficacy. Here, we continuously monitored week-long glucose levels in an 800-person cohort, measured responses to 46,898 meals, and found high variability in the response to identical meals, suggesting that universal dietary recommendations may have limited utility. We devised a machine-learning algorithm that integrates blood parameters, dietary habits, anthropometrics, physical activity, and gut microbiota measured in this cohort and showed that it accurately predicts personalized postprandial glycemic response to real-life meals. We validated these predictions in an independent 100-person cohort. Finally, a blinded randomized controlled dietary intervention based on this algorithm resulted in significantly lower postprandial responses and consistent alterations to gut microbiota configuration. Together, our results suggest that personalized diets may successfully modify elevated postprandial blood glucose and its metabolic consequences.

### Highlights

- High interpersonal variability in post-meal glucose observed in an 800-person cohort
- Using personal and microbiome features enables accurate glucose response prediction
- Prediction is accurate and superior to common practice in an independent cohort
- Short-term personalized dietary interventions successfully lower post-meal glucose

## Datierung

### RENNE 1997

P. R. Renne, W. D. Sharp, A. L. Deino, G. Orsi & L. Civetta, *<sup>40</sup>Ar/<sup>39</sup>Ar Dating into the Historical Realm, Calibration Against Pliny the Younger.* *science* **277** (1997), 1279–1280.

Laser incremental heating of sanidine from the pumice deposited by the Plinian eruption of Vesuvius in 79 A.D. yielded a <sup>40</sup>Ar/<sup>39</sup>Ar isochron age of 1925 ± 94 years ago. Close agreement with the Gregorian calendar-based age of 1918 years ago demonstrates that the <sup>40</sup>Ar/<sup>39</sup>Ar method can be reliably extended into the temporal range of recorded history. Excess <sup>40</sup>Ar is present in the sanidine in concentrations that would cause significant errors if ignored in dating Holocene samples.

### WARREN 1984

Peter Warren, *Absolute dating of the Bronze Age eruption of Thera (Santorini).* *nature* **308** (1984), 492–493.

On this evidence, it would seem there is little support for linking the White Mountains frost-ring event at 1626 BC specifically with the eruption of Thera. Moreover the link is not substantiated by archaeological data, nor strongly supported by radiocarbon evidence from Thera.

## Klima

### HVIDBERG 2016

Christine S. Hvidberg, *Ice sheet in peril.* *science* **351** (2016), 562–563.

Radar data reveal how sensitive the Greenland Ice Sheet is to long-term climatic changes.

They propose that changes in ice dynamics have also contributed to the deceleration, mainly because of a general hardening of the ice sheet as glacial ice is being replaced by Holocene ice. Glacial ice contains more impurities than interglacial ice and is softer than ice deposited during the Holocene. The dynamic response to this gradual hardening may be effective for tens of thousands of years after the climate transition at the end of the last glacial period, and it affects estimates of future mass loss from the Greenland Ice Sheet. A general hardening of the Greenland Ice Sheet could increase the long-term resilience of the ice sheet if global warming proceeds.

### MACGREGOR 2016

Joseph A. MacGregor et al., *Holocene deceleration of the Greenland Ice Sheet.* *science* **351** (2016), 590–593.

s351-0590-Supplement.pdf

Joseph A. MacGregor, William T. Colgan, Mark A. Fahnestock, Mathieu Morlighem, Ginny A. Catania, John D. Paden & S. Prasad Gogineni

Recent peripheral thinning of the Greenland Ice Sheet is partly offset by interior thickening and is overprinted on its poorly constrained Holocene evolution. On the basis of the ice sheet's radiostratigraphy, ice flow in its interior is slower now than the average speed over the past nine millennia. Generally higher Holocene accumulation rates relative to modern estimates can only partially explain this millennial-scale deceleration. The ice sheet's dynamic response to the decreasing proportion of softer ice from the last glacial period and the deglacial collapse of the ice bridge across Nares Strait also contributed to this pattern. Thus, recent interior thickening of the Greenland Ice Sheet is partly an ongoing dynamic response to the last deglaciation that is large enough to affect interpretation of its mass balance from altimetry.

#### MCKINLEY 2016

Galen A. McKinley, Darren J. Pilcher, Amanda R. Fay, Keith Lindsay, Matthew C. Long & Nicole S. Lovenduski, *Timescales for detection of trends in the ocean carbon sink*. *nature* **530** (2016), 469–472.

The ocean has absorbed 41 per cent of all anthropogenic carbon emitted as a result of fossil fuel burning and cement manufacture<sup>1,2</sup>. The magnitude and the large-scale distribution of the ocean carbon sink is well quantified for recent decades<sup>3,4</sup>. In contrast, temporal changes in the oceanic carbon sink remain poorly understood<sup>5–7</sup>. It has proved difficult to distinguish between air-to-sea carbon flux trends that are due to anthropogenic climate change and those due to internal climate variability<sup>5,6,8–13</sup>. Here we use a modelling approach that allows for this separation<sup>14</sup>, revealing how the ocean carbon sink may be expected to change throughout this century in different oceanic regions. Our findings suggest that, owing to large internal climate variability, it is unlikely that changes in the rate of anthropogenic carbon uptake can be directly observed in most oceanic regions at present, but that this may become possible between 2020 and 2050 in some regions.

#### SNIDERMAN 2016

J. M. Kale Sniderman et al., *Pliocene reversal of late Neogene aridification*. *PNAS* **113** (2016), 1999–2004.

pnas113-01999-Supplement.xlsx

J. M. Kale Sniderman, Jon D. Woodhead, John Hellstrom, Gregory J. Jordan, Russell N. Drysdale, Jonathan J. Tyler & Nicholas Porch

The Pliocene epoch (5.3–2.6Ma) represents the most recent geological interval in which global temperatures were several degrees warmer than today and is therefore considered our best analog for a future anthropogenic greenhouse world. However, our understanding of Pliocene climates is limited by poor age control on existing terrestrial climate archives, especially in the Southern Hemisphere, and by persistent disagreement between paleo-data and models concerning the magnitude of regional warming and/or wetting that occurred in response to increased greenhouse forcing. To address these problems, here we document the evolution of Southern Hemisphere hydroclimate from the latest Miocene to the middle Pliocene using radiometrically-dated fossil pollen records preserved in speleothems from semiarid southern Australia. These data reveal an abrupt onset of warm and wet climates early within the Pliocene, driving complete biome turnover. Pliocene warmth thus clearly represents a discrete interval which reversed a long-term trend of late Neogene cooling and aridification, rather than being simply the most recent period of greater-than-modern warmth within a continuously cooling trajectory.

These findings demonstrate the importance of high-resolution chronologies to accompany paleoclimate data and also highlight the question of what initiated the sustained interval of Pliocene warmth.

**Keywords:** paleoclimate | pollen | speleothems | aridification | Neogene

**Significance:** The warm climates of the Pliocene epoch are considered our best analog for a future anthropogenic greenhouse world. However, understanding of the nature of Pliocene climate variability and change on land is currently limited by the poor age control of most existing terrestrial climate archives. We present a radiometrically dated history of the evolution of Southern Hemisphere vegetation and hydroclimate from the latest Miocene to the middle Pliocene. These data reveal a sharp increase in precipitation in the Early Pliocene, which drove complete vegetation turnover. The development of warm, wet early Pliocene climates clearly reversed a long-term Southern Hemisphere trend of late Neogene cooling and aridification, highlighting the question of what initiated this sustained,  $\approx 1.5$ -My-long interval of warmth.

## Kultur

COWEN 2016

Ron Cowen, *Ancient Babylonians took first steps to calculus*. [science 351 \(2016\), 435](#).

Math whizzes left precocious geometric calculations on clay tablets by 50 B.C.E.

Calculating the area under a curve to determine a numerical value is a basic operation, known as the integral between two points, in calculus. Discovering that the Babylonians understood this “was the real ‘aha!’ moment,” Ossendrijver says.

OSSENDRIJVER 2016

Mathieu Ossendrijver, *Ancient Babylonian astronomers calculated Jupiter’s position from the area under a time-velocity graph*. [science 351 \(2016\), 482–484](#).

s351-0482-Supplement.pdf

The idea of computing a body’s displacement as an area in time-velocity space is usually traced back to 14th-century Europe. I show that in four ancient Babylonian cuneiform tablets, Jupiter’s displacement along the ecliptic is computed as the area of a trapezoidal figure obtained by drawing its daily displacement against time. This interpretation is prompted by a newly discovered tablet on which the same computation is presented in an equivalent arithmetical formulation. The tablets date from 350 to 50 BCE. The trapezoid procedures offer the first evidence for the use of geometrical methods in Babylonian mathematical astronomy, which was thus far viewed as operating exclusively with arithmetical concepts.

## Mathematik

GILPIN 2016

William Gilpin, Marcus W. Feldman & Kenichi Aoki, *An ecocultural model predicts Neanderthal extinction through competition with modern humans*. [PNAS 113 \(2016\), 2134–2139](#).

Archaeologists argue that the replacement of Neanderthals by modern humans was driven by interspecific competition due to a difference in culture level. To assess the cogency of this argument, we construct and analyze an interspecific

cultural competition model based on the Lotka-Volterra model, which is widely used in ecology, but which incorporates the culture level of a species as a variable interacting with population size. We investigate the conditions under which a difference in culture level between cognitively equivalent species, or alternatively a difference in underlying learning ability, may produce competitive exclusion of a comparatively (although not absolutely) large local Neanderthal population by an initially smaller modern human population. We find, in particular, that this competitive exclusion is more likely to occur when population growth occurs on a shorter timescale than cultural change, or when the competition coefficients of the Lotka-Volterra model depend on the difference in the culture levels of the interacting species.

**Keywords:** Lotka-Volterra | cultural evolution | Paleolithic | feedback | replacement

**Significance:** Ecocultural niche modeling and radiocarbon dating suggest a causal role for interspecific competition in the extinction of Neanderthals. Most archaeologists argue that the advantage to modern humans lay in a higher culture level (a sizable minority dispute this view). Competition between the two species may have occurred when a modern human propagule entered a region occupied by a larger Neanderthal population. We present a model for this replacement, stressing the importance of the founder effect. Our findings shed light on the disappearance of the Neanderthals, showing that endogenous factors such as relative culture level, rather than such extrinsic factors as epidemics or climate change, could have caused the eventual exclusion of a comparatively larger population by an initially smaller one.

## Metallzeiten

HITTITES 2016

*The Hittites Between Tradition and History.* [Biblical Archaeology Review](#) **42** (2016), ii, 28–40, 68.

At the beginning of the 12th century B.C.E., major historical, social and cultural changes swept through the entire Near East. The long-lasting geopolitical system of the so-called “International Era” of the Late Bronze Age collapsed. Major superpowers such as Egypt, Assyria and Babylonia were weakened and diminished; others completely disappeared from the scene. Such was the fate of the Hittite kingdom. Inexplicably, the vast realm ceased to exist. With its demise, the writing of the Hittite language ended.

The map of the region was then redrawn as numerous smaller kingdoms emerged within the Anatolian-Syrian-Canaanite basin, in what marked the transition from the Bronze Age to the Iron Age. Some of these new kingdoms, known as Neo-Hittite kingdoms, were the successors of the ancient Hittite empire and were established by people who originated from it.

One of the outcomes of this upheaval in the southern Levant was the emergence of ancient Israel as a One of the outcomes of this upheaval in the southern Levant was the emergence of ancient Israel as a geopolitical entity. The Neo-Hittite states and the Kingdoms of Israel and Judah show up essentially contemporaneously.

## Methoden

PEREZ 2016

S. Ivan Perez, Paula N. Gonzalez & Valeria Bernal, *Past population*

*dynamics in Northwest Patagonia, An estimation using molecular and radiocarbon data.* [Journal of Archaeological Science](#) **65** (2016), 154–160.

Studying demographic changes in past human populations is of great interest due to their role in processes of cultural change as well as the biological evolution of populations. Despite this, a general consensus about the most adequate methodological approach to this end is still lacking. Here, a new approach that combines radiocarbon frequency distributions uncorrected and corrected by taphonomic bias and demographic curves independently estimated with modern mitochondrial DNA (mtDNA) is used to estimate population size changes in Northwest Patagonia since the Pleistocene eHolocene transition to recent times. Results based on mtDNA sequences suggest a census size of approximately 3000 individuals (with an estimated female effective size of ca. 750 individuals) by the initial peopling of this region around 10,000 years ago. A strong correspondence between curves based on mtDNA data and those based on archaeological radiocarbon dates ( $n = 251$ ) was obtained after the effect of taphonomic bias was accounted for. The demographic curves indicate that the population size was relatively stable during the earlier Early Holocene and it increased between 7000 and 5000 years ago, reaching a maximum size around 1000 years ago. Then, the population size declined until present time. We conclude that demographic inferences made on the basis of radiocarbon dates are not necessarily biased but this needs to be evaluated with independent evidence in each specific geographical region.

Keywords: Demography | Hunter-gatherers | Mitochondrial DNA | Radiocarbon frequency | Taphonomic bias

## Neolithikum

BENZ 2016

Marion Benz, *Frieden stiftende Ahnen, Steinzeitliche Megasites.* [Spektrum der Wissenschaft](#) **2016**, iii, 56–61.

Die ersten Großsiedlungen der Geschichte entstanden vor 9500 Jahren im Nahen Osten. Interdisziplinäre Forschungen zeigen, welche enormen Herausforderungen die neue Art des Zusammenlebens für die Menschen bedeutete.

**1** Im 8. Jahrtausend v. Chr. entstanden im Nahen Osten erstmals Großsiedlungen mit bis zu 15 Hektar Fläche und mehreren tausend Einwohnern, so genannte Megasites.

**2** Aufflammende Konflikte mussten in dieser ungewohnten sozialen Verdichtung durch neue Regeln des Zusammenlebens kontrolliert werden. Dazu dienten auch Rituale wie Bestattungszeremonien, die das Gefühl einer gemeinsamen Identität stärkten.

**3** Megasites waren ein frühes Experimentierfeld für präurbanes Leben. Spätestens im Lauf des 7. Jahrtausends v. Chr. wurden die meisten von ihnen aufgegeben. Übernutzung von Ressourcen und eine Klimaverschlechterung gelten als wahrscheinliche Ursachen.