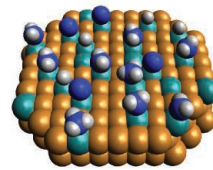


RESEARCH

Light-dependent activation in photocatalysis

Zhou et al., p. 69



IN SCIENCE JOURNALS

Edited by Stella Hurtley



Boulder-filled channel near the eastern margin of the Tibetan Plateau, a setting similar to the Bhotekoshi River

GEOMORPHOLOGY

A sudden outburst of erosion

Glacial lake outburst floods (GLOFs) are exactly what they sound like. The sudden emptying of a glacial lake in high-topography regions like the Himalaya can quickly destroy everything in its path. Cook *et al.* intercepted a GLOF in the Bhotekoshi and Sunkoshi river valleys in central Nepal as they were monitoring the region in the aftermath of the 2015 Gorkha earthquake. They found that a massive amount of erosion occurred during the outburst flood, which suggests that GLOFs may be the primary factor in landscape evolution for these regions. —BG

Science, this issue p. 53

SUPERCONDUCTIVITY

Conspiring interactions in a cuprate

More than 30 years after the discovery of high-temperature superconductivity in copper oxides, its mechanism remains a mystery. Electron pairing mediated solely by lattice vibrations—phonons—is thought to

be insufficient to account for the high transition temperatures. He *et al.* found a rapid and correlated increase of the superconducting gap and electron-phonon interactions as the chemical composition of their bismuth-based cuprate samples was varied across a critical doping concentration. The interplay of electron-phonon with electron-electron interactions

may lead to enhanced transition temperatures. —JS

Science, this issue p. 62

ADAPTIVE RADIATIONS

Secrets revealed by kangaroo teeth

The teeth of mammals display complex adaptations to diet

and can thus provide a window into the environments of extinct species. Couzens and Prideaux used such a window to examine the expansion and diversification of kangaroos, Australia's largest herbivores (see the Perspective by Polly). True kangaroos diversified not in response to drying in the Miocene, as suggested by molecular results, but rather as grasslands expanded during the Pliocene. Furthermore, the now-extinct short-faced kangaroos were not declining because of increases in aridity at the end of the Pleistocene but instead were experiencing an increase in dietary divergence. —SNV

Science, this issue p. 72;
see also p. 25

INFLUENZA

Seasonal flu by ZIP code

Influenza virus strikes communities in northern latitudes during winter, straining health care provision almost to the breaking point. Change in environmental humidity is a key driver, but many other seasonal and social factors contribute. Dalziel *et al.* obtained a geographical distribution of doctor visits for influenza-like illness for more than 600 U.S. cities (see the Perspective by Wallinga). Some ZIP codes regularly experienced sharply defined peaks of cases, or intense epidemics, and others showed a longer, more diffuse influenza season. The surges tended to occur in smaller cities with less residential density and lower household incomes. Larger, more densely populated cities had more-diffuse epidemics, presumably because of higher rates of personal

contact, which makes influenza transmission less subject to climate variation. —CA

Science, this issue p. 75;
see also p. 29

ECONOMICS

Educating for economic rationality

The hypothesis that education enhances economic decision-making has been surprisingly underexplored. Kim *et al.* studied this question using a randomized control trial in a sample of 2812 girls in secondary schools in Malawi. Four years after providing financial support for a year's schooling, they presented the subjects with a set of decision problems (for example, allocating funds to immediate versus future expenses) that test economic rationality. The education intervention enhanced both educational outcomes and economic rationality as measured by consistency with utility maximization in the long run. —AMS

Science, this issue p. 83

MUSCLE DISEASE

Gene editing and muscular dystrophy

Duchenne muscular dystrophy (DMD) is characterized by progressive muscle weakness and a shortened life span. The disease is caused by mutations that reduce or prevent expression of dystrophin, an essential structural protein in skeletal and heart muscle. The gene editing technology CRISPR-Cas9 can correct disease-causing mutations and has yielded promising results in mouse models of DMD. In a small, short-term study, Amoasii *et al.* tested this strategy in a dog model of DMD that exhibits many features of the human disease. Intramuscular or systemic delivery of the gene editing components resulted in a substantial increase in dystrophin protein levels in skeletal and heart muscle. Restoration

of dystrophin expression was accompanied by improved muscle histology. —PAK

Science, this issue p. 86

ASTRONOMY

New moon rising

Although the existence of exomoons—moons orbiting extrasolar planets—is probable, direct observational evidence has been elusive. Previous observations made using NASA's Kepler space telescope suggested that Kepler-1625b, a Jupiter-sized planet orbiting the solar-mass yellow star Kepler-1625, may be orbited by an exomoon. Now, Teachey and Kipping report additional observations made using the Hubble Space Telescope, as well as a refined analysis of Kepler photometry data, that strongly support the exomoon hypothesis. This moon, if it exists, would be similar in size to Neptune or Uranus in our own Solar System. —KVH

Sci. Adv. 10.1126/
sciadv.aav1784 (2018).

HIV

Gut check for a promising HIV treatment

Eradicating HIV in infected patients likely requires disrupting the reservoir of infected T cells in the gastrointestinal tract. One approach may be targeting cells expressing the integrin $\alpha 4\beta 7$, which has been tested in simian immunodeficiency virus models and is an approved therapy for inflammatory bowel disease. Uzzan *et al.* studied a small cohort of HIV-infected individuals on antiretroviral therapy who began receiving an antibody against $\alpha 4\beta 7$ as a treatment for their mild inflammatory bowel disease. Longitudinal colonoscopies revealed that the anti- $\alpha 4\beta 7$ therapy disrupted local lymphoid aggregates. The treatment was well tolerated, but long-term effects on the HIV reservoir remain to be determined. —LP

Sci. Transl. Med. 10, eaau4711 (2018).

IN OTHER JOURNALS

Edited by **Caroline Ash**
and **Jesse Smith**



Osteoporosis reduces bone density because of imbalances in signaling feedbacks.

GENOMICS

Evolving risks to personality

The origin of the uniquely large and complex human brain has been shrouded in mystery. To identify genetic changes that may underlie human evolution, Sato and Kawata examined human-specific genetic changes associated with neuropsychiatric disease and identified selection for variants in three genes. Interestingly, one variant of the *SLC18A1* gene, which encodes a neurotransmitter, arose at the time humans migrated out of Africa. It appears to be under balancing selection in some populations, which has resulted in two variants in most non-African populations. This variant is linked with anxiety, but it is not yet understood what conditions favor its selection. —LMZ

Evol. Lett. 2, 499 (2018).

SOCIOLOGY

Joke theft and comedians' authenticity

Joke theft among comedians is difficult to discern because jokes are rarely identical and may be discovered independently of each other. To determine how people adjudicate instances of joke theft, Reilly conducted 4 years of participant observation and interviews among stand-up comics in Los Angeles to examine norms surrounding joke theft. He found that accusations of joke theft are driven less by joke similarity and more by a comedian's reputation, authenticity, and past success. Comedians perceived as being more successful than they deserve to be are more vulnerable to accusations of joke theft. These data have implications for understanding how intellectual property disputes are handled in other creative and scientific domains, as well as how character and action information are

PHOTO: ALAN BOYDE/VISUALS UNLIMITED, INC.

ALSO IN SCIENCE JOURNALS

Edited by Stella Hurtley

GAS GIANT PLANETS

Cassini's final phase of exploration

The Cassini spacecraft spent 13 years orbiting Saturn; as it ran low on fuel, the trajectory was changed to sample regions it had not yet visited. A series of orbits close to the rings was followed by a Grand Finale orbit, which took the spacecraft through the gap between Saturn and its rings before the spacecraft was destroyed when it entered the planet's upper atmosphere. Six papers in this issue report results from these final phases of the Cassini mission. Dougherty *et al.* measured the magnetic field close to Saturn, which implies a complex multilayer dynamo process inside the planet. Roussos *et al.* detected an additional radiation belt trapped within the rings, sustained by the radioactive decay of free neutrons. Lamy *et al.* present plasma measurements taken as Cassini flew through regions emitting kilometric radiation, connected to the planet's aurorae. Hsu *et al.* determined the composition of large, solid dust particles falling from the rings into the planet, whereas Mitchell *et al.* investigated the smaller dust nanograins and show how they interact with the planet's upper atmosphere. Finally, Waite *et al.* identified molecules in the infalling material and directly measured the composition of Saturn's atmosphere. —KTS

Science, this issue p. 46, p. 47, p. 48, p. 49, p. 50, p. 51

STRUCTURAL BIOLOGY

It takes two to signal

The Hedgehog (HH) signaling pathway is important in development, and excessive HH signaling is associated with cancer. Signaling occurs through the G protein-coupled receptor Smoothened. The pathway is repressed by the membrane receptor Patched-1 (PTCH1),

and this inhibition is relieved when PTCH1 binds the secreted protein HH. Two recent papers have described structures of HH bound to PTCH1, but surprisingly, each described a different binding epitope on HH. Qi *et al.* present a cryo-electron microscopy structure that explains this apparent contradiction by showing that a single HH protein uses both of these interfaces to engage two PTCH1 receptors (see the Perspective by Sommer and Lemmon). Functional assays suggest that both interfaces must be bound for efficient signaling. —VV

Science, this issue p. 52; see also p. 26

GEOPHYSICS

Detailing subduction zones

Subduction zones are responsible for the most-damaging and tsunami-generating great earthquakes. Hayes *et al.* updated their Slab1.0 model to include all seismically active subduction zones, including geometrically complex regions like the Philippines. The new model, Slab2, details the geometry of 24 million square kilometers of subducted slabs, from ocean trench to upper mantle. The model will be vital for fully understanding seismic hazard in some of the most populated regions in the world. —BG

Science, this issue p. 58

SOLID-STATE PHYSICS
Insulator or a metal?

When a metal is cooled to low temperatures and placed in an external magnetic field, its resistivity may oscillate as the magnitude of the field is varied. Seeing these so-called quantum oscillations in an insulating material would be very unusual. Xiang *et al.* report such findings in the insulator ytterbium dodecaboride (YbB₁₂) (see the Perspective by Ong). In addition

to oscillations in resistivity, the authors observed oscillations in the magnetic torque. The results present a challenge to theories that aim to explain the insulating state of YbB₁₂. —JS

Science, this issue p. 65; see also p. 32

PLASMONIC CHEMISTRY

Hot carriers reducing thermal barriers

Plasmonic catalysts can generate hot charge carriers that can activate reactants and, in turn, reduce the overall barrier to a reaction. Zhou *et al.* studied the decomposition of ammonia to hydrogen on a copper alloy nanostructure that absorbed light and generated electrons that activated nitrogen atoms on ruthenium surface atoms (see the Perspective by Cortés). By measuring reaction rates at different wavelengths, light intensities, and catalyst surface temperatures, the light-induced reduction of the apparent activation barrier was quantified. —PDS

Science, this issue p. 69; see also p. 28

FOREST ECOLOGY

Tree diversity improves forest productivity

Experimental studies in grasslands have shown that the loss of species has negative consequences for ecosystem functioning. Is the same true for forests? Huang *et al.* report the first results from a large biodiversity experiment in a subtropical forest in China. The study combines many replicates, realistic tree densities, and large plot sizes with a wide range of species richness levels. After 8 years of the experiment, the findings suggest strong positive effects of tree diversity on forest productivity and carbon accumulation. Thus, changing from monocultures to more mixed forests could benefit both restoration

of biodiversity and mitigation of climate change. —AMS

Science, this issue p. 80

CANCER

Some (re)programming notes on cancer

Epithelial cancers develop resistance to targeted therapies in a number of different ways. Several cancer types do so by undergoing phenotypic conversion to a highly aggressive cancer called small cell neuroendocrine carcinoma (SCNC). Whether distinct cancer types accomplish this "reprogramming" through the same mechanism has been unclear. Park *et al.* show that the same set of oncogenic factors transforms both normal lung and normal prostate epithelial cells into SCNCs that resemble clinical samples (see the Perspective by Kareta and Sage). This convergence of molecular pathways could potentially simplify the development of new therapies for SCNC, which is currently untreatable. —PAK

Science, this issue p. 91; see also p. 30

MICROBIOLOGY

Industrialization reduces microbiota diversity

Disturbances in the microbiota that live on or in the human body are associated with various diseases. In a Perspective, Dominguez Bello *et al.* propose that a reduction in microbiota diversity associated with modern, industrialized living is linked to the increasing incidence of metabolic, immune, and cognitive diseases. They propose that microbiota samples should be collected from individuals in traditional societies. These could potentially be used to reinstate microbiota ecology, which might help to prevent and/or treat modern diseases. —GKA

Science, this issue p. 33

INFECTIOUS DISEASES

Turning the tables on interferon

An early step in the host response to viral infection involves a burst of synthesis of type I interferons that allow cells to quickly fight back against the offending viruses. Shaabani *et al.* investigated how the same interferon-stimulated genes (ISGs) that usually help against viruses surprisingly dampen the host's ability to resist many bacterial infections. Deletion of a single ISG called *Usp18* in mouse dendritic cells was sufficient to enhance host control of infections with two strains of Gram-positive bacteria. Normal induction of USP18 after infection impaired antibacterial responses mediated by tumor necrosis factor. USP18 thus represents a potential therapeutic target for control of serious bacterial infections. —IW

Sci. Immunol. **3**, eaau2125 (2018).

BIOCHEMISTRY

How *Vibrio* disrupts Ras signaling

Many pathogenic bacteria, including *Vibrio vulnificus*, target the small guanosine triphosphatase Ras because it is critical for signaling pathways that control host cell biology and innate defenses. Biancucci *et al.* solved the crystal structure of RRSP, a toxin effector domain from *V. vulnificus* that cleaves KRAS, a member of the Ras family. Cleavage by RRSP did not release any fragments but structurally altered KRAS so that it could not bind to its downstream effector Raf. These findings may prove useful for developing strategies to inhibit Ras proteins that are aberrantly activated in tumors. —AV

Sci. Signal. **11**, eaat8335 (2018).