

in mice that were treated with antibiotics and were thus lacking gut bacteria (see the Perspective by d'Enfert). Passage accelerated fungal mutation, especially around the *FLO8* gene, resulting in low-virulence phenotypes unable to form hyphae. Nevertheless, these phenotypes stimulated proinflammatory cytokines and conferred transient cross-protection against several other gut inhabitants. However, if an intact microbiota was present, only the virulent hyphal forms persisted. —CA

Science, this issue p. 589;
see also p. 523

ANTI-FLU THERAPY

Durable influenza protection

Vaccines are indispensable for the control and prevention of influenza, but there are several challenges to efficacy. Some individuals respond poorly to vaccination, and virus variation makes targeting optimal antigens difficult. Broadly neutralizing antibodies are one solution, but they have their own pitfalls, including limited cross-reactivity to both influenza A and B strains and the need for repeated injections. Now, Laursen *et al.* have developed multidomain antibodies with breadth and potency. Administered intranasally to mice with an adenovirus vector, the antibodies provided durable and continuous protection from a panoply of influenza strains. —STS

Science, this issue p. 598

PARKINSON'S DISEASE

The benefits of a missing appendix

Misfolded α -synuclein is a pathological hallmark of Parkinson's disease (PD). Killinger *et al.* report that the human appendix contains an abundance of misfolded α -synuclein and that removal of the appendix decreases the risk of developing PD. The appendixes of both individuals with PD and healthy

individuals contained abnormally cleaved and aggregated forms of α -synuclein, analogous to those found in postmortem brain tissue from PD patients. Furthermore, α -synuclein derived from the appendix seeds rapid aggregation of recombinant α -synuclein *in vitro*. In two large-scale epidemiological studies, an appendectomy occurring decades before reduced the risk of developing PD. —OMS

Sci. Transl. Med. **10**, eaar5280 (2018).

NANOMATERIALS

More alloying on silica

Controlling the stoichiometry and achieving a high degree of alloying of metals at ultrasmall scales for catalysis can be difficult. Double complex salts, formed by a cation like $\text{Pd}(\text{NH}_3)_4^{2+}$ and an anion like IrCl_6^{2-} , should be excellent precursors but are poorly soluble and difficult to adsorb directly on metal oxide surfaces. Ding *et al.* show that sequentially adsorbing the cations and anions from organic solvents onto a silica surface, followed by heating in hydrogen, creates well-mixed nanoparticles, most less than 3 nanometers in diameter, for a variety of alloys. These materials were then tested as catalysts for acetylene hydrogenation to ethylene. —PDS

Science, this issue p. 560

ORGANIC CHEMISTRY

Steps to smaller rings

Certain ring-forming reactions in organic chemistry are efficient because the orbital symmetries match up in the reactants and products. Oxyallyl ions tend to react with dienes in this paradigm to form seven-membered rings. Under palladium catalysis, Trost *et al.* redirected this reaction toward more common five-membered tetrahydrofuran rings by appending an ester to the diene. Although that pathway is symmetry-forbidden, the electron-withdrawing ester appears to stabilize a key intermediate along a stepwise route to the smaller ring. —JSY

Science, this issue p. 564

IN OTHER JOURNALS

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



Neutrophils can aid and abet metastasis.

CANCER

An ironclad role in metastasis

In the body's defense against cancer, immune cells are generally viewed as friends, not foes. One exception is neutrophils, which promote the growth of metastatic tumor cells. Liang *et al.* explored the signaling mechanism underlying this effect and identified a surprising culprit. Studying lung metastases in mice, they found that the tumor growth-promoting signal secreted by neutrophils is transferrin, an iron-transporting protein previously thought to be expressed mainly in liver cells. Transferrin synthesis in neutrophils was stimulated by a specific growth factor, called granulocyte-macrophage colony-stimulating factor (GM-CSF), produced by tumor cells in the metastatic microenvironment. Drugs blocking the activity of GM-CSF and its signaling pathway are already available and conceivably could be repurposed as treatments for metastatic disease. —PAK

Proc. Natl. Acad. Sci. U.S.A. **115**, 11060 (2018).

EVOLUTION

Networks of phenotypic variation

Evolution depends on phenotypic variation. Gene regulatory networks are theoretically expected to be likely sources

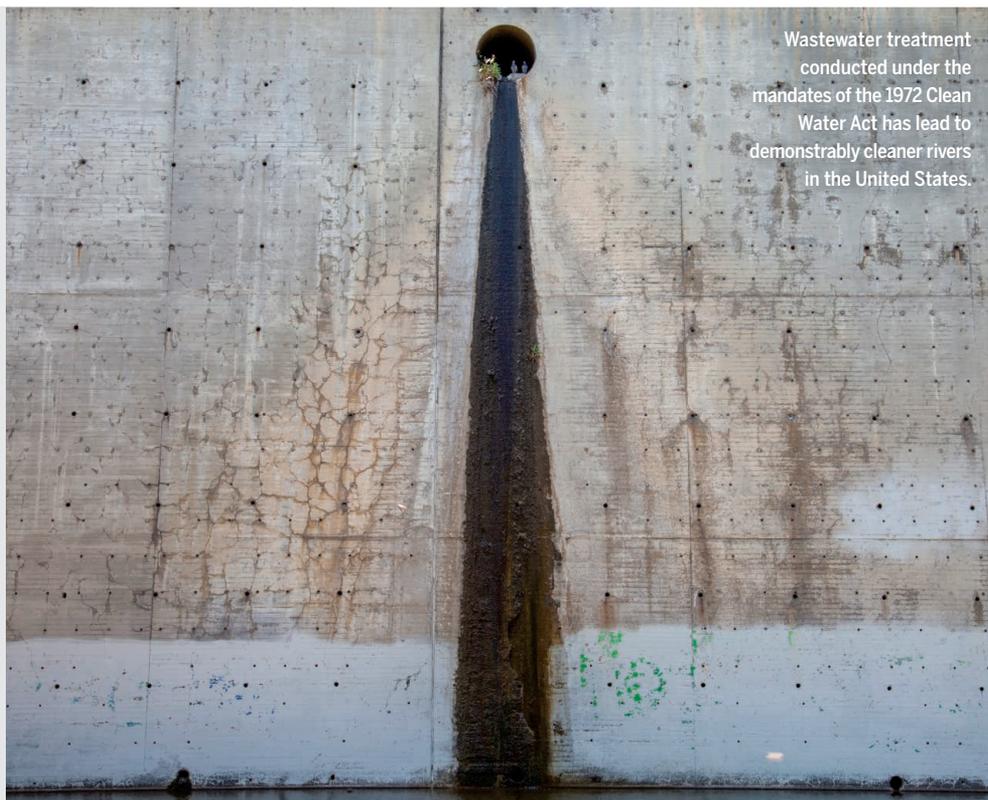
of variation. Schaefer *et al.* explored how the structure of gene regulatory circuits contributes to the range of mutant phenotypes that are produced. Synthetic networks in the bacteria *Escherichia coli* were built to test this idea

ENVIRONMENTAL POLICY

The Clean Water Act actually cleans water

Though the U.S. Clean Water Act has been in effect since 1972, evidence of its effectiveness has been unclear. Keiser and Shapiro compile comprehensive data on water pollution and its drivers, including 50 million pollution readings from 240,000 monitoring sites. They find that \$650 billion in federal grants to wastewater treatment plants made rivers significantly cleaner for 25 miles downstream for 30 years (\$1.5 million per mile per year). But the economic benefit in terms of home values within 25 miles of improved waters increased by only 25% of the cost of the grants. —BW

Quart. J. Econ. 10.1093/qje/qjy019 (2018).



Wastewater treatment conducted under the mandates of the 1972 Clean Water Act has led to demonstrably cleaner rivers in the United States.

experimentally. In colonies responding to a gradient of a stimulatory chemical, the networks produced a striped pattern of cells. Ultimately, the structure of the networks was critical in specifying the phenotypes that could be obtained by mutation. —LBR

Mol. Syst. Biol. 14, e8102 (2018).

EVOLUTIONARY GENOMICS

Mapping genotype to phenotype

Identifying genetic factors that contribute to trait variation among species is difficult. Weiss *et al.* developed a method for unbiased genome-scale mapping of trait differences and used it to work out how a range of yeast species evolved. When crossed, these yeast species produce sterile offspring, preventing the use of traditional genetic-mapping techniques. However, by reciprocal hemizyosity analysis via sequencing (RH-seq), alleles that contributed to differences in thermotolerance were spotted that diverged between two

species. Surprisingly, these turned out to map to essential housekeeping genes. Thus, without taking a candidate locus approach, RH-seq allowed identification of genes responsible for traits that differ between species. —LMZ

Nat. Genet. 50, 1501 (2018).

ANTHROPOLOGY

Osteobiology of Italian miners

There are few historical records of the lives of working-class people. In the late 1400s, alum—hydrated salts of aluminium sulfate—was valued as a primer for wood-panel paintings and as a mordant to stabilize textile dyes. To gain some insight into the diet and lives of the people who mined and processed alum mineral, Baldoni *et al.* analyzed bones from a grave site in the town of Allumiere, one of the first alunite mining sites in Italy. Each phase of the process left telltale musculoskeletal markers, including fractures and osteodegenerative disease.

Dietary analyses hint at consumption of beans, cabbage, and sheep and cattle meat, as well as medicinal plants. In this case, the record lies in the very bones of the people. —PJH

PLOS ONE 13, e0205362 (2018).

CLIMATE CHANGE

Oceans of help

The 2015 Paris Agreement advances the ambitious goal of trying to keep the global average temperature to less than 1.5°C higher than preindustrial levels, but current national pledges to reduce emissions are insufficient to achieve that target. The Ocean Solutions Initiative examined what steps might be taken to mitigate three major climate-related changes in the ocean—warming, acidification, and sea-level rise—as part of that effort. Gattuso *et al.* summarize the suggestions, limitations, and trade-offs discussed in the Initiative, finding that global-scale actions have both the greatest potential impact and the largest limitations and risks, whereas more-local

efforts are less risky but also less effective. A combination of global and local efforts has the greatest potential benefit. —HJS

Front. Mar. Sci. 5, 337 (2018).

METALLIC GLASSES

Packing away fractal structure

Metallic glasses are strong, but relatively elastic, making them interesting for a wide variety of applications. Much debate around the structure of these glasses has recently centered on the scaling between volume and the spacing between atoms. In two papers, Feng *et al.* show that this scaling overall is compact, like other solids. This contrasts with recent claims of more exotic, widespread fractal packing for similar metallic glasses. It also helps us understand the atomic origin of these fascinating materials. —BG

J. Phys. Condens. Matter 30, 255402 (2018); *Phys. Rev. B* 98, 024201 (2018).