

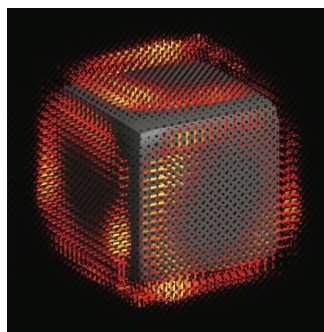
is also a high priority, especially with the rise of variants that may partially evade vaccines. The viral protein main protease is required for cleaving precursor polyproteins into functional viral proteins. This essential function makes it a key drug target. Qiao *et al.* designed 32 inhibitors based on either boceprevir or telaprevir, both of which are protease inhibitors approved to treat hepatitis C virus. Six compounds protected cells from viral infection with high potency, and two of these were selected for in vivo studies based on pharmacokinetic experiments. Both showed strong antiviral activity in a mouse model. —VV

*Science*, this issue p. 1374

## SPECTROSCOPY

### Mapping nanostructure surface excitations

Atomic vibrations (phonons) govern many physical properties of materials, especially those related to heat and thermal transport. They also provide fingerprints of the chemistry of a wide variety of materials, from solids to molecules. The behavior of phonons in nanostructures can be appreciably modified because of confinement effects. Li *et al.* combined several electron microscopy techniques to map out the phonon-polariton excitations across the surface of magnesium oxide nanostructures with high spatial, spectral, and angular resolution. The reconstruction of the surface excitation maps



Three-dimensional reconstruction of electromagnetic local density of states in a magnesium oxide cube

in three dimensions will be useful for understanding and optimizing the properties of the nanostructured materials for advanced functionality. —ISO

*Science*, this issue p. 1364

## QUANTUM CONTROL

### Dynamic stabilization of an array

Large-scale systems comprising one-dimensional chains and two-dimensional arrays of excited atoms held in a programmable optical lattice are a powerful platform with which to simulate emergent phenomena. Bluvstein *et al.* built an array of up to 200 Rydberg atoms and subjected the system to periodic excitation. Under such driven excitation, they found that the array of atoms stabilized, freezing periodically into what looked like time crystals. Understanding and controlling the dynamic interactions in quantum many-body systems lies at the heart of contemporary condensed matter physics and the exotic phenomena that can occur. —ISO

*Science*, this issue p. 1355

## SOLAR CELLS

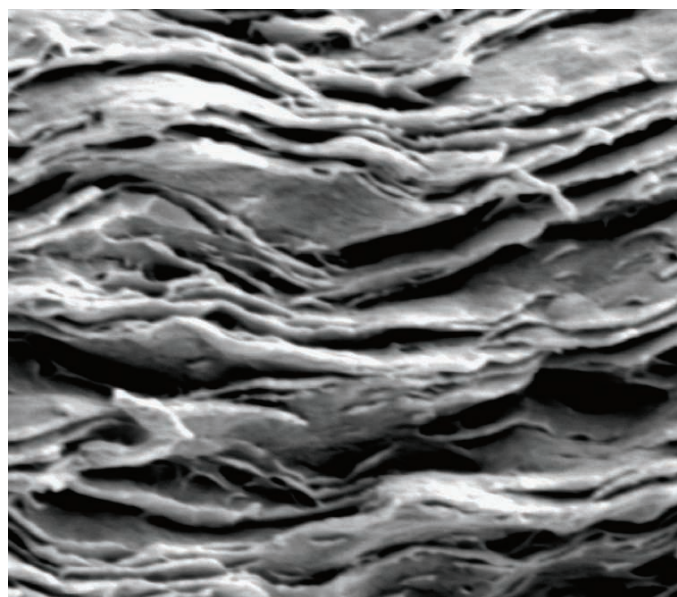
### Perovskite synthesis out in the open

Although methods have been developed that create the photoactive black perovskite phase of formamidinium lead iodide ( $\alpha$ -FAPbI<sub>3</sub>), these routes are temperature and humidity sensitive and less compatible with large-scale solar cell production. Hui *et al.* report an alternative route in which vertically aligned lead iodide thin films are grown from the ionic liquid methylamine formate. Nanoscale channels in the films lower the barrier to permeation of formamidinium iodide and enable transformation to  $\alpha$ -FAPbI<sub>3</sub>, even at high humidity and room temperature. Solar cells made with these films have power conversion efficiencies as high as 24.1% that display high stability. —PDS

*Science*, this issue p. 1359

## IN OTHER JOURNALS

Edited by **Caroline Ash**  
and **Jesse Smith**



## MATERIALS SCIENCE

### Recyclable nacre-like composites

The brick-and-mortar structure of nacre combines stiffness and exceptional toughness far in excess of the properties of the constituent materials and has thus been used as an inspiration for making tough composites. Lossada *et al.* combined nanoclay (the bricks) with a methacrylate-methacrylamide vitrimer polymer and some catalyst (the mortar) in aqueous solution. Vitrimers contain chemical cross-links, but the structure can be modified at elevated temperatures through bond-shuffling mechanisms. Thus, the properties of the nanocomposite can be tuned and the material can even be recycled by grinding and hot-pressing. The addition of a small amount of reduced graphene oxide enabled localized heating of the nanocomposites using laser irradiation. —MSL *ACS Nano* 10.1021/acsnano.0c10001 (2021).

Scanning electron micrograph of a fractured cross-section of a nacre-mimetic nanocomposite

## NEURODEGENERATION

### It takes tau to tangle

In Alzheimer's disease and in other neurodegenerative diseases known as tauopathies, misfolded tau protein forms filamentous aggregates, known as tangles, in the brain. These tangles have often been considered end-stage features that will remain indefinitely within the brain once formed. Croft *et al.* studied the formation and potential clearance

dynamics of tau inclusions in brain slices from tauopathy model mice. Initially, inclusions formed relatively rapidly, within a day or two, and turned over with a half-time of about a week. This turnover slowed down as the slices aged in culture. After 2 months in culture, deposited tau took ~3 weeks to turn over and its half-life had tripled. Thus, although they can be long-lived, tau inclusions may not necessarily be permanent. —SMH

*Acta Neuropathol.* **141**, 359 (2021).

## MYCOLOGY

**Indescribably delicious odors**

**T**ruffle fungi bring intense flavors to the table, with hints of garlic, potato, malt, cabbage, popcorn, and butter. Niimi *et al.* analyzed how volatiles from the white truffle *Tuber magnatum* vary with fruiting body maturity, the truffle's own microbiome, and soil, climate, and season. Volatiles exuded from truffles collected in Italy and Croatia comprised a similar range of compounds that nonetheless varied in relative concentration to produce distinct aromas. The diversity in volatile profile, it turns out, is associated with diversity in microbial affiliates. Although like fine wines, truffle aromas can also be attributed to terroir, the volatile profiles of individual truffles vary more within a region. —PJH

*New Phytol.* 10.1111/NPH.17259 (2021).

White truffles are prized for their delicious aromas that often originate from diverse microbial associates.



## EDUCATION

**Social justice meets STEM education**

It is critical that STEM students learn how science has been implicated in creating social inequities over time. Ali *et al.* describe a method for incorporating social justice themes into an organic chemistry curriculum. Instructors deliberately infused social justice themes into a standard curriculum by including key compounds that have had important social, cultural, and environmental impacts. Students then predicted products and identified functional groups of compounds now placed in a historical and social context. Although most of the students agreed that this method made the material more relevant, only 4% reported social justice discussions in other STEM courses, highlighting a plethora of missed opportunities. STEM instructors across disciplines are encouraged to emulate this approach and

infuse social justice into their courses. —MMc

*J. Chem. Educ.* 97, 3984 (2020).

## COSMOLOGY

**Curvature with interacting dark energy**

Some analyses of the cosmic microwave background (CMB) imply that the Universe probably has a closed geometry (positive curvature). This disagrees with several other cosmological observations indicating a flat (zero curvature) Universe. Di Valentino *et al.* investigated whether this discrepancy can be alleviated in cosmologies that allow dark energy to interact with dark matter. They found that these more general models strengthen the arguments for a closed Universe and lessen the tension with the large-scale galaxy distribution. However, the authors caution that the discrepancy in the Hubble constant becomes worse, and that a flat Universe cannot be ruled out. —KTS

*Mon. Not. R. Astron. Soc.* 502, L23 (2021).

## SIGNAL TRANSDUCTION

**Target for antidepressants**

Antidepressants are clinically effective and widely used but their mechanisms of action are not fully understood. Casarotto *et al.* propose that several different types of antidepressants all act directly on the neuronal receptor tyrosine kinase receptor 2 (TRKB). TRKB is the receptor for brain-derived neurotrophic factor, regulates activity-dependent synaptic plasticity, and has been implicated in antidepressant actions. The authors found three different types of antidepressant bound with relatively low affinity to the transmembrane domain of TRKB. Mutation of the site impaired antidepressant action in cellular and animal studies. The authors propose that the low-affinity binding can help to explain the known slow time course of antidepressant action, which might reflect slow accumulation of the drugs in the brain to reach a dose that enhances TRKB signaling. —LBR

*Cell* 184, P1299 (2021).

## MALARIA

**Forest-going risks**

Forest malaria occurs among economically driven migrants working in the Amazon. However, in the literature, conclusions about the role of forest activities in relation to malaria incidence are conflicting. Rerolle *et al.* investigated the risk of forest malaria in Lao People's Democratic Republic (PDR) in the context of a nationwide malaria elimination program. High-resolution Landsat remote-sensing imagery of forest cover and malaria incidence data were systematically gathered from four northern and four southern districts of Lao PDR between 2013 and 2016. Deforestation in a 30-kilometer radius around villages was associated with higher malaria incidence within a year, particularly of *Plasmodium falciparum* malaria, but declined over 3 years. In Lao PDR, unlike the Amazon, it is resident not migrant populations who suffer from forest malaria. —CA

*eLife* 10, e56974 (2021).

# Science

## Social justice meets STEM education

Melissa McCartney

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DOI: 10.1126/science.371.6536.1329-d

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