

Angiosperm taxa came to dominate the forests over the 6 million years of recovery, when the flora began to resemble that of modern lowland neotropical forest. The leaf data also imply that the forest canopy evolved from relatively open to closed and layered, leading to increased vertical stratification and a greater diversity of plant growth forms. —AMS

Science, this issue p. 63;
see also p. 28

QUANTUM OPTICS

A dissipative quantum gas of light

Our textbook understanding of quantum systems tends to come from modeling these systems isolated from the environment. However, an emerging focus is understanding how many-body quantum systems behave when interacting with their surroundings and how they subsequently become dissipative, or non-Hermitian, systems. Öztürk *et al.* formed a quantum condensate of light by trapping photons in an optical cavity, a system that is naturally dissipative. By altering the trapping conditions, they demonstrated that the system provides a powerful platform with which to explore the complex dynamics and phase transitions occurring in dissipative quantum systems. —ISO

Science, this issue p. 88

BIOSENSORS

A simple sweat test for cystic fibrosis

Cystic fibrosis is often diagnosed in infants using dried blood spot testing, but this method can have poor sensitivity and a high false-positive rate. Toward the goal of developing a noninvasive, simple test for cystic fibrosis, Ray *et al.* devised an adhesive microfluidic device, or “sweat sticker,” to capture and analyze sweat in real time with colorimetric readout. Elevated chloride concentrations in sweat are indicative of cystic fibrosis. Benchtop testing and validation

in patients with cystic fibrosis showed that smartphone imaging of sweat stickers adhered to the skin could monitor sweat chloride concentrations. Results support further testing of the sweat stickers in larger studies. —CC

Sci. Transl. Med. **13**, eabd8109 (2021).

HEART PHYSIOLOGY

Blocking the nuclear option for GRK5

Myocardial infarction results in pressure overload on the heart, which stimulates β -adrenergic signaling and the translocation of G protein-coupled receptor kinase 5 (GRK5) to the nucleus, where it promotes changes in gene expression that lead to hypertrophy. Coleman *et al.* investigated whether blocking the nuclear translocation of GRK5 could prevent the pathological signaling of this kinase. The N-terminus of GRK5 contains a sequence that is required for nuclear translocation, and mice expressing a peptide encompassing the GRK5 N-terminus developed less cardiac hypertrophy, fibrosis, and dysfunction after pressure overload. —WW

Sci. Signal. **14**, eabb5968 (2021).

CATALYSIS

Isolating and stabilizing boron

Oxidative dehydrogenation of propane can produce propene from shale gas and help to replace petroleum as a propene feedstock. Boron-based catalysts can have high selectivity to propene, but the water by-product can deactivate the catalyst by hydrolyzing boron. Zhou *et al.* synthesized boron-doped silicate zeolites containing isolated boron sites that were stable against hydrolysis. The catalyst could achieve one-pass propane conversions up to ~44% with selectivities for propene and >80% for ethene. They observed no deactivation after a 210-hour continuous test. —PDS

Science, this issue p. 76

IN OTHER JOURNALS

Edited by **Caroline Ash**
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CHEMICAL ENGINEERING

Advancing chemical kinetic modeling

Quantitative prediction of the time evolution of chemical mixtures is the central problem of reactive chemical engineering. This is a challenging task because of the thousands of elementary chemical reactions that must be considered in chemical kinetic modeling. Usually, such models are developed and refined gradually over many years. Using broadband rotational spectroscopy, combined with automated ab initio transition state theory-based master equation calculations and high-level thermochemical parametrization, Zaleski *et al.* reveal an important role of a variety of radical substitution reactions in the flash pyrolysis of acetone that was previously omitted in the corresponding combustion mechanisms. Their unified combination of modeling, experiment, and theory is a promising approach in the development of comprehensive chemical kinetic models. —YS

J. Am. Chem. Soc. **143**, 3124 (2021).

TUBERCULOSIS

Cellulose as virulence factor

Infections with *Mycobacterium tuberculosis* commonly display antibiotic treatment failure and immune evasion. The pathogen itself has several physiological properties that contribute to these resistances. Chakraborty *et al.* show that several mycobacterial pathogens can produce cellulose-containing biofilms. Biofilms are formed by *M. tuberculosis* in vitro and within granulomas in lung samples of mice, macaques, and humans. When nebulized cellulose was administered to infected mice in combination with frontline drugs such as isoniazid and rifampicin, lung tissue damage was minimal compared with controls receiving heat-inactivated cellulose. Strains of the pathogen engineered to overexpress bacterial cellulases grew well but were sensitive to antibiotics, produced deficient biofilms, and had limited capacity to cause tissue damage. Mycobacterial

PHOTO: TIM PAGE/GETTY IMAGES



POLITICAL SCIENCE

Engaging more after war

Exposure to war has been linked to short-term increases in collective action and prosocial behavior, but the extent to which these effects persist across generations is unclear. Barceló examined records of bombing locations and civilians' provinces of residence during and after the Vietnam War and found that civilians who lived in areas that were heavily bombed were still more likely to volunteer and participate in social groups more than a quarter of a century later. These civilians were also more likely to support participatory values such as believing people should have more say in government decisions. These findings suggest that war may have long-lasting effects on civic participation. —TSR

Proc. Acad. Natl. Acad. Sci. U.S.A. **118**, e2015539118 (2021).

A bombing strike in Vietnam, 1968

NEUROSCIENCE

Framing anti-depressant action

Essentially, all antidepressant drugs increase the expression and signaling of brain-derived neurotrophic factor (BDNF). These drugs act through tyrosine kinase receptor 2 (TRKB), the receptor for BDNF, to regulate neuronal plasticity. Casarotto *et al.* investigated the potential interactions among TRKB, cholesterol, and antidepressants. The authors found that a dimer of TRKB forms a binding pocket, where several antidepressants from different drug classes bind with a low but physiologically meaningful affinity. This low-level binding depends on membrane cholesterol to stabilize the TRKB structure in synaptic membranes and thereby promotes BDNF signaling. Such direct binding to TRKB and promotion of BDNF-mediated plasticity may therefore be a common mechanism of action for antidepressant drugs. —PRS

Cell, **184**, 1299 (2021).

CANCER

T cell burn out

Tumors generally contain infiltrating immune cells such as T lymphocytes, but these cells are often dysfunctional and offer little or no antitumor benefit. Cancer immunotherapies, such as immune checkpoint inhibitors, aim to reactivate these inactive T cells, but this approach is often unsuccessful as well. Sanmamed *et al.* have discovered a distinct subset of intratumoral T cells that could help to explain these observations. This subset of cells, which the authors call "burned-out" effector T cells, are able to proliferate and accumulate in the microenvironment of human non-small-cell lung cancer but lack antitumor effects and contribute to therapeutic resistance. —YN

Cancer Discov. 10.1158/2159-8290.CD-20-0962 (2021).

cellulose may represent an Achilles heel to target for tuberculosis therapies. —CA

Nat. Commun. **12**, 1606 (2021).

NANOMATERIALS

Growing up with the twist

Twisted layers of two-dimensional materials can display a variety of electron-correlation effects, but their fabrication usually requires exfoliation, transfer, and alignment of the sheets. Yu *et al.* show that twisted grain boundaries can form when monolayer crystals of molybdenum disulfide grown with random orientations by chemical vapor deposition on a silica surface collide and coalesce. Electron microscopy and Raman and second-harmonic generation spectroscopy showed that misorientations at the shared grain boundary $>20^\circ$ were preserved and led to moiré twist angles between 20° and 55° . Bilayers with dimensions from 2 to 10 micrometers formed from the top layer climbing over the bottom layer and aligning with it through

kink nucleation and propagation. —PDS

ACS Nano **15**, 4504 (2021).

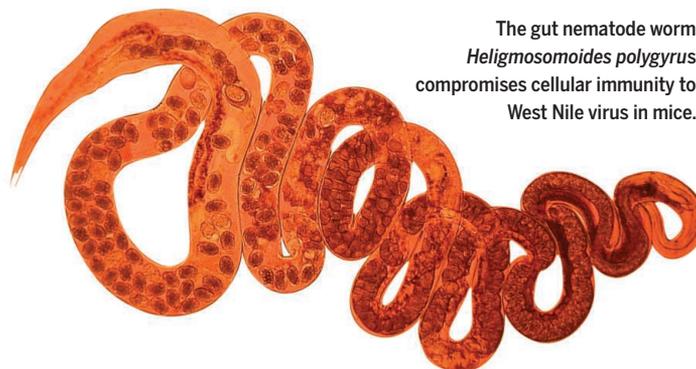
COINFECTION

Virus worms its way out of trouble

The immune system regularly encounters an array of bacteria, viruses, and multicellular organisms such as fungi and helminths. It remains unclear how the disparate responses mounted by the immune system are coordinated and the extent to which they affect one another. Desai *et al.* report that mice infected with the intestinal helminth *Heligmosomoides*

polygyrus bakeri were more prone to die during West Nile virus (WNV) coinfection. Coinfected animals had alterations in their gut mucosa that allowed translocation of commensal gut bacteria and induced failure of the anti-WNV CD8 T cell response. Helminth-derived succinate triggered tuft cells in the gut to produce type 2 cytokines. The cytokines were detected by intestinal epithelium and triggered gut barrier defects. Future studies are needed to tease out whether coinfections with other flavivirus–helminth combinations cause similarly detrimental immune synergies. —STS

Cell **184**, P1214 (2021).



The gut nematode worm *Heligmosomoides polygyrus* compromises cellular immunity to West Nile virus in mice.

Science

Framing anti-depressant action

Peter Stern

Science **372** (6537), 44-45.

DOI: 10.1126/science.372.6537.44-f

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