lysosomes. Jin *et al.* demonstrate that in naïve CD4$^+$ T cells from older individuals, mTORC1 activation instead occurs at late endosomes and depends on the amino acid transporter SLC7A5. Late endosomal mTORC1 impairs T cell lysosomal function, reducing the degradation of PD-1 and proliferative responses. Silencing VPS39, a gene that promotes late endosome formation, was able to increase the proliferation of aged human T cells and memory responses of lysosome-defective T cells in a mouse viral infection model, demonstrating that targeting late endosomal mTORC1 activity may improve T cell function. —CO

Sci. Immunol. **6**, eabg0791 (2021).

CATALYSIS

Rhodium atoms for alkane dehydrogenation

Nanoparticles of rhodium dispersed on metal oxides are generally poor catalysts for alkane dehydrogenation because the reactants bind too strongly to the metal. Hannagan *et al*. performed first-principle calculations indicating that single rhodium atoms in a copper surface should be stable and selective for conversion of propane to propene and hydrogen. Model studies of single rhodium atoms embedded in a copper (111) surface revealed a very high selectivity to propene and high resistance to the formation of surface carbon that would deactivate the catalyst. —PDS

Science, abg8389, this issue p. 1444

An artist's rendition of the electron density redistribution occurring as a single methane molecule is activated by a rhodium atom within a copper surface lattice

MATERIALS SCIENCE

The making of a monolith

Amorphous calcium carbonate is a hard material that is difficult to make into large, clear blocks. It is also sensitive to heating, and compacting the starting nanoparticles too much tends to lead to crystallization. Mu *et al*. determined the optimal amount of water in amorphous calcium carbonate to create clear, solid monoliths through compression. The key is to regulate the amount of diffusion in the system so that particle boundaries fuse without triggering sample-wide crystallization. This fusion strategy may also work for similar amorphous inorganic ionic compounds. —BG

Science, abg1915, this issue p. 1466

CORONAVIRUS

Masking out air sharing

The effectiveness of masks in preventing the transmission of severe acute respiratory syndrome coronavirus 2 has been debated since the beginning of the COVID-19 pandemic. One important question is whether masks are effective despite the forceful expulsion of respiratory matter during coughing and sneezing. Cheng *et al*. convincingly show that most people live in conditions in which the airborne virus load is low. The probability of infection changes nonlinearly with the amount of respiratory matter to which a person is exposed. If most people in the wider community wear even simple surgical masks, then the probability of an encounter with a virus particle is even further limited. In indoor settings, it is impossible to avoid breathing in air that someone else has exhaled, and in hospital situations where the virus concentration is the highest, even the best-performing masks used without other protective gear such as hazmat suits will not provide adequate protection. —CA

Science, abg6296, this issue p. 1439

IN OTHER JOURNALS

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

IMAGE: MICHAIL STAMATAKIS

MEDICINE

Acceptable algorithms for radiotherapy

Machine-learning applications in medicine have so far promised more than they have delivered. McIntosh *et al*. evaluated an algorithm that was integrated into the clinical workflow to plan curative-intent radiation therapy for prostate cancer. Human- and algorithm-generated treatment plans were compared in a blinded manner by physicians and one plan was selected. The machine-learning plans were generated faster than the human-generated plans and were selected by physicians for 72% of patients. However, when it came to treating patients, implementation of the machine-learning–generated plans decreased, likely because of the perception and preferences of the treating physicians and their experience to ensure patient care. Thus, such real-world variables need to be accounted for in studies of medical applications for machine learning to increase its utility and acceptance in the clinical setting. —GKA

Nat. Med. **27**, 999 (2021).

STEM WORKFORCE

Grassroots effort for change

Efforts to increase diversity in STEM (science, technology, engineering, and math) will not be truly successful until the systemic issues within academia that have historically prevented marginalized populations from persisting and succeeding there are transformed. Stachl *et al.* present the details of a collaborative effort to improve the academic climate of an R1 (very high research activity) STEM department: that

PHOTO: CATHERINE FALLS COMMERCIAL/GETTY IMAGES

FOOD SECURITY

Beef and more than two veg

To grow beef requires many more resources and emits 11-fold more greenhouse gases than raising poultry. It is easy to say eat less meat to mitigate environmental degradation and climate change, but how to do this? Eshel calculated how adopting nitrogen-sparing agriculture (NSA) in the United States could feed the country nutritiously, enhance carbon sequestration, and reduce nitrogen leakage into water supplies. The proposal is to shift to small, mixed agricultural enterprises in which the nitrogen budget is kept closed (nitrogen and carbon resources are biogeochemically tightly linked in agriculture). The core of a 1.43–hectare unit NSA farm is an intensive cattle facility from which manure production supports a variety of rain-fed and rotated crops of plant-based foods for humans, as well as livestock fodder. Less than half of today's current cropland in the United States is suitable for NSA. Nevertheless, this area has the potential to feed 330 million Americans and still have some left over for export. Arid rangelands could thus be spared or left to low-intensity grazing. —CA

PLoS Biol. 10.1371/journal.pbio.3001264 (2021).

In a rain-fed nitrogen-sparing agricultural system, intensive cattle farming can still play a role.

of the University of California, Berkeley. Longitudinal assessment of the academic climate by annual department-wide surveys indicated that these interventions have succeeded in shifting perceptions. These results support the idea that implementing practical, sustainable, and data-driven frameworks for effecting change can improve the climate within a departmental community. —MMc

ACS Omega **6**, 14410 (2021).

GRAPHENE GROWTH

Graphene growth on molten copper

Although graphene can be grown on solid copper surfaces, higher precursor pressures that lead to faster growth can be used on molten metals, and smoother graphene films can be made on liquid surfaces. However, investigating chemical vapor deposition growth on a liquid surface can be challenging. Jankowski *et al*. used a combination of x-ray diffraction and reflectivity, Raman spectroscopy, and optical microscopy methods to characterize and control graphene growth on molten copper. By changing the ratios of methane to hydrogen, the authors were able to produce highly ordered flake assemblies, and by using a single nucleation seed, they could grow millimeter-scale, single-crystalline graphene sheets. —PDS

ACS Nano 10.1021/acsnano.0c10377 (2021).

DEVELOPMENT

Cavernous lesions

Blood vessels within the brain supply oxygen but also allow circulation of other molecules, ions, and cells between the blood and the brain. About one in 200 people form cerebral cavernous malformations (CCMs), which are irregular collections of small cerebral vessels that alter the flow of blood and can result in headaches, seizure, hemorrhage, paralysis, or stroke. Li *et al.* used the zebrafish model system and CRISPR-Cas9 mutagenesis to inactivate the CCM gene. As a result, the caudal venous plexus became dilated, "honeycombing" of the vein lumen disrupted blood flow, and multiple blood-filled chambers with a risk of hemorrhaging formed. —BAP

eLife 10.7554/eLife.62155 (2021).

EXTINCTION EVENTS

Immediate impact

The environmental effects of the Chicxulub impact, the trigger of the mass extinction event at the Cretaceous–Paleogene boundary, can be seen clearly in the geological record on time scales of hundreds of thousands to millions of years. However, how this affected the marine biosphere in the decades and centuries after the strike is difficult to tell from proxy data because of their low temporal resolution. Brugger *et al.* modeled the immediate aftermath of sulfate aerosols, carbon dioxide, and dust caused by the impact, and found a short-lived algal bloom caused by upwelling of nutrients from the deep ocean and nutrient input from the impactor, a strong temperature decrease, and moderate surface ocean acidification. These results help to fill in a gap that proxies have left blank. —HJS

Geophys. Res. Lett. 10.1029/2020GL092260 (2021).

CELL BIOLOGY

Revealing hotspots for interaction

Biomolecular condensates are compartments in eukaryotic cells that are not membrane bound but can still concentrate specific functions. These phase-separated entities are increasingly recognized for their role in regulating a range of cellular processes. Interactions between intrinsically disordered protein regions are key to regulating phase separation, but experimentally obtaining atomic-resolution information remains challenging. Kim *et al.* have developed a suite of nuclear magnetic resonance (NMR) techniques to obtain quantitative and site-specific data on interactions that govern the phase separation of the RNA-binding protein CAPRIN 1. Aromatic and arginine residues are known to be important, but this work also shows a major role for backbone interactions. The NMR experiments also explore how interactions are modulated by posttranslational modifications or interactions with ATP. —VV

Proc. Natl. Acad. Sci. U.S.A. **118**, e2104897118 (2021).