

SYNTHETIC BIOLOGY

Using bugs in the gut to detect blood

Bacteria are environmentally resilient and can be engineered to sense various biomolecules. Mirmee *et al.* combined biosensor bacteria with a miniaturized wireless readout capsule to produce a minimally invasive device capable of in vivo biosensing in harsh, difficult-to-access environments (see the Perspective by Gibson and Burgell). The device successfully measured gastrointestinal bleeding in pigs. —SYM

Science, this issue p. 915;
see also p. 856

DIABETES

A stimulating therapy for diabetes

In type 2 diabetes, insulin resistance leads to elevated blood glucose and increased risk of cardiovascular disorders. The brain participates in glucose metabolism, but whether and how modulation of brain activity affects systemic blood concentrations of glucose is poorly understood. In diabetic and nondiabetic patients, ter Horst *et al.* found that dopamine release induced by deep brain electrical stimulation of the nucleus accumbens decreased systemic glucose concentrations. Conversely, pharmacological systemic dopamine depletion reduced insulin-mediated blood glucose uptake. —MM

Sci. Transl. Med. **10**, eaar3752 (2018).

EPIDEMIOLOGY

A faster way to detect Zika in mosquitoes

A major challenge in preventing mosquito-borne diseases is providing rapid and affordable tests to identify infected insects. Conventional techniques are often time-consuming and too expensive when analyzing large numbers of mosquitoes. Leveraging a technique known as near-infrared spectroscopy (NIRS), Fernandes *et al.* tested for Zika virus in female *Aedes aegypti* mosquitoes. NIRS distinguished

infected from uninfected mosquitoes with up to 99% accuracy 7 days after infection. NIRS is faster by a factor of 18 and cheaper by a factor of 110 than RT-qPCR (quantitative reverse transcription polymerase chain reaction), a technique commonly used for pathogen screening in mosquitoes. —PJB

Sci. Adv. **10**.1126/
sciadv.aat0496 (2018).

MICROBIOME

Bile acids and liver cancer

Liver cancer is a leading cause of cancer-related deaths in the United States. The composition of the gut microbiome influences many human diseases, including liver inflammatory disorders. Ma *et al.* found that commensal gut bacteria can recruit the immune system to control the growth of liver tumors in mice (see the Perspective by Hartmann and Kronenberg). *Clostridium* species modified bile acids to signal liver sinusoidal endothelial cells to produce the chemokine CXCL16. This recruited natural killer T (NKT) immune cells to perform antitumor surveillance of the liver. Growth of both primary and metastatic cancer was reduced by NKT cell-driven killing. —PNK

Science, this issue p. 876;
see also p. 858

MIGRATORY BEHAVIOR

Follow the leader

What role do social dynamics play in guiding collective migrations? Identifying such dynamics requires following individual animals across long migratory distances. Flack *et al.* used GPS tags to follow individual juvenile white storks on their southern migration (see the Perspective by Nevitt). Birds generally fell into two categories: leaders and followers. Leaders sought out areas of thermal uplift, flapped less in transit, and flew farther. Followers followed leaders into thermals but had different trajectories, exhibited greater flapping effort, and flew shorter total distances. —SNV

Science, this issue p. 911;
see also p. 852

IN OTHER JOURNALS

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



Premature graying of hair is related to immune function.

HAIR COLOR

The roots of gray hair

Gray hair is an inevitable part of aging. Melanocytes are the culprit cells that slow production of the color pigments called melanin, but how and why this occurs with age largely remains a mystery. Harris *et al.* make a link between the immune system and premature graying. They find that the protein MITF (microphthalmia-associated transcription factor), which controls melanocyte stem cell function, also works to trigger melanocyte immune responses. Interferons normally kickstart the immune response to viral and bacterial infection, but when MITF cannot regulate interferon, hair turns gray in mouse models. These findings may shed light on why chronic illness or certain autoimmune disorders can accelerate the graying process. —PNK

PLoS Biol. **10**.1371/journal.pbio.2003648 (2018).

ORGANOMETALLICS

Aluminum's breakup with fluoroalkenes

Carbon-fluorine bonds are hard to break. As a result, remediation of fluorocarbon waste streams is an enduring challenge. Bakewell *et al.* explored C–F scission in a variety of fluorinated propene derivatives by using an unusual synthetic aluminum compound. The electron-rich compound, with Al in the +1 oxidation state, inserted into both olefinic and allylic C–F bonds to form Al(III) products that were characterized

crystallographically. Theory implicated two simultaneous competing mechanisms, respectively involving stereoretentive direct oxidative addition and stereoinverting intermediacy of a metallocyclopropane. —JSY

Angew. Chem. Int. Ed. **10**.1002/
anie.201802321 (2018).

GENE THERAPY

Better to transfer than transfuse?

β -Thalassemia is a blood disease caused by mutations

A gene controlling *Wolbachia* proliferation in *Nasonia* wasps is under positive selection.



GENETICS

How hosts can defeat selfish elements

Wolbachia bacterial infections are horizontally passed through the eggs of nematodes and insects and can selfishly affect reproductive outcomes, resulting in an increased number of female offspring. Because *Wolbachia* can affect reproduction, it has been eyed as a potential gene drive system to eliminate disease-carrying vectors, such as mosquitos. Crossing species of *Nasonia* wasps that maintain differing levels of *Wolbachia*, Funkhouser-Jones *et al.* mapped a gene named *Wolbachia density suppressor* that controls *Wolbachia* proliferation within hosts. Further investigation suggested that this gene is under positive selection. This adds to our understanding of the dynamics between hosts and selfish parasites such as *Wolbachia* and may provide information of interest for the design of gene drive systems. —LMZ

Curr. Biol. 10.1016/j.cub.2018.04.010 (2018).

in the β -globin gene. β -Globin is a subunit of hemoglobin, an oxygen-carrying protein in red blood cells. Patients with β -thalassemia are severely anemic and require lifelong transfusions of red blood cells. In two clinical trials involving a total of 22 patients, Thompson *et al.* tested a gene therapy-based treatment that might eliminate the need for repeated transfusions. They isolated hematopoietic stem cells from the patients, used a lentiviral vector to transfer a “normal” copy of the β -globin gene into the cells, and then infused the modified cells back into the patients. After 26 months, the patients showed

sustained expression of the transgenic hemoglobin, and nearly 70% of them no longer required transfusions. —PAK

New Engl. J. Med. **378**, 1479 (2018).

PHYSIOLOGY

How drinking (alcohol) affects drinking (water)

The hormone FGF21 (fibroblast growth factor 21) is a major regulator of drinking in mice. FGF21 is produced in the liver and links metabolic status to behavioral responses through actions in the brain. It has many effects on metabolism, including regulation

of preference for sugar consumption. Song *et al.* found that various stresses, such as alcohol consumption or a ketogenic diet, caused increased production of FGF21 and stimulation of water drinking. Although alcohol consumption has well-known acute effects on water balance through inhibition of antidiuretic hormone action, this work shows an important role for FGF21 in stimulating water drinking after alcohol consumption. FGF21 can even suppress preference for alcohol consumption in favor of pure water. —LBR

Cell Metab. 10.1016/j.cmet.2018.04.001 (2018).

ENZYME EVOLUTION

Something from nothing

Specialized enzymes often originate from the refinement of a promiscuous enzyme by evolution, rather than through the emergence of activity from an inactive protein. Chalcone isomerase (CHI) catalyzes a simple chemical reaction but emerged within a protein family whose other extant members have no known enzymatic function. Kaltenbach *et al.* used phylogenetic reconstruction to predict the sequence of ancestors along the course of CHI evolution. The distant ancestor of the protein family had no CHI activity, despite presenting catalytic residues within an active site–like pocket. A small number of peripheral mutations could induce CHI activity in the ancestral protein, unlocking the catalytic potential already present in the binding site. —MAF

Nat. Chem. Biol. 10.1038/s41589-018-0042-3 (2018).

COSMOLOGY

Simulating the future of our Universe

The energy densities of matter and dark energy in our Universe are approximately equal at the current epoch. Testing whether this is a coincidence requires running cosmological simulations into the future, something that has generally been avoided because only the past can be observed. Salcido *et al.* simulated the futures of universes with and without dark energy, assessing its impact on the total star formation within each universe. The presence of dark energy has surprisingly little effect, because most stars have formed before it becomes dominant. Eighty-eight percent of all stars that will ever form in our Universe have done so already. The results suggest that the current epoch is not particularly special. —KTS

Mon. Not. R. Astron. Soc. 10.1093/mnras/sty879 (2018).

Aluminum's breakup with fluoroalkenes

Jake Yeston

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