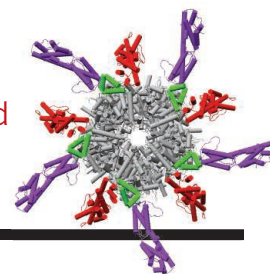


# RESEARCH

## Penton of human cytomegalovirus capsid

Yu et al., p. 1350



## IN SCIENCE JOURNALS

Edited by **Caroline Ash**



### GLOBAL FIRE ACTIVITY

## Burn less, baby, burn less

**H**umans have, and always have had, a major impact on wildfire activity, which is expected to increase in our warming world. Andela *et al.* use satellite data to show that, unexpectedly, global burned area declined by ~25% over the past 18 years, despite the influence of climate. The decrease has been largest in savannas and grasslands because of agricultural expansion and intensification. The decline of burned area has consequences for predictions of future changes to the atmosphere, vegetation, and the terrestrial carbon sink. —HJS

*Science*, this issue p. 1356

Because of agricultural expansion, less grassland and savanna burn.

### MEDICINAL CHEMISTRY

## Are better drugs just a click away?

Drugs that show promise in pre-clinical models often fail in the clinic, in part because of limited information on drug localization within cells and across tissues. In a proof-of-concept study, Tyler *et al.* applied click chemistry methods to study the localization of bromodomain inhibitors. These are cancer drugs that alter chromatin structure and gene expression. Clickable derivatives of the drugs localized within chromatin and showed that the drugs exhibit distinct modes of binding at responsive and unresponsive genes. In a mouse leukemia model, the click-probes revealed that the drugs accumulate to different extents in

the spleen and bone marrow, which are two tissue sources of leukemic cells. —PAK

*Science*, this issue p. 1397

### FOREST ECOLOGY

## Maintaining tree diversity

Negative interaction among plant species is known as conspecific negative density dependence (CNDD). This ecological pattern is thought to maintain higher species diversity in the tropics. LaManna *et al.* tested this hypothesis by comparing how tree species diversity changes with the intensity of local biotic interactions in tropical and temperate latitudes (see the Perspective by Comita). Stronger local specialized biotic interactions seem to prevent erosion of biodiversity in tropical

forests, not only by limiting populations of common species, but also by strongly stabilizing populations of rare species, which tend to show higher CNDD in the tropics. —AMS

*Science*, this issue p. 1389;

see also p. 1328

### DEVICE TECHNOLOGY

## Carbon nanotubes on the roadmap

The formal challenge for high-performance transistors is to fit within ever smaller devices. They need to shrink from a lateral dimension of about 100 to 40 nanometers. Cao *et al.* fabricated tiny devices by using a single semiconducting carbon nanotubes, as well as arrays of these nanotubes. High

performance (a high saturation on-state current >1.2 milliamperes per micrometer and a conductance >2 millisiemens per micrometer) was delivered by making end-bonded contacts to the nanotubes with cobalt-molybdenum alloys. —PDS

*Science*, this issue p. 1369

### NEURODEVELOPMENT

## Building the neural tube

The development of the neural tube is regulated by a pair of morphogens acting in opposing gradients. The mature neural tube is built from a variety of different cell types organized in a consistent dorsal-ventral pattern. Zagorski *et al.* asked how this pattern is defined in a reproducible way from individual to individual. The morphogens define positions most accurately toward the top of their respective gradients, but things get a bit messy in the middle. Modeling the gene regulatory network's response as a maximum likelihood estimation from the combined input of both morphogens, however, succeeds at defining even the intermediate positions. Thus, the computation of position by the gene regulatory network establishes accurate tissue patterning despite messy inputs. —PJH

*Science*, this issue p. 1379

### SPACE ROBOTS

## Get a grip

Grabbing a smooth object requires a delicately sensed combination of pressure and friction—something that humans do routinely, but that is complicated for a robot. Imagine grabbing things in a

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

**M**ADS-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

Downloaded from <http://science.sciencemag.org/> on August 11, 2018

## ALSO IN SCIENCE JOURNALS

Edited by Caroline Ash

## BIOENERGY

**The promise of cellulose**

Cellulosic bioenergy, obtained from the lignocellulose that makes up nearly half of plant biomass, has considerable potential as an environmentally friendly energy source, but it still requires substantial resources to produce. Robertson *et al.* review the trade-offs between the use of cellulosic biofuels and climate mitigation, biodiversity, reactive nitrogen loss, and water use to direct more effective policies for their production. Growing native species on unfarmed land is a promising way forward. —HJS

*Science*, this issue p. 1349

## STRUCTURAL BIOLOGY

**Strong under pressure**

Human cytomegalovirus (HCMV) is a member of the herpesvirus family that can cause life-threatening infections in those who are immunocompromised. HCMV encodes a genome that is about 50% larger than that of herpes simplex virus 1 (the virus that causes cold sores), but these two viruses have similar-sized capsids. Yu *et al.* used cryo-electron microscopy to determine the structure of the HCMV capsid to 3.9-Å resolution. This is the first high-resolution capsid structure from the herpesvirus family. It reveals extensive interactions that stabilize the capsid to withstand the high pressure that comes from accommodating such a large genome. —VV

*Science*, this issue p. 1350

## NEURODEVELOPMENT

**Reopening a critical period**

Young brains, compared with adult brains, are plastic. This phenomenon has given rise to the concept of critical periods, during which acquisition of certain skills is optimal. In mice,

an auditory critical period is only open in early postnatal days. The youthful brain tunes circuits to sounds in its environment in a way that the adult brain does not. This facility may form the basis for childhood language acquisition in humans. Blundon *et al.* show that by manipulating adenosine signaling in mice, some plasticity of the adult auditory cortex can be regained (see the Perspective by Kehayas and Holtmaat). Disruption of adenosine production or adenosine receptor signaling in adult mice leads to improved tone discrimination abilities. —PJH

*Science*, this issue p. 1352;

see also p. 1335

## ECONOMICS

**Costing out the effects of climate change**

Episodes of severe weather in the United States, such as the present abundance of rainfall in California, are brandished as tangible evidence of the future costs of current climate trends. Hsiang *et al.* collected national data documenting the responses in six economic sectors to short-term weather fluctuations. These data were integrated with probabilistic distributions from a set of global climate models and used to estimate future costs during the remainder of this century across a range of scenarios (see the Perspective by Pizer). In terms of overall effects on gross domestic product, the authors predict negative impacts in the southern United States and positive impacts in some parts of the Pacific Northwest and New England. —GJC

*Science*, this issue p. 1362;

see also p. 1330

## OPTICS

**To bunch or to antibunch**

Particles of matter can be classed as either as bosons or fermions. Their subsequent

behavior in terms of their physical properties and interactions depends on which quantum statistics they obey. Photons, for instance, are bosons and tend to bunch. Electrons are fermions and tend to antibunch. Vest *et al.* show that surface plasmon polaritons, a hybrid excitation of light and electrons, can exhibit both kinds of behavior (see the Perspective by Faccio). By tuning the level of loss in their system, bunching and antibunching of interfering plasmons can be seen. —ISO

*Science*, this issue p. 1373;

see also p. 1336

## NEURODEVELOPMENT

**Specialization in brain neurogenic niche**

The adult mammalian brain generates neurons from the subventricular zone (SVZ). In mice, Paul *et al.* were able to link environmental signals with the type of neurons that are generated and showed that anatomical subspecialization occurs in the SVZ. Neural circuits that respond to hunger or satiety enervate a subregion of the SVZ and retune the production of new olfactory neurons just from that portion of the subventricular niche. —PJH

*Science*, this issue p. 1383

## SOLAR CELLS

**Healing defects with triiodide ions**

Deep-level defects in organic-inorganic perovskites decrease the performance of solar cells through unproductive recombination of charge carriers. Yang *et al.* show that introducing additional triiodide ions during the formation of layers of formamidinium lead iodide, which also contain small amounts of methylammonium lead bromide, suppresses the formation of deep-level defects. This process boosts

the certified efficiency of 1-cm<sup>2</sup> solar cells to almost 20%.

—PDS

*Science*, this issue p. 1376

## PLANT SCIENCE

**Active transport of aromas**

Volatile organic compounds (VOCs) serve as invisible lines of communication among host plants, pathogens, commensals, community groups, and, with flowers, their pollinators. Studying petunia flowers, Adebisin *et al.* show that VOCs do not passively diffuse out of the cells but are actively shuttled across the plasma membrane by an ABC (ATP-binding cassette) transporter (see the Perspective by Eberl and Gershenzon). Disabling the transporter results in damage to the cell's membranes by intracellular accumulation of VOCs. —PJH

*Science*, this issue p. 1386;

see also p. 1334

## EMERGING INFECTIONS

**Antiviral gets the jump on coronaviruses**

Coronaviruses can jump from animal reservoirs into the human population with devastating effects, as in the cases of the SARS (severe acute respiratory syndrome) and MERS (Middle East respiratory syndrome) viruses. Sheahan *et al.* tested a small-molecule inhibitor, which has shown activity against Ebola virus, as a potential cure for coronavirus infection. This drug was effective against multiple types of coronaviruses in cell culture and a mouse model of SARS and did not seem to be toxic. —LP

*Sci. Transl. Med.* **9**, eaal3653 (2017).

The WNT signaling pathway powers the growth of various tumors, particularly colorectal cancer (CRC). However, WNT-targeted inhibitors are toxic to normal gastrointestinal tissue, precluding their clinical use. Li *et al.* found that a small-molecule activator of the kinase CK1 $\alpha$  suppressed WNT activity in CRC cell lines and prevented tumor growth and increased survival in mouse models of primary and metastatic CRC. This inhibitor was selective for cells with high WNT activity and low CK1 $\alpha$  levels and was minimally toxic to normal gastrointestinal epithelium.  
—LKF

*Sci. Signal.* **10**, eaak9916 (2017).

## **ELECTROCHEMISTRY** **Separating charges** **is a gas**

Solid and liquid electrolytes allow for charges or ions to move while keeping anodes and cathodes separate. Separation prevents short circuits from occurring in energy storage devices. Rustomji *et al.* show that separation can also be achieved by using fluorinated hydrocarbons that are liquefied under pressure. The electrolytes show excellent stability in both batteries and capacitors, particularly at low temperatures.  
—MSL

*Science*, this issue p. 1351

# Science

## Antiviral gets the jump on coronaviruses

Lindsey Pujanandez

*Science* **356** (6345), 1346-1348.

DOI: 10.1126/science.356.6345.1346-q

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