

RESEARCH

IN SCIENCE JOURNALS

Edited by Michael Funk

CARBON CYCLING

Plants can take the heat

Plant respiration contributes several times the amount of carbon emissions to the atmosphere as anthropogenic sources. Respiration also increases with temperature, leading to a positive feedback loop. However, plants can acclimatize to warmer temperatures and reduce their respiration rate. Using a model based on ecological-evolutionary optimality principles, Zhang *et al.* predicted the rate of respiration acclimation to warming driven by decreasing water viscosity within the plant. They then tested these predictions using a dataset of stem respiration measurements from 186 woody plant species collected in the field and laboratory. Incorporating thermal acclimation into emissions projections reduced the predicted terrestrial carbon emissions estimate by nearly one third. —Bianca Lopez

Science p. 984, 10.1126/science.adr9978

Respiration in woody tissues, such as the trunk of this maritime pine (*Pinus pinaster*), acclimates to higher temperatures, potentially reducing one climate change feedback mechanism.



SOLAR CELLS

Surviving summer days and nights

Vapor deposition of a polydentate ligand stabilizes perovskite surfaces by blocking iodide migration into the charge transport layer and reducing surface defects. Sun *et al.* treated preformed

formamidinium lead iodide films with a terpyridine molecule to cap defective octahedra on the surface, which helped to reduce ion migration driven by light-dark cycles. Large-area perovskite solar modules (areas of ~0.8 square meters) had a power conversion efficiency of ~19% and

maintained this power output after 45 days of summer outdoor operation. —Phil Szuromi

Science p. 957, 10.1126/science.adv4280

CANCER

Targeting tumors

Chimeric antigen receptor (CAR) T cells have not proven as successful for

solid tumors as they have for blood cancers, in part due to a lack of true tumor-specific targets. Some targets may be enriched on tumor cells, but their expression on healthy tissue raises the concern of on-target off-tumor toxicity. Greco *et al.* applied a rational workflow considering both target expression and

localization on healthy and tumor cells for antigen identification. They found that the expression of Cadherin 17 is enriched in colorectal cancer tumors (CRCs) compared with healthy tissue, including CRC liver metastases. Moreover, although Cadherin 17 is homogeneously expressed on the surface of CRC cells, as determined in patient samples, its expression is restricted to cell-to-cell junctions in healthy colon tissue, a site inaccessible to CAR T cells. These data, coupled with preclinical studies screening a panel of CARs in models of efficacy and toxicity, support the further clinical development of Cadherin 17 CAR T cells. —Courtney Malo

Sci. Transl. Med. (2025)
10.1126/scitranslmed.adr1928

PALEOPROTEOMICS

Telling ancient hominin tales

It is now well known that the early hominin fauna was species rich, with many overlapping lineages existing in the African Pleistocene. However, our knowledge of diversity within many of these lineages has been limited because current ancient DNA technologies have not been able to reveal genetic sequences older than around 0.2 million years. Madupe *et al.* examined protein sequences from approximately 2-million-year-old *Paranthropus robustus* teeth that were particularly well preserved. Using proteomics approaches, the authors were able to assign the individual teeth to sex and to identify patterns of diversity suggesting the existence of multiple populations. —Sacha Vignieri

Science p. 969, 10.1126/science.adt9539

PALEONTOLOGY

Cretaceous birds in the Arctic

In the modern world, birds represent key components of polar ecosystems. This is true even in the face of the extreme seasonal changes that occur in these regions. Although the Cretaceous world was considerably warmer than ours, the polar regions still experienced months of near total darkness, suggesting that this was a challenging environment to colonize even when it didn't experience extreme cold. Wilson *et al.* report on a fossil assemblage of birds from the late Cretaceous Arctic. This assemblage includes both chicks and adults of multiple species, suggesting that birds began breeding in Arctic regions early on in their evolution. —Sacha Vignieri

Science p. 974, 10.1126/science.adt5189

NANOMATERIALS

Robust high-entropy oxides

High temperature and corrosion stability, as well as high wear resistance and stiffness, have now been shown for oxides containing five transition metals. Shahbazi *et al.* prevented phase segregation of the metals by oxidizing metal sulfide precursors. The resulting metal oxide nanoribbons were stable in strong acids and bases, at temperatures up to 1000°C, and at pressures up to 12 gigapascals. Above 30 gigapascals, they underwent a reversible amorphization transition. —Phil Szuromi

Science p. 950, 10.1126/science.adr5604

ATOMIC PHYSICS

Testing quantum electrodynamics

Lithium-like ions, those having three electrons orbiting the nucleus, can be used to test

the predictions of quantum electrodynamics (QED). Such tests are more stringent than those possible with hydrogen-like ions because of interelectron interactions present in lithium-like systems. A discrepancy that had existed between theory and experiment for the g-factor of lithium-like silicon and calcium was recently resolved, but testing this resolution using a heavier lithium-like ion has remained challenging. Morgner *et al.* performed a high-precision g-factor measurement of the much heavier lithium-like tin ion and compared it with their QED calculations. The agreement they found provides confidence in theoretical calculations in a previously unexplored regime. —Jelena Stajic

Science p. 945, 10.1126/science.adn5981

CHEMISTRY

Smaller, better, faster

Machine learning relies on accurate, well-annotated, and well-distributed training data to generate accurate predictions. High-throughput methods offer a means of generating very large training datasets. Götz *et al.* developed an on-demand miniaturized and automated synthesis platform based on a three-component reaction that produces drug-like molecules. Equipped with a dataset based on 50,000 distinct microscale reactions, the authors used machine learning to develop accurate predictions for reactions with unseen reactants. This dataset is large enough to critically evaluate emerging machine learning approaches to chemical reactivity. —Dennis Hall

Sci. Adv. (2025)
10.1126/sciadv.adw6047

IN OTHER JOURNALS

Edited by **Corinne Simonti**
and **Jesse Smith**

ANIMAL BEHAVIOR

Fighting or flirting?

In animal societies, groups often fight over resources, and success depends on members contributing to collective efforts. However, individual fitness incentives can undermine group performance. Green *et al.* studied banded mongooses to understand how intergroup conflict outcomes relate to reproductive success. They found that groups with females in heat were more likely to win fights, but surprisingly, winning groups often lost paternity to rival males, suggesting that rivals prioritized mating over fighting. Younger males benefited disproportionately from outgroup matings. These findings reveal a conflict between individual and group interests, challenging assumptions that collective success always aligns with fitness gains and highlighting how personal incentives can shape group dynamics in animal societies. —Di Jiang

Anim. Behav. (2025)
10.1016/j.anbehav.2025.123194

IMMUNOLOGY

Give-and-take during lung infection

Cross-talk between immune cells helps balance control of infection with tissue damage in the lung. Cembellin-Prieto *et al.* found that acetylcholine, which is synthesized by choline acetyltransferase and secreted by B cells, signaled to macrophages to decrease their production of the proinflammatory cytokine tumor necrosis factor. When choline acetyltransferase was deleted in B cells, mice had lower levels of influenza virus the day after infection

Edited by **Michael Funk****ECOLOGY****Shifting seasonality**

Climate change is having widely recognized effects on ecosystems by increasing temperatures, changing precipitation patterns, and causing more frequent extreme events. Less well understood are the effects of changes to seasonal patterns, which include shifts in the timing, size, and consistency of fluctuations. In a Review, Hernández-Carrasco *et al.* synthesized ways that seasonal shifts can span biological levels from individuals to populations and whole ecosystems. The authors highlight the roles that demographic responses to the environment, species specialization to seasonal trends, and evolutionary constraints play in ecological responses to changing seasonality. —Bianca Lopez
Science p. 928, 10.1126/science.ads4880

CANCER**A Rho family swap gets cells moving**

The transcriptional coactivator YAP promotes development and wound healing and is implicated in various diseases. Shah *et al.* found that YAP promotes cell motility by inducing a switch in the activity of Rho family GTPases, setting off a sequence of signaling events. This mechanism drives the infiltration of patient-derived glioblastoma cells across the mouse brain, and markers of this mechanism were found to be correlated with poor prognosis in glioblastoma patients. These findings provide insight into the role of YAP in regulating cell behavior in health and disease. —Leslie K. Ferrarelli
Sci. Signal. (2025)
10.1126/scisignal.ad07737

DOMESTICATION**Tracing the origins of a red confection**

Adzuki beans are an important East Asian legume given the frequent use of red bean paste in many confections. However, the history and domestication of this plant has been fraught with contradicting evidence. Chien *et al.* analyzed genomic data from 693 wild and cultivated adzuki bean accessions. Cultivated accessions showed high similarity in their chloroplast genomes to Japanese wild accessions, although Chinese varieties displayed higher levels of nuclear genome diversity, which is often indicative of a source population. These results were reconciled in that domestication of adzuki beans likely occurred in Japan, with introgression from wild Chinese varieties being responsible for the complex genomic patterns. —Corinne Simonti
Science p. 932, 10.1126/science.ads2871

NEUROSCIENCE**Emotion processing in mice and humans**

Many animal species have been shown to display distinct emotional states. However, little is known about the neuronal mechanisms underlying the emergence of emotional responses to discrete events. Kauvar *et al.* performed parallel behavioral, pharmacological, and electrophysiological experiments in mice and humans and identified evolutionarily conserved brain signals forming a basis of sensory and emotional processing of salient aversive stimuli (see the Perspective by Karamihalev and Gogolla). After stimulus-specific (sensory) information is rapidly disseminated throughout the mammalian brain, a slower and more persistent

(emotional) activation of brainwide networks occurs. These translational results enhance our understanding of the neural substrates of affective states across species. —Mattia Maroso
Science p. 933, 10.1126/science.adt3971;
see also p. 917, 10.1126/science.adx8992

SIGNAL TRANSDUCTION**Visualizing oncogenic BRAF mutants**

The protein kinase BRAF functions in mitogenic signaling from the RAS small guanosine triphosphatase to activate mitogen-activated protein kinases. Activated mutants of BRAF are oncogenic. Lavoie *et al.* solved structures of such mutants using cryo-electron microscopy, which helps to clarify how conformational changes relieve an autoinhibitory domain interaction within the enzyme. A BRAF inhibitor was found to restore the interaction of the autoinhibitory domain with the kinase domain. These results help to explain the regulation of normal and oncogenic BRAF and may assist in the development of more effective inhibitors for cancer therapy. —L. Bryan Ray
Science p. 934, 10.1126/science.adp2742

ANCIENT DNA**Genomes from ancient Tibet and Yunnan**

Waves of human migration have resulted in population admixture and turnover across the world, resulting in complex histories that are difficult to untangle without ancient DNA. Wang *et al.* sequenced 127 ancient humans from southwestern China living

7100 years ago to the present day. In addition to determining finer population dynamics such as contributions of Central Yunnan ancestry to modern Austroasiatic speakers, the authors uncovered a potential representative of a deeply divergent lineage similar to a long-specified “ghost” population that contributed to Tibetans. This study gives greater insight into the populations that have lived in this area. —Corinne Simonti
Science p. 935, 10.1126/science.adq9792

DIAPAUSE**Clock genes also affect moth diapause**

Akin to hibernation in other species, diapause allows insects to remain dormant through harsh seasons. Zheng *et al.* examined the genetic basis of this trait in silk moths (*Bombyx mori*), the strains of which vary in their diapause timing and expression. Several genomic loci associated with this variation, including a peak encompassing the gene *Cycle*. This transcription factor is well known for its importance in circadian rhythms across species. Strains lacking the diapause phenotype altogether were homozygous for a frameshift mutation that completely disrupted a single isoform of *Cycle*. Given the conservation of *Cycle* across Lepidoptera (moths and butterflies), this gene may control diapause more broadly. —Corinne Simonti
Science p. 936, 10.1126/science.ad02129

PLAGUE**Ring a ring o’ roses**

Plague has devastated human and rodent populations alike many times throughout history. Sidhu *et al.* tracked the genetics of virulence in the plague pathogen *Yersinia pestis* in ancient and modern samples.

They observed that the bacterial virulence factor *pla*, a gene encoding a protease, periodically becomes depleted late in epidemics. The authors verified that *pla* depletion reduces virulence in mouse models of bubonic plague. Therefore, in response to high disease mortality, selection could act to attenuate virulence. This would allow the pathogen to persist in tolerant reservoir hosts when susceptible host populations fragment and pathogen transmission becomes uncertain. —Caroline Ash

Science p. 937, 10.1126/science.adt3880

SUPERCONDUCTIVITY

Probing the pairing symmetry

The material uranium ditelluride harbors a superconducting phase that has shown interesting properties that are potentially consistent with a spin-triplet character. Such superconductors are more resilient to the presence of magnetic fields and may even have topologically nontrivial excitations. However, one of the most important properties of this phase, the symmetry of its superconducting order parameter, remains unknown. Gu *et al.* used a scanning tunneling microscope with a superconducting tip to probe this symmetry (see the Perspective by Nevidomskyy). By comparing their findings with theoretical predictions, the authors concluded that uranium ditelluride is a nonchiral superconductor, narrowing down the possible pairing symmetries. —Jelena Stajic

Science p. 938, 10.1126/science.adk7219; see also p. 916, 10.1126/science.ady3202

GLACIERS

Less is more

As climate warms, glaciers melt, causing sea level rise, exacerbating natural hazards, and affecting water supplies,

biodiversity, and ecosystems. Zekollari *et al.* estimated how much glacial loss will occur with different amounts of warming and found that nearly twice as much glacial mass loss will occur if climate warms by 2.7°C compared with that which would accompany a warming of only 1.5°C above the preindustrial average global mean value (see the Perspective by Howe and Boyer). Without stringent mitigation policies, glaciers around the globe will be under serious threat. —Jesse Smith

Science p. 979, 10.1126/science.adu4675; see also p. 914, 10.1126/science.ady1688

SOLAR CELLS

A salty fullerene anchor

A thin layer of an ionic salt of fullerene addresses the mechanical instability associated with fullerene electron transporters in inverted perovskite solar cells. You *et al.* found that the ionic nature of this electron shuttle enhanced molecular packing and led to a roughly threefold increase in interfacial toughness. For minimodules based on 6-centimeter-square subcells, power conversion efficiencies of ~23% were achieved with less than 9% loss after 2200 hours of operation at 55°C.

—Phil Szuromi

Science p. 964, 10.1126/science.adv4701

INFECTIOUS DISEASE

T cell immune defect and tuberculosis

Inborn errors of immunity to *Mycobacterium tuberculosis* infection can underlie tuberculosis. Ogishi *et al.* identified a rare autosomal-recessive complete deficiency in the lymphocytic surface receptor LY9 in three unrelated individuals with tuberculosis. This LY9 deficiency was linked to impaired interferon- γ production by a specific class of memory T helper cells. LY9

expression was critical to polarizing naïve T helper cells toward memory T helper 1* cells and providing costimulation to these cells to promote interferon- γ production.

—Christiana N. Fogg

Sci. Immunol. (2025)
10.1126/sciimmunol.ads7377