

IMMUNOLOGY

A different way for $\gamma\delta$ T cells to bind

The ligands bound by $\gamma\delta$ T cell receptors (TCRs) are less well characterized than those of their $\alpha\beta$ TCR cousins, which are antigens presented by major histocompatibility complex (MHC) and related proteins. Le Nours *et al.* identified a phenotypically diverse $\gamma\delta$ T cell subset in human tissues that reacts to MHC-related protein 1 (MR1), which presents vitamin B derivatives. A crystal structure of a $\gamma\delta$ TCR–MR1–antigen complex revealed that some of these TCRs can bind underneath the MR1 antigen-binding cleft instead of recognizing the presented antigen. This work thus uncovers an additional ligand for $\gamma\delta$ T cells and reconceptualizes the nature of T cell antigen recognition. —STS

Science, this issue p. 1522

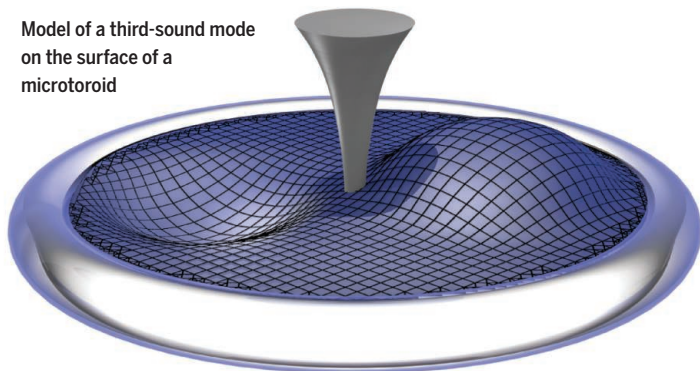
SUPERFLUIDITY

Following vortices around

When stirred, superfluids react by creating quantized vortices. Studying the dynamics of these vortices, especially in the strongly interacting regime, is technically challenging. Sachkou *et al.* developed a technique for the nondestructive tracking of vortices in thin films of superfluid helium-4. Their system contained a microtoroid optical cavity coated by a thin film of helium-4, in which vortices were created by using laser light. When imaging the subsequent dynamics of the vortices, the researchers found that coherent dynamics strongly dominated over dissipation. —JS

Science, this issue p. 1480

Model of a third-sound mode on the surface of a microtoroid



MATERIALS SCIENCE

Probing polycrystals' stress

The way that a polycrystalline material deforms is in part determined by internal stresses between and within crystal grains. Hayashi *et al.* developed an x-ray method for mapping the intragranular stresses in a polycrystalline material. They found surprisingly large stresses, which are important for the fundamental understanding of how these materials will fail. This method will work for other materials and provides important information for multiscale deformation modeling. —BG

Science, this issue p. 1492

CANCER

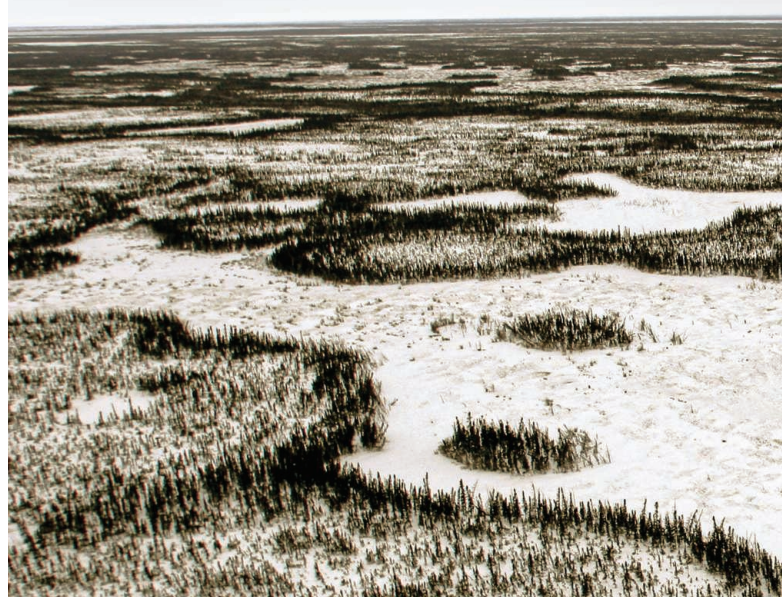
p53 makes a comeback

One reason that cancer cells are so difficult to kill is that they often lack p53, a key tumor suppressor that promotes apoptosis. To address this problem, Kong *et al.* devised a way to restore p53 gene expression in tumors by delivering p53 messenger RNA (mRNA) in nanoparticles. To minimize damage to healthy tissues, the authors used redox-responsive nanoparticles, taking advantage of the relative hypoxia of tumors. The use of mRNA rather than DNA provided an additional safeguard because mRNA acts directly in the cytoplasm, without integrating into host cell DNA and introducing mutations. The researchers tested their approach in multiple models in vitro and in vivo, with promising results. —YN

Sci. Transl. Med. **11**, eaaw1565 (2019).

IN OTHER JOURNALS

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TISSUE REGENERATION

Attending to tendons

For many athletes, an injury to a tendon (the tissue that connects muscle to bone) can be career ending. The regenerative capacity of tendons is limited; even after surgical repair, tendons often do not regain their original mechanical strength because of scar tissue formation. The mechanisms involved in the response to tendon injury are poorly understood. Studying the patellar tendon in mice, Harvey *et al.* found that tendon stem cells and scar tissue progenitor cells reside within the same micro-environmental niche and that the activity of both cell types is stimulated by platelet-derived growth factor receptor α . The shared response to this signaling pathway explains why fibrosis accompanies tendon healing and suggests that therapeutically disentangling the two responses may be difficult. —PAK

Nat. Cell Biol. **12**, 1490 (2019).

SOCIAL PSYCHOLOGY

Repeated fake headlines feel more moral

The repetition of false claims in the news may have downstream

effects on information processing. Effron and Raj found that repeatedly viewing a false headline increased approval and reduced perceptions of how unethical it would be to share it with others. Drawing on prior research, the authors hypothesized that repeated exposure increases the extent to which information feels true, even when participants know it is not. This intuitive feeling of truth is then used as an incorrect cue to signal the moral acceptability of sharing. These results suggest that news headlines that repeat false claims may inadvertently improve the moral standing of the speakers of those claims. —TSR

Psychol. Sci.

10.1177/0956797619887896 (2019).

BIOMINERALIZATION

Getting attached early

Carbonate biomineralization in a variety of organisms relies on a crystallization process whereby small calcium carbonate particles directly attach to one another to grow hard parts like shells, spines, and skeletons. Although this mechanism is reasonably widespread today, Gilbert *et al.* wondered how far



CLIMATE ECOLOGY

Trees stumped

As global temperatures rise, the distribution of ecological communities will shift, and their composition will change. Other things being equal, tree communities in the northern temperate zone are expected to expand northward. However, this will not be a seamless migration. Solarik *et al.* assessed the factors affecting the potential spread of temperate-zone trees into the boreal forest zone in northeastern North America. They found that substrate conditions, especially decaying wood and conifer needle cover, inhibit germination and establishment of temperate tree seedlings at the temperate-boreal transition. Hence, the northward progress of the temperate forest is likely to be patchy. —AMS
J. Ecol. 10.1111/1365-2745.13311 (2019).

Aerial view of the Canadian taiga in northern Manitoba

back they could find evidence of a similar process. By studying a characteristic texture that develops from crystallization by particle attachment, they identified this type of mineralization in a wide range of fossils. Particle attachment likely occurred as far back as the Cambrian and developed independently in different species. —BG

Proc. Natl. Acad. Sci. U.S.A.
116, 17659 (2019).

AGING

Inside the matrix

By performing a screen in human fibroblasts to detect genes that help cells survive the stress of protein misfolding in the endoplasmic reticulum (ER stress), Schinzel *et al.* detected the gene encoding transmembrane protein 2 (TMEM2), which is a cell-surface hyaluronidase active in the extracellular matrix. TMEM2 acted independently of the canonical unfolded-protein response pathways in the ER, instead relying on the cell surface receptor CD44 and stress-activated mitogen-activated protein kinase signaling. Like ER stress, disruptions in the extracellular

matrix are seen in aging, and enhanced hyaluronic acid synthesis is thought to be one of the ways that the naked mole-rat, a mammal known for its longevity, is protected from cancer. Thus, such signaling from glycosaminoglycan metabolism may have broad implications in health and disease. —LBR

Cell 179, 1306 (2019).

ROBOT BEHAVIOR

Dave versus HAL 9000

Cooperation between people depends on a willingness to establish common ground. Zanatto *et al.* asked how the basic rules of human cooperation apply when the other entity is a robot that has as much decision-making range as a

human (like HAL 9000 in the film *2001: A Space Odyssey*). In a money-investment game in which cooperativity enhanced gain, just as between two humans, the human-robot pair rewarded cooperativity and punished selfishness. But the human response was tuned according to whether the game was more or less successful than expected and whether the robot was more anthropomorphic or more machinelike. In a benign setting, the machinelike robot elicited more cooperation from the human game players. In a less rewarding setting, the more anthropomorphic robot elicited more cooperation from the human. The authors speculate that in the more hostile environment, people draw more

on social attributes to develop cooperation. —PJH

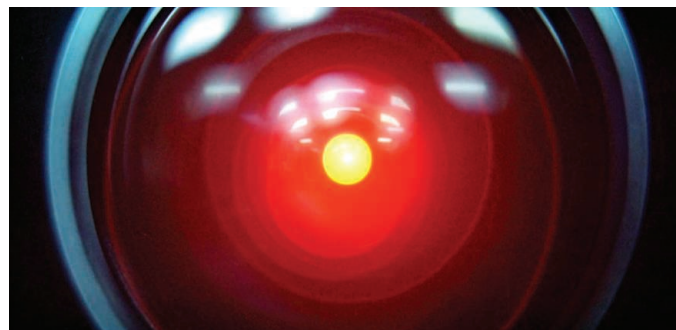
PLOS ONE 14, e0225028 (2019).

NANOELECTRONICS

A guiding path for graphene circuits

The favorable optical, electronic, and mechanical properties of graphene make it a target material for next-generation opto-electronics. However, that graphene is an atomic layer thick, or several for bilayer and few-layer graphene, can make it challenging to pattern circuits with usual lithographic methods, especially at lateral nanometer scales. Cheng *et al.* show that a carbon nanotube, separated from the graphene by a thin layer of hexagonal boron nitride, creates a one-dimensional conduction path in the graphene that can be controlled by electrostatic gating. Demonstrating that the charged massless quasiparticles, Dirac fermions, can now be confined to an electronic waveguide provides a route to developing a platform for patterning complex graphene circuitry. —ISO

Phys. Rev. Lett. 123, 216804 (2019).



HAL 9000, a nonanthropomorphic robot in the film *2001: A Space Odyssey*