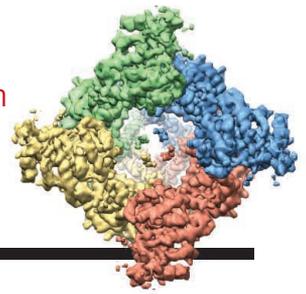


RESEARCH

Structure of TRPM ion channels elucidated

Yin et al., p. 237



IN SCIENCE JOURNALS

Edited by Stella Hurtley



Egyptian fruit bats were used to identify a brain region that recognizes fellow individuals.

NEUROSCIENCE

The representation of others in space

Different sets of neurons encode the spatial position and orientation of an organism. However, social animals need to know the position of other individuals for social interactions, observational learning, and group navigation. Surprisingly, very little is known about how the position of other animals is represented in the brain. Danjo *et al.* and Omer *et al.* now report the discovery of a subgroup of neurons in hippocampal area CA1 that encodes the presence of conspecifics in rat and bat brains, respectively. —PRS

Science, this issue p. 213, p. 218

SOLID-STATE PHYSICS

Neutrons peek into f-electron bands

Neutron scattering can be used to tease out the details of collective magnetic excitations that yield well-defined peaks in the data. In principle, it could also be used to look into single-electron band excitations, but collecting enough data to capture broad

distributions of intensity is tricky. Goremychkin *et al.* used neutron spectrometers that could efficiently capture a large amount of data by rotating the sample, a crystal of the intermediate-valence compound CePd_3 (see the Perspective by Georges). The measured dynamical magnetic susceptibility, in combination with detailed *ab initio* calculations, showed the formation of

coherent f-electron bands at low temperatures. —JS

Science, this issue p. 186;
see also p. 162

MARTIAN GEOLOGY

Water ice cliffs on Mars

Some locations on Mars are known to have water ice just below the surface, but how much has remained unclear. Dundas

et al. used data from two orbiting spacecraft to examine eight locations where erosion has occurred. This revealed cliffs composed mostly of water ice, which is slowly sublimating as it is exposed to the atmosphere. The ice sheets extend from just below the surface to a depth of 100 meters or more and appear to contain distinct layers, which could preserve a record of Mars' past climate. They might even be a useful source of water for future human exploration of the red planet. —KTS

Science, this issue p. 199

HYBRID SPECIATION

Rapid hybrid speciation in Darwin's finches

Galapagos finches have driven hypotheses of how speciation occurs. Most commonly, it is assumed that natural selection separates species originating from a single population on the basis of variation in traits that confer advantages for survival and reproduction. Lamichhane *et al.* document a case where cross-species hybridization established a reproductively isolated lineage, which demonstrates a process known as homoploid hybrid speciation in action (see the Perspective by Wagner). The authors used genetic markers and phenotypic analyses to create a pedigree that revealed how a cross-island migrant bred with a native species to form a self-perpetuating hybrid population that was reproductively isolated from both parental species. —LMZ

Science, this issue p. 224;
see also p. 157

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⁺ 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

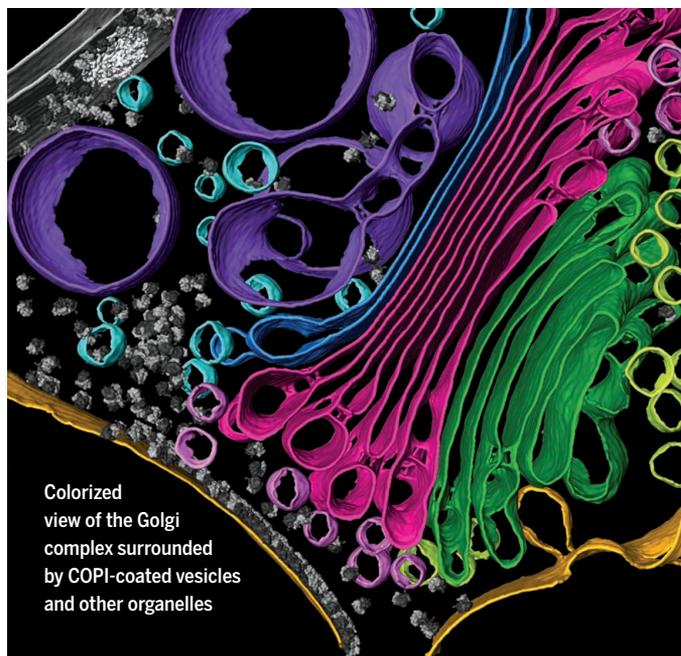
Mesoporous metal-organic frameworks

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

ANTIVIRAL IMMUNITY

The interferon boomerang

Interferon- α/β receptor (IFNAR)-deficient mice are highly susceptible to viruses, including Zika virus (ZIKV). Previous studies modeled ZIKV infection during pregnancy in mice by crossing *Ifnar1*^{-/-} females to wild-type males, generating *Ifnar1*^{+/-} fetuses that retain type I IFN responsiveness. Yockey *et al.* directly examined the role of fetal type I IFN signaling in protection in this context by crossing *Ifnar1*^{-/-} females to *Ifnar1*^{+/-} males. Although *Ifnar1*^{-/-} fetuses had higher ZIKV titers than *Ifnar1*^{+/-} fetuses, *Ifnar1*^{-/-} fetuses survived longer. Furthermore, activation of type I IFN signaling in the placentas of *Ifnar1*^{+/-} fetuses led to fetal hypoxia, demise, and resorption. —AB

Sci. Immunol. **3**, eaao1680 (2018).

STRUCTURAL BIOLOGY

Architecture of the TRPM subfamily

Transient receptor potential melastatin (TRPM) ion channels constitute the largest TRP subfamily and are involved in many physiological processes. TRPM8 is the primary cold and menthol sensor, and TRPM4 is associated with cardiovascular disorders. Yin *et al.* and Autzen *et al.* shed light on the general architecture of the TRPM subfamily by solving the structures of TRPM8 and TRPM4, respectively (see the Perspective by Bae *et al.*). The three-layered architecture of the TRPM8 channel provides the framework for understanding the mechanisms of cold and menthol sensing. The two distinct closed states of TRPM4, with and without calcium, reveal a calcium-binding site and calcium-binding-induced conformational changes. —SYM

Science, this issue p. 237, p. 228; see also p. 160

IMMUNOLOGY

Epigenetic modulation of effector T cells

The epigenetic states and associated chromatin dynamics underlying the initiation and maintenance of memory and effector CD8⁺ T cells are poorly understood. Pace *et al.* found that mice lacking the histone H3 lysine 9 methyltransferase Suv39h1 had markedly reduced antigen-specific effector CD8⁺ T cell responses to *Listeria monocytogenes* infection (see the Perspective by Henning *et al.*). Instead, CD8⁺ T cells in these mice were enriched for genes associated with naïve and memory signatures and showed enhanced memory potential and increased survival capacity. Thus, Suv39h1 marks chromatin through H3K9me3 deposition and silences memory and stem cell programs during the terminal differentiation of effector CD8⁺ T cells. —STS

Science, this issue p. 177; see also p. 163

CROHN'S DISEASE

A shared history

Crohn's disease (CD), an inflammatory bowel disease, has a relatively high prevalence in Ashkenazi Jewish populations. Hui *et al.* conducted genome-wide association analysis in 2066 CD patients and 3633 healthy control individuals of Ashkenazi Jewish ancestry and identified two functional variants in the *LRRK2* gene. The *LRRK2* gene has been linked previously to the development of Parkinson's disease (PD). The newly discovered *LRRK2* variants conferred risk for CD (N2081D) or protection from CD (N551K and R1398H). Analysis of other variants within the *LRRK2* locus in 24,570 individuals revealed similar genetic effects between CD and PD in both Ashkenazi Jewish and non-Jewish cohorts. The presence of shared *LRRK2* alleles in CD and PD provides

insight into disease mechanisms and potential treatments. —OMS
Sci. Transl. Med. **10**, eaai7795 (2018).

ASTROCHEMISTRY

A specific interstellar aromatic molecule

Aromatic molecules such as polycyclic aromatic hydrocarbons (PAHs) are known to exist in the interstellar medium owing to their characteristic infrared emission features. However, the infrared emission only indicates the general class of molecule, and identifying which specific molecular species are present is difficult. McGuire *et al.* used radio astronomy to detect rotational transitions of benzonitrile emitted from a well-known nearby cloud of interstellar gas (see the Perspective by Joblin and Cernicharo). This molecule may be a precursor to more complex PAHs. The identification of benzonitrile sheds light on the composition of aromatic material within the interstellar medium—material that will eventually be incorporated into new stars and planets. —KTS

Science, this issue p. 202; see also p. 156

MALARIAL GENOMICS

Dissecting *Plasmodium* drug resistance

Malaria is a deadly disease with no effective vaccine. Physicians thus depend on antimalarial drugs to save lives, but such compounds are often rendered ineffective when parasites evolve resistance. Cowell *et al.* systematically studied patterns of *Plasmodium falciparum* genome evolution by analyzing the sequences of clones that were resistant to diverse antimalarial compounds across the *P. falciparum* life cycle (see the Perspective by Carlton). The findings identify hitherto unrecognized drug targets and drug-resistance genes, as well as

additional alleles in known drug-resistance genes. —LMZ

Science, this issue p. 191; see also p. 159

PROTEIN MODIFICATION

Fattening up proteins

Many eukaryotic proteins are modified by the attachment of lipids, and these modifications can alter how proteins interact with cellular membranes. Rana *et al.* present x-ray crystal structures of an integral membrane enzyme that appends a fatty acyl chain onto a cysteine residue of target proteins. The enzyme active site is situated at the membrane surface, thus explaining the enzyme's preference for substrates that are already membrane-associated. The structure of a fatty acid-like inhibitor bound within a hydrophobic cavity elucidates the mechanism for the enzyme's acyl chain specificity. —MAF

Science, this issue p. 176

MEDICINE

Gene therapy: The power of persistence

Nearly 50 years after the concept was first proposed, gene therapy is now considered a promising treatment option for several human diseases. The path to success has been long and tortuous. Serious adverse effects were encountered in early clinical studies, but this fueled basic research that led to safer and more efficient gene transfer vectors. Gene therapy in various forms has produced clinical benefits in patients with blindness, neuromuscular disease, hemophilia, immunodeficiencies, and cancer. Dunbar *et al.* review the pioneering work that led the gene therapy field to its current state, describe gene-editing technologies that are expected to play a major role in the field's future, and discuss practical challenges in getting these therapies to patients who need them. —PAK

Science, this issue p. 175