

not migrate as historical herds had. However, after several decades, newly established herds were better able to track the emergence of vegetation in the environment and were increasingly migratory. Thus, newly introduced animals learned about their environment and shared the information through social exchange. —SNV

Science, this issue p. 1023; see also p. 972

FERTILIZATION Bouncer keeps fertilization specific

Fertilization needs to be highly efficient while remaining species-specific. However, despite decades of research, it is still unclear how these two requirements are met. Herberg *et al.* report the discovery of the Ly6/uPAR-type protein Bouncer as a species-specific fertilization factor in zebrafish (see the Perspective by Lehmann). Bouncer localizes to the egg membrane and is required for sperm entry. Remarkably, expression of Bouncer from another fish species (medaka) in zebrafish allowed for cross-species fertilization. —BAP

Science, this issue p. 1029; see also p. 974

CANCER Metastatic drivers same as primary

Treatment decisions for cancer patients are increasingly guided by analysis of the gene mutations that drive primary tumor growth. Relatively little is known about driver gene mutations in metastases, which cause most cancer-related deaths. Reiter *et al.* explored whether the growth of different metastatic lesions within an individual patient is fueled by the same or distinct gene mutations. In a study of 76 untreated metastases from 20 patients with different types of cancer, all metastases within a patient shared the same functional driver gene mutations. Thus, analysis of a single biopsy

could help oncologists select the optimal therapy for patients with widespread metastatic disease. —PAK

Science, this issue p. 1033

ANTHROPOLOGY Organization of historical cemeteries

The organization of Early Medieval cemeteries of the Alemanni, a Germanic tribe, is thought to be based on households. However, specific kinship relationships between individuals found in these cemeteries have not been tested formally. O'Sullivan *et al.* examined 13 individuals from the Niederstotzingen cemetery in southern Germany using ancient DNA. The strontium and oxygen isotope content of their dental enamel revealed that, whereas five of the individuals were second-degree relatives born in the region, two others were of nonlocal origin. Thus, other social processes, such as personal fealty to powerful families, might also have influenced the composition of these cemeteries. —MSA

Sci. Adv. 10.1126/sciadv.aao1262 (2018).

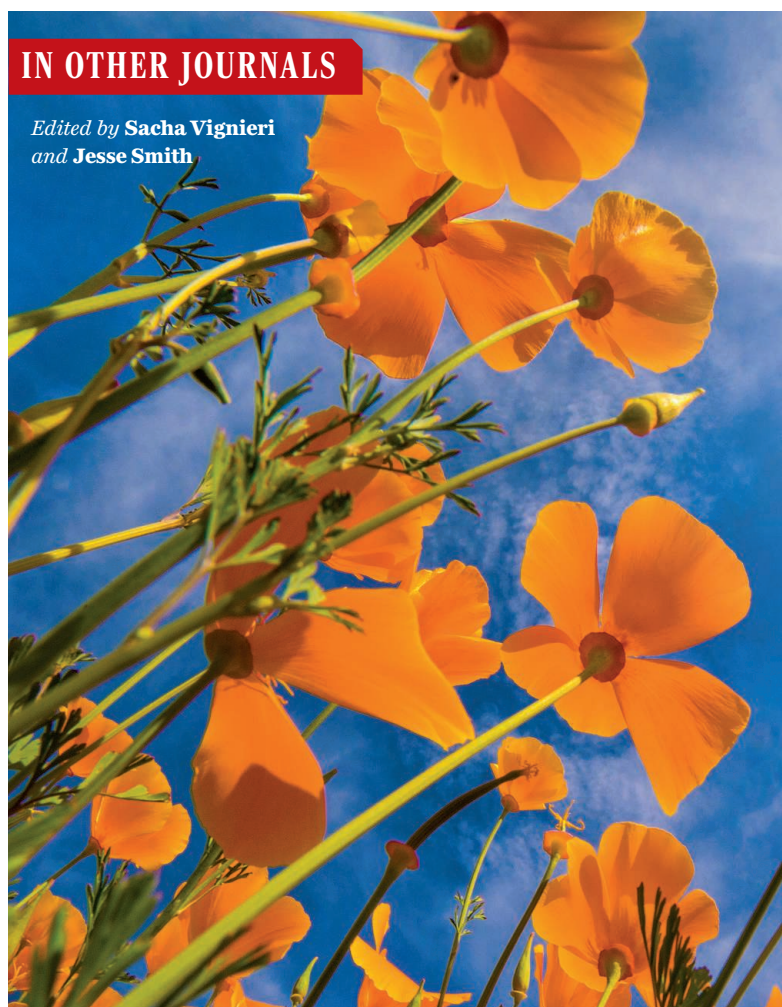
INFECTIOUS DISEASES Killer trifecta for leprosy

Cytotoxic granule proteins secreted by CD8⁺ T cells assist in the killing of both infected cells and intracellular bacteria. Balin *et al.* studied the ability of subsets of human CD8⁺ T cells that express different combinations of granule proteins to kill macrophages infected with *Mycobacterium leprae*. The CD8⁺ T cell subset with the highest efficiency of mycobacterial killing simultaneously expressed three granule proteins: granzyme B, perforin, and granulysin. Transcriptional profiling of CD8⁺ T cell subsets identified the natural killer (NK)-activating receptor NKG2C as a surface marker for identification and enrichment of these potent antimicrobial cells. —IW

Sci. Immunol. 3, eaat7668 (2018).

IN OTHER JOURNALS

Edited by **Sacha Vignieri**
and **Jesse Smith**



SYNTHETIC BIOLOGY Synthesizing a therapeutic probiotic

Phenylketonuria is a disease caused by an inability to metabolize the amino acid phenylalanine, which can accumulate in the blood and brain, causing neurotoxicity. Patients are treated by restricting phenylalanine intake through a low-protein diet, but this can cause failure to thrive. To improve the therapeutic options, Isabella *et al.* developed a probiotic that meets the current requirements for clinical testing. They engineered a strain of *Escherichia coli* with a strong safety profile in humans to inducibly express a phenylalanine-degrading enzyme. Oral administration of this probiotic in a mouse model of phenylketonuria prevented increased phenylalanine concentrations in the blood when the mice were

injected with phenylalanine, suggesting that gastrointestinal degradation can regulate circulating phenylalanine concentrations. Thus, this synthetic probiotic could have potential in clinical trials. —GKA

Nat. Biotechnol. 10.1038/nbt.4222 (2018).

CANCER Watching kidney cancer metabolism

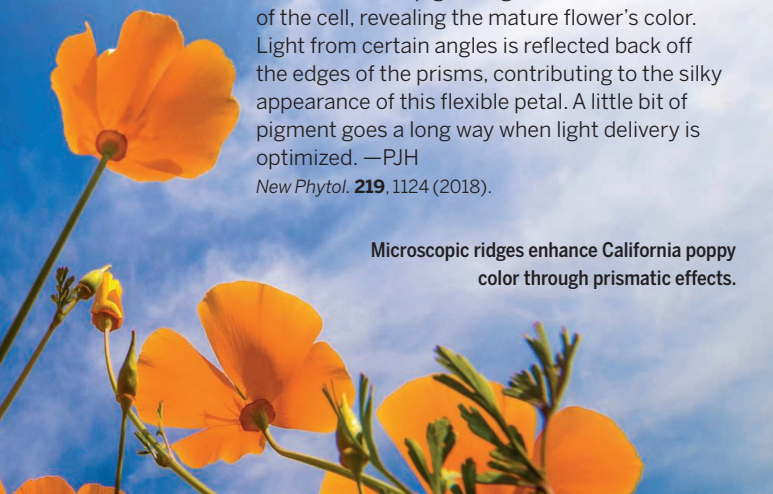
Clear cell renal cell carcinoma (ccRCC) is the most common and aggressive form of kidney cancer and undergoes extensive metabolic reprogramming. Courtney *et al.* infused a glucose isotope into patients with primary ccRCC who were undergoing surgery and traced metabolic and isotopic flux. Compared with cells of the adjacent kidney, tumor cells exhibited prominent

PLANT SCIENCE

Cell wall microlensing produces brilliant flower color

The California poppy is a drought-tolerant plant with brilliant yellow to orange flowers. Wilts *et al.* looked more closely to reveal the optics behind these intense colors. The surface of the flower's petals is covered with a tidy array of microscopic ridges that act like prisms. The ridges develop with successive deposits of cell wall and are aligned by rows of cells. When the ridge has been built and the cell has reached optimal size, light captured by the prism-like ridge is focused by microlensing onto carotenoid pigment granules at the bottom of the cell, revealing the mature flower's color. Light from certain angles is reflected back off the edges of the prisms, contributing to the silky appearance of this flexible petal. A little bit of pigment goes a long way when light delivery is optimized. —PJH
New Phytol. **219**, 1124 (2018).

Microscopic ridges enhance California poppy color through prismatic effects.



glycolysis, whereas the presence of tricarboxylic acid (TCA) cycle metabolites (indicating glucose oxidation) was diminished. ccRCC tumors were more glycolytic compared with brain and lung tumors from different patients. In one patient who was infused with an acetate isotope (acetate is a direct substrate of the TCA cycle), low TCA cycle turnover of metabolites was also observed. This phenomenon describes the Warburg effect of metabolism in ccRCC and highlights metabolic differences between different types of cancer. —MY
Cell Metab. **10.1016/j.cmet.2018.07.020** (2018).

QUANTUM OPTICS

A quantum optical storage box

The development of information technologies based on

quantum optics relies crucially on the ability to generate and propagate single photons in free space or optic fibers over vast distances. However, information processing also requires memory or storage functionality, and the ability to hold on to photons tends to pose a challenge. Seri *et al.* used femtosecond laser pulses to micromachine waveguides in an optical crystal of $\text{Pr}^{3+}:\text{Y}_2\text{SiO}_5$. By identifying irradiation conditions that avoid damage to the crystal, they found that the properties of the waveguide, such as the storage time for single photons, are enhanced. Relatively long storage times, combined with compatibility with other optical processing technologies, could provide a powerful platform for developing complex integrated quantum architectures. —ISO
Optica **5**, 934 (2018).

HUMAN GENETICS

Linking disease genotypes to phenotype

The penetrance of a genetic variant is the degree to which a specific genetic change affects an individual's phenotype. However, it is not clear why a specific pathogenic mutation exhibits an unpredictable phenotype among individuals. Castel *et al.* examined the genomes and expression of RNA across individuals and found that deleterious mutations affecting protein-coding genes are more likely to be linked to regulatory elements that lower the expression of the pathogenic gene—hence lowering the overall penetrance of the mutation. However, relative to unaffected people, the overall penetrance was higher in individuals with cancer and autism. These results suggest that the joint effects of regulatory and coding mutations are subject to purifying selection to reduce penetrance. —LMZ

Nat. Genet. **10.1038/s41588-018-0192-y** (2018).

METALLURGY

Tracking corroding chloride

Corrosion is a major problem for metals, reducing their performance and shortening their lifetimes. Passive films that form on metal surfaces can help provide corrosion resistance but are also susceptible to localized attack. Zhang *et al.* used transmission electron microscopy to

take a detailed look at chloride attack on the passive films of an iron-chromium-nickel alloy. This direct visualization of chloride-ion transport allows for a much better understanding of how these ions modify the surface layer of metals and deeper insight into the corrosion process. —BG

Nat. Commun. **10.1038/s41467-018-04942-x** (2018).

SOCIAL NETWORKS

Segregated travel patterns within cities

People within cities are often segregated by race and class. To find out if segregation is limited to where people reside or if it extends to movements outside of their homes, Wang *et al.* analyzed 650 million geocoded tweets from 400,000 residents of America's 50 most populous cities to track their travel patterns. They found that people who live in primarily black or Hispanic neighborhoods, regardless of income, were less likely to travel to white or middle-class neighborhoods, even more so than residents of poor white neighborhoods. This relationship held even though all groups travel approximately the same distance during their day to the same number of neighborhoods. These data have implications for understanding the breadth of racial segregation within cities. —TSR

Proc. Natl. Acad. Sci. U.S.A. **115**, 7735 (2018).



Chloride ions attack passive films on metal surfaces and cause corrosion.