

### IN SCIENCE JOURNALS

Edited by **Caroline Ash**



#### EVOLUTIONARY BIOLOGY

### Hybrid camouflage variation

**S**nowshoe hares molt from a brown coat to a white coat in winter. In some populations, however, where winter snow is less extensive, hares molt from a brown coat to a brown coat. Jones *et al.* show that regulation of the pigmentation gene *Agouti* is responsible for the winter coat color change. Hybridization with jackrabbits has led to introgression around this gene that facilitates the brown winter morph. Hybridization appears to have provided important adaptive variation to the snowshoe hare. —SNV

*Science*, this issue p. 1355

Hybrid snowshoe hares can stay brown in snowless winters.

describe a species of gibbon found in a 2200- to 2300-year-old tomb ascribed to a Chinese noblewoman. This previously unknown species was likely widespread, may have persisted until the 18th century, and may be the first ape species to have perished as a direct result of human activities. This discovery may also indicate the existence of unrecognized primate diversity across Asia. —SNV

*Science*, this issue p. 1346

#### PAIN

### Dialing down the opioids

The pain relief afforded by morphine and other opioids comes with the cost of behavioral side effects and high addiction potential. He *et al.* found that the analgesic response to morphine could be enhanced by compounds that activate the peripheral sensory neuron–localized receptor MrgC11 in mice and MrgX1 in humans. Activation of MrgC11 promoted its interaction with the  $\mu$ -opioid receptor. This interaction enabled the use of lower morphine doses to achieve pain relief in mice, without the tolerance and locomotor side effects typically associated with the drug. —LKF

*Sci. Signal.* **11**, eaao3134 (2018).

#### ENVIRONMENTAL STUDIES

### China's plastic waste import ban

China, the world's top plastic waste importer, implemented a permanent ban on importing nonindustrial plastic waste beginning on 31 December 2017. Brooks *et al.* examined how this ban may affect countries that had previously exported difficult-to-manage plastic waste to China. Through analyzing 28 years of

data on imports and exports from the United Nations Comtrade Database, they found that China has imported 45% of the world's plastic waste since 1992. This means that an estimated 111 million metric tons of plastic waste will have to be redirected by 2030 because of this ban. The analysis further highlights how, for decades, higher-income countries have been exporting plastic waste to lower-income countries that do not have robust

waste management infrastructures. —PJB

*Sci. Adv.* **10**.1126/sciadv.aat0131 (2018).

#### ANTHROPOLOGY

### The noblewoman's ape

Human activities are causing extinctions across a wide array of taxa. Yet there has been no evidence of humans directly causing extinction among our relatives, the apes. Turvey *et al.*

#### IMMUNODEFICIENCIES

### Fingers on the trigger

Hyper-immunoglobulin E syndromes (HIESs) are rare genetic immunodeficiency diseases characterized by bacterial infections, chronic mucocutaneous candidiasis, allergies, and skeletal abnormalities associated with impaired T helper 17 (T<sub>H</sub>17) cell immunity. Béziat *et*

*al.* and Frey-Jakobs *et al.* have studied patients with an autosomal recessive form of HIES and identified mutations in the zinc finger transcription factor ZNF341 as the culprit. Loss-of-function mutations encoding truncated forms of ZNF341 interfered with its ability to recognize a bipartite binding site located in the promoter of STAT3, the transcription factor mutated in most cases of autosomal dominant HIES. ZNF341-supported transcription of STAT3 is a key upstream regulatory step needed to trigger the  $T_H17$  differentiation pathway. These findings reveal a previously unappreciated layer of transcriptional regulation controlling JAK-STAT signaling. —IW

*Sci. Immunol.* **3**, eaat4956, eaat4941 (2018).

## QUANTUM CRITICALITY

### A nanostructure quantum simulator

Phase transitions occurring at absolute zero temperature, or quantum phase transitions (QPTs), can be grouped into broad categories called universality classes. The classification is based on the properties of the transition rather than the microscopic details of the underlying system. Iftikhar *et al.* exploited this fact to study QPTs in clean, tunable nanostructures, rather than in complex materials, where they most often occur. Within a single nanostructure, two different classes of QPTs with profoundly different characters were studied and comprehensively characterized. —JS

*Science*, this issue p. 1315

## GEOPHYSICS

### A quick rebound for Antarctic crust

Earth's crust deforms under the load of glaciers and ice sheets. When these masses are removed, the crust rebounds at a time scale determined by the viscosity of the upper mantle. Using GPS, Barletta *et al.* found that the viscosity of the mantle

under the West Antarctic Ice Sheet is much lower than expected. This means that as ice is lost, the crust rebounds much faster than previously expected. Although estimates of total ice loss have to be revised upward, the surprising finding indicates that the ice sheet may stabilize against catastrophic collapse. —BG

*Science*, this issue p. 1335

## GRAVITATION

### Testing General Relativity on galaxy scales

Einstein's theory of gravity, General Relativity (GR), has been tested precisely within the Solar System. However, it has been difficult to test GR on the scale of an individual galaxy. Collett *et al.* exploited a nearby gravitational lens system, in which light from a distant galaxy (the source) is bent by a foreground galaxy (the lens). Mass distribution in the lens was compared with the curvature of space-time around the lens, independently determined from the distorted image of the source. The result supports GR and eliminates some alternative theories of gravity. —KTS

*Science*, this issue p. 1342

## NEUROSCIENCE

### Rebalancing strength between synapses

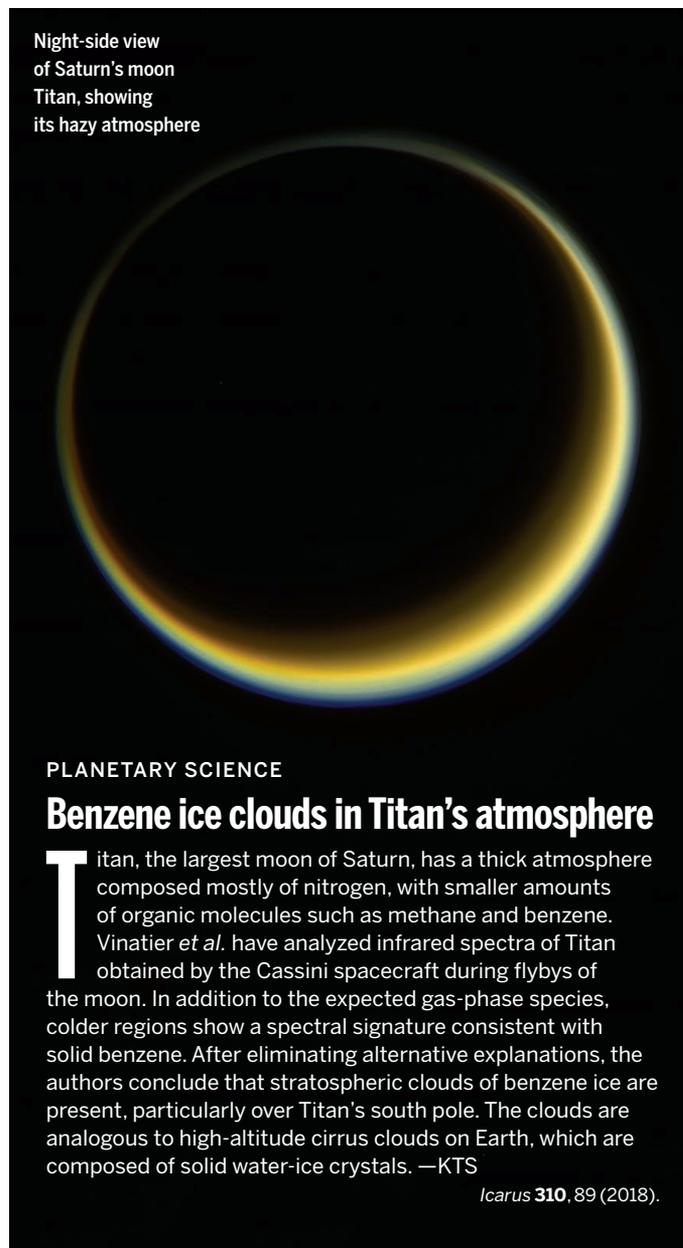
Activation of a neuronal pathway is often associated with inhibition of surrounding pathways. How locally coordinated synaptic plasticity occurs *in vivo* is not known, nor is its role in shaping neuronal responses. El-Boustani *et al.* paired optogenetic stimulation of single neurons with a visual input and were able to shift the neuron's receptive field toward the target location. Spines that expressed structural long-term potentiation had receptive fields overlapping the target stimulus but were surrounded by spines that expressed receptive fields away from the target. —PRS

*Science*, this issue p. 1349

## IN OTHER JOURNALS

Edited by **Sacha Vignieri**  
and **Jesse Smith**

Night-side view  
of Saturn's moon  
Titan, showing  
its hazy atmosphere



## PLANETARY SCIENCE

### Benzene ice clouds in Titan's atmosphere

**T**itan, the largest moon of Saturn, has a thick atmosphere composed mostly of nitrogen, with smaller amounts of organic molecules such as methane and benzene. Vinatier *et al.* have analyzed infrared spectra of Titan obtained by the Cassini spacecraft during flybys of the moon. In addition to the expected gas-phase species, colder regions show a spectral signature consistent with solid benzene. After eliminating alternative explanations, the authors conclude that stratospheric clouds of benzene ice are present, particularly over Titan's south pole. The clouds are analogous to high-altitude cirrus clouds on Earth, which are composed of solid water-ice crystals. —KTS

*Icarus* **310**, 89 (2018).

## ORGANIC CHEMISTRY

### Making a triple negative

The trifluoromethanesulfonyl (Tf) group is remarkably adept at stabilizing negative charge: It boasts highly withdrawing fluorines and sulfur-oxygen bonds that can delocalize electrons through resonance. Höfler *et al.* took full advantage of these properties in generating a

molecule with three independent anionic carbon centers. The synthetic reaction coupled trimethylmethane with three equivalents of  $Tf_2CH_2$ , after which a base deprotonated all three Tf-substituted carbon centers. The compound was characterized by crystallography and showed trigonal-planar geometries at each charged carbon. —JSY

*Angew. Chem. Int. Ed.* **10.1002/anie.201803647** (2018).

## ALSO IN SCIENCE JOURNALS

Edited by **Caroline Ash**

## ECOLOGY

**Where have all the monarchs gone?**

North American monarch butterfly populations have declined at their Mexican overwintering sites in recent years. The picture is less clear for monarch summer breeding sites in the United States and Canada. In a Perspective, Agrawal and Inamine report on recent survey results and conclude that several stressors affect monarch populations, including reduced availability of milkweed plants for caterpillars, stress during migration, and degradation of fir forest at the overwintering sites in Mexico. Migratory success is highly variable from one year to the next, complicating efforts to conserve monarch populations. —JFU

*Science*, this issue p. 1294

## ANTHROPOLOGY

**Out of Africa, with a difference**

According to the recent African origin model, modern humans emerged in Africa by about 200,000 years ago. They spread across the rest of the world, successively replacing archaic populations along the way. In a Perspective, Galway-Witham and Stringer show that recent evidence calls for modification of this influential model. Fossil evidence indicates that modern humans may have evolved for longer than previously thought. Genetic evidence for mixing between modern humans and archaic populations, such as Neandertals and Denisovans, makes it difficult to clearly delineate species boundaries between them. Genomic data for African fossils older than 15,000 years will help to resolve these questions. —JFU

*Science*, this issue p. 1296

## PLANT PATHOLOGY

**Networks in plant immunity**

Plant defenses against pathogens have traditionally been viewed as pairwise matching of a resistance gene in a host plant to a virulence gene in a pathogen (Flor's gene-for-gene hypothesis). In a Perspective, Wu *et al.* discuss emerging data that show that plant immune responses function as a network in which key nodes coordinate the host response to multiple pathogen factors. —GKA

*Science*, this issue p. 1300

## PSYCHIATRIC GENOMICS

**Brainstorming diseases**

Consistent classification of neuropsychiatric diseases is problematic because it can lead to misunderstanding of etiology. The Brainstorm Consortium examined multiple genome-wide association studies drawn from more than 200,000 patients for 25 brain-associated disorders and 17 phenotypes. Broadly, it appears that psychiatric and neurologic disorders share relatively little common genetic risk. However, different and independent pathways can result in similar clinical manifestations (e.g., psychosis, which occurs in both schizophrenia and Alzheimer's disease). Schizophrenia correlated with many psychiatric disorders, whereas the immunopathological affliction Crohn's disease did not, and posttraumatic stress syndrome was also largely independent of underlying traits. Essentially, the earlier the onset of a disorder, the more inheritable it appeared to be. —LMZ

*Science*, this issue p. 1313

## SIGNAL TRANSDUCTION

**Mechanisms of drug action**

Advanced mass spectrometry methods enable monitoring of tens of thousands of phosphorylation sites in proteins. This technology can potentially distinguish cellular signaling pathways that produce beneficial effects from those that produce unwanted side effects. Liu *et al.* treated mice with various agonists of the kappa opioid receptor (a G protein-coupled receptor) and monitored changes in phosphorylation over time in different brain regions. The phosphorylation patterns revealed distinct patterns of signaling in various brain tissues, some of which were associated with unwanted side effects. —LBR

*Science*, this issue p. 1314

## ALCOHOL DEPENDENCY

**Finding the vulnerable minority**

"Only" about 10 to 15% of people exposed to alcohol develop alcohol-related problems. The behavioral repertoire of people confronted with opportunities to consume alcohol involves numerous choices between this drug reward and healthy alternatives. Augier *et al.* established a choice procedure that begins to address alcohol addiction in rats (see the Perspective by Spanagel). They found that a minority of outbred rats continued to self-administer alcohol even when a high-value alternative (such as sugar) was available. That minority displayed a remarkable constellation of behavioral traits resembling the human clinical condition, including a high motivation to obtain alcohol and continued use despite adverse consequences. The cause was impaired GABA ( $\gamma$ -aminobutyric acid) clearance in the central amygdala. Postmortem tissue

analysis supported the possibility of a similar pathology in human alcoholism. —SMH

*Science*, this issue p. 1298;  
see also p. 1321

## ATTOSECOND DYNAMICS

**Time and place of electron exit**

Until about a decade ago, laser-induced ionization was considered instantaneous. Since then, applications of attosecond laser pulses have shown multiple subtle and complex factors that influence the precise timing of electron ejection from atoms and surfaces. Vos *et al.* measured the corresponding attosecond dynamics of dissociative photoionization in a diatomic molecule, carbon monoxide. By imaging the charged fragments, the timing could be correlated with the specific spatial portion of the molecule from which the electron wave packet emerged. —JSY

*Science*, this issue p. 1326

## CHIRAL RESOLUTION

**Taking enantiomers for a spin**

There are two common ways to distinguish mirror-image molecules, or enantiomers. The first relies on their distinct interactions with circularly polarized light, the second on their interactions with a pure enantiomer of some other molecule. Now Banerjee-Ghosh *et al.* report a conceptually different approach to chiral resolution. Experiments showed that, depending on the direction of magnetization, chiral oligopeptides, oligonucleotides, and amino acids have enantiospecific differences in initial adsorption rates on ferromagnetic surfaces. This effect is attributed to enantiospecific induced spin polarization. —JSY

*Science*, this issue p. 1331

## WATER PROPERTIES

### Water's surface dielectric

Theoretical studies predict that the inhibition of rotational motion of water near a solid surface will decrease its local dielectric constant. Fumagalli *et al.* fabricated thin channels in insulating hexagonal boron nitride on top of conducting graphene layers (see the Perspective by Kalinin). The channels, which varied in height from 1 to 300 nanometers, were filled with water and capped with a boron nitride layer. Modeling of the capacitance measurements made with an atomic force microscope tip revealed a surface-layer dielectric constant of 2, compared with the bulk value of 80 for water. —PDS

*Science*, this issue p. 1339;  
see also p. 1302

## TISSUE ENGINEERING

### Disjointed no more

Temporomandibular joint (TMJ) dysfunction causes pain and limits movement of the jaw joint. Thinning of the TMJ disc, a fibrocartilage structure that allows for smooth joint movement, is an early sign of TMJ dysfunction. To help prevent joint degeneration, Vapniarsky *et al.* implanted engineered discs derived from rib cartilage cells into a minipig model of TMJ disc thinning. The implants exhibited biomechanical and biochemical properties similar to those of native discs, improved closure of disc defects, reduced osteoarthritis scores, and relieved degenerative changes in the jaw joint. —CC

*Sci. Transl. Med.* **10**, eaaq1802 (2018).

## IMMUNOLOGY

### Surface antibody maturation

Affinity maturation in B cells generates antibodies with increasingly enhanced antigen-binding properties. Imkeller *et al.* investigated the maturation of human B cells that express protective antibodies against the circumsporozoite protein

of the malaria-causing parasite *Plasmodium falciparum* (PfCSP). The repetitive structure of PfCSP induces mutations in B cells, facilitating direct interactions between two repeat-bound antibodies against PfCSP, which enhance antigen affinity and B cell activation. Such interactions may optimize binding and promote clustering of surface antibodies in general. —STS

*Science*, this issue p. 1358