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References

Aktuell

CLAS Collaboration 2019

The CLAS Collaboration, *Modified structure of protons and neutrons in correlated pairs*. nature **566** (2019), 354–358.

n566-0354-Supplement.pdf

The atomic nucleus is made of protons and neutrons (nucleons), which are themselves composed of quarks and gluons. Understanding how the quark–gluon structure of a nucleon bound in an atomic nucleus is modified by the surrounding nucleons is an outstanding challenge. Although evidence for such modification—known as the EMC effect—was first observed over 35 years ago, there is still no generally accepted explanation for its cause1–3. Recent observations suggest that the EMC effect is related to closeproximity short-range correlated (SRC) nucleon pairs in nuclei4,5. Here we report simultaneous, high-precision measurements of the EMC effect and SRC abundances. We show that EMC data can be explained by a universal modification of the structure of nucleons in neutron–proton SRC pairs and present a data-driven extraction of the corresponding universal modification function. This implies that in heavier nuclei with many more neutrons than protons, each proton is more likely than each neutron to belong to an SRC pair and hence to have distorted quark structure. This universal modification function will be useful for determining the structure of the free neutron and thereby testing quantum chromodynamics symmetrybreaking mechanisms and may help to discriminate between nuclear physics effects and beyond-the-standard-model effects in neutrino experiments.

B. Schmookler, M. Duer, A. Schmidt, O. Hen, S. Gilad, E. Piasetzky, M. Strikman, L. B. Weinstein, S. Adhikari, M. Amaryan, A. Ashkenazi, H. Avakian, J. Ball, I. Balossino, L. Barion, M. Bashkanov, M. Battaglieri, A. Beck, I. Bedlinskiy, A. S. Biselli, S. Boiarinov, W. J. Briscoe, W. K. Brooks, V. D. Burkert, D. S. Carman, A. Celentano, G. Charles, T. Chetry, G. Ciullo, E. Cohen, P. L. Cole, V. Crede, R. Cruz-Torres, A. D'Angelo, N. Dashyan, E. De Sanctis, R. De Vita, A. Deur, S. Diehl, C. Djalali, R. Dupre, H. Egiyan, L. El Fassi, L. Elouadrhiri, P. Eugenio, G. Fedotov, R. Fersch, A. Filippi, T. A. Forest, G. Gavalian, G. P. Gilfoyle, F. X. Girod, E. Golovatch, R. W. Gothe, K. A. Griffioen, M. Guidal, L. Guo, K. Hafidi, H. Hakobyan, C. Hanretty, N. Harrison, F. Hauenstein, T. B. Hayward, K. Hicks, D. Higinbotham, M. Holtrop, C. E. Hyde, Y. Ilieva, D. G. Ireland, B. S. Ishkhanov, E. L. Isupov, H.-S. Jo, S. Johnston, K. Joo, S. Joosten, M. L. Kabir, D. Keller, G. Khachatryan, M. Khachatryan, M. Khandaker, A. Kim, W. Kim, A. Klein, F. J. Klein, I. Korover, V. Kubarovsky, S. E. Kuhn, S. V. Kuleshov, L. Lanza, G. Laskaris, P. Lenisa, K. Livingston, I. J. D. MacGregor, N. Markov, B. McKinnon, S. Mey-Tal Beck, T. Mineeva, M. Mirazita, V. Mokeev, R. A. Montgomery, C. Munoz Camacho, B. Mustapha, S. Niccolai, M. Osipenko, A. I. Ostrovidov, M. Paolone, R. Paremuzyan, K. Park, E. Pasyuk, M. Patsyuk, O. Pogorelko, J. W. Price, Y. Prok, D. Protopopescu, M. Ripani, D. Riser, A. Rizzo, G. Rosner, P. Rossi, F. Sabatié, C. Salgado, R. A. Schumacher, E. P. Segarra, Y. G. Sharabian, I. U. Skorodumina, D. Sokhan, N. Sparveris, S. Stepanyan, S. Strauch, M. Taiuti, J. A. Tan, M. Ungaro, H. Voskanyan, E. Voutier, D. P. Watts, X. Wei, M. Wood, N. Zachariou, J. Zhang, Z. W. Zhao & X. Zheng

Crossan 2019

John Dominic Crossan & Sarah Sexton Crossan, *Resurrecting Easter, Hunting for the Original Resurrection Image*. Biblical Archaeology Review **45** (2019), ii, 20–28, 60.

All of the main events in Jesus's life are directly described in the New Testament—except for the Resurrection. This central event happens off-screen and is not directly witnessed. As a result, early Christians created two very different depictions of this moment. Join the Crossans as they hunt for the earliest images of Jesus's resurrection—and attempt to resurrect the original Easter vision.

Dilkes-Hoffman 2019

Leela Dilkes-Hoffman, *When the trail gets steep*. science **363** (2019), 662.

When I was younger I loved going on long, meandering trail runs on the outskirts of my hometown in the Australian countryside. It was my favorite way to escape the stresses of everyday life. I didn't worry about time or distance or pace. I just enjoyed the immersive and meditative experience of running in a beautiful place. So, when I was back in my hometown for a visit after a tough first year of my Ph.D. program, I thought a trail run was just what I needed. But instead of helping me relax, the run did just the opposite: It made me anxious. In the end, I figured out why.

Jordan 2019

Kayla N. Jordan, Joanna Sterling, James W. Pennebaker & Ryan L. Boyd, *Examining long-term trends in politics and culture through language of political leaders and cultural institutions*. PNAS **116** (2019), 3476–3481.

pnas116-03476-Supplement.pdf

From many perspectives, the election of Donald Trump was seen as a departure from long-standing political norms. An analysis of Trump's word use in the presidential debates and speeches indicated that he was exceptionally informal but at the same time, spoke with a sense of certainty. Indeed, he is lower in analytic thinking and higher in confidence than almost any previous American president. Closer analyses of linguistic trends of presidential language indicate that Trump's language is consistent with long-term linear trends, demonstrating that he is not as much an outlier as he initially seems. Across multiple corpora from the American presidents, non-US leaders, and legislative bodies spanning decades, there has been a general decline in analytic thinking and a rise in confidence in most political contexts, with the largest and most consistent changes found in the American presidency. The Results suggest that certain aspects of the language style of Donald Trump and other recent leaders reflect long-evolving political trends. Implications of the changing nature of popular elections and the role of media are discussed.

Keywords: language analysis | analytic thinking | confidence | political leadership | culture

Significance: Donald Trump and a small group of emerging leaders around the world have been labeled as outliers in the ways that they think and communicate with others. Are they really anomalies, or do they fit into larger political trends? This study adds to existing scholarship by analyzing two important psychological dimensions, analytic thinking and confidence, in 12 large corpora of political texts representing political leaders of various levels in both the United States and other countries as well as 4 corpora of cultural texts. Rather than being anomalous, linguistic analyses find that, over the last century, there have been consistent

declines in analytic thinking and rises in confidence in the ways that political leaders communicate with the public.

Koeberl 2019

Christian Koeberl, *When Earth got pummeled.* science **363** (2019), 224–225.

The frequency of impacts on Earth's surface increased about 290 million years ago.

Thus, Earth's impact record is quite limited: nothing for the first billion years, then some ejecta layers until about 2.5 billion years ago, and then less than a handful of impact craters prior to about 750 million years ago. Nevertheless, the discovery of these ejecta layers aids in the discussion of the importance of impact events in Earth's early history. So, despite having a good explanation for why a single time window in Earth's history might have seen as many impacts as originally anticipated, the earlier (pre–600 million years ago) impact record on Earth, which spans most of the age of the planet, is still a wide open field of research.

Lindsay 2019

Emily K. Lindsay, Shinzen Young, Kirk Warren Brown, Joshua M. Smyth & J. David Creswell, *Mindfulness training reduces loneliness and increases social contact in a randomized controlled trial.* PNAS **116** (2019), 3488–3493.

pnas116-03488-Supplement1.pdf, pnas116-03488-Supplement2.xlsx

Loneliness and social isolation are a growing public health concern, yet there are few evidence-based interventions for mitigating these social risk factors. Accumulating evidence suggests thatmindfulness interventions can improve social-relationship processes. However, the active ingredients of mindfulness training underlying these improvements are unclear. Developing mindfulness-specific skills—namely, (i) monitoring present-moment experiences with (ii) an orientation of acceptance—may change the way people perceive and relate toward others. We predicted that developing openness and acceptance toward present experiences is critical for reducing loneliness and increasing social contact and that removing acceptance-skills training from a mindfulness intervention would eliminate these benefits. In this dismantling trial, 153 community adults were randomly assigned to a 14-lesson smartphone-based intervention: (i) training in both monitoring and acceptance (Monitor+ Accept), (ii) training in monitoring only (Monitor Only), or (iii) active control training. For 3 d before and after the intervention, ambulatory assessments were used to measure loneliness and social contact in daily life. Consistent with predictions, Monitor+Accept training reduced daily-life loneliness by 22 % (d = 0.44, P = 0.0001) and increased social contact by two more interactions each day (d = 0.47, P = 0.001) and one more person each day (d = 0.39, P = 0.004), comparedwith both Monitor Only and control trainings. These findings describe a behavioral therapeutic target for improving social-relationship functioning; by fostering equanimity with feelings of loneliness and social disconnect, acceptance-skills training may allow loneliness to dissipate and encourage greater engagement with others in daily life.

Keywords: mindfulness | social relationships | loneliness | acceptance | ambulatory assessment

Significance: Loneliness (i.e., feeling alone) and social isolation (i.e., being alone) are among the most robust known risk factors for poor health and accelerated mortality. Yet mitigating these social risk factors is challenging, as few interventions have been effective for both reducing loneliness and increasing social contact. Mindfulness interventions, which train skills in monitoring present-moment

experiences with an orientation of acceptance, have shown promise for improving social-relationship processes. This study demonstrates the efficacy of a 2-wk smartphone-based mindfulness training for reducing loneliness and increasing social contact in daily life. Importantly, this study shows that developing an orientation of acceptance toward present-moment experiences is a critical mechanism for mitigating these social risk factors.

Mazrouei 2019

Sara Mazrouei, Rebecca R. Ghent, William F. Bottke, Alex H. Parker & Thomas M. Gernon, *Earth and Moon impact flux increased at the end of the Paleozoic*. science **363** (2019), 253–257.

s363-0253-Supplement.pdf

The terrestrial impact crater record is commonly assumed to be biased, with erosion thought to eliminate older craters, even on stable terrains. Given that the same projectile population strikes Earth and the Moon, terrestrial selection effects can be quantified by using a method to date lunar craters with diameters greater than 10 kilometers and younger than 1 billion years. We found that the impact rate increased by a factor of 2.6 about 290 million years ago. The terrestrial crater record shows similar results, suggesting that the deficit of large terrestrial craters between 300 million and 650 million years ago relative to more recent times stems from a lower impact flux, not preservation bias. The almost complete absence of terrestrial craters older than 650 million years may indicate a massive global-scale erosion event near that time.

Reese 2019

April Reese, *The Bones of Bears Ears*. science **363** (2019), 218–220.

Paleontologists struggle to protect sites that could rewrite Earth's history.

Looting has long been a problem in San Juan County, where the monument is located. When Gay and his students found the phytosaur cache in 2016, for example, a snout from one of the creatures was missing. It was eventually returned, but looters rarely repent, Gay says. Without the protection and increased attention from BLM officials, he fears the excised areas are more vulnerable to pillaging. Scientists will also have to compete with law-abiding private fossil collectors. The 2009 Paleontological Resources Preservation Act makes removing vertebrate fossils from federal lands a crime for nonscientists. But the rules are different for plant and invertebrate fossils, which are crucial to understanding ancient ecosystems and evolution. Within a monument, those fossils, too, can be collected only by researchers, but outside monument boundaries, anyone can gather and sell them. "Without special protection, [the sites] are more vulnerable to vandalism, which they have suffered in the past, and [fossils] can be more easily sold away to private buyers or repurposed for other uses," Gay says.

Roffet-Salque 2019

Mélanie Roffet-Salque et al., *Synchronicity of climate and cultural proxies around 8.2 kyBP at Çatalhöyük*. PNAS **116** (2019), 3345–3346.

Mélanie Roffet-Salque, Arkadiusz Marciniak, Paul J. Valdes, C. Neil Roberts, Kamilla Pawłowska, Joanna Pyzel, Lech Czerniak, Marta Krüger, Sharmini Pitter & Richard P. Evershed

Fifth, they also state that the paleoenvironmental record at Çatalhöyük suggests no significant changes at this time. In fact, previous studies (e.g., ref. 6) show a significant well-dated change in off-site stratigraphy just before 8.1 kyBP. Whether or not this was influenced by the climate event, the local environment at Çatalhöyük saw important changes around this time. Finally, they incorrectly suggest we argue

for the collapse of Çatalhöyük during the 8.2-kyBP event. It has been reported previously that the East Mound was uninterruptedly occupied until 5950 BC, with redesigning of its architecture and settlement pattern around 6100 BC (7). Toward the end of the seventh millennium, the West Mound settlement was created and both settlements coexisted for short period of time before the East Mound was abandoned (8). It is indisputable that developments around 6200 BC significantly accelerated changes across the Near East and that "profound human responses are clearly visible in the archaeological record." However, as to whether these changes were driven by local or regional climate impacts is hypothetical; our approach of combining different lines of evidence to test such a hypothesis would seem to be a perfectly reasonable nuanced approach.

Stokstad 2019

Erik Stokstad, *The New Potato*. science **363** (2019), 574–577.

Breeders seek a breakthrough to help farmers facing an uncertain future.

Once the potato caught on, there was no turning back. The plant can grow in cold climates and poor soil, and in some places yields several crops per season. Once harvested, the energy-rich tubers, packed with vitamin C, can be stored for months and cooked in many ways. A hectare of potatoes can provide up to four times the calories of a grain crop.

Then there is heat and drought, which climate change is exacerbating. In some parts of the world, farmers are planting their crop earlier so that it matures before the nights get too hot, which prevents tubers from forming. But eventually farmers will need hardier plants.

Trainor 2019

Michael Trainor, *Colossae—Colossal in Name Only?* Biblical Archaeology Review **45** (2019), ii, 44–50.

The once great city of Colossae in modern Turkey has never been excavated. To the untrained eye, the site may appear unimpressive, but great archaeological treasures lie beneath its surface. Join Michael Trainor on an exploration of this ancient city awaiting the spade!

Trietsch 2019

Carolyn Trietsch, *Crafting social ties*. science **363** (2019), 554.

On Thursday nights, the yarn comes out. Every week, my fellow entomology graduate students and I get together to make insect-inspired crafts. One crochets butterflies, another makes earrings out of wings from discarded research specimens, and a third decoupages notebooks with figures and illustrations from journal articles thrown out after a lab cleanup. It may sound light or frivolous, but it's far from it. A regular social night like this—whether built around crafts or some other shared interest—can make a significant difference in our work and our lives.

Wainwright 2019

John Wainwright & Gianna Ayala, *Teleconnections and environmental determinism, Was there really a climate-driven collapse at Late Neolithic Çatalhöyük?* PNAS **116** (2019), 3343–3344.

Thus, not only is the attribution of the 8.2-kyBP event not supported by the data of Roffet-Salque et al. (1), the regional paleoclimate does not seem to be significantly linked to the event (Fig. 1 C and D). It is hard to justify a link to the purported social collapse. Our interpretation of the site's paleoenvironment (4) suggests that there were no significant changes at this time, and there is now evidence

for an overlap in settlement between the East and West Mounds at Çatalhöyük (5), which conflicts with the interpretation of a collapse (1).

Wong 2019

Victor S. C. Wong, *Lessons from a postdoc gone wrong*. science **363** (2019), 314.

I sat hunched over my computer screen, analyzing data, when a university administrator walked into our lab and handed out a series of sealed envelopes. Puzzled, I opened the letter addressed to me: "It has become necessary for the University to effect a layoff of your position as a Postdoctoral Scholar." In silence, my labmates opened their own letters, all of which said essentially the same thing. I knew that our lab was under investigation, but I had no inkling that my job was in jeopardy, so the news came as a huge shock. My mind raced from concerns about my personal finances—"How will I pay rent?"—to questions about my future in science: "How will we finish our experiments? Will this mark the end of my research career?"

Anthropologie

Callaway 2019

Ewen Callaway, *Ghosts in the cave*. nature **566** (2019), 444–446.

A mysterious group of ancient humans known as Denisovans is helping to rewrite our understanding of human evolution. Who were they?

Other scientists share Douka's hunch, largely owing to the distribution of Denisovan DNA in modern humans —it is common in many Chinese populations. Some scientists wonder whether there might even be a Denisovan skeleton already knocking around a museum collection in China.

Viola says that the Xuchang skulls don't resemble his parietal bone fragment. He's more interested in the roughly 300,000-year-old remains from a site in northern China called Xujiayao, which contain molars that look similar to those from Denisova Cave. "I would be very surprised if it turns out that some of the material from China, especially Xujiayao, is not Denisovan," says Viola.

Gibbons 2019

Ann Gibbons, *A room with a view—for three kinds of humans*. science **363** (2019), 438.

Mysterious Denisovan people moved into Siberian cave 100,000 years earlier than thought.

The Denisovans were "evidently a hardy bunch," Jacobs says. They apparently persisted at the site through multiple episodes of cold Siberian climate, based on analysis of fossil pollen. In contrast, when the Neanderthals showed up, the pollen shows that the forest around the cave had hornbeam, oak, and Eurasian linden trees, which thrive in a relatively warm and humid climate.

Bibel

Bar-Asher Siegal 2018

Elitzur A. Bar-Asher Siegal & Michal Bar-Asher Siegal, *The Hebrew-Based Traditions in Galatians 4:21–31*. Early Christianity **9** (2018), 404–431.

Dieser Artikel schlägt vor, den Fokus für das Gesamtargument in Gal 4:21–31 auf Jes 54,1 zu legen. Der Gedankengang des Paulus wird offenbar klarer, wenn das Wort בעולה aus Jesaja in seiner späthebräischen Bedeutung als "nicht jungfräulich" interpretiert wird statt in seiner gewöhnlichen biblischen Bedeutung als "die, die den Mann hat", die sich auch in der Formulierung der Septuaginta ([...]) wiederfindet. Die vorgeschlagene Lesart löst einige interpretative Probleme, auf die manche Leser der Galaterpassage bereits hingewiesen haben, und erklärt insbesondere die argumentative Funktion des Jesajaverses. Die Annahme der späthebräischen Bedeutung stimmt außerdem mit weiteren Verwendungen midraschisch und semitisch basierter Tradition überein, die an anderen Stellen in Gal 4 zu finden sind. Die resultierende Lesart wird auf ähnliche Weise gestützt durch die etwa gleichzeitig entstandenen Schriften Philos von Alexandrien und gibt Aufschluss über die Existenz hebräischer Traditionen in der jüdisch-hellenistischen Welt.

Keywords: Gal 4 | Paul | Isa 54 | Philo | virginity | Hellenistic Judaism

Faust 2019

Avraham Faust, *Purity and Impurity in Iron Age Israel*. Biblical Archaeology Review **45** (2019), ii, 36–43, 60, 62.

Purification practices of ancient Israelite society before the introduction of mikva'ot remain largely unexplored. Recent excavations at Tel 'Eton, in the southeastern Shephelah, yielded rich data on household life and practices in the tenth through the eighth centuries B.C.E. A large four-room house at Tel 'Eton offers a rare glimpse of how Iron Age Israelites coped with the issues of ritual impurity, and it enables the author to reconstruct the purification ritual.

van der Toorn 1987

K. van der Toorn, *From Patriarchs To Prophets, A Reappraisal Of Charismatic Leadership In Ancient Israel*. Journal of Northwest Semitic Languages **13** (1987), 191–218.

With the present contribution I hope to have shown that, despite the difficulties of a diachronic reconstruction, the effort is worth making. The genetic inquiry is certainly more than a means of satisfying our curiosity concerning the distant beginnings of Israelite prophecy. Its results also affect our understanding of biblical prophecy in its hey-day, and shape our conception of the actual role of the Israelite 'men of God'. In view of these consequences the 'questions about the origins of Israelite prophecy' are no matter of idle preoccupation, but vital to anyone who wishes to understand the Old Testament prophets.

Biologie

Pennisi 2019

Elizabeth Pennisi, *Gut bacteria linked to mental well-being and depression*. science **363** (2019), 569.

Microbial biochemistry may affect nerve cell function.

Now, a study of two large groups of Europeans has identified several species of gut bacteria that are largely missing in people with depression. The researchers can't say whether the absence is a cause or an effect of the illness, but they showed that many gut bacteria could make or break down substances that affect nerve cell function—and maybe mood.

Two kinds of bacteria, Coprococcus and Dialister, were missing from the microbiomes of the depressed subjects, but not from those with a high quality of life.

The finding held up when the researchers allowed for factors such as age, sex, or antidepressant use, all of which influence the microbiome, the team reports this week in Nature Microbiology. The data don't prove causality, Raes says, but they are "an independent observation backed by three groups of people."

Grabung

Barkay 2004

Gabriel Barkay & David Ussishkin, *Area S: The Late Bronze Age Strata*. In: David Ussishkin (Hrsg.), *The Renewed Archaeological Excavations at Lachish*, *Band 1: The Bronze Age stratigraphy and architecture*. Publications of the Institute of Archaeology 22 (Tel Aviv 2004), 316–407.

Area S, the main stratigraphic section of the renewed excavations, extends along the centre of the western side of the tell's summit and the western slope, its eastern edge reaching the south-western corner of the Judean Palace-Fort (Podium B) (Figs. 8.1; 8.2). The section was excavated perpendicularly to the contour line of the upper periphery of the tell, hence askance of the differently oriented Judean Palace-Fort. The section's location opposite the corner of Podium B made possible a stratigraphic connection between the Judean Palace-Fort and all the strata that lay beneath it (revealed in Areas D and P) and the city walls extending along the edge of the site, which in turn connect to the city-gates (Areas GW, GE and R). Thus, the excavation of the section enabled the physical and stratigraphic connection of the main monumental architectural components at Tel Lachish (see Ussishkin, Chapter 2).

Barkay Iron-Age 2004

Gabriel Barkay & David Ussishkin, *Area S: The Iron Age Strata*. In: David Ussishkin (Hrsg.), *The Renewed Archaeological Excavations at Lachish*, *Band 2: The Iron Age stratigraphy and architecture*. Publications of the Institute of Archaeology 22 (Tel Aviv 2004), 411–503.

Isotope

Makarewicz 2017

Cheryl A. Makarewicz & Sarah Pederzani, *Oxygen ($\delta^{18}O$) and carbon ($\delta^{13}C$) isotopic distinction in sequentially sampled tooth enamel of co-localized wild and domesticated caprines*. Palaeo **485** (2017), 1–15.

Complications to establishing seasonality and mobility in herbivores

Dietary intake, drinking behavior, and physiology together influence the isotopic composition of herbivore tooth enamel, but the degree to which these factors influence the sequence of d13C and d18O values along the tooth crown remain underexplored. Analysis of serially sampled molars from sympatric wild and domesticated caprines inhabiting the Gobi steppe-desert reveal inter-species distinction in carbon and oxygen isotope ratios as as well as pronounced differences in the amplitude of intra-tooth isotopic change. For domesticated sheep, consistently high d13C values visible in intra-tooth sequences and 13C enrichment in enamelwith a winter season formation period indicates pronounced graze intake throughout

the year including receipt of a C4 fodder source during the winter months. This pattern contrasts with low d13C values visible in the teeth of wild caprines indicating the intake of C3 graze and browse throughout the year. Domesticated sheep also demonstrate a wide amplitude of intra-tooth oxygen isotope variation compared to wild caprines in addition to higher summer season maxima d18O values and lower winter season minima d18O values. The greater contribution of graze to the domesticated sheep diet suggests 18O-enriched leaf water strongly influences summer season d18O values, while 18O-depleted groundwater imbibed from wells is likely responsible for low winter season d18O values. The oxygen isotopic distinction betweenwild and domesticated sheep populations affirm previous observations that the ingestion of isotopically distinctwater sources impacts body water oxygen isotopic composition and subsequent expression of d18O values in herbivore tooth carbonates. This has important implications for the use of d18O values obtained fromserially sampled teeth for reconstructing paleoenvironment, seasonality and also themovement of wild and domesticated herbivores through modern and ancient landscapes.

Keywords: Oxygen | Carbon | Isotope | Leaf water | Enamel carbonate

Judentum

Weingarten 2019

Susan Weingarten, *The Ancient Diet of Roman Palestine*, *Biblical Archaeology 101*. Biblical Archaeology Review **45** (2019), ii, 29–35.

What did people eat in Roman Palestine? Milk and honey? Olive oil and wine? Food historian Susan Weingarten takes readers on a culinary adventure through historical and archaeological remains to reconstruct the diet of the average person in Roman Palestine.

Klima

Lozier 2019

M. S. Lozier et al., *A sea change in our view of overturning in the subpolar North Atlantic*. science **363** (2019), 516–521.

s363-0516-Supplement.pdf

M. S. Lozier, F. Li, S. Bacon, F. Bahr, A. S. Bower, S. A. Cunningham, M. F. de Jong, L. de Steur, B. deYoung, J. Fischer, S. F. Gary, B. J. W. Greenan, N. P. Holliday, A. Houk, L. Houpert, M. E. Inall, W. E. Johns, H. L. Johnson, C. Johnson, J. Karstensen, G. Koman, I. A. Le Bras, X. Lin, N. Mackay, D. P. Marshall, H. Mercier, M. Oltmanns, R. S. Pickart, A. L. Ramsey, D. Rayner, F. Straneo, V. Thierry, D. J. Torres, R. G. Williams, C. Wilson, J. Yang, I. Yashayaev & J. Zhao

To provide an observational basis for the Intergovernmental Panel on Climate Change projections of a slowing Atlantic meridional overturning circulation (MOC) in the 21st century, the Overturning in the Subpolar North Atlantic Program (OSNAP) observing system was launched in the summer of 2014. The first 21-month record reveals a highly variable overturning circulation responsible for the majority of the heat and freshwater transport across the OSNAP line. In a departure from the prevailing view that changes in deep water formation in the Labrador Sea dominate MOC variability, these results suggest that the conversion of warm, salty, shallow Atlantic waters into colder, fresher, deep waters that move southward in the Irminger and Iceland basins is largely responsible for overturning and its variability in the subpolar basin.

Rhein 2019

Monika Rhein, *Taking a close look at ocean circulation.* science **363** (2019), 456–457.

Ocean circulation patterns in the North Atlantic provide a benchmark for climate models.

In climate models, declining deep-water formation in the Labrador Sea is also the main process that weakens the future AMOC under global warming, with severe consequences for climate (especially in western and northern Europe), regional sea level, and the rate at which the oceans take up heat and anthropogenic carbon (5). Lozier et al. argue that their results contradict the view that change in the Labrador Sea deep-water formation is the key process for the AMOC variability.

Kultur Metallzeiten

Driessen 2019

Jan Driessen, *The Santorini eruption. An archaeological investigation of its distal impacts on Minoan Crete.* Quaternary International **499** (2019), 195–204.

In this paper, I have argued that the basic hypothesis presented in 1997 – that of a gradual process of disintegration of Minoan society over the course of several generations triggered by the Santorini eruption rather than a single dramatic event that took place at the end of the period – still stands.

Whether the picture I have drawn here comes close to Tainter (1988)'s law of diminishing returns awaits to be seen. Was the Minoan system bound for collapse from the outset? Were elites not willing to adapt, instead remaining too focused on feeding on a 'weakened population' with the eruption simply accelerating the situation? With the law of diminishing returns, one would assume that the collapse was something of a sensible economic decision, decreasing political complexity, breaking down the social landscape into more simple units and eliminating the cost of the managerial organization (cf. Rethemiotakis and Christakis, 2011). The subsequent Mycenaean-inspired period, LM II-IIIA/B, seems, however, to suggest that the opposite was the case, with an even more complex administrative organization based on the introduction of a new language using Linear B script (Driessen and Langohr, 2007). Future research should focus on clarifying the sociopolitical situation during the LM I period and establishing whether the system was indeed unstable, requiring only the eruption and its accompanying effects to push the system to, and beyond, its inherent limits.

Mathematik Klima

Rohling 2019

Eelco J. Rohling, Gianluca Marino, Katharine M. Grant, Paul A. Mayewski & Bernhard Weninger, *A model for archaeologically relevant Holocene climate impacts in the Aegean-Levantine region (easternmost Mediterranean).* Quaternary Science Reviews **208** (2019), 38–53.

A repeating pattern of multi-centennial-scale Holocene climate events has been widely (globally) documented, and they were termed Rapid Climate Change (RCC) events. Non-seasalt potassium ion (K^3) series in Greenland ice cores provide well-constrained timings for the events, and a direct timing relationship

has been inferred between these events and the frequency of northerly cold polar/continental air outbreaks over the eastern Mediterranean Sea through gaps in the mountain ranges along the northern margin of the basin. There also appears to be a remarkable timing agreement with major archaeological turnover events in the Aegean/Levantine region. Yet no physically consistent assessment exists for understanding the regional climatic impacts of the events around this critical region. We present a simple 2-dimensional Lagrangian model, which yields a broad suite of physically coherent simulations of the impacts of frequency changes in winter-time northerly air outbreaks over the Aegean/ Levantine region. We validate this with existing reconstructions from palaeoclimate proxy data, with emphasis on well-validated sea-surface temperature reconstructions and a highly resolved cave speleothem stable oxygen isotope record from Lebanon. Given that the RCCs were clearly marked by negative sea surface temperature anomalies in the region, we find that the predominant climatic impacts of this winter-time mechanism were "cold and wet," in contrast with intercalated "warmer and more arid" conditions of non-RCC periods. More specifically, the RCCs are found to be periods of highly variable conditions, with an overall tendency toward cold and wet conditions with potential for flash flooding and for episodic snow-cover at low altitudes, at least in the lower-altitude (lower 1–1.5 km) regions of Crete and the Levant. The modelled winter-anomaly process cannot address underlying longer-term, astronomically forced trends, or the relatively warm and arid anomalies in between RCCs. The latter require further study, for example with respect to potential (summer-time?) extension of evaporative subtropical conditions over the region. Finally, our results imply that the "amount effect" observed in Levantine cave d18O (and precipitation or drip-water d18O) may not reflect the conventional concept related to temperature-dependent fractionation and Rayleigh distillation. Instead, it appears to arise from a complex and somewhat counter-intuitive mixing, in shifting proportionalities, between advected (external) and evaporated (Mediterranean) moisture.

Keywords: Holocene | Palaeoclimate modelling | Middle east

Methoden

Hawks 2019

John Hawks, *How Can Archaeologists Make a Difference to Media and Public Perceptions of Ancient DNA?* SAA Archaeological Record **19** (2019), i, 39–43.

In communicating the importance of aDNA research, I often emphasize ways that the science is still developing. Results are almost never completely deinitive. The questions anthropologists and archaeologists ask of ancient populations are rarely those that can be answered by DNA alone. When aDNA establishes that interbreeding occurred between ancient groups, it may say little about the circumstances of contact and mixture. When aDNA establishes a large demographic turnover between earlier and later time periods within a region, it may say little about the economic, climatic, or conlict conditions that gave rise to the turnover. It is a major step to establish what happened in demographic terms, but leaves much work to understand why and how demographic changes took place, and whether they left material or linguistic traces.

Hofman 2019

Courtney A. Hofman & Christina Warinner, *An Introductory Guide in the Era of High-Throughput Sequencing, Ancient DNA 101.* SAA Archaeological Record **19** (2019), i, 18–25.

We are living in the golden age of paleogenomics. The ield has advanced enormously over the past decade, and although many of the recent changes can at times feel confusing and bewildering, do not get discouraged. There has never been a better time for doing aDNA research.

Piscitelli 2019

Matthew Piscitelli, *The Office Odd Couple, Bones And Chromosomes: The Ancient DNA Revolution in Archaeology (Part 1)*. SAA Archaeological Record **19** (2019), i, 15–17.

"Closer collaboration certainly can't hurt and I already know that it's happening. However, we can probably do a better job at the research design stage. Maybe archaeologists need to be in the driver's seat when we set the agenda."

"Really?! Does that mean I can be irst author on your next paper?"

"Don't get too crazy." Mateo's computer chirped, signaling the arrival of a new e-mail, which he immediately opened. "Oh look! I'm a co-author on another paper that was accepted in Nature." Michael just grumbled and opened the irst of his 100 e-mails.

Sedig 2019

Jakob W. Sedig, *Ancient DNA's Impact on Archaeology, What Has Been Learned and How to Build Strong Relationships*. SAA Archaeological Record **19** (2019), i, 26–32.

While some major diferences in approaches exist between archaeologists and aDNA specialists, it is incumbent on archaeologists and geneticists to ind a shared language that allows them to work together with shared values. Ancient DNA is most powerful when hundreds of individuals from multiple time periods, sites, and regions can be studied in synthesis—this is the population level at which geneticists work. However, this large, population-level scale is not what many archaeologists are accustomed to. Archaeologists, including myself, often research a particular site, or particular features at a site. Thus, researchers on both sides need to better appreciate the diferent approaches and research questions addressed by the respective ields.

Keeping up with the speed of aDNA research can be overwhelming. Some of the research mentioned in this issue will undoubtedly be out of date by the time of publication. Ancient DNA is rapidly revolutionizing what we know about the past, from the spread of our hominin ancestors, to the social organization of speciic archaeological groups. As with other technologies that have revolutionized the ield (e.g., radiocarbon dating, GIS analysis, LiDAR), it seems likely that future generations will ind it diicult to imagine a time when aDNA wasn't an integral part of archaeological research.

Terrell 2019

John Edward Terrell, *Show-And-Tell Genetics, Diagnosis and Treatment*. SAA Archaeological Record **19** (2019), i, 33–38.

It is also long past the time when those reporting aDNA results should have stopped kidding themselves and others that they are studying populations, however ancient or modern. They aren't, as any statistician will tell them. Even under the best of conditions, they are studying samples, not populations. And their samples are drawn from an almost entirely unknown historical universe.

Methoden Jungpaläolithikum

Schmidt 2019

Isabell Schmidt & Andreas Zimmermann, *Population dynamics and socio-spatial organization of the Aurignacian*, *Scalable quantitative demographic data for western and central Europe*. PLoS ONE **14** (2019), e211562. DOI:10.1371/journal.pone.0211562.

pone14-e0211562-Supplement1.png, pone14-e0211562-Supplement2.png, pone14-e0211562-Supplement3.pdf, pone14-e0211562-Supplement4.pdf, pone14-e0211562-Supplement5.pdf

Demographic estimates are presented for the Aurignacian techno-complex (≈42,000 to 33,000 y calBP) and discussed in the context of socio-spatial organization of hunter-gatherer populations. Results of the analytical approach applied estimate a mean of 1,500 persons (upper limit: 3,300; lower limit: 800) for western and central Europe. The temporal and spatial analysis indicates an increase of the population during the Aurignacian as well as marked regional differences in population size and density. Demographic increase and patterns of socio-spatial organization continue during the subsequent early Gravettian period. We introduce the concept of Core Areas and Extended Areas as informed analytical spatial scales, which are evaluated against additional chronological and archaeological data. Lithic raw material transport and personal ornaments serve as correlates for human mobility and connectedness in the interpretative framework of this study. Observed regional differences are set in relation with the new demographic data. Our large-scale approach on Aurignacian population dynamics in Europe suggests that past socio-spatial organization followed socially inherent rules to establish and maintain a functioning social network of extremely low population densities. The data suggest that the network was fully established across Europe during the early phase of the Gravettian, when demographic as well as cultural developments peaked.

Neolithikum

Schulz Paulsson 2019

B. Schulz Paulsson, *Radiocarbon dates and Bayesian modeling support maritime diffusion model for megaliths in Europe*. PNAS **116** (2019), 3460–3465.

pnas116-03460-Supplement1.pdf, pnas116-03460-Supplement2.xlsx, pnas116-03460-Supplement3.pdf, pnas116-03460-Supplement4.xlsx, pnas116-03460-Supplement5.pdf

There are two competing hypotheses for the origin of megaliths in Europe. The conventional view from the late 19th and early 20th centuries was of a single-source diffusion of megaliths in Europe from the Near East through the Mediterranean and along the Atlantic coast. Following early radiocarbon dating in the 1970s, an alternative hypothesis arose of regional independent developments in Europe. This model has dominated megalith research until today. We applied a Bayesian statistical approach to 2,410 currently available radiocarbon results from megalithic, partly premegalithic, and contemporaneous nonmegalithic contexts in Europe to resolve this long-standing debate. The radiocarbon Results suggest that megalithic graves emerged within a brief time interval of 200 y to 300 y in the second half of the fifth millennium calibrated years BC in northwest France, the Mediterranean, and the Atlantic coast of Iberia. We found decisive support for the

spread of megaliths along the sea route in three main phases. Thus, a maritime diffusion model is the most likely explanation of their expansion.

Keywords: megaliths | mobility | radiocarbon dates | Bayesian analysis | megalithic seafaring

Significance: For thousands of years, prehistoric societies built monumental grave architecture and erected standing stones in the coastal regions of Europe (4500–2500 calibrated years BC). Our understanding of the rise of these megalithic societies is contentious and patchy; the origin for the emergence of megalithic architecture in various regions has been controversial and debated for over 100 y. The result presented here, based on analyses of 2,410 radiocarbon dates and highly precise chronologies for megalithic sites and related contexts, suggests maritime mobility and intercultural exchange. We argue for the transfer of the megalithic concept over sea routes emanating from northwest France, and for advanced maritime technology and seafaring in the megalithic Age.

Physik

Cheisson 2019

Thibault Cheisson & Eric J. Schelter, *Rare earth elements, Mendeleev's bane, modern marvels*. science **363** (2019), 489–493.

The rare earths (REs) are a family of 17 elements that exhibit pronounced chemical similarities as a group, while individually expressing distinctive and varied electronic properties. These atomistic electronic properties are extraordinarily useful and motivate the application of REs in many technologies and devices. From their discovery to the present day, a major challenge faced by chemists has been the separation of RE elements, which has evolved from tedious crystallization to highly engineered solvent extraction schemes. The increasing incorporation and dependence of REs in technology have raised concerns about their sustainability and motivated recent studies for improved separations to achieve a circular RE economy.

Feldman 2019

Gerald Feldman, *Origin of neutron and proton changes in nuclei*. nature **566** (2019), 332–333.

The structure of a neutron or a proton is modified when the particle is bound in an atomic nucleus. Experimental data suggest an explanation for this phenomenon that could have broad implications for nuclear physics.

Gordin 2019

Michael D. Gordin, *Ordering the elements*. science **363** (2019), 471–473.

Elegant and intuitive, today's periodic table belies the hard-won discoveries hidden within.

Mendeleev knew nothing of atomic number, which was fully elaborated by Henry Moseley in 1913, 6 years after the Russian's death. Indeed, Mendeleev waxed hot and cold about the notion of atoms in general and was especially suspicious of electrons (discovered by Joseph John Thomson in 1897). The numbers in Mendeleev's classification are atomic weights, the only principle he ever recognized for organizing the elements.

He appended question marks to those weights he felt were still dubious. This is especially true for the two "inversions" inversions" of copper and nickel (both listed as 59) and tellurium and iodine, with the lighter iodine stuck behind the

heavier tellurium because of its chemical properties. (Mendeleev always believed there was some mistake in the tellurium weight. There isn't.)

Most striking, however, are the three elements that are just listed as atomic weights with a question mark: 45, 68, and 70. By 1871, Mendeleev would come to dub these eka-boron, eka-aluminum, and ekasilicon (the prefix being the Sanskrit word for "one") and offered detailed predictions of their chemical properties. Unexpectedly for all concerned, they were soon discovered as scandium (in 1879), gallium (in 1876), and germanium (in 1886).

Johnson 2019

Jennifer A. Johnson, *Populating the periodic table*, *Nucleosynthesis of the elements*. science **363** (2019), 474–478.

Elements heavier than helium are produced in the lives and deaths of stars. This Review discusses when and how the process of nucleosynthesis made elements. High-mass stars fuse elements much faster, fuse heavier nuclei, and die more catastrophically than low-mass stars. The explosions of high-mass stars as supernovae release elements into their surroundings. Supernovae can leave behind neutron stars, which may later merge to produce additional heavy elements. Dying low-mass stars throw off their enriched outer layers, leaving behind white dwarfs. These white dwarfs may also later merge and synthesize elements as well. Because these processes occur on different time scales and produce a different pattern of elements, the composition of the Universe changes over time as stars populate the periodic table.

Kean 2019

Sam Kean, *The Quest for Superheavies*. science **363** (2019), 466–470.

After stalling for nearly a decade, the hunt for new elements is set to resume this spring at a storied Russian lab.

The long dry spell—no new elements have been created since 2010—worries some researchers. "If you look backwards over several decades," says Pekka Pyykkö, a theoretical chemist at the University of Helsinki, "people have made roughly one new element maybe every 3 years—until now." Today's barrenness could be the new normal.

Pyykkö has pushed the idea of anomalous elements to its extreme, calculating theoretical properties for all elements through 172 and arranging them into a futuristic table. The result is jarring: At one point, the sequence of atomic numbers jumps backward from 164 to 139 and 140 before skipping ahead to 169 (see table, left). The bizarro table now hangs on his office wall. "When I give talks," he says, "I usually joke that this periodic table should be enough for the rest of this century."

Tinkering with existing elements might even allow scientists to reach the island of stability—a supposed region of longer-lived superheavy elements—and study those elements' properties. If nothing else, the technologies used to make new elements can help produce radioisotopes for medicine and test how well satellite components withstand bombardment by particles.

Politik

Zhu 2019

Bi Zhu, Chuansheng Chen, Xuhao Shao, Wenzhi Liu, Zhifang Ye, Liping Zhuang, Li Zheng, Elizabeth F. Loftus & Gui Xue, *Multiple interactive memory representations underlie the induction of false memory*. PNAS **116** (2019), 3466–3475.

pnas116-03466-Supplement.pdf

Theoretical and computational models such as transfer-appropriate processing (TAP) and global matching models have emphasized the encoding–retrieval interaction of memory representations in generating false memories, but relevant neural mechanisms are still poorly understood. By manipulating the sensory modalities (visual and auditory) at different processing stages (learning and test) in the Deese–Roediger–McDermott task, we found that the auditory-learning visual-test (AV) group produced more false memories (59 %) than the other three groups (42–44 %) [i.e., visual learning visual test (VV), auditory learning auditory test (AA), and visual learning auditory test (VA)]. Functional imaging results showed that the AV group's proneness to false memories was associated with (i) reduced representational match between the tested item and all studied items in the visual cortex, (ii) weakened prefrontal monitoring process due to the reliance on frontal memory signal for both targets and lures, and (iii) enhanced neural similarity for semantically related words in the temporal pole as a result of auditory learning. These results are consistent with the predictions based on the TAP and global matching models and highlight the complex interactions of representations during encoding and retrieval in distributed brain regions that contribute to false memories.

Keywords: false memory | study modality | fMRI | visual | auditory

Significance: False memories appear in our daily life due to the reconstructive nature of memory. They are affected by the contexts of both learning and testing. The combination of auditory learning and visual test (AV) resulted in more false memories compared with other three combinations of sensory modalities during learning and test (VV, VA, and AA). Using sophisticated neural representation analysis of fMRI data, we found that this effect was jointly related to three neural mechanisms: Compared with VV, AV showed weaker memory signals in the visual cortex, reduced prefrontal monitoring, and a greater reliance on semantic encoding during learning. These mechanisms highlight the complex interactions of memory representations during encoding and retrieval that give rise to the appearance of false memories.

Story or Book

Brandt 2019

Sara Brandt, *Liquid lessons*. science **363** (2019), 591.

From ink to oceans, a materials scientist explores the properties of fluids encountered on a transatlantic flight.

Liquid Rules. The Delightful and Dangerous Substances That Flow Through Our Lives. Mark Miodownik. Houghton Mifflin Harcourt, 2019. 256 pp.

Liquid Rules answered questions I never thought to ask. What makes something "sticky," for example? And why is saliva so stringy? Where does the "soap" in "soap opera" come from? I especially enjoyed Miodownik's careful consideration of everyday, often overlooked technologies and came away with a new appreciation for the liquidbased engineering involved in candle-making and the non-Newtonian fluid dynamics of a ballpoint pen.

There are also two distinct narrative voices: a personable, enthusiastic narrator whose anecdotes add charm to the discussion and a more authoritarian voice that occasionally stretches to make connections between disparate concepts. At times, the switch between these two was not as smooth as it could have been.

Hannibal 2019

Mary Ellen Hannibal, *Lessons from the Little Ice Age*. science **363** (2019), 460.

Citing 17th-century culture shifts, an author implicates climate in human destiny.

Nature's Mutiny. How the Little Ice Age of the Long Seventeenth Century Transformed the West and Shaped the Present. Philipp Blom. Liveright, 2019. 332 pp.

Blom suggests that the crisis in agriculture led to a vast reorganization of land use and land ownership, which changed social structures and power relationships. Farms and estates that once operated in a selfenclosed system began to produce more efficiently and to look to long-distance trade. To facilitate the new system of production and far-flung markets, regulatory bodies were established, and roads were built. European powers looking outward identified whole continents full of natural resources that they enthusiastically plundered, ushering in the age of colonialism.

Trade in cities such as Amsterdam, London, and Naples, Blum argues, facilitated social mobility and "a market-based pragmatic tolerance and a broadening of intellectual horizons that was frequently associated with immigrants and minorities." This, he asserts, "was the soil in which a largely secular, emphatically rational, and universalist philosophy could grow."

Schmid 2019

Sonja Schmid, *Chernobyl: ruin, redux*. nature **566** (2019), 450–451.

Sonja Schmid extols two studies probing anew the nuclear catastrophe's aftermath.

Manual for Survival: A Chernobyl Guide to the Future. Kate Brown. W. W. Norton (2019)

effects of the Chernobyl disaster. Today, the official number of fatalities quoted by United Nations agencies ranges from 31 to 54, with another 2,000–9,000 future cancer deaths predicted. Yet in 2005, environ mental charity Greenpeace indicated that 200,000 people had already died as a consequence of the disaster, and a further 93,000 fatal cancers were to be expected. A bewildered Brown uses this discrepancy, and our ignorance about it, as a starting point in Manual for Survival.

Ultimately, Manual for Survival is not a revisionist telling of the Chernobyl accident. Although it goes some way towards documenting a hidden post-Chernobyl publichealth crisis, Brown argues that Chernobyl really accelerated a global one. Since 1945, above-ground nuclear weapons tests have spread fallout from the equivalent of 29,000 Hiroshima-sized bombs over the planet.

Schmid 2019

Sonja Schmid, *Chernobyl: ruin, redux*. nature **566** (2019), 450–451.

Sonja Schmid extols two studies probing anew the nuclear catastrophe's aftermath.

Midnight in Chernobyl: The Untold Story of the World's Greatest Nuclear Disaster. Adam Higginbotham. Simon & Schuster (2019)

A focus on Chernobyl and its immediate aftermath, from the perspective of eyewitnesses, is offered in Midnight in Chernobyl. Higginbotham's tome is based on more than 80 interviews — from scientists to truck drivers, firefighters to doctors, widows to survivors, the majority done on site, with former Soviet citizens involved in the disaster. This is a highly detailed, carefully documented, beautifully narrated telling of this breathtakingly complex accident and its mitigation.

Higginbotham's book documents a very specific disaster, and by doing so suggests how challenging it will be to respond to a future event. We can perhaps

succeed at preparing for another Chernobyl, maybe for another Fukushima, but never for the next unprecedented, mindbogglingly complex, 'beyond design basis' accident. Do we, instead, need a manual for survival? And if so, what would one look like?