more fluorine atoms. However, the methods used to prepare mono-, di-, or trifluorocarbon centers tend to differ from each other in inconvenient ways. Yu *et al*. developed a radical reaction that can successively remove one or two fluorine atoms from trifluoromethyl groups adjacent to amides or esters. The mechanism relies on a spin-center shift after attack at the carbonyl oxygen by a boryl radical. —JSY

Science, this issue p. 1232

ASTROCHEMISTRY

Identifying PAHs in space

Midinfrared spectroscopy has shown that polycyclic aromatic hydrocarbons (PAHs) are abundant in many astronomical objects, but this technique cannot determine which specific PAH molecules are present. Radio astronomy could provide individual identifications if the molecule is sufficiently abundant and has a large dipole moment, but PAHs are expected to produce large numbers of very weak lines. McGuire *et al*. performed a stacking and matched filter analysis to search for PAHs in radio observations of TMC-1, located within the interstellar Taurus Molecular Cloud. They identified emission from two isomers of the small PAH cyanonapthalene, two fused benzene rings with a CN group attached. —KTS

Science, this issue p. 1265

TOPOLOGICAL OPTICS

Topology in the open

Controlling the topology of a system provides a route to develop devices that are robust against defects. Whereas earlier developments of topological band theory focused on Hermitian (closed) systems, recent efforts have been toward non-Hermitian (open) systems. K. Wang *et al*. report on the measurement and control of topologically nontrivial windings of a non-Hermitian energy band. By implementing non-Hermitian lattice Hamiltonians along a frequency synthetic dimension formed by optical frequency modes in a modulated ring-resonator, they directly visualized the nontrivial topological band winding and showed that the winding can be controlled. Such control provides a route for the experimental synthesis, characterization, and control of topologically nontrivial phases in open physical systems. —ISO

Science, this issue p. 1240

PAIN

Painful intercellular connections

Chronic pain impairs quality of life and is challenging to treat. Wangzhou *et al*. measured ligand and receptor gene expression in sensory neurons and various peripheral cell types from humans and mice. Using these data, the authors constructed a connectome of potential cell type–specific interaction points between sensory nerves and innervated tissues, which suggested that blocking heparin-binding epidermal growth factor (HBEGF) signaling may be an effective way to alleviate chronic pain in multiple diseases. This target was validated in a mouse model of mechanical pain. —LKF

Sci. Signal. **14**, abe1648 (2021).

INNATE IMMUNITY

Deep-sea microbes exhibit immunosilence

The innate immune system of mammals uses pattern recognition receptors (PRRs) to detect conserved ligands displayed by potentially pathogenic microbes. Gauthier *et al.* tested whether bacteria from deep-sea Pacific Ocean water samples could evade such immune surveillance mechanisms. The prototype PRR agonist lipopolysaccharide (LPS) from most strains of the deep-sea genus *Moritella* was deficient at engaging with mouse and human LPS-sensing PRRs despite retaining many common features of LPS in gut bacteria. The broad recognition powers of PRRs are thus not broad enough to detect a subset of microbes recovered from extreme environments. —IRW

Sci. Immunol. **6**, eabe0531 (2021).

IN OTHER JOURNALS

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

POLLINATION ECOLOGY

Insects in the city

The floral landscape for insect pollinators has undergone major changes in human-dominated environments. Tew *et al.* compared the distribution of floral resources in urban areas, nature reserves, and farmland in the United Kingdom. They estimated nectar supply in the three habitats by combining data on nectar sugar production and floral abundance. Nectar sugar production was similar per unit area in all three habitats, but the diversity of nectar sources in cities was substantially higher than that in farmland or nature reserves. Residential gardens were found to be of key importance in providing nectar resources from a wide variety of plant species for pollinating insects. —AMS

J. Ecol. 10.1111/1365-2745.13598 (2021).

The diversity of nectar sources in cities for pollinators such as this meadow brown butterfly now exceeds other major habitats in the UK.

MEDICINE

Bacteriotherapy for the skin

Atopic dermatitis, a form of eczema, can be exacerbated by colonization of the affected skin with *Staphylococcus aureus*. Nakatsuji *et al*. report a phase 1 clinical trial of *Staphylococcus hominis* A9 (*Sh*A9) as a topical treatment for atopic dermatitis. *Sh*A9 is found on the skin of healthy people and selectively

PHOTO: NICK UPTON/ALAMY STOCK PHOTO

SOIL CONSERVATION

Agricultural soil loss

The current era of major loss of agriculturally productive soils has gained relatively little public attention. It seems intuitively unnecessary to spell out what will happen to food production, hydrology, carbon sequestration, and ecological services if we allow soil erosion to proceed at current rates. However, it is difficult to quantify soil loss and to translate that into agricultural loss. Thaler *et al.* focused on the US Corn Belt and used remote sensing to map areas in fields that have no carbon-rich (i.e., A-horizon) soils remaining. Previous attempts to quantify soil loss suggested that little damage had occurred. By contrast, the new estimate indicates that ~35% of an area of ~400,000 square kilometers (a third of the Corn Belt area) has lost its A-horizon soil (~1.4 petagrams), especially on hillslopes. The authors suggest that mechanically working the land (tillage) has been responsible for most soil loss in this region. This degree of erosion translates into a 6% reduction in overall crop yield and ~$3 billion in economic loss. —CA

Proc. Natl. Acad. Sci. U.S.A. **118**, e1922375118 (2021).

Recent estimates show that up to 35% of the US Corn Belt has lost its carbon-rich topsoil, with mechanical tillage promoting erosion.

inhibits strains of *S. aureus* that have been associated with atopic dermatitis. It also improves atopic dermatitis in mice. The authors report that *Sh*A9 treatment did not cause serious adverse events, and *S. aureus* abundance was reduced, even during a short 7-day trial. Additionally, application of *Sh*A9 altered the microbial composition on affected skin, suggesting that the treatment induces a more beneficial skin microbiota. —GKA

Nat. Med. 10.1038/s41591-021-01256-2 (2021).

QUANTUM GASES

A versatile microscope

Quantum microscopes have been used for more than a decade now to image the many-body states of quantum gases in optical lattices. However, their resolution is limited to optical wavelengths, and they can typically image only a single layer of atoms. As a complementary technique for imaging quantum gases, Veit *et al.* developed an ion microscope. Atoms were first ionized by laser light, and the resulting ions were controlled using electrostatic lenses and imaged. Although the technique was demonstrated on rubidium atoms in their ground state, it is expected that it will also work on highly excited Rydberg atoms and will enable three-dimensional and time-dependent imaging. —JS

Phys. Rev. X **11**, 011036 (2021).

POLYMER CHEMISTRY

C–H activation goes macro

Methods to oxidize carbon-hydrogen (C–H) bonds under mild conditions are showing increasing promise in streamlining small-molecule synthesis. Chen *et al.* report an application tailored instead to a macromolecule: polyethylene. The world's most common plastic has proven hard to tweak without damaging its structural integrity, but a ruthenium porphyrin catalyst is just selective enough to introduce hydroxyl and carbonyl substituents without disrupting the backbone. The oxidized polymers remained mechanically robust while showing improved adhesion properties and wettability by simple latex paint. —JSY

Chem **7**, P137 (2021).

MACROCYCLES

Hold that pose

Within proteins, individual peptide bonds have free rotation but typically keep to a narrow conformational space. Macrocycles are already conformationally hindered and provide an interesting venue for pushing peptide bonds into uncharted territory. Diaz *et al*. prepared a series of small macrocycles using so-called dominant rotors, peptide-like units that are kinetically locked in a particular conformation. Structural analysis revealed unusual conformations of the peptide backbone beside the dominant rotor, perhaps indicative of the kinds of fleeting intermediates expected during peptide folding. —MAF

Nat. Chem. **13**, 218 (2021).

REPRODUCTION

Halting the flow of the embryo

After release of ova from the ovary, female germ cells are transported to the uterus through the oviduct or fallopian tubes. Various factors influence transit, including cilia, muscle contractions, and signaling molecules. Many mammalian species display temporary pausing and release, described as "valve-like tubal locking," as ova transit the oviduct, and this arrest may assist in fertilization. However, ova are occasionally inappropriately stalled in the oviduct, and an ectopic pregnancy can result if they are fertilized by sperm. Bianchi *et al.* identified the oviduct-expressed gene adhesion G protein–coupled receptor D1 (Adgrd1) as being important for mouse embryo transport, in particular the restraining mechanism during embryo transit. When the gene is defective, fluid flow in the oviduct is altered and embryos become retained in the oviduct ampulla. —BAP

Nat. Commun. **12**, 1251 (2021).

C–H activation goes macro

Jake Yeston

Science **371** (6535), 1217-1218.
DOI: 10.1126/science.371.6535.1217-e