

## References

### Aktuell

BOVA 2021

Samantha Bova, Yair Rosenthal, Zhengyu Liu, Mi Yan, Anthony J. Broccoli, Shital P. Godad & Cheng Zeng, *Non-trivial role of internal climate feedback on interglacial temperature evolution, Replying to X. Zhang and F. Chen.* [nature 600 \(2021\), e4–e6.](#)

CALLAWAY 2021

Ewen Callaway, *Heavily mutated Omicron variant puts scientists on alert.* [nature 600 \(2021\), 21.](#)

Researchers are racing to determine whether a fast-spreading coronavirus variant poses a threat.

CAUCHEMEZ 2021

Simon Cauchemez & Paolo Bosetti, *A reconstruction of early cryptic COVID spread.* [nature 600 \(2021\), 40–41.](#)

To respond better to future pandemics, we must understand how the SARS-CoV-2 virus dispersed so rapidly. A model of COVID-19 spread sheds light on cryptic transmission, undetected by surveillance efforts, in early 2020.

DAVIS 2021

Jessica T. Davis et al., *Cryptic transmission of SARS-CoV-2 and the first COVID-19 wave.* [nature 600 \(2021\), 127–132.](#) DOI:10.1038/s41586-021-04130-w.

[n600-0127-Supplement.pdf](#)

Considerable uncertainty surrounds the timeline of introductions and onsets of local transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) globally<sup>1–7</sup>. Although a limited number of SARS-CoV-2 introductions were reported in January and February 2020 (refs.8,9), the narrowness of the initial testing criteria, combined with a slow growth in testing capacity and porous travel screening<sup>10</sup>, left many countries vulnerable to unmitigated, cryptic transmission. Here we use a global metapopulation epidemic model to provide a mechanistic understanding of the early dispersal of infections and the temporal windows of the introduction of SARS-CoV-2 and onset of local transmission in Europe and the USA. We find that community transmission of SARS-CoV-2 was likely to have been present in several areas of Europe and the USA by January 2020, and estimate that by early March, only 1 to 4 in 100 SARS-CoV-2 infections were detected by surveillance systems. The modelling results highlight international travel as the key driver of the introduction of SARS-CoV-2, with possible introductions and transmission events as early as December 2019 to January 2020. We find a heterogeneous geographic distribution of cumulative infection attack rates by 4 July 2020, ranging from 0.78 % to 15.2 % across US states and 0.19 % to 13.2 % in European countries. Our approach complements phylogenetic analyses and other

surveillance approaches and provides insights that can be used to design innovative, model-driven surveillance systems that guide enhanced testing and response strategies.

Jessica T. Davis, Matteo Chinazzi, Nicola Perra, Kunpeng Mu, Ana Pastore y Piontti, Marco Ajelli, Natalie E. Dean, Corrado Gioannini, Maria Litvinova, Stefano Merler, Luca Rossi, Kaiyuan Sun, Xinyue Xiong, Ira M. Longini Jr, M. Elizabeth Halloran, Cécile Viboud & Alessandro Vespignani

## GOEL 2021

Rishi R. Goel, Mark M. Painter, Sokratis A. Apostolidis & Divij Mathew et al., *mRNA vaccines induce durable immune memory to SARS-CoV-2 and variants of concern.* *science* **374** (2021), 1214.

[DOI:10.1126/science.abm0829](https://doi.org/10.1126/science.abm0829).

[s374-1214-Supplement.pdf](#)

The durability of immune memory after severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) messenger RNA (mRNA) vaccination remains unclear. In this study, we longitudinally profiled vaccine responses in SARS-CoV-2-naïve and -recovered individuals for 6 months after vaccination. Antibodies declined from peak levels but remained detectable in most subjects at 6 months. By contrast, mRNA vaccines generated functional memory B cells that increased from 3 to 6 months postvaccination, with the majority of these cells cross-binding the Alpha, Beta, and Delta variants. mRNA vaccination further induced antigen-specific CD4+ and CD8+ T cells, and early CD4+ T cell responses correlated with long-term humoral immunity. Recall responses to vaccination in individuals with preexisting immunity primarily increased antibody levels without substantially altering antibody decay rates. Together, these findings demonstrate robust cellular immune memory to SARS-CoV-2 and its variants for at least 6 months after mRNA vaccination.

Rishi R. Goel, Mark M. Painter, Sokratis A. Apostolidis, Divij Mathew, Wenzhao Meng, Aaron M. Rosenfeld, Kendall A. Lundgreen, Arnold Reynaldi, David S. Khoury, Ajinkya Pattekar, Sigrid Gouma, Leticia Kuri-Cervantes, Philip Hicks, Sarah Dysinger, Amanda Hicks, Harsh Sharma, Sarah Herring, Scott Korte, Amy E. Baxter, Derek A. Oldridge, Josephine R. Giles, Madison E. Weirick, Christopher M. McAllister, Moses Awofolaju, Nicole Tanenbaum, Elizabeth M. Drapeau, Jeanette Dougherty, Sherea Long, Kurt D'Andrea, Jacob T. Hamilton, Maura McLaughlin, Justine C. Williams, Sharon Adamski, Oliva Kuthuru, The UPenn C. O. V. Processing Uni, Ian Frank, Michael R. Betts, Laura A. Vella, Alba Grifoni, Daniela Weiskopf, Alessandro Sette, Scott E. Hensley, Miles P. Davenport, Paul Bates, Eline T. Luning Prak, Allison R. Greenplate & E. John Wherry

## KRAUSE 2021

Philip R. Krause et al., *Considerations in boosting COVID-19 vaccine immune responses.* *The Lancet* **398** (2021), 1377–1380.

[DOI:10.1016/S0140-6736\(21\)02046-8](https://doi.org/10.1016/S0140-6736(21)02046-8).

[Lancet398-1377-Supplement.pdf](#)

Current evidence does not, therefore, appear to show a need for boosting in the general population, in which efficacy against severe disease remains high.

The message that boosting might soon be needed, if not justified by robust data and analysis, could adversely affect confidence in vaccines and undermine messaging about the value of primary vaccination.

The vaccines that are currently available are safe, effective, and save lives. The limited supply of these vaccines will save the most lives if made available to people

who are at appreciable risk of serious disease and have not yet received any vaccine. Even if some gain can ultimately be obtained from boosting, it will not outweigh the benefits of providing initial protection to the unvaccinated. If vaccines are deployed where they would do the most good, they could hasten the end of the pandemic by inhibiting further evolution of variants.

Keywords: Philip R Krause, Thomas R Fleming, Richard Peto, Ira M Longini, | Peter Figueroa, Jonathan A C Sterne, Alejandro Cravioto, Helen Rees, Julian P T Higgins, Isabelle Boutron, Hongchao Pan, Marion F Gruber, Narendra Arora, Fatema Kazi, Rogerio Gaspar, Soumya Swaminathan, Michael | Ryan, Ana-Maria Henao-Restrepo

#### KUPFERSCHMIDT 2021

Kai Kupferschmidt, *Startling new variant raises urgent questions.* [science](#) **374** (2021), 1178–1180.

Omicron’s many mutations look troubling but understanding its danger will take time.

#### MAROM 2021

Assaf Marom & Yoel Rak, *Comment on “A Middle Pleistocene Homo from Nesher Ramla, Israel”.* [science](#) **374** (2021), eabl4336.

Hershkovitz et al. (Reports, 25 June 2021, p. 1424) conclude that the Nesher Ramla (NR) fossils represent a distinctive Homo paleodeme that played a role as a source population for Neanderthals. However, the highly diagnostic features of the Neanderthal mandible—clearly displayed by the NR fossils—are largely overlooked. Our analyses indicate that the NR fossils represent simply a Neanderthal.

#### MAY 2021

Hila May et al., *“A Middle Pleistocene Homo from Nesher Ramla, Israel”, Response to Comment.* [science](#) **374** (2021), eabl5789.

Marom and Rak claim, on the basis of a few mandibular features, that the Nesher Ramla (NR) Homo is a Neanderthal. Their comments lack substance and contribute little to the debate surrounding the evolution of Middle Pleistocene Homo. Limitations and preconceptions in their study prevented them from achieving resolution beyond a dichotomous interpretation of the NR as either a Neanderthal or a modern human.

Hila May, Rachel Sarig, Ariel Pokhojaev, Cinzia Fornai, María Martín-Torres, José María Bermúdez de Castro, Gerhard W. Weber, Yossi Zaidner & Israel Hershkovitz

#### WOROBAY 2021

Michael Worobey, *Dissecting the early COVID-19 cases in Wuhan.* [science](#) **374** (2021), 1202–1204. DOI:10.1126/science.abm4454.

Elucidating the origin of the pandemic requires understanding of the Wuhan outbreak.

#### ZHANG 2021

Xu Zhang & Fahu Chen, *Non-trivial role of internal climate feedback on interglacial temperature evolution, Arising from S. Bova et al.* [nature](#) **600** (2021), e1–e3.

## Amerika

### MAURICIO 2021

Ana Cecilia Mauricio et al., *The earliest adobe monumental architecture in the Americas*. [PNAS 118 \(2021\), e2102941118](#).

[pnas118-e2102941118-Supplement.pdf](#)

Adobe bricks, or mud bricks, are construction elements which have defined major architectural traditions in the Andes over thousands of years. From Moche pyramids and the ancient city of Chan Chan in pre-Hispanic times, to Spanish casonas of the colonial period and rural houses in contemporary South America, adobe has been a central component in Andean architecture. Discovery of the remains of an early monumental building constructed primarily of adobes at Los Morteros (lower Chao Valley, north coast of Peru) places the invention of adobe architecture before 5,100 calendar years B.P. The unique composition, internal structure, and chronology of the adobes from Los Morteros show the beginnings of this architectural technique, which is associated with El Nino rainfall and the construction of the earliest adobe monumental building in the Americas. We propose that adobe architecture became a major Andean tradition after a long period of technical evolution and experimentation with both shape and composition.

Keywords: geoarchaeology | El Nino | adobe | preceramic | early monumentality

Ana Cecilia Mauricio, Rolf Grieseler, Andrew R. Heller, Alice R. Kelley, Francisco Rumiche, Daniel H. Sandweiss & Willem Viveen

Significance: This study documents the previously unrecognized technological evolution of pre-Hispanic Andean adobe bricks, the central component of this region's millennia-long earthen architectural tradition. Multidisciplinary geoarchaeological research in northern Peru shows that the earliest known standing adobe brick architecture in the Andes dates before 5,100 calendar years B.P., using adobes cut from natural clay deposits created by El Nino flooding. Other than the deliberate shaping of the material, they were unmodified but were used like later adobe bricks. Later pre-Hispanic adobe bricks were made more durable by mixing clay with temper and water. The beginning of adobe architecture in the Andes is associated with the construction of early monumental structures for communal ceremonies and the rise of social complexity.

### WATERS 2021

Matthew Neal Waters, Mark Brenner, Jason Hilleary Curtis, Claudia Suseth Romero-Oliva, Margaret Dix & Manuel Cano, *Harmful algal blooms and cyanotoxins in Lake Amatitlán, Guatemala, coincided with ancient Maya occupation in the watershed*. [PNAS 118 \(2021\), e2109919118](#).

[pnas118-e2109919118-Supplement.pdf](#)

Human-induced deforestation and soil erosion were environmental stressors for the ancient Maya of Mesoamerica. Furthermore, intense, periodic droughts during the Terminal Classic Period, ca. Common Era 830 to 950, have been documented from lake sediment cores and speleothems. Today, lakes worldwide that are surrounded by dense human settlement and intense riparian land use often develop algae/cyanobacteria blooms that can compromise water quality by depleting oxygen and producing toxins. Such environmental impacts have rarely been explored in the context of ancient Maya settlement. We measured nutrients, biomarkers for cyanobacteria, and the cyanotoxin microcystin in a sediment core from Lake Amatitlan, highland Guatemala, which spans the last  $\approx 2,100$  y. The lake is currently hypereutrophic and characterized by high cyanotoxin concentrations from persistent blooms of the cyanobacterium *Microcystis aeruginosa*. Our paleolimnological

data show that harmful cyanobacteria blooms and cyanotoxin production occurred during periods of ancient Maya occupation. Highest prehistoric concentrations of cyanotoxins in the sediment coincided with alterations of the water system in the Maya city of Kaminaljuyu, and changes in nutrient stoichiometry and maximum cyanobacteria abundance were coeval with times of greatest ancient human populations in the watershed. These prehistoric episodes of cyanobacteria proliferation and cyanotoxin production rivaled modern conditions in the lake, with respect to both bloom magnitude and toxicity. This suggests that pre-Columbian Maya occupation of the Lake Amatitlan watershed negatively impacted water potability. Prehistoric cultural eutrophication indicates that human-driven nutrient enrichment of water bodies is not an exclusively modern phenomenon and may well have been a stressor for the ancient Maya.

**Keywords:** harmful algal blooms | cyanotoxins | Maya | water quality | ancient

**Significance:** Harmful algal blooms (HABs) are dense populations of algae and/or cyanobacteria that can harm aquatic ecosystems by reducing water column oxygen and producing toxins. Whereas HABs are well documented in modern lakes, there has been little research on HABs associated with ancient societies. We inferred the magnitude of past HABs using a sediment core from Lake Amatitlan, Guatemala, which hosted large, prehistoric Maya populations in its watershed and currently experiences toxic HABs. About 1,000 y ago, ancient Maya in the area experienced periods of intense HABs and cyanotoxin concentrations in the lake, which rivaled the degraded conditions in the water body today. Human-associated HABs have affected both modern and ancient societies and deserve attention when exploring past human–environment interactions.

## Anthropologie

### MASTER 2021

Allison Master, Andrew N. Meltzoff & Sapna Cheryan, *Gender stereotypes about interests start early and cause gender disparities in computer science and engineering*. [PNAS 118 \(2021\), e2100030118](#).  
[pnas118-e2100030118-Supplement.pdf](#)

Societal stereotypes depict girls as less interested than boys in computer science and engineering. We demonstrate the existence of these stereotypes among children and adolescents from first to 12th grade and their potential negative consequences for girls' subsequent participation in these fields. Studies 1 and 2 (n = 2,277; one preregistered) reveal that children as young as age six (first grade) and adolescents across multiple racial/ethnic and gender intersections (Black, Latinx, Asian, and White girls and boys) endorse stereotypes that girls are less interested than boys in computer science and engineering. The more that individual girls endorse gender-interest stereotypes favoring boys in computer science and engineering, the lower their own interest and sense of belonging in these fields. These gender-interest stereotypes are endorsed even more strongly than gender stereotypes about computer science and engineering abilities. Studies 3 and 4 (n = 172; both preregistered) experimentally demonstrate that 8- to 9-y-old girls are significantly less interested in an activity marked with a gender stereotype ("girls are less interested in this activity than boys") compared to an activity with no such stereotype ("girls and boys are equally interested in this activity"). Taken together, both ecologically valid real-world studies (Studies 1 and 2) and controlled preregistered laboratory experiments (Studies 3 and 4) reveal that stereotypes that girls are less interested than boys in computer science and engineering emerge early and may contribute to gender disparities.

Keywords: STEM | inequities | gender | stereotypes | motivation

Significance: Societal stereotypes that girls are less interested than boys in computer science and engineering are endorsed by children and adolescents in a large and socioeconomically diverse sample, across multiple racial/ethnic and gender intersections, and as early as age six (first grade). Genderinterest stereotypes may contribute to subsequent gender disparities in the pursuit of these societally important fields. Addressing interest stereotypes may help improve educational equity.

## Biologie

BRÜLHART 2021

Marius Brühlhart, Valentin Klotzbücher, Rafael Lalive & Stephanie K. Reich, *Mental health concerns during the COVID-19 pandemic as revealed by helpline calls*. *nature* **600** (2021), 121–126.

n600-0121-Supplement.pdf

Mental health is an important component of public health, especially in times of crisis. However, monitoring public mental health is difficult because data are often patchy and low-frequency<sup>1–3</sup>. Here we complement established approaches by using data from helplines, which offer a real-time measure of ‘revealed’ distress and mental health concerns across a range of topics<sup>4–9</sup>. We collected data on 8 million calls from 19 countries, focusing on the COVID-19 crisis. Call volumes peaked six weeks after the initial outbreak, at 35 % above pre-pandemic levels. The increase was driven mainly by fear (including fear of infection), loneliness and, later in the pandemic, concerns about physical health. Relationship issues, economic problems, violence and suicidal ideation, however, were less prevalent than before the pandemic. This pattern was apparent both during the first wave and during subsequent COVID-19 waves. Issues linked directly to the pandemic therefore seem to have replaced rather than exacerbated underlying anxieties. Conditional on infection rates, suicide-related calls increased when containment policies became more stringent and decreased when income support was extended. This implies that financial relief can allay the distress triggered by lockdown measures and illustrates the insights that can be gleaned from the statistical analysis of helpline data.

HALL 1894

N. Hall, *Vaccination*. *science* **23** (1894), 72.

There is, indeed, a certain element of danger in vaccination, as in every other thing of established value, but it is strange that in the face of such evidence as may be obtained from scores of reports of boards of health, medical departments of armies, etc., etc., there are still found those who deny the value of the most beneficent discovery ever made by man.

## Energie

MCFADDEN 2021

Christopher McFadden, *Can Transient Plasma Ignition Save the Internal Combustion Engine? Transient plasma ignition can boost ICE efficiency by up to 50 percent*. Online **2021**, Dec. 2. <<http://interestingengineering.com/can-transient-plasma-ignition-save-the-internal-combustion-engine>> (2021-12-04).

In these kinds of plasmas, the electrons and ions are not in thermal equilibrium. This is by design so that the energetic or “hot” electrons can accomplish something useful, such as breaking a chemical bond, while the energy imparted to the “cool” ions and neutral species is minimized.

The spatial distribution of plasma in systems like the Transient Plasma Ignition System enables a single streamer discharge to impact a large volume. “The TPS Transient Plasma Ignition System uses a nanosecond electrical pulse to generate plasma, to create instantaneous high power at a much faster rate than a traditional spark. This high-power but low energy pulse creates low-temperature plasma that will not light a match, yet ignites dilute air-fuel mixtures efficiently and immediately,” explained Dan Singleton to Interesting Engineering.

## Mittelalter

WILSTER-HANSEN 2021

B. Wilster-Hansen, D. Mannes, K. L. Holmqvist, K. Ødeby & H. Kutzke, *Virtual unwrapping of the Bispegata amulet, a multiple folded medieval lead amulet, by using neutron tomography*. *Archaeometry* (2021), preprint, 1–24. DOI:10.1111/arcm.12734.

In recent decades, computed tomography (CT) combined with suitable image processing software has become a valuable tool to enable the reading of texts written on scrolls, which are fragile, damaged or fused together, without physically unwrapping them. X-ray based computer tomography has successfully been used on scrolls made of soft materials such as papyrus and parchment. Although in few cases inscriptions on thin metal plates that have been rolled up and worn as amulets, have been deciphered by using a high energy X-ray source, the readability of writings on of metal scrolls is limited by the high attenuation factor of this type of material.

In this paper, we present for the first time the use of neutron tomography as an alternative to X-ray tomography for studying hidden inscriptions on folded metal objects. It is shown that the method overcomes the limitations of X-ray tomography caused by high attenuation of X-rays in lead objects.

The inscription on the medieval Bispegata amulet, unearthed during excavations in Oslo’s Old Town, has been read by using neutron tomography combined with VG Studio software. The amulet was made up of a thin lead sheet with an inscribed text, folded together into a rectangle. The inscription was runic, containing words of religious and magic meaning.