

## GUT IMMUNITY

### Phagocytes patrol intestinal fungi

Maintaining a healthy balance of gut bacteria can promote good health. Leonardi *et al.* show that fungi can also interact with gut immune cells to maintain intestinal well-being. CX3CR1<sup>+</sup> mononuclear phagocytes (MNs) patrol the intestine and promote antifungal immunity. Genetic deletion of CX3CR1 in MNs caused colitis-like symptoms in mice. CX3CR1 polymorphisms were detected in Crohn's disease patients that were unable to produce antibodies against multiple fungal species. Thus, commensal fungi may be as important as bacteria in maintaining gut health, and antifungal therapy could hold promise for treating intestinal inflammation. —PNK

*Science*, this issue p. 232

## GEOLOGY

### Volcanic eruptions in the deep sea

Large subaerial volcanic eruptions are among the most dramatic and intensively studied geological events on our planet, but similar submarine eruptions are less well understood. Carey *et al.* describe the largest submarine eruption in the past century. In 2012, the Havre volcano erupted off northern New Zealand at ocean depths in excess of 900 meters, producing an enormous raft of pumice—a gaseous froth of silica-rich lava. —KH

*Sci. Adv.* 10.1126/sciadv.1701121 (2017).

## DNA DAMAGE

### The many roles of ATM

The kinase ATM coordinates the response to DNA damage. Lee *et al.* report that ATM also coordinates a response to oxidative stress that is independent of its response to DNA damage. Activation of ATM by oxidative stress promoted

mitochondrial function and autophagy, thus enabling cell survival through metabolic changes and the clearance of toxic protein aggregates. Thus, the loss of ATM in the neurodegenerative disease ataxia telangiectasia may reflect wide-ranging cellular stresses beyond a defective DNA-damage response. —LKF

*Sci. Signal.* 10, eaan5598 (2018).

## INFECTION

### Cholera pathogen zaps competition

Many bacterial pathogens inject their hosts with virulence effectors delivered by specialist secretion machines. *Vibrio cholerae* has a type VI secretion system (T6SS) that can be loaded with protein toxins that target eukaryote host cells or kill competing bacteria. Zhao *et al.* discovered that mutant *V. cholerae* lacking a T6SS could not compete against *Escherichia coli* strains in the mouse gut. In contrast, intact *V. cholerae* readily gained a foothold in the gut of young mice, pumping up inflammatory immune responses and prompting more violent symptoms. —CA

*Science*, this issue p. 210

## POROUS MATERIALS

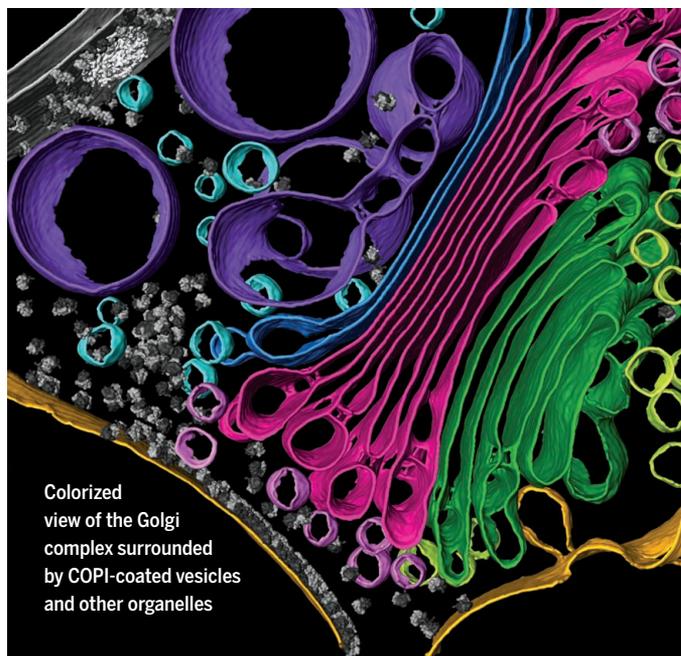
### Mesoporous metal-organic frameworks

The diffusion limitations on gas storage and catalytic reaction of microporous materials can often be overcome if they are incorporated into a mesoporous structure with much larger pores. Shen *et al.* grew ordered arrays of microcrystals of the ZIF-8 metal-organic framework, in which zinc ions are bridged by 2-methylimidazole linkers, inside a porous polystyrene template. These materials showed higher reaction rates for the Knoevenagel reaction between benzaldehydes and malononitriles and better catalyst recyclability. —PDS

*Science*, this issue p. 206

## IN OTHER JOURNALS

Edited by Sacha Vignieri and Jesse Smith



Colorized view of the Golgi complex surrounded by COPI-coated vesicles and other organelles

## CELL BIOLOGY

### Seeing the real thing

Membrane trafficking within the Golgi complex is mediated by COPI (coat protein complex I)-coated vesicles. Much is known about these vesicles and coats from in vitro studies, but their makeup in situ is less well understood. Bykov *et al.* used cryo-electron tomography of vitrified *Chlamydomonas reinhardtii* cells to analyze COPI-coated vesicles directly. The native algal structure resembled a previously described structure of in vitro reconstituted mammalian COPI-coated vesicle, but it also revealed bound cargo. The observations suggest that coat components disassemble simultaneously shortly after vesicle budding. The distribution of vesicles around the morphologically polarized Golgi complex allowed the authors to parse out the stage of vesicles in the transport pathway. The COPI-coated vesicles increased in size as they progressed from cis to trans Golgi compartments, and the density of their cargoes varied. Nevertheless, the structure of the coat machinery itself remained the same. —SMH

*eLife* 10.7554/eLife.32493 (2017).

## CANCER

### A death knell for relapsed leukemia?

A subset of patients with acute myeloid leukemia (AML) experience partial or even complete remissions after treatment with conventional chemotherapeutic drugs. Almost invariably, however, the disease returns and is often fatal. Relapse has

been attributed to the expansion of preexisting leukemic clones that are resistant to therapy. In a preclinical study, Pan *et al.* investigated whether better efficacy might be achieved by using a class of drugs that work by inducing apoptotic cell death. They found that mice with drug-resistant AML showed dramatically extended survival after treatment with a



## AGRICULTURE

## Multiple strategies needed to improve agricultural productivity

**T**he world will need 50% more agricultural output by 2050 to keep up with global population growth. Muller *et al.* ask whether organic agriculture is compatible with producing enough food to feed the world in a sustainable manner. Analysis of various production and environmental factors showed the pluses and minuses of large-scale organic farming. Organic farming needs more land than conventional farming, although that need could be counterbalanced if food waste and demand for animal products were reduced. An anticipated deficiency in nitrogen supply could be ameliorated by recycling and by using legumes and crops optimized for nitrogen-use efficiency. Thus, organic farming could be part of a strategy that includes shifts in diet, reductions in food waste, and changes in crops to move toward an agricultural system that is both more productive and more sustainable. —PJH

*Nat. Comm.* 10.1038/s41467-017-01410-w (2017).

Shifts in behavior and process will facilitate the integration of organic farming as a large-scale, sustainable agricultural approach.

combination of two drugs that promote apoptosis by distinct mechanisms. This combination therapy of venetoclax (a Bcl-2 inhibitor) and idasanutlin (a p53 activator) is now in clinical trials for relapsed AML. —PAK

*Cancer Cell* 32, 748 (2017).

## EDUCATION

### Labs, lectures, and gender differences

Gendered performance differences (GPDs) remain an issue in ensuring equitable access in science, technology, engineering, and mathematics (STEM). Matz *et al.* systematically measured performance gaps across STEM courses to further investigate the contribution of GPDs to performance and/or persistence in STEM. This report is the first wide-ranging, multi-institution assessment of GPDs, encompassing more than a million student enrollments at five universities. Controlling for factors relating to academic performance, the team found evidence that GPDs in many courses were statistically significant and

consistent from term to term. GPDs in STEM lecture courses tended to favor men, although these differences were not seen in the corresponding laboratory courses, suggesting further research is needed on the structure and evaluative schemes of STEM lecture courses. —MMc

*AERA Open* 10.1177/2332858417743754 (2017).

## GENE THERAPY

### CRISPR corrects deafness in mice

Limited treatment options are available for individuals with hereditary hearing loss. CRISPR-Cas9 editing can be used as molecular scissors that snip out mutant DNA sequences to permit gene repair. Gao *et al.* asked whether the Cas9 cutting enzyme could be used to correct genetic deafness caused by dominant mutations in the *Tmc1* gene. The researchers performed a lipid-mediated delivery of Cas9-RNA complexes to the inner ear of neonatal mice. They were able to edit the mutant *Tmc1* gene within the cochlear

hair cells that sense acoustic vibrations. Mice showed signs of improved cochlear function and hearing restoration. —PNK

*Nature* 10.1038/nature25164 (2017).

## BIOMATERIALS

### Make no bones about titanium

Titanium and its alloys with aluminum or niobium have been used for medical implants, such as metal plates to hold fractured bones together, because titanium bonds well to bone. However, pure titanium is much stiffer than bone material, and it can shield the surrounding bone from normal loads and stresses. This causes the bone to weaken because remodeling depends on stress history. Takizawa *et al.* compressed and sheared titanium fibers to make plates with the same elastic modulus of bone cortex. By being porous, these plates become suitable scaffolds for cell infiltration and bone repair. In vivo studies in rabbits showed that the plates could help immobilize small bone fragments, without the risk

of leaching niobium or aluminum into the host. —MSL

*Adv. Mater.* 10.1002/adma.201703608 (2017).

## FRAMEWORK CATALYSIS

### Shifting zwitterion reactivity

Phosphines are often ligands for transition metal catalysts, but they can catalyze reactions at unsaturated carbon atoms by forming phosphonium zwitterions. For example, triphenylphosphine forms a zwitterion with methylvinylketone that acts as a nucleophile to convert *n*-alkyl aldehydes to  $\beta$ -hydroxy enones (the Morita-Baylis-Hillman reaction). Bauer *et al.* show that when the reaction is conducted in metal-organic framework compounds with linkers bearing amino groups, rather than in solution, the phosphonium zwitterion can act as an electrophile. The products—1- and 3-*n*-alkylesters of 2-alkyl-1,3-diols—form through the Aldol-Tishchenko reaction. —PDS

*J. Am. Chem. Soc.* 10.1021/jacs.7b10928 (2017).