

but important for monitoring earthquakes and tsunamis. Zhan *et al.* used the polarization of regular telecommunication traffic to detect earthquakes and water swells in a 10,000-kilometer-long fiber-optic submarine cable (see the Perspective by Wilcock). The deep-water Curie cable is not as noisy as terrestrial counterparts, allowing the authors to detect strain from the cable. Results from the 9-month observation period showed how current submarine fiber-optic cables can also be used as a geophysical tool. —BG

Science, this issue p. 931;
see also p. 882

TRANSPLANTATION

A ratio to predict rejection

Current strategies to identify rejection of transplanted kidneys rely on invasive surveillance biopsies or have limited predictive value. Therefore, an early and noninvasive biomarker to predict rejection is needed. Cherukuri *et al.* characterized the ratio of interleukin-10 to tumor necrosis factor- α expressed by transitional B cells as a biomarker of early T cell-mediated allograft rejection. The authors found that this ratio predicted rejection at 3 months after transplantation in three patient cohorts, and it may be an effective biomarker that can be used clinically to tailor therapy based on risk of rejection. —CSM

Sci. Transl. Med. **13**, eabe4929 (2021).

NANO-OPTICAL WRITING

Toward next-generation optical disks

Subdiffraction information bits can be written using superresolution methods to achieve extremely high-density information storage. Using lanthanide-doped upconversion nanoparticles to locally reduce graphene oxide flakes through upconversion resonance energy transfer upon engineered illumination, Lamon *et al.* achieved an

estimated storage capacity of 700 terabytes on a 12-centimeter optical disk by nanoscale optical writing, comparable to a storage capacity of 28,000 single-layer Blu-ray disks. This technology offers an inexpensive solution for the next generation of high-capacity optical data storage and enables energy-efficient nanofabrication of flexible, graphene-based electronics. —LNL

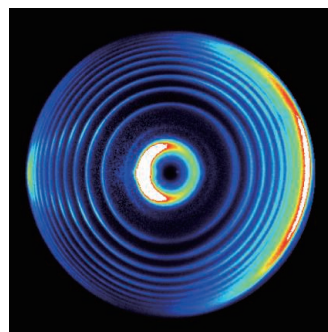
Sci. Adv. **10**.1126/sciadv.abe2209 (2021).

CHEMICAL DYNAMICS

Intriguing dynamics pattern in F + HD

Despite decades of studies, the role of relativistic spin-orbit interactions in the dynamics of chemical reactions remains an intriguing topic. Using a high-resolution velocity map imaging crossed beams technique, Chen *et al.* observed an interesting pattern in the differential cross sections in the $F + HD \rightarrow HF + D$ reaction near the partial wave resonances (see the Perspective by Rakitzis). Further theoretical analysis showed that this pattern originates from quantum interference between spin-orbit split partial wave resonances with different total parities. The effect of the fine structure of the partial waves observed for this long known yet not completely explored three-atom system represents one more remarkable demonstration of the truly quantum nature of chemical reaction dynamics. —YS

Science, this issue p. 936;
see also p. 886



The scattering pattern for the F + HD reaction reveals the fine structure of partial waves.

IN OTHER JOURNALS

Edited by Caroline Ash
and Jesse Smith



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POPULATION GENETICS

Linking phenotype with genotype

In humans, it is difficult to work out how natural selection affects phenotypic variation. With the accumulation of huge repositories of human genetic data and new computational methods, the impact of medical conditions and their evolutionary importance can be estimated. One challenge is that many complex diseases are linked to phenotypes with common and widely occurring genetic variants. Vy *et al.* predicted the overall number of deleterious genetic variants in coding proteins (known as the deleterious load) within individuals from the UK Biobank. Although overall deleterious load is not linked with any specific disease states, the authors found statistically significant associations between 27 traits and phenotypes associated with disease, including body mass, metabolic rate, and adiposity. Thus, the accumulative

effect of deleterious load might be a useful indicator for general health. —LMZ

PLoS Genet. **17**, e1009337 (2021).

EPIGENETICS

Inheriting female infertility

Polycystic ovary syndrome (PCOS) is a major cause of female infertility. It is characterized by hormonal and often metabolic dysfunction but little is understood about its etiology. For women with PCOS who do become pregnant, there is a high probability that their daughters will develop PCOS. This heritability has been proposed to arise, at least partially, if the embryos are exposed to abnormal levels of hormones. Mimouni *et al.* studied a mouse model of PCOS and found several differentially methylated genes in the ovaries of third-generation mice, indicating epigenetic-mediated heritability. Several of these genes were also differentially methylated in blood samples from mothers and

CREDITS: (FROM LEFT): CHEN ET AL.; JEFF ROTMAN/ALAMY STOCK PHOTO



PERCEPTION

Feel the light

Octopuses have remarkable bodies that they stretch and reshape in response to the environment and to the animal's needs. How control over such flexibility is managed is an ongoing question.

Work in this area has shown that octopus arms exert a degree of individual control. Katz *et al.* found that octopus arms display a phototactic response to light, automatically withdrawing when the arm (especially the tip) is illuminated. Unlike previously described photoresponsive cells in the skin of the arms, this response appears to be both autonomic and channeled through the central nervous system. Perhaps, the authors suggest, this allows the arms to be protected from foraging predators during the day, but gives the octopus an override option during their own foraging bouts. —SNV

J. Exp. Biol. 10.1242/jeb.237529 (2021).

Each arm of an octopus is capable of an autonomous response to light to ensure that it remains hidden when predators are active.

daughters with PCOS, indicating the potential for methylation as a diagnostic biomarker. —GKA

Cell Metab.

10.1016/j.cmet.2021.01.004 (2021).

THIN FILMS

Ionic liquids assist in vacuum

Molecular layer deposition, an analog of atomic layer deposition, alternates self-limiting reactions to grow materials such as polymers. However, the vacuum conditions in practice generally limit the choices to polymers in which the barrier to reaction is low without solvent assistance, such as those with thionyl or acyl backbones. Shi and Bent show that an ionic liquid, 1-ethyl-3-methylimidazolium, can create a solvation environment for the Friedel-Crafts reaction in vacuum. This ionic liquid did not evaporate at reaction temperatures, wetted a silicon substrate, and formed a eutectic with the $AlCl_3$ catalyst. The authors alternated deposition of isophthaloyl

dichloride and diphenyl ether along with the catalyst to grow polyetherketoneketone thin films at a rate of about 5.5 angstroms per reaction cycle. —PDS

ACS Nano 10.1021/acsnano.0c09329 (2021).

MATERIALS SCIENCE

Robust water-repellant fabrics

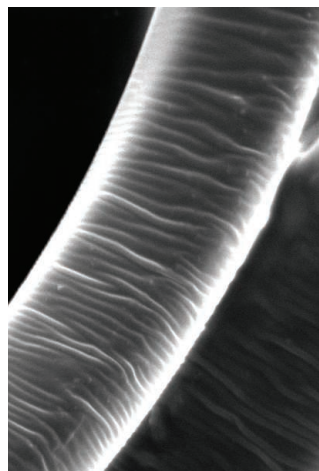
Materials that aggressively repel water are useful for protective fabrics and self-cleaning surfaces. However, it can be challenging to make coatings on woven fabrics that can resist rubbing and frequent washing cycles without using fluorinated molecules. Drawing inspiration from earthworms, which have wrinkled skins, Xu *et al.* created a similar surface texture on poly(ethylene terephthalate) fabric coating with poly(dimethylsiloxane) (PDMS). The PDMS is treated with an argon plasma, leading to the formation of cross links that have a graduated

depth concentration profile.

This causes the PDMS surface to wrinkle, which leads to water repellence. The fabrics could survive hundreds of washing or rubbing cycles, and damage to the PDMS could be repaired using heat or further argon plasma treatment. —MSL

ACS Appl. Mat. Interfaces

13, 6758 (2021).



Wrinkled poly(ethylene terephthalate)-coated fibers can make durable, water-repellant fabrics.

WORKFORCE

The chemistry of inequality

More and more data on the issues surrounding diversity and inclusion in STEM are surfacing. Stockard *et al.* contribute to these data by providing evidence of inequities in experiences and career plans of doctoral students in chemistry. Using mixed-model regression analyses, they show that graduate students identifying as part of a traditionally underrepresented group were less likely to report supportive relationships with peers and postdocs. Women were less likely to (i) report supportive relationships with advisers, (ii) commit to remaining in chemistry, and (iii) aspire to academic research careers. Overall, the results suggest that the reality for traditionally underrepresented graduate students remains full of subtle obstacles, which are likely not specific to the chemistry field, that continue to impede efforts toward a diverse and inclusive scientific workforce. —MMc

Proc. Natl. Acad. Sci. U.S.A. 118, e2020508118 (2021).

SIGNAL TRANSDUCTION

Signaling for stress

Guanosine triphosphatase-activating protein-binding proteins called G3BP1 and G3BP2 function as a core component of stress granules. Stress granules are dynamic assemblages of ribonucleoproteins that form in distressed cells found in tumors or neurodegenerative disease states. G3BP1 also has an unexpected role in tethering the tuberous sclerosis complex (TSC) of proteins to lysosomes. At the lysosome, the TSC regulates a key metabolic regulator called mTORC1. Prentzell *et al.* detected G3BP1 in a screen for proteins that interact with mTORC1. If G3BP1 levels are low, then mTORC1 becomes hyperactive, stimulating cell motility in tumors or neuronal hyperactivity, which could be bad news for patients. —LBR

Cell 184, P655 (2021).

Science

Signaling for stress

L. Bryan Ray

Science **371** (6532), 902-903.
DOI: 10.1126/science.371.6532.902-g

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