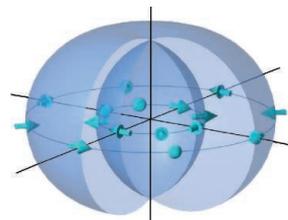


RESEARCH

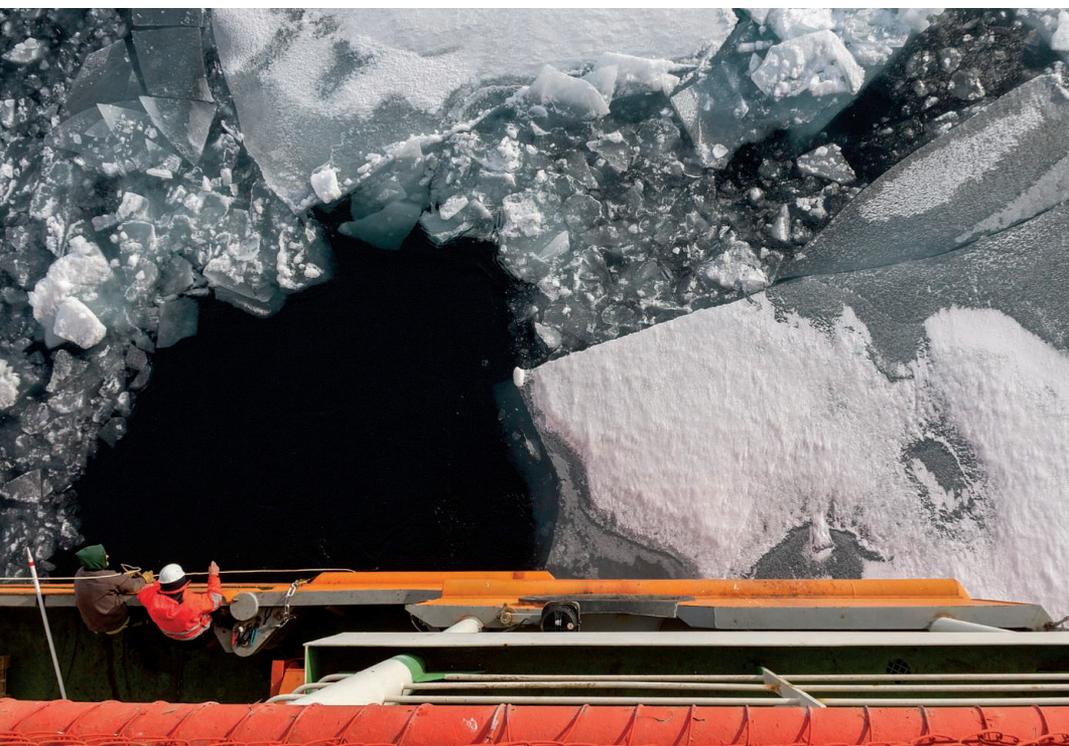
Multipolar electronic nematic

Harter et al., p. 295



IN SCIENCE JOURNALS

Edited by **Caroline Ash**



ARCTIC OCEANOGRAPHY

Losing its character

The eastern Eurasian Basin of the Arctic Ocean is on the far side of the North Pole from the Atlantic, but it is becoming more like its larger neighbor as the climate warms. Polyakov *et al.* show that this region is also evolving toward a state of weakened stratification with increased vertical mixing, release of oceanic heat, and less sea ice. These changes could have considerable impacts on other geophysical and biogeochemical aspects of the Arctic Ocean system and presage a fundamentally new Arctic climate state. —HJS

Science, this issue p. 285

Surveying the retreat of ice in the eastern Arctic Ocean

WOUND HEALING

Capturing chemokines in chronic wounds

In chronic poorly healing wounds, the initial proinflammatory signaling by chemokines persists. Lohmann *et al.* designed a synthetic hydrogel wound dressing based on heparin, a glycosaminoglycan that can bind and sequester chemokines. The hydrogel mops up inflammatory chemokines, such as monocyte chemoattractant protein-1 and interleukin-8, in the fluid of chronic venous leg ulcers and inhibits neutrophil and monocyte migration. The heparin hydrogel improved healing and vascularization of skin wounds in diabetic mice and reduced inflammation more effectively

than the FDA-approved hydrogel Promogran. —CC

Sci. Transl. Med. **9**, eaai9044 (2017).

SUPERNOVAE

Multiple images of a type Ia supernova

General relativity indicates that any sufficiently massive object bends the path of light passing by it. This effect is known as gravitational lensing. Goobar *et al.* have identified a supernova that is strongly lensed by a foreground galaxy, causing it to be highly magnified and splitting the light into four separate images. What is more, it is a type Ia supernova, a well-studied variety with reliable properties that can be used to constrain models

of the lensing. This distinctive object will enable cosmological measurements and can be used to probe the distribution of mass in the foreground galaxy. —KTS

Science, this issue p. 291



Palomar observations detected a strongly lensed supernova.

SURFACE CHEMISTRY

Low-temperature methane reactions

Methane is a potential feedstock for more valuable products. The strong carbon-hydrogen bonds of methane can be activated by heterogeneous catalysts but often at temperatures that make it difficult to control reactions selectively. Liang *et al.* show that methane, adsorbed on the stoichiometric IrO₂(110) under ultrahigh-vacuum conditions, reacts with exposed iridium atoms to break the carbon-hydrogen bonds at temperatures as low as 150 K. On heating, the surface fragments react cleanly with surface oxygen to form carbon dioxide, carbon monoxide, and water. —PDS

Science, this issue p. 299

MICROBIOTA

Gut anaerobes protect against pathogen invasion

Intestinal infections are a common problem for young animals. One explanation is that the protective gut microbiota is not fully established in infants. How the microbiota might protect against pathogens is unclear. Kim *et al.* found that members of the group of strictly anaerobic, spore-forming bacteria known as clostridia protect neonatal mice against diarrhea-causing pathogens. The protective effect is enhanced by giving mice the metabolite succinate in drinking water. Succinate favors colonization of the neonatal gut by cluster IV and XIVa clostridia and concomitantly excludes *Salmonella typhimurium*. —CA

Science, this issue p. 315

PHYSIOLOGY

Safe anaerobic metabolism

Naked mole-rats live in large colonies deep underground in hypoxic conditions. Park *et al.* found that these animals fuel anaerobic glycolysis with fructose by a rewired pathway that avoids tissue damage (see the Perspective by Storz and McClelland). These results provide insight into the adaptations that this strange social rodent has to make for life underground. They also have implications for medical practice, particularly for understanding how to protect tissues from hypoxia. —SNV

Science, this issue p. 307;
see also p. 248

EPIGENETIC INHERITANCE

Ancestral legacy effects

Environmental change can critically affect the lifestyle, reproductive success, and life span of adult animals and their for generations. Klosin *et al.* showed that in the nematode worm *Caenorhabditis elegans*, exposure to high temperatures

led to expression of endogenously repressed copies of genes—sometimes called “junk” DNA. This effect persisted for >10 generations of worms. The changes in chromatin occurred in the early embryo before the onset of transcription and were inherited through eggs and sperm. —BAP

Science, this issue p. 320

MUSCLE DEVELOPMENT

Micromanaging muscle cell fusion

Adult skeletal muscles are characterized by long, multinucleated cells called myofibers. Myofibers form when muscle precursor cells, or myoblasts, differentiate and fuse together during embryogenesis. The fusion process is not fully understood. Studying cell culture and mouse models, Bi *et al.* identified an 84–amino acid peptide that promotes myoblast fusion. This small peptide, called Myomixer, physically interacts with and stimulates the activity of a fusogenic membrane protein called Myomaker. Notably, the Myomaker-Myomixer pair can also promote the fusion of nonmuscle cells, such as fibroblasts. —PAK

Science, this issue p. 323

CANCER

Resident memory responses to cancer

Melanoma patients with vitiligo are more likely to have a positive outcome, but it is not known how. Malik *et al.* report that skin-resident memory T (T_{RM}) cells specific to melanoma antigens are maintained in vitiligo-affected skin. The cells persist and function independently of the lymphoid compartment, indicating that the vitiligo lesions provide a niche for T_{RM} cells. What is more, T_{RM} cells provide durable memory responses to the tumor, even in pigmented skin. —ACC

Sci. Immunol. **2**, eaam6346 (2017).

IN OTHER JOURNALS

Edited by Sacha Vignieri
and Jesse Smith



A combination of local organization and top-down enforcement facilitates successful accommodation of migrating pink-footed geese by farmers.

CONSERVATION

Facilitating refuges

As the human population has grown and spread, conflict between human activities, especially agriculture, and wildlife have become increasingly damaging and unsustainable. Policies that both legally protect wildlife populations and subsidize farmers for allocating resources to wildlife can help to mitigate these conflicts. Eythórrsson *et al.* evaluate the Norwegian portion of a plan put in place to reduce conflict between pink-footed geese (*Anser brachyrhynchus*) and farmers along the goose's northern flyway. They found that local organization of farmers and subsidies contributed to the success of the plan, especially when reimbursements were corrected to be more directly related to damages. However, top-down input (in the form of the intercountry species management plan) was also deemed essential for ensuring that the focus remained on goose conservation, as opposed to farmer reimbursement. Their analysis demonstrates the importance of combining transparency for stakeholders and strict enforcement for species conservation in efforts to facilitate species persistence in the face of human land use. —SNV

Ambio 10.1007/s13280-016-0884-4 (2017).

CANCER TREATMENT

Countering chemo's effects on fertility

Conventional chemotherapy with DNA-damaging agents has helped countless cancer patients become cancer survivors. This

successful outcome is sometimes accompanied by long-term side effects, however. In young female patients, for example, the alkylating agent cyclophosphamide can compromise fertility. This occurs because the drug causes inappropriate activation

ALSO IN SCIENCE JOURNALS

Edited by Caroline Ash

IMMUNOGENOMICS

What's in a drop of blood?

Blood contains many types of cells, including many immune system components. Immune cells used to be characterized by marker-based assays, but now classification relies on the genes that cells express. Villani *et al.* used deep sequencing at the single-cell level and unbiased clustering to define six dendritic cell and four monocyte populations. This refined analysis has identified, among others, a previously unknown dendritic cell population that potently activates T cells. Further cell culture revealed possible differentiation progenitors within the different cell populations. —LMZ

Science, this issue p. 283

CYTOSKELETON

Acetylation keeps microtubules strong

Cells need microtubules for intracellular transport and to avoid being crushed. On investigating microtubule breakage in live fibroblasts, Xu *et al.* found that if they were not acetylated, long-lived microtubules underwent frequent rupture after buckling. Acetylation makes microtubules more mechanically stable, facilitates sliding between filaments, and makes the lattice more plastic. —SMH

Science, this issue p. 328

STEM CELL NICHE

Double duty for mammary stem cell niche

The stem cell niche is a complex local signaling microenvironment that regulates stem cell activity for tissue and organ maintenance and regeneration. As well as responding locally, during puberty, the mammary gland stem cell niche also responds to systemic hormonal signals. Zhao *et al.* have found that Gli2, a transcriptional effector of Hedgehog signaling,

coordinates the niche-signaling program and activates expression of receptors for the mammatrophic hormones estrogen and growth hormone throughout the mammary gland (see the Perspective by Robertson). Disease may result not only from stem cell defects, but also from dysregulation of the microenvironment. —BAP

Science, this issue p. 284;

see also p. 250

NANOMATERIALS

Watching nanomaterials transform in time

Real-time analysis of chemical transformations of nanoparticles is usually done with electron microscopy of a few particles. One limitation is interference by the electron beam. Sun *et al.* monitored the oxidation of iron nanoparticles in solution by using small- and wide-angle x-ray scattering and molecular dynamics simulations (see the Perspective by Cadavid and Cabot). These methods revealed the formation of voids within the nanoparticles, diffusion of material into and out of the nanoparticles, and ultimately the coalescence of the voids. —MSL

Science, this issue p. 303;

see also p. 245

ANTIBIOTIC RESISTANCE

Drug efflux machinery inherited asymmetrically

In dividing bacterial cells, asymmetric distribution of cell wall constituents occurs between mother cells and their progeny. Asymmetric distribution of efflux machinery in a growing population of bacterial cells results in heterogeneity in antibiotic resistance. One consequence is that in the presence of low levels of antibiotic, older cells tend to live longer than younger cells. Using a microfluidic device to trap and measure dividing cells, Bergmiller *et al.* showed that

AcrAB-TolC, the main multidrug efflux pump of *Escherichia coli*, clusters at the pole of older cells (see the Perspective by Barrett *et al.*). As cell division proceeds and daughter cells age, they too gradually accumulate polar efflux pumps. —CA

Science, this issue p. 311;

see also p. 247

SOCIETY

Humans—an overwhelming force?

Human activities are the dominant force shaping Earth's surface processes today. In an Essay, Foley explores efforts to understand the human impacts on our planet and delineate boundaries beyond which the impacts will cause serious environmental damage. Starting from planetary boundaries that Earth has encountered in the past 10,000 years, he proposes frameworks for living within Earth's boundaries, building on ideas derived from natural ecological systems. Unlike humans, ecosystems do not use resources faster than they can be regenerated, they power nearly every process with the Sun, and they do not produce waste faster than it can be assimilated by the environment. —JFU

Science, this issue p. 251

PULMONARY DISEASES

A transcription factor drug for asthma

In asthma patients, too many goblet cells in the lung differentiate and produce excess mucus in response to inflammatory signals. In mice sensitized to house dust mite allergens, Sun *et al.* characterized a small molecule called RCM-1 that inhibits the activity of FOXM1, a transcription factor that is critical for airway goblet cell differentiation. RCM-1 also prevented airway hyper-reactivity and inflammation and

improved lung function in these mice. This molecule may have applications for other chronic pulmonary disorders associated with mucus hypersecretion.

—WW

Sci. Signal. **10**, eaai8583 (2017).

SOLID-STATE PHYSICS

A nonlinear peek into electronic symmetry

Strong interactions among electrons in some materials can cause them to assume configurations that are less symmetric than the underlying crystal lattice. These so-called electronic nematic states usually have inversion symmetry, but theorists have predicted that in metals with strong spin-orbit coupling, the inversion symmetry can be lost. Harter *et al.* teased out the symmetry of the electronic order in the compound Cd₂Re₂O₇ (see the Perspective by Dodge). They found that a known structural transition in this material is a consequence of another, previously hidden electronic order that breaks inversion symmetry. —JS

Science, this issue p. 295;

see also p. 246