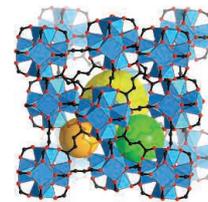


RESEARCH

Harvesting water from air
with a metal-organic framework

Kim et al., p. 430



IN SCIENCE JOURNALS

Edited by Stella Hurtley



ECONOMICS

Aspiring to do better than one's parents

The American dream promises that hard work and opportunity will lead to a better life. Although the specifics of what constitutes a better life vary from generation to generation, one constant is that children expect to do better—or at least to have a good chance at doing better—than their parents. Chetty *et al.* show that this dream did come true for children born in the middle of the 20th century, but only for half of children born in 1984 (see the Policy Forum by Katz and Krueger). A more even distribution of economic growth, rather than more growth, would allow more children to fulfill their dreams. —GJC

Science, this issue p. 398;
see also p. 382

Success in achieving the American dream may have been easier then than now.

NEURODEVELOPMENT

Pattern formation in the brain

Neurons in the developing brain cooperate to build circuits. Mountoufaris *et al.* found that ~50 variable protocadherin genes support a combinatorial identity code that allows millions of olfactory neuron axons to sort into ~2000 glomeruli. Sharing olfactory receptors drives axons to one glomerulus, and protocadherin diversity allows the multiple axons to touch each other as they converge. On the other hand, Chen *et al.* found that a single C-type protocadherin underlies the tiled distribution of serotonergic neurons throughout the central nervous system. These neurons, which share protocadherin

identity, enervate broad swaths evenly without touching neighboring neurons. —PJH

Science, this issue p. 411, p. 406

ORGANIC CHEMISTRY

Getting phosphorus into healthy shape

ProTide therapeutics play a trick on the body, getting nucleoside analogs where they need to be by decorating them with unnatural phosphoramidates in place of ordinary phosphates. These compounds pose an unusual synthetic challenge because their configuration must be controlled at phosphorus; most methods have been refined to manipulate the geometry of carbon. DiRocco *et al.* report a metal-free, small-molecule catalyst that attains

high selectivity for nucleoside phosphoramidation by activating both reaction partners. Kinetic studies with an early prototype revealed a double role for the catalyst that inspired the rational design of a more active and selective dimeric structure. —JSY

Science, this issue p. 426

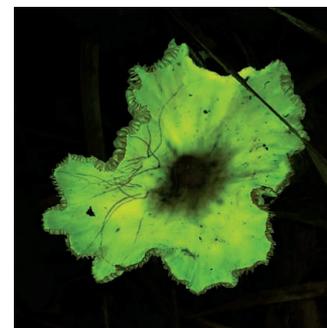
BIOCHEMISTRY

Taking a look at fungal bioluminescence

Certain mushrooms can emit their own light. Addressing an Aristotelian question unanswered for more than two millennia, Kaskova *et al.* found the source of mushroom bioluminescence. The mushrooms use the substrate oxyluciferin and the enzyme luciferase in

a previously uncharacterized catalytic pathway that emits photons. The luciferase has a broader substrate specificity than expected, which may widen possibilities for using bioluminescence in analytical and imaging technologies. —PLY

Sci. Adv. 10.1126/sciadv.1602847 (2017).



Glowing fungus, *Neonothopanus gardneri*

ATOMIC GASES

Imaging an atomic soliton train

Solitons—waveforms that keep their shape as they travel—can form in various environments where waves propagate, such as optical media. In a one-dimensional tube of bosonic atoms, solitons are formed when the interaction between the atoms is suddenly switched from repulsive to attractive. This causes the atoms to clump together into a “train” of solitons. Nguyen *et al.* used a nearly nondestructive imaging technique to follow the dynamics of this train. The solitons repulsed each other and underwent collective oscillations known as breathing modes. —JS

Science, this issue p. 422

BATTERIES

Zinc can compete with lithium

Although lithium-based batteries are ubiquitous, there are still challenges related to their longevity and safety, as well as concerns about material availability. Aqueous rechargeable batteries based on zinc might provide an alternative, but they have been plagued by the formation of dendrites during cycling. Parker *et al.* show that when zinc is formed into three-dimensional sponges, it can be used with nickel to form primary batteries that allow for deep discharge. Alternatively, the sponges can be used to produce secondary batteries that can be cycled thousands of times and can compete with lithium ion cells. —MSL

Science, this issue p. 415

PALEOGENOMICS

Ancient genomics of horse domestication

The domestication of the horse was a seminal event in human cultural evolution. Librado *et al.* obtained genome sequences from 14 horses from the Bronze and Iron Ages, about 2000 to 4000 years ago, soon after

domestication. They identified variants determining coat color and genes selected during the domestication process. They could also see evidence of admixture with archaic horses and the demography of the domestication process, which included the accumulation of deleterious variants. The horse appears to have undergone a different type of domestication process than animals that were domesticated simply for food. —LMZ

Science, this issue p. 442

CRISPR TECHNOLOGY

Sensitive and specific CRISPR diagnostics

Methods are needed that can easily detect nucleic acids that signal the presence of pathogens, even at very low levels. Gootenberg *et al.* combined the allele-specific sensing ability of CRISPR-Cas13a with recombinase polymerase amplification methods to detect specific RNA and DNA sequences. The method successfully detected attomolar levels of Zika virus, as well as the presence of pathogenic bacteria. It could also be used to perform human genotyping from cell-free DNA. —LMZ

Science, this issue p. 438

ROBOTICS ARCHITECTURE

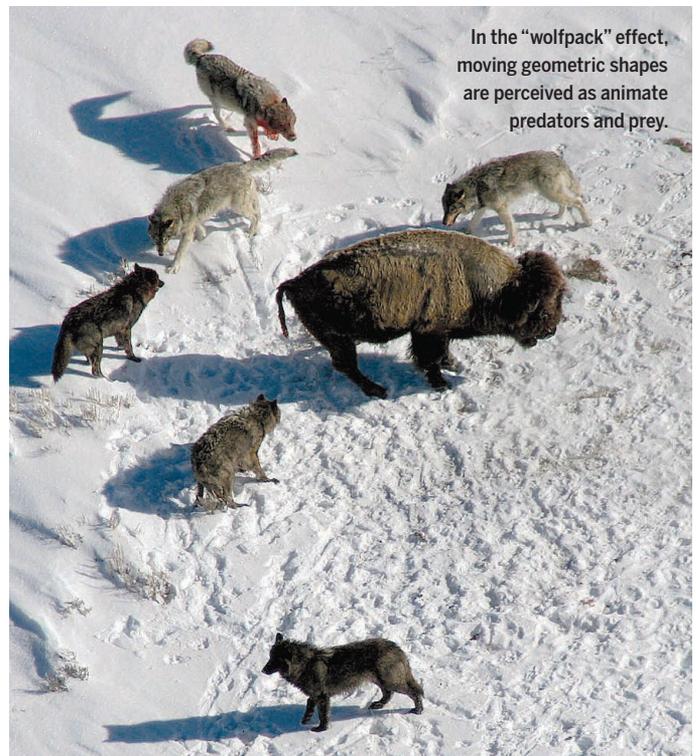
Thinking local about building

Custom manufacturing is commonly associated with small, specialized parts and designs. However, a growing branch of tools is being developed for making much larger buildings and objects. Keating *et al.* successfully built a 15-m open dome structure with a solar-powered array of robotic arms that used sand, compressed earth, ice, recycled plastic, and chains as building materials. The robot used real-time data to adjust its processing, making it adaptable to the local conditions. —MSL

Sci. Robot. **2**, eaam8986 (2017).

IN OTHER JOURNALS

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



In the “wolfpack” effect, moving geometric shapes are perceived as animate predators and prey.

PSYCHOLOGY

A privileged status for animate objects

Some stimuli are so important that they capture our attention and influence how we think even when we perform an unrelated task. Moving geometric shapes, especially if moving in what appear to be a self-directed fashion, are invariably perceived to be animate, as though they represent live agents. Using “wolfpack” animations of dart shapes whose points track the movement of a disc (the prey), van Buren and Scholl show that these are more readily remembered than identical animations in which the dart points are oriented away from or perpendicular to the prey. Perceiving such moving shapes as animate reinforces visual memory and has possibly been important in human evolution. —GJC

Cognition **163**, 87 (2017).

CEREBRAL ORGANOIDS

The making of the human brain

The human brain differs greatly from those of other species in the development of a strikingly expanded and extensively folded cerebral neocortex. This feature is considered to underpin humans’ augmented intellectual capacity. Human ventricular

and subventricular zones also contain more radial glial cells and intermediate progenitors than those of other mammals. To investigate the development of cortical folding, Yu *et al.* used a three-dimensional culture system to generate cerebral organoids from pluripotent human stem cells. They found that mutations in growth factor signaling—specifically, deletion

ALSO IN SCIENCE JOURNALS

Edited by Stella Hurtley

NEURODEVELOPMENT

Single-cell diversity in the brain

The cells that make up an organism may all start from one genome, but somatic mutations mean that somewhere along the line of development, an organism's individual cellular genomes diverge. McConnell *et al.* review the implications and causes of single-cell genomic diversity for brain function. Somatic mutations caused by mobile genetic elements or errors in DNA repair may underlie certain neuropsychiatric disorders. —PJH

Science, this issue p. 395

PLANT BIOLOGY

Germ cells on demand

Unlike animals, plants do not set aside a germline. Instead, germ cells are developed on demand from somatic lineages. Zhao *et al.* examined the regulatory pathways that manage the transition from somatic to germ cell development in the small plant *Arabidopsis* (see the Perspective by Vielle-Calzada). The transcription factor WUSCHEL (WUS) was needed early on for development of ovules. Soon after, a trio of inhibitors that work through a cyclin-dependent kinase allowed a transcriptional repressor to down-regulate WUS. This opened the door to meiosis, while restricting the number of reproductive units per seed to one. —PJH

Science, this issue p. 396;
see also p. 378

CANCER THERAPY

An old cancer drug's degrading new look

Typically, cancer drugs that help only a small number of patients in clinical trials are not pursued. This might change in a future world of precision medicine, where biomarkers will match specific drugs to the patients most likely to respond. Han *et*

al. identified the mechanism of action of a cancer drug called indisulam, a sulfonamide tested previously in patients with solid tumors. Indisulam and related sulfonamides killed cells by disrupting precursor mRNA splicing. The drugs targeted a specific RNA splicing factor for degradation by "gluing" it to the CUL4-DCAF15 ubiquitin ligase. Experiments with cancer cell lines suggest that future clinical trials of these drugs should focus on leukemias and lymphomas with high DCAF15 expression levels. —PAK

Science, this issue p. 397

RENEWABLE RESOURCES

Solar heat helps harvest humidity

Atmospheric humidity and droplets constitute a huge freshwater resource, especially at the low relative humidity (RH) levels typical of arid environments. Water can be adsorbed by microporous materials such as zeolites, but often, making these materials release the water requires too much energy to be practical. Kim *et al.* used a metal-organic framework (MOF) material that has a steep increase in water uptake over a narrow RH range to harvest water, using only ambient sunlight to heat the material. They obtained 2.8 liters of water per kilogram of MOF daily at 20% RH. —PDS

Science, this issue p. 430

INTERGALACTIC MEDIUM

Using quasar pairs to measure smoothness

Space between galaxies is filled with a tenuous gas known as the intergalactic medium (IGM). The presence of hydrogen atoms in the IGM at different redshifts imprints a series of absorption lines in the spectra of background quasars. Rorai *et al.* studied pairs of closely spaced quasars and quantified how

similar their absorption lines are as a function of transverse separation and redshift. They thus assessed the smoothness of the IGM on relatively small scales—several times the size of a galaxy. The results constrain interactions between galaxies and the IGM, such as heating by ultraviolet photons. —KTS

Science, this issue p. 418

MATERIALS SCIENCE

When forces depend on orientation

In oriented attachment, small nuclei or crystals come together to make a larger crystal, but only when complementary facets approach each other. Does this mean that there is an orientational dependence of the force between two nanocrystals? Zhang *et al.* report a delicate method to measure the van der Waals attraction between rutile TiO₂ nanocrystals. They imaged the contact point in situ with environmental transmission electron microscopy, which allowed the interparticle distances to be measured accurately. This elucidated the relationship between the nanocrystals' orientations, surface hydrations, and interactions. The results suggest that there is enough force to generate a torque between the crystals to ensure a complementary interaction. —MSL

Science, this issue p. 434

ECOLOGY

Plant the right tree

City trees can perform important functions, such as removing harmful particulates from the air and increasing the physical and mental well-being of city dwellers. In a Perspective, Willis and Petrokofsky explain, however, that not all trees are equally beneficial. Particulate uptake differs widely from one species to another. Tree size and shape also matter, because large trees

may trap air pollution. And pollen from certain tree species can cause severe allergic reactions. Tree-planting efforts in cities should move beyond simple considerations of beauty to consider the distinct advantages and disadvantages of individual tree species for improving urban living. —JFU

Science, this issue p. 374

IMMUNOLOGY

Interferon-independent antiviral defense

Antiviral responses are normally initiated by interferon production, which stimulates the phosphorylation and activation of STAT1 and STAT2. These transcription factors, in complex with the transcriptional regulator IRF9, mediate antiviral gene expression. Wang *et al.* report that interferon-stimulated gene expression can be mediated by unphosphorylated STAT1 and STAT2 with IRF9 in the absence of interferon production or signaling. This complex protected cells from viral infection and, thus, mediates homeostatic, interferon-independent antiviral responses. —JFF

Sci. Signal. **10**, eaah4248 (2017).

METABOLIC DISEASE

Liver T cells in obesity-associated diabetes

Obesity is associated with increased risk of developing a range of disorders, including cardiovascular diseases and type 2 diabetes. In obese individuals, accumulation of fat in the liver, termed nonalcoholic fatty liver disease (NAFLD), has been linked to the development of insulin resistance. Ghazarian *et al.* found that type I interferon-driven activation of CD8⁺ T cells in the liver correlated with insulin resistance in patients with NAFLD and in mouse models of obesity. Furthermore, the gut microbiome played an important

role in driving inflammation in the livers of obese mice. These findings add to the growing recognition of the immune axis in metabolic disorders associated with obesity. —AB

Sci. Immunol. **2**, eaai7616 (2017).

MALARIA

An antimalarial to add to the armamentarium

Malaria continues to be a scourge in much of Africa. Paquet *et al.* screened a small-molecule library against the human malaria parasite, *Plasmodium falciparum*, and identified the 2-aminopyridine chemical class as having potent activity. An optimized compound, MMV390048, was active against multiple parasite life cycle stages, both in the mammalian host and the mosquito vector, and also killed drug-resistant parasites. MMV390048 killed the malaria parasite by blocking the parasite's phosphatidylinositol 4-kinase and protected monkeys from malaria infection. MMV390048 has potential as a new antimalarial drug that may contribute to global malaria eradication efforts. —OMS

Sci. Transl. Med. **9**, eaad9735 (2017).