

low-gravity environment that may also be under vacuum conditions. In outer space, neither vacuum nor sticky pads may hold. Jiang *et al.* devised a robotic gripper using gecko feet—inspired dry adhesives that can be activated or deactivated by shearing motions. Small adhesive patches can be mechanically coupled to allow for load sharing over a large area. By attaching these to a wristlike structure that is stiff at low forces, but becomes compliant at larger ones, objects can be moved without damaging the adhesives. —MSL

Sci. Robot. 10.1126/scirobotics.aan4545 (2017).

ANTHROPOLOGY

An early skull cult from Neolithic Turkey

Veneration of human skulls is well known from many Neolithic sites in Anatolia and the Levant. Gresky *et al.* discovered a new manifestation of the cult from the important site of Göbekli Tepe, which was occupied between 9600 and 8000 BCE. The site is distinguished by T-shaped monolithic pillars found in massive megalithic buildings. Three skulls were found that show signs of perimortem modification, including deeply incised grooves, circular perforations, cut marks indicative of defleshing, and, in one instance, the application of red ochre. The placement of these

modifications indicates that the skulls were likely suspended by cords and displayed in a ritual context. —MSA

Sci. Adv. 10.1126/sciadv.1700564 (2017).

NEONICOTINOIDS

Damage confirmed

Early studies of the impacts of neonicotinoid insecticides on insect pollinators indicated considerable harm. However, lingering criticism was that the studies did not represent field-realistic levels of the chemicals or prevailing environmental conditions. Two studies, conducted on different crops and on two continents, now substantiate that neonicotinoids diminish bee health (see the Perspective by Kerr). Tsvetkov *et al.* find that bees near corn crops are exposed to neonicotinoids for 3 to 4 months via nontarget pollen, resulting in decreased survival and immune responses, especially when coexposed to a commonly used agrochemical fungicide. Woodcock *et al.*, in a multicounty experiment on rapeseed in Europe, find that neonicotinoid exposure from several nontarget sources reduces overwintering success and colony reproduction in both honeybees and wild bees. These field results confirm that neonicotinoids negatively affect pollinator health under realistic agricultural conditions. —SNV

Science, this issue p. 1395, p. 1393; see also p. 1331

IN OTHER JOURNALS

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



Spatial separation of hormones across cells facilitates temperature-mediated initiation of seed germination.

PLANT EVOLUTION

Genomics trace plant gene evolution

MADS-box genes have essential functions in plant development and morphology. However, in plants, as a result of multiple rounds of whole-genome duplications combined with specific gene gains and losses, the relationships and evolution of this gene family have been difficult to trace. Zhao *et al.* applied a network-based phylogenetic analysis examining synteny—the location of genes and their relative position within the genome—across all identified MADS-box genes from 51 plant species. Through this analysis, the relationships, approximate timing, gains and losses, and specific movements of these genes within the genome could be traced. This allows for a better understanding of how evolution has acted on a key regulatory gene family in the plant kingdom. —LMZ

Plant Cell 10.1105/tpc.17.00312 (2017).

PHYSIOLOGY

Characterizing a 12-hour biological clock

A mathematical analysis of changes in gene expression in mouse liver, designed to detect oscillations of various frequencies, showed more than 3500 genes whose expression cycled with a 12-hour period. This is distinct from circadian gene

expression, which is coupled to the 24-hour light cycle, and has been noted before in marine animals, perhaps because of a need to synch with 12-hour tidal changes. Zhu *et al.* found that gene products associated with 12-hour cycles are particularly related to metabolic function, endoplasmic reticulum stress, and the unfolded protein response. The 12-hour clock



The massive megalithic buildings of Göbekli Tepe

PHOTOS: (FROM LEFT) GRESKY ET AL.; JEREMY BURGESS/SCIENCE SOURCE



STRATOSPHERIC OZONE

Great American ozone loss

The central United States is a region particularly vulnerable to stratospheric ozone loss in summer, in part because of the severe storms that occur over the Great Plains. Anderson *et al.* present measurements of the convective penetration of water into the stratosphere over the United States in summer caused by these storms, along with relevant accompanying physical and chemical effects, to better understand the mechanisms of stratospheric ozone loss and to facilitate decadal forecasting in our changing environment. Their findings imply that there exists an increased risk of ozone loss over the Great Plains in summer as the climate warms. —HJS

Proc. Natl. Acad. Sci. U.S.A. 10.1073/pnas.1619318114 (2017).

Strong atmospheric convection over the badlands of South Dakota

appears to be distinct from the well-known circadian oscillator and was evident in nematodes and crustaceans, as well as mammals. —LBR

Cell Metab. 10.1016/j.cmet.2017.05.004 (2017).

EDUCATION

Social activity: A new dimension in STEM

As active learning continues to replace traditional lectures, a new dimension of learning needs to be measured: social activity. Specifically, how are students interacting with and learning from their peers? Wiggins *et al.* developed and validated a 16-item survey to measure multiple facets of student experience in active-learning classrooms. The Assessing Student Perspective of Engagement in Class Tool (ASPECT) was

designed to be widely applicable for different types of active learning and allows for the comparison of relative student engagement levels across various active-learning strategies. As researchers begin to investigate what makes active learning effective, tools such as ASPECT will provide insight into potential barriers presented by active learning, as well as strategies that increase engagement of all students. —MMc

CBE Life Sci. Educ. 10.1187/cbe.16-08-0244 (2017).

PLANT BIOLOGY

Temperature signals in seed germination

The switch between seed dormancy and germination in *Arabidopsis thaliana* is regulated by the balance between the hormones abscisic acid

(ABA) and gibberellin (GA). Low temperatures are known to cause an increase in GA synthesis and receptor abundance, thereby increasing the probability of germination. Topham *et al.* studied the integration of temperature signals and determined that the embryo radicle is enriched for factors involved in hormone signaling, synthesis, and degradation. A clear spatial pattern emerged whereby ABA and GA pathway components were broadly separated into different cell types. This spatial separation and control over transport of hormones between cells facilitates processing of fluctuating temperature inputs and increases their propensity to break seed dormancy, compared with signals from continuous cold exposure. This is hypothesized to ensure accurate timing of seedling establishment through recognition of

environmental temperature oscillations.

—CHG

Proc. Natl. Acad. Sci. U.S.A. 10.1073/pnas.1704745114 (2017).

DRUG ADDICTION

A vaccine for heroin addiction?

Addiction to opiate drugs has become a worldwide public health epidemic. Bremer *et al.* sought to test whether a vaccination approach might be a way to combat heroin addiction. They designed a vaccine that contained part of the heroin molecule, which trained the immune system in monkeys to produce antibodies against heroin. The vaccine was able to neutralize heroin and prevent the heroin high feeling for up to 8 months. Antiheroine immunity continued to improve over time with the administration of booster shots. The researchers next aim to test the vaccine in human trials. —PNK.

J. Am. Chem. Soc. 10.1021/jacs.7b03334 (2017).

ELECTROCHEMISTRY

Pairing up copper and tin to reduce CO₂

Copper could be a cost-effective catalyst for solar-powered reduction of CO₂ to fuels and chemicals, but it tends to produce a variety of different products. Building on recent observations, Schreier *et al.* now show that coating copper oxide nanowires with tin oxide by atomic layer deposition confers high selectivity for CO production in CO₂ electrolysis. Moreover, these nanowires proved effective in catalyzing the anodic oxidation of water to oxygen as well. The authors took advantage of a bipolar membrane to carry out the cathodic and anodic reactions at neutral and basic pH, respectively, reaching a solar-to-CO₂ conversion efficiency of 13.4% with a three-junction solar cell to power the process. —JSY

Nat. Energy 2,17087 (2017).

Science

A vaccine for heroin addiction?

Priscilla N. Kelly

Science **356** (6345), 1347-1348.
DOI: 10.1126/science.356.6345.1347-f

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