

found that substantial reductions in plastic-waste generation can be made in the coming decades with immediate, concerted, and vigorous action, but even in the best case scenario, huge quantities of plastic will still accumulate in the environment. —HJS

*Science*, this issue p. 1515, p. 1455

## SURFACE CHEMISTRY

### Nature of the molecule-surface encounter

Adsorption is an important initial step in all heterogeneous chemical processes. However, detailed adsorption dynamics are complex and challenging to follow experimentally. Using the fact that vibrationally excited carbon monoxide molecules can be trapped on the Au(111) surface with all degrees of freedom being equilibrated except the vibrational ones, Borodin *et al.* show that the vibrational relaxation time can serve as an internal clock to follow the microscopic pathways of adsorption and equilibration on the surface. On the basis of molecular beam experiments and theoretical modeling of this prototypical system, the authors reveal the intricate interplay between physisorption and chemisorption states. These observed characteristics are relevant to many other heterogeneous systems. —YS

*Science*, this issue p. 1461

## WATER STRUCTURE

### Supercooled water structures

Water displays a number of anomalous properties that are further enhanced in its supercooled state, but experimental studies at ambient pressure must obtain data before the onset of rapid crystallization at temperatures below ~240 kelvin. Kringle *et al.* obtained infrared spectra of supercooled water films at temperatures between 135 and 235 kelvin that formed for a few nanoseconds by ultrafast heating and cooling.

Supercooled water thermally equilibrates before crystallization above 170 kelvin, and over the range of temperatures studied, the structure of water was shown to be a linear combination of a high-density and a low-density liquid. —PDS

*Science*, this issue p. 1490

## STELLAR EVOLUTION

### Complex stellar winds from evolved stars

Stars less than eight times the mass of the Sun end their lives as planetary nebulae, structures of ionized gas thrown off by the star and heated by the exposed stellar core. Planetary nebulae are often bipolar in shape or contain complex morphological features such as rings or spirals. Decin *et al.* observed the stellar winds of 14 stars during their asymptotic giant branch (AGB) phase of stellar evolution, which immediately precedes the planetary nebula phase. They found morphologies in the AGB winds similar to planetary nebulae and demonstrated that they are produced by the influence of a binary companion on the AGB wind. —KTS

*Science*, this issue p. 1497

## CANCER IMMUNOLOGY

### PD-1 keeps immune and tumor cells apart

When cytotoxic T cells enter tumors and become tumor-infiltrating lymphocytes (TILs), they lose their ability to kill target tumor cells. TILs in this state express inhibitory receptors, including programmed cell death protein-1 (PD-1), which are engaged in the tumor environment. Ambler *et al.* found that the suppressed cells had impaired cytoskeletal rearrangements and a decreased ability to form productive contacts with their targets. Blocking PD-1 signaling in vivo, but not in vitro, reversed these defects, stabilized the interactions between tumor cells and TILs, and improved cell killing. —JFF

*Sci. Signal.* **13**, eaau4518 (2020).

## IN OTHER JOURNALS

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

## IMMUNOLOGY

### NK cell nanotubes to the rescue?

**D**uring pregnancy, maternal decidual natural killer (dNK) cells maintain fetal tolerance while simultaneously fighting placental infection. How this happens is unresolved. Crespo *et al.* report that dNK cells could treat *Listeria monocytogenes*-infected fetal cells by selectively transferring granulysin (GLNY), but not granzymes or perforin, to fetal cells through cytoplasmic bridges called nanotubes. Transfer of GLNY inhibited the pathogen without harming placental trophoblasts. Moreover, transgenic mice overexpressing human GLNY were protected from *L. monocytogenes*-induced miscarriage. This work provides insight into how the maternal immune system protects the fetus from pathogens, which may help to improve pregnancy outcomes after mother-to-offspring transmission of infection. —STS *Cell* **182**, P1125 (2020).

The bacterial pathogen *Listeria monocytogenes*, shown here in a colored scanning electron micrograph, can be cleared from the placenta by specialized immune cells without risk to the fetus.

## MEDICINE

### Encouraging results for ALS

Amyotrophic lateral sclerosis (ALS) is a motor neuron degeneration disorder that leads to progressive muscle loss. There are limited therapies to treat ALS patients. Paganoni *et al.* report a phase 2 randomized, placebo-controlled trial involving 137 ALS patients, 89 of whom were treated with the combination of sodium phenylbutyrate plus taurursodiol. This combination has been shown to reduce neuron death and features of neurodegenerative diseases (including ALS) in preclinical models. This small trial, which treated patients for 3 weeks and monitored their progress for 24 weeks, found a modest reduction in functional decline in patients receiving the combination therapy. This is an

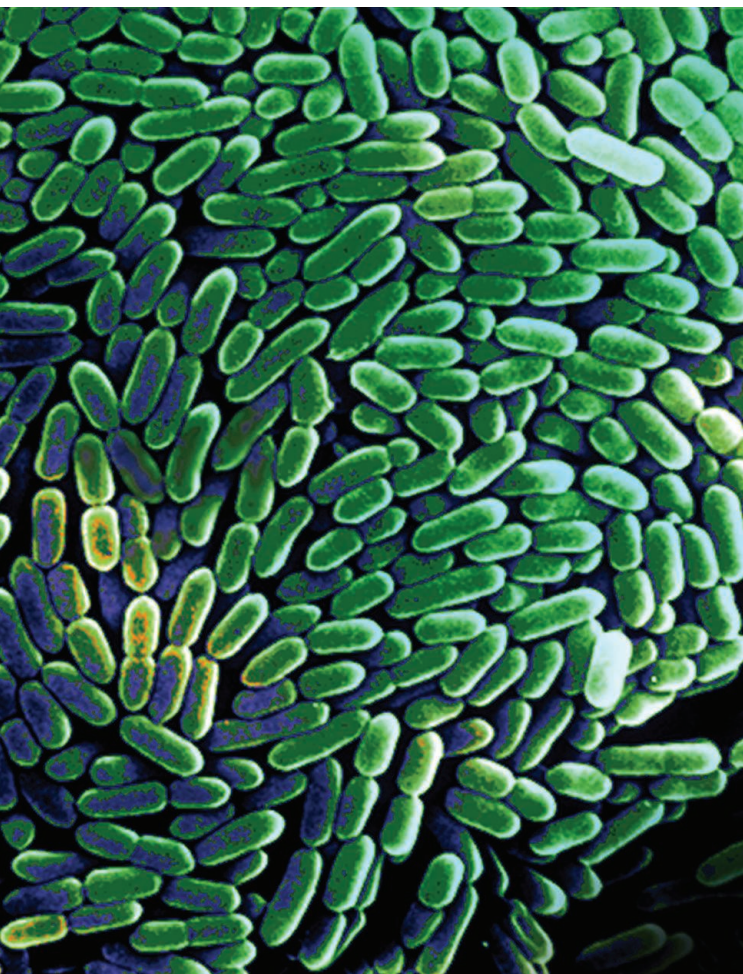
encouraging finding, and larger trials testing more patients over a longer period are expected. —GKA

*N. Engl. J. Med.* **383**, 919 (2020).

## CELL BIOLOGY

### Clonable EM labeling

Widespread use of the green fluorescent protein for protein localization at the light microscopy level has revolutionized cell biology. The search for a similar genetically encoded label for electron microscopy (EM) that could raise the resolution to the single-molecule level has not yet been successful. Jiang *et al.* developed a method for synthesizing 2- to 6-nm-diameter gold nanoparticles directly and specifically on individual cysteine-rich tags. This enables the unambiguous visualization of genetically tagged proteins in bacterial,



yeast, and mammalian cells with single-molecule resolution. This approach holds promise in circumventing the difficulties of conventional EM immunolabeling and enables biologists to probe the ultrastructure of cells with greater ease. —DJ

*Nat. Methods* **17**, 937 (2020).

## ECOLOGY

### A tipping point to a carbon sink

The ability of soils to act as carbon sinks has tended to diminish under current climate change conditions and from other anthropogenic influences. More rarely, the reverse can be true. Milner *et al.* sampled cores from an upland peatbog site in Wales, revealing a tipping point in the late 19th century, when

peat loss through erosion switched to peat accumulation through revegetation. Since then, 5 to 10 kilograms of carbon per square meter has accumulated. The causes of this flip are uncertain and may reflect a combination of shifts in grazing and mining activity in the region, as well

as geomorphological changes. This work may hold lessons for promoting carbon sinks in peatlands more widely. —AMS

*J. Ecol.* **10.1111/1365-2745.13453** (2020).

## ATMOSPHERIC MIXING

### Anti-aging scheme

The air of the lower stratosphere in the Southern Hemisphere has been getting younger since 1994. Strahan *et al.* report measurements of atmospheric  $\text{HNO}_3$  and  $\text{HCl}$  showing that changes in the transport circulation between the troposphere and stratosphere in the Southern Hemisphere are decreasing the age of its stratospheric air, whereas the age of its Northern Hemisphere counterpart is not declining. Understanding and quantifying the processes behind this differential aging is important for modeling how the protective stratospheric ozone layer will evolve in the future. —HJS

*Geophys. Res. Lett.* **47**, e2020GL088567 (2020).

## MATERIALS SCIENCE

### Leather-based radiation shield

Shielding the human body from x-rays frequently requires heavy materials, which often have poor mechanical properties. Wang *et al.* developed a lightweight and flexible x-ray shielding material made of leather treated with a solution

of radiation-absorbing metals. This “retanning” process is inexpensive and produces a radiation-blocking, flexible material. One potential application is replacing the heavy and uncomfortable lead aprons used for x-ray shielding in the medical field. —BG

*Adv. Mater. Technol.* **10.1002/admt.202000240** (2020).

## PHYSICS

### Magnons in 2D

Layered magnetic materials such as  $\text{CrI}_3$  can be thinned to the two-dimensional (2D) limit and still exhibit magnetic properties. These properties depend on the exact number of layers, with monolayer and bilayer materials having different symmetries. Cenker *et al.* studied the propagation of spin excitations, or magnons, in monolayers and bilayers of  $\text{CrI}_3$ . They used magneto-Raman spectroscopy to observe excitations consistent with magnons and tracked their dependence on the magnetic field and temperature. The optical selection rules extracted from these data agreed with theoretical predictions based on the threefold symmetry of the honeycomb crystal lattice of  $\text{CrI}_3$ . Because the material is insulating, the magnons are long-lived compared with those in metallic thin films, making this an attractive system for studying 2D magnon dynamics. —JS

*Nat. Phys.* **10.1038/s41567-020-0999-1** (2020).



Peat bogs, like these once severely eroded examples, can recover their carbon storage function if allowed to revegetate.