

Most patients thus receive treatment according to standardized protocols; some respond to treatment, but others only experience side effects. Ooft *et al.* developed a method of testing drugs in patient-derived organoids, which are biopsy-derived cells from individual patients grown in a dish. In a clinical study, the responses of organoids to the cancer drug irinotecan correlated with patients' responses, suggesting that screening in organoids could help avoid giving irinotecan to patients who would not benefit. —YN

Sci. Transl. Med. **11**, eaay2574 (2019).

ELECTROCHEMISTRY

A direct route to pure peroxide

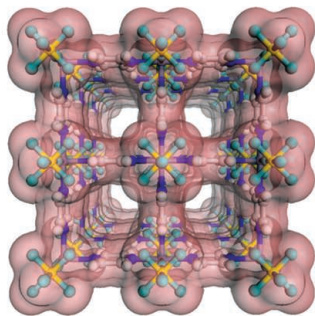
Despite the widespread use of hydrogen peroxide as an oxidant and disinfectant, its commercial synthesis still requires inefficient concentration and purification steps. Xia *et al.* now report an electrochemical approach to synthesizing pure peroxide solutions straight from hydrogen and oxygen. Using a solid-state electrolyte, they avoid contamination of the product solution by extraneous ions. Varying the flow rate of water through the electrochemical cell tunes the final concentration over a range from 0.3% to 20% by weight. —JSY

Science, this issue p. 226

GAS SEPARATIONS

Selecting for ethylene

Purification of ethylene from other gases produced during its synthesis, such as acetylene, ethane, and carbon dioxide, is an energy-intensive process.



Metal-organic framework with molecular selectivity

Chen *et al.* use a mixture of microporous metal-organic framework physisorbents that are selective for one of these four gases. A series of sorbents in a packed-bed geometry produced ethylene pure enough for making polymers. —PDS

Science, this issue p. 241

ECOSYSTEM SERVICES

The future of nature's contributions

A recent Global Assessment by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services has emphasized the urgent need to determine where and how nature's contribution matters most to people. Chaplin-Kramer *et al.* have developed a global-scale modeling of ecosystem services, focusing on water quality regulation, coastal protection, and crop pollination (see the Perspective by Balvanera). By 2050, up to 5 billion people may be at risk from diminishing ecosystem services, particularly in Africa and South Asia. —AMS

Science, this issue p. 255; see also p. 184

RADIO ASTRONOMY

Probing a galaxy halo with a radio burst

Fast radio bursts (FRBs) are millisecond flashes of radio emission from distant galaxies. It has only recently become possible to locate single bursts precisely enough to determine the host galaxy. Prochaska *et al.* have observed and localized a FRB using a radio interferometer. The line of sight to the host galaxy coincidentally passes through the outskirts of a closer foreground galaxy. By analyzing the propagation of the FRB, the authors put constraints on the density and magnetization of gas in the outskirts of the foreground galaxy. The technique provides complementary information to existing methods using background quasars. —KTS

Science, this issue p. 231

PLANT ECOLOGY

Plants, soils, and climate

Environmental change is rarely straightforward in its consequences for natural communities, because of the complexity of spatial and temporal interspecific interactions. Rasmussen *et al.* experimentally studied the effects of temperature and moisture variation on the growth patterns of a perennial herb (*Plantago lanceolata*) and its associated soil microbial community. They used a reciprocal multifactorial design, using plants and soil communities from three different habitats in Sweden. Although warming and increased moisture had a generally positive effect on plant growth, the strength of the response depended on the origin of the plants, as did the responses of root-associated fungi. Thus, climate change may be expected to produce complex patterns of variation in plant-soil interactions, which may be difficult to predict. —AMS

J. Ecol. **10.1111/1365-2745.13292** (2019).



The perennial herb *Plantago lanceolata*

MATERIALS SCIENCE

Glassy carbon for maximum impact

Materials designed for impact absorption need to be able not only to cope with high-stress deformations but also to accommodate high strain, as the energy absorbed is the

integral of the stress-strain response. Although lightweight designed materials, such as those based on trusses, can show high strength or high deformability, they usually cannot do both. Guell Izard *et al.* devised an architected material with smooth interconnected surfaces, similar to a shell, that

CREDITS: (LEFT TO RIGHT) CHEN ET AL.; ANVALON/PICTURE NATURE/ALAMY STOCK PHOTO

CONSERVATION

Species shuffling by humans

Loogeographic regions describe general patterns of faunal organization across the world and our definition of these regions has largely been consistent since the versions put forward by Wallace and Sclater in the mid to late 19th century. As the result of thousands of years of evolution, these regions have largely been thought to be relatively static and resistant to change. Human activities, especially in the 20th and 21st centuries, have caused substantial upheavals in natural systems, leading to the question of whether our activities have also affected these larger faunal associations. Bernardo-Madrid *et al.* surveyed mammals, amphibians, and birds using large datasets and network approaches to determine whether classic associations have been altered. They found that the introduction and movement of species between regions have led to homogenization of many of these regions. Further, predicated extinctions could exacerbate these trends, leading to loss of regional faunal uniqueness. —SNV

Ecol. Lett. **22**, 1297 (2019).



Human activities are resulting in ubiquitous distribution of some species, such as the pigeon, *Columba livia*.

they fabricated out of glassy carbon. Under optimal conditions with a spinodal topology, the propagation of cracks is impeded as they do not align with the stress direction. This enables a slow, progressive failure during impact, and thus higher energy absorption. —MSL

Small **10**.1002/smll.201903834 (2019).

BIOTECHNOLOGY

Expanding DNA storage capacity

DNA makes a good archival medium for information storage, thanks to its remarkably high physical density and the relatively low cost of high-throughput sequencing. However, its synthesis presents a challenge both technically and

economically. Two recent studies invented similar methods to augment DNA-based information storage capacity. Instead of using only four standard DNA nucleotides (A, T, G, and C), Choi *et al.* and Anavy *et al.* have developed platforms for reading and writing degenerate nucleotides and mixtures of nucleotides in various predetermined ratios. This expanded alphabet enables higher information content per synthesis cycle. —SYM

Sci. Rep. **9**, 6582 (2019);
Nat. Biotechnol. **37**, 1229 (2019).

NANOMATERIALS

Better contact to WSe₂ nanosheets

The high electron and hole mobility of tungsten selenide (WSe₂) nanosheets should make

them ideal semiconductors for field-effect transistor (FET) devices, but with typical contact materials (silica layers on silicon and gold), mobilities, and on-off ratios fall to impractical levels. Stoeckel *et al.* functionalized one or both sides of WSe₂ single-layer nanosheets with molecules containing silane groups. The tails of these molecules formed monolayers on the nanosheets, whereas the head groups formed monolayers on silica. These molecules also appeared to functionalize defect sites, and their presence changed the work function of the nanosheet and decreased the contact resistance to gold. High mobilities enabled unipolar and, for doubly-functionalized nanosheets, ambipolar FET operation in devices with gold top contacts. —PDS

ACS Nano **10**.1021/acsnano.9b05423 (2019).

MICROBIOME
Antibiotics blunt flu immunity

The microbiome influences our immune system and how we respond to various physiological stresses. Hagan *et al.* report that depleting gut microbiota reduces the ability of influenza vaccine to induce functional immunity in humans. The researchers conducted a small clinical trial of healthy individuals who had low prior exposure either to influenza virus or to the vaccine. One group took a course of broad-spectrum antibiotics before receiving the vaccine, while the other group did not take antibiotics and only received the vaccine. Antibiotic use diminished the gut microbiome composition and impaired the ability of the immune system to generate antibodies. Treatment with antibiotics also disturbed bile acid metabolism and caused inflammatory responses.

—PNK

Cell **178**, 1313 (2019).

SCIENTIFIC WORKFORCE
Experience versus salary

Unpaid internships are common in STEM fields, but little is known about the career trajectories of STEM graduates in unpaid versus paid positions. Fournier *et al.* took data from the U.K. Destination of Leavers from Higher Education survey and compared whether science graduates in paid or unpaid positions 6 months after graduating successfully obtained a high salary or were working in a STEM field 3.5 years later. Results show that unpaid work was strongly associated with persistence in STEM but that there is a negative association between unpaid work and future earnings. Personal connections frequently were used by men and high socioeconomic-status graduates to find unpaid work, raising concerns about the diversity of the unpaid workforce. —MMC

PLOS ONE **14**, e0217032 (2019).