

Literatur

Aktuell

ASSMY 2013

Philipp Assmy et al., *Thick-shelled, grazer-protected diatoms decouple ocean carbon and silicon cycles in the iron-limited Antarctic Circumpolar Current*. [PNAS 110 \(2013\), 20633–20638](#).

Philipp Assmy, Victor Smetacek, Marina Montresor, Christine Klaas, Joachim Henjes, Volker H. Strass, Jesús M. Arrieta, Ulrich Bathmann, Gry M. Berg, Eike Breitbart, Boris Cisewski, Lars Friedrichs, Nike Fuchs, Gerhard J. Herndl, Sandra Jansen, Sören Krägensky, Mikel Latasa, Ilka Peeken, Rüdiger Röttgers, Renate Scharek, Susanne E. Schüller, Sebastian Steigenberger, Adrian Webb & Dieter Wolf-Gladrow

Diatoms of the iron-replete continental margins and North Atlantic are key exporters of organic carbon. In contrast, diatoms of the iron-limited Antarctic Circumpolar Current sequester silicon, but comparatively little carbon, in the underlying deep ocean and sediments. Because the Southern Ocean is the major hub of oceanic nutrient distribution, selective silicon sequestration there limits diatom blooms elsewhere and consequently the biotic carbon sequestration potential of the entire ocean. We investigated this paradox in an in situ iron fertilization experiment by comparing accumulation and sinking of diatom populations inside and outside the iron-fertilized patch over 5 wk. A bloom comprising various thin- and thick-shelled diatom species developed inside the patch despite the presence of large grazer populations. After the third week, most of the thinner-shelled diatom species underwent mass mortality, formed large, mucous aggregates, and sank out en masse (carbon sinkers). In contrast, thicker-shelled species, in particular *Fragilariopsis kerguelensis*, persisted in the surface layers, sank mainly empty shells continuously, and reduced silicate concentrations to similar levels both inside and outside the patch (silica sinkers). These patterns imply that thick-shelled, hence grazer-protected, diatom species evolved in response to heavy copepod grazing pressure in the presence of an abundant silicate supply. The ecology of these silica-sinking species decouples silicon and carbon cycles in the iron-limited Southern Ocean, whereas carbonsinking species, when stimulated by iron fertilization, export more carbon per silicon. Our results suggest that large-scale iron fertilization of the silicate-rich Southern Ocean will not change silicon sequestration but will add carbon to the sinking silica flux.

evolutionary arms race | top-down control | geo-engineering

BARKER 2013

David Barker, Mary Barker, Tom Fleming & Michelle Lampl, *Support mothers to secure future public health*. [nature 504 \(2013\), 209–211](#).

Evidence that long-term health is shaped by the environment in early life calls for prenatal interventions to tackle chronic disease, argue David Barker and colleagues.

At the moment of conception, the growing embryo seems to be exquisitely sensitive to its nutritional environment. Studies of babies born through in vitro fertilization, for instance, have shown that birth weights can be affected simply by changing the constituents of the medium in which the embryos are cultured.

More than 20 years ago, one of us (D.B.) wrote in this journal that “if more was known about the processes by which the environment in early life influences adult health . . . the rise in incidence of ‘Western’ disease [might be] minimized.” Today, we have the knowledge to readily prevent chronic diseases, had we but the will to do so.

BONHOMMEAU 2013

Sylvain Bonhommeau, Laurent Dubroca, Olivier Le Pape, Julien Barde, David M. Kaplan, Emmanuel Chassot & Anne-Elise Nieblas, *Eating up the world’s food web and the human trophic level*. [PNAS 110 \(2013\), 20617–20620](#).

Trophic levels are critical for synthesizing species’ diets, depicting energy pathways, understanding food web dynamics and ecosystem functioning, and monitoring ecosystem health. Specifically, trophic levels describe the position of species in a food web, from primary producers to apex predators (range, 1–5). Small differences in trophic level can reflect large differences in diet. Although trophic levels are among the most basic information collected for animals in ecosystems, a human trophic level (HTL) has never been defined. Here, we find a global HTL of 2.21, i.e., the trophic level of anchoveta. This value has increased with time, consistent with the global trend toward diets higher in meat. National HTLs ranging between 2.04 and 2.57 reflect a broad diversity of diet, although cluster analysis of countries with similar dietary trends reveals only five major groups. We find significant links between socio-economic and environmental indicators and global dietary trends. We demonstrate that the HTL is a synthetic index to monitor human diets and provides a baseline to compare diets between countries.
human ecology | nutrition transition | trophic ecology

BOYD 2013

Philip W. Boyd, *Diatom traits regulate Southern Ocean silica leakage*. [PNAS 110 \(2013\), 20358–20359](#).

Assmy et al. provide unprecedented detail of how the ecological traits of different polar diatom species contribute to the regulation of ocean nutrient stoichiometry.

CLARK 2013

Katherine A. Clark, Salima Ikram & Richard P. Evershed, *Organic chemistry of balms used in the preparation of pharaonic meat mummies*. [PNAS 110 \(2013\), 20392–20395](#).

The funeral preparations for ancient Egyptian dead were extensive. Tomb walls were often elaborately painted and inscribed with scenes and objects deemed desirable for the afterlife. Votive objects, furniture, clothing, jewelry, and importantly, food including bread, cereals, fruit, jars of wine, beer, oil, meat, and poultry were included in the burial goods. An intriguing feature of the meat and poultry produced for the deceased from the highest levels of Egyptian society was that they were mummified to ensure their preservation. However, little is known about the way they were prepared, such as whether balms were used, and if they were used, how they compared with those applied to human and animal mummies? We present herein the results of lipid biomarker and stable carbon isotope investigations of tissues, bandaging, and organic balms associated with a variety of meat mummies that reveal that treatments ranged from simple desiccation and wrapping in bandages to, in the case of the tomb of Yuya and Tjuiu (18th Dynasty, 1386–1349 BC), a balm associated with a beef rib mummy containing a high abundance of Pistacia

resin and, thus, more sophisticated than the balms found on many contemporaneous human mummies.

food mummies | pharaohs | Egypt | triterpenoids | fatty acyl lipids

DEGRYSE 2013

Patrick Degryse & Andrew J. Shortland, *Nourishing archaeology and science*. [PNAS 110 \(2013\), 20352–20353](#).

DIXSON 2013

Alan F. Dixson, *Male infanticide and primate monogamy*. [PNAS 110 \(2013\), E4937](#).

It is often assumed that the importance of male infanticide for the evolution of primate social organization is well established. This assumption is not so. As well as the sexual selection hypothesis, there are currently nine other adaptive explanations for the evolution of infanticidal behavior. Unfortunately, sufficient observational data to effectively test these hypotheses do not exist. Indirect measures of presumed “infanticide risk” are unlikely to resolve these problems.

KAUFMAN 2013

Jordy Kaufman, Joanne C. Tarasuik, Leila Dafner, Judy Russell, Sandra Marshall & Denny Meyer, *Parental misperception of youngest child size*. [Current Biology 23 \(2013\), R1085–R1086](#).

In the multi-child family, human and non-human animal research shows that parents experience conflict regarding how to divide their care and attention among offspring — providing more care to either the older or younger depending on a range of ecological and biological factors. In this case, the baby illusion, by exaggerating the smallness of the younger child, would help parents to more readily distinguish relative age and importance of care at a perceptual level and allocate resources accordingly.

KLATT 2013

Björn K. Klatt, Andrea Holzschuh, Catrin Westphal, Yann Clough, Inga Smit, Elke Pawelzik & Teja Tschardt, *Bee pollination improves crop quality, shelf life and commercial value*. [Proc. Royal Society B \(2013\), preprint, 1–8](#). DOI:10.1098/rspb.2013.2440.

[ProcRSocB2013-preprint-Supplement1219.pdf](#)

Pollination improves the yield of most crop species and contributes to one-third of global crop production, but comprehensive benefits including crop quality are still unknown. Hence, pollination is underestimated by international policies, which is particularly alarming in times of agricultural intensification and diminishing pollination services. In this study, exclusion experiments with strawberries showed bee pollination to improve fruit quality, quantity and market value compared with wind and self-pollination. Bee-pollinated fruits were heavier, had less malformations and reached higher commercial grades. They had increased redness and reduced sugar–acid–ratios and were firmer, thus improving the commercially important shelf life. Longer shelf life reduced fruit loss by at least 11 %. This is accounting for 0.32 billion US\$ of the 1.44 billion US\$ provided by bee pollination to the total value of 2.90 billion US\$ made with strawberry selling in the European Union 2009. The fruit quality and yield effects are driven by the pollination-mediated production of hormonal growth regulators, which occur in several pollination-dependent crops. Thus, our comprehensive findings should be transferable to a wide range of

crops and demonstrate bee pollination to be a hitherto underestimated but vital and economically important determinant of fruit quality.

Subject Areas: ecology

Keywords: commercial grades, ecosystem services, post-harvest quality, shelf life, strawberry, crop yield

LEWIS 2013

Ceri N. Lewis, Kristina A. Brown, Laura A. Edwards, Glenn Cooper & Helen S. Findlay, *Sensitivity to ocean acidification parallels natural pCO₂ gradients experienced by Arctic copepods under winter sea ice*. [PNAS 110 \(2013\), E4960–E4967](#).

The Arctic Ocean already experiences areas of low pH and high CO₂, and it is expected to be most rapidly affected by future ocean acidification (OA). Copepods comprise the dominant Arctic zooplankton; hence, their responses to OA have important implications for Arctic ecosystems, yet there is little data on their current under-ice winter ecology on which to base future monitoring or make predictions about climate-induced change. Here, we report results from Arctic under-ice investigations of copepod natural distributions associated with late-winter carbonate chemistry environmental data and their response to manipulated pCO₂ conditions (OA exposures). Our data reveal that species and life stage sensitivities to manipulated OA conditions were correlated with their vertical migration behavior and with their natural exposures to different pCO₂ ranges. Vertically migrating adult *Calanus* spp. crossed a pCO₂ range of >140 μatm daily and showed only minor responses to manipulated high CO₂. *Oithona similis*, which remained in the surface waters and experienced a pCO₂ range of <75 μatm, showed significantly reduced adult and nauplii survival in high CO₂ experiments. These results support the relatively untested hypothesis that the natural range of pCO₂ experienced by an organism determines its sensitivity to future OA and highlight that the globally important copepod species, *Oithona* spp., may be more sensitive to future high pCO₂ conditions compared with the more widely studied larger copepods.

climate change | diel vertical migration | ecophysiology | pH response

McNULTY 2013

James K. McNulty, Michael A. Olson, Andrea L. Meltzer & Matthew J. Shaffer, *Though They May Be Unaware, Newlyweds Implicitly Know Whether Their Marriage Will Be Satisfying*. [science 342 \(2013\), 1119–1120](#).

s342-1119-Supplement.pdf

For decades, social psychological theories have posited that the automatic processes captured by implicit measures have implications for social outcomes. Yet few studies have demonstrated any long-term implications of automatic processes, and some scholars have begun to question the relevance and even the validity of these theories. At baseline of our longitudinal study, 135 newlywed couples (270 individuals) completed an explicit measure of their conscious attitudes toward their relationship and an implicit measure of their automatic attitudes toward their partner. They then reported their marital satisfaction every 6 months for the next 4 years. We found no correlation between spouses' automatic and conscious attitudes, which suggests that spouses were unaware of their automatic attitudes. Further, spouses' automatic attitudes, not their conscious ones, predicted changes in their marital satisfaction, such that spouses with more positive automatic attitudes were less likely to experience declines in marital satisfaction over time.

MERALI 2013

Zeeya Merali, *Life possible in the early Universe*. [nature 504 \(2013\), 201](#).

Planets orbiting the first stars could have been habitable, challenging arguments for a multiverse.

OPIE 2013

Christopher Opie, Quentin D. Atkinson, Robin I. M. Dunbar & Susanne Shultz, *Infanticide triggers primate monogamy, Reply to Dixon*. [PNAS 110 \(2013\), E4938](#).

Second, the substantive issue is whether there is a general selection pressure for monogamy in primates as a whole. Three hypotheses have been proposed in the literature over the years. We tested between these hypotheses, using a Bayesian approach to disentangle phylogenetic from nonphylogenetic effects. We found significant support for only one of the proposed evolutionary drivers (that monogamy is a response to high infanticide risk); the other two appear to be evolutionary by-products of having adopted monogamy.

Anthropologie

DING 2013

Qiliang Ding, Ya Hu, Shuhua Xu, Jiucun Wang & Li Jin, *Neanderthal Introgression at Chromosome 3p21.31 was Under Positive Natural Selection in East Asians*. [Molecular Biology and Evolution \(2013\), preprint, 1–32](#). .

MolBiolEvol2013-preprint-Supplement1219.zip

Studies of the Neanderthal and Denisovan genomes demonstrate archaic hominin introgression in Eurasians. Here we present evidence of Neanderthal introgression within the chromosome 3p21.31 region, occurring with a high frequency in East Asians (ranging from 49.4% to 66.5%) and at a low frequency in Europeans. We also detected a signal of strong positive selection in this region only in East Asians. Our data indicate that likely candidate targets of selection include rs12488302-T and its associated alleles—among which four are non-synonymous, including rs35455589-G in HYAL2, a gene related to the cellular response to ultraviolet-B irradiation. Furthermore, suggestive evidence supports latitude-dependent selection, implicating a role of ultraviolet-B. Interestingly, the distribution of rs35455589-G suggests that this allele was lost during the exodus of ancestors of modern Eurasians from Africa, and reintroduced to Eurasians from Neanderthals.

Bibel

SNEH 2010

Amihai Sneh, Ram Weinberger & Eyal Shalev, *The Why, How, and When of the Siloam Tunnel Reevaluated*. [Bulletin of the American Schools of Oriental Research 359 \(2010\), 57–65](#).

The Siloam Tunnel, an important engineering achievement of the Iron Age II, led the water of the Gihon Spring inside the city perimeter of ancient Jerusalem, ensuring water supply in peacetime as well as during war. This enterprise was planned after an earlier aqueduct failed to adequately supply Jerusalem's water needs because of hydrological limitations; also it was insufficiently defensible.

We hypothesize that the tunnel was hewn at a level close to that of the local groundwater, along a natural winding route of interconnected karstic cavities developed in fissures and in dipping bedding planes. Because of the time needed to complete the project (we estimate at least four years), it could not have been undertaken as a countermeasure to the Assyrian king Sennacherib's siege in the year 701 B.C.E., nor could it have been completed before King Hezekiah's death in 698 B.C.E. We therefore suggest that it was carried out by Manasseh, King of Judah, at the beginning of the seventh century B.C.E.

SNEH 2013

Amihai Sneh, Ram Weinberger & Eyal Shalev, *Again the Siloam Tunnel*. [Bible History Daily 2013, Dec. 12](#).

Biologie

FILLOUX 2013

Alain Filloux, *Fit and resistant is a worst case scenario with bacterial pathogens*. [PNAS 110 \(2013\), 20360–20361](#).

The work performed by Skurnik et al. challenges the common concept that resistant bacteria are less fit, and their results may dampen our enthusiasm in finding solutions on how to outcompete pathogens that acquire antibiotic resistance. Until now, an improved fitness has only been shown for carbapenem resistance and could be a feature of the oprD mutation that may not apply to other mechanisms of resistance. Once a resistance emerges, the best strategy is to stop the use of the incriminated drug, but the antibiotic pipeline is quickly drying up. We need to trust in our ability to find new drugs and to address and solve pertinent and difficult questions relevant to bacterial fitness and resistance.

PRESCOTT 2012

Graham W. Prescott, David R. Williams, Andrew Balmford, Rhys E. Green & Andrea Manica, *Quantitative global analysis of the role of climate and people in explaining late Quaternary megafaunal extinctions*. [PNAS 109 \(2012\), 4527–4531](#).

[pnas109-04527-Comment.pdf](#), [pnas109-04527-Reply.pdf](#), [pnas109-04527-Supplement1.doc](#), [pnas109-04527-Supplement2.doc](#), [pnas109-04527-Supplement3.doc](#), [pnas109-04527-Supplement4.doc](#), [pnas109-04527-Supplement5.doc](#), [pnas109-04527-Supplement6.doc](#)

The late Quaternary period saw the rapid extinction of the majority of the world's terrestrial megafauna. The cause of these dramatic losses, especially the relative importance of climatic change and the impacts of newly arrived people, remains highly controversial, with geographically restricted analyses generating conflicting conclusions. By analyzing the distribution and timing of all megafaunal extinctions in relation to climatic variables and human arrival on five landmasses, we demonstrate that the observed pattern of extinctions is best explained by models that combine both human arrival and climatic variables. Our conclusions are robust to uncertainties in climate data and in the dates of megafaunal extinctions and human arrival on different landmasses, and strongly suggest that these extinctions were driven by both anthropogenic and climatic factors.

SKURNIK 2013

David Skurnik et al., *Enhanced in vivo fitness of carbapenem-resistant oprD mutants of Pseudomonas aeruginosa revealed through high-throughput sequencing*. [PNAS 110 \(2013\), 20747–20752](#).

[pnas110-20747-Supplement1.xlsx](#), [pnas110-20747-Supplement2.xlsx](#), [pnas110-20747-Supplement3.xlsx](#), [pnas110-20747-Supplement4.xlsx](#), [pnas110-20747-Supplement5.xlsx](#)

David Skurnik, Damien Roux, Vincent Cattoir, Olga Danilchanka, Xi Lu, Deborah R. Yoder-Himes, Kook Han, Thomas Guillard, Deming Jiang, Charlotte Gaultier, François Guerin, Hugues Aschard, Roland Leclercq, John J. Mekalanos, Stephen Lory & Gerald B. Pier

An important question regarding the biologic implications of antibiotic-resistant microbes is how resistance impacts the organism's overall fitness and virulence. Currently it is generally thought that antibiotic resistance carries a fitness cost and reduces virulence. For the human pathogen *Pseudomonas aeruginosa*, treatment with carbapenem antibiotics is a mainstay of therapy that can lead to the emergence of resistance, often through the loss of the carbapenem entry channel OprD. Transposon insertion-site sequencing was used to analyze the fitness of 300,000 mutants of *P. aeruginosa* strain PA14 in a mouse model for gut colonization and systemic dissemination after induction of neutropenia. Transposon insertions in the *oprD* gene led not only to carbapenem resistance but also to a dramatic increase in mucosal colonization and dissemination to the spleen. These findings were confirmed in vivo with different *oprD* mutants of PA14 as well as with related pairs of carbapenem-susceptible and -resistant clinical isolates. Compared with OprD+ strains, those lacking OprD were more resistant to killing by acidic pH or normal human serum and had increased cytotoxicity against murine macrophages. RNA-sequencing analysis revealed that an *oprD* mutant showed dramatic changes in the transcription of genes that may contribute to the various phenotypic changes observed. The association between carbapenem resistance and enhanced survival of *P. aeruginosa* in infected murine hosts suggests that either drug resistance or host colonization can cause the emergence of more pathogenic, drug-resistant *P. aeruginosa* clones in a single genetic event.

Klima

MÜLLER 2011

Ulrich C. Müller et al., *The role of climate in the spread of modern humans into Europe*. [Quaternary Science Reviews 30 \(2011\), 273–279](#). [qsr030-0273-Supplement.pdf](#)

Ulrich C. Müller, Jörg Pross, Polychronis C. Tzedakis, Clive Gamble, Ulrich Kotthoff, Gerhard Schmiedl, Sabine Wulf & Kimon Christanis

The spread of anatomically modern humans (AMH) into Europe occurred when shifts in the North Atlantic meridional overturning circulation triggered a series of large and abrupt climate changes during the last glacial. However, the role of climate forcing in this process has remained unclear. Here we present a last glacial record that provides insight into climate-related environmental shifts in the eastern Mediterranean region, i.e. the gateway for the colonisation of Europe by AMH. We show that the environmental impact of the Heinrich Event H5 climatic deterioration c. 48 kyr ago was as extreme as that of the glacial maximum of Marine Isotope Stage (MIS) 4 when most of Europe was deserted by Neanderthals. We argue that Heinrich H5 resulted in a similar demographic vacuum so that invasive AMH populations had the opportunity to spread into Europe and occupy large parts before

the Neanderthals were able to reoccupy this territory. This spread followed the resumption of the Atlantic meridional overturning circulation at the beginning of Greenland Interstadial (GIS) 12 c. 47 kyr ago that triggered an extreme and rapid shift from desert-steppe to open woodland biomes in the gateway to Europe. We conclude that the extreme environmental impact of Heinrich H5 within a situation of competitive exclusion between two closely related hominids species shifted the balance in favour of modern humans.

Metallzeiten

MIDANT-REYNES 2014

Béatrix Midant-Reynes, *Die Geburt des Pharaonenstaats*. [Spektrum der Wissenschaft 2014, i, 48–55](#).

Innerhalb eines Jahrtausends, zwischen 4000 und 3000 v. Chr., wandelte sich Ägypten von einem Land der Nomaden und einfachen Ackerbauern zu einem mächtigen Staat, dem Reich der Pharaonen.

WILLEITNER 2014

Joachim Willeitner, *Hierakonpolis – die Stadt des Falken*. [Spektrum der Wissenschaft 2014, i, 56–57](#).

Auf die Frage, wo Ägypten entstanden ist, hätte man im Altertum eine klare Antwort gegeben: in Nechen, das die Griechen später Hierakonpolis nannten.

Mittelpaläolithikum

DALÉN 2012

Love Dalén et al., *Partial Genetic Turnover in Neandertals: Continuity in the East and Population Replacement in the West*. [Molecular Biology and Evolution 29 \(2012\), 1893–1897](#).

[MolBiolEvol29-1893-Supplement.pdf](#)

Love Dalén, Ludovic Orlando, Beth Shapiro, Mikael Brandström-Durling, Rolf Quam, M. Thomas P. Gilbert, J. Carlos Díez Fernández-Lomana, Eske Willerslev, Juan Luis Arsuaga & Anders Götherström

Remarkably little is known about the population-level processes leading up to the extinction of the neandertal. To examine this, we use mitochondrial DNA sequences from 13 neandertal individuals, including a novel sequence from northern Spain, to examine neandertal demographic history. Our analyses indicate that recent western European neandertals (.48 kyr) constitute a tightly defined group with low mitochondrial genetic variation in comparison with both eastern and older (.48 kyr) European neandertals. Using control region sequences, Bayesian demographic simulations provide higher support for a model of population fragmentation followed by separate demographic trajectories in subpopulations over a null model of a single stable population. The most parsimonious explanation for these results is that of a population turnover in western Europe during early Marine Isotope Stage 3, predating the arrival of anatomically modern humans in the region.

Keywords: Neanderthal, demography, climate change, ancient DNA

Physik

BLUM 2013

Kfir Blum, Boaz Katz, & Eli Waxman, *AMS-02 Results Support the Secondary Origin of Cosmic Ray Positrons*. [Physical Review Letters **111** \(2013\), 211101](#). DOI:10.1103/PhysRevLett.111.211101.

We show that the recent AMS-02 positron fraction measurement is consistent with a secondary origin for positrons and does not require additional primary sources such as pulsars or dark matter. The measured positron fraction at high energy saturates the previously predicted upper bound for secondary production, obtained by neglecting radiative losses. This coincidence, which will be further tested by upcoming AMS-02 data at higher energy, is a compelling indication for a secondary source. Within the secondary model, the AMS-02 data imply a cosmic ray propagation time in the Galaxy of $<10^6$ yr and an average traversed interstellar matter density of $\approx 1 \text{ cm}^{-3}$, comparable to the density of the Milky Way gaseous disk, at a rigidity of 300 GV.