365 **DAYS:**
the year in science

2017 EDITORS' CHOICE

Extracts from selected News & Views articles published this year.

MATERIALS SCIENCE

LONG-LIVED ELECTRODES FOR PLASTIC BATTERIES

Byungju Lee & Kisuk Kang (*Nature* 549, 339–340; 2017)

Writing in *Energy & Environmental Science*, Kolek *et al.* report a battery electrode based on an organic polymer that could provide long-lasting, affordable energy storage. In typical organic batteries, electrons and guest ions (such as lithium ions in lithium-ion batteries) are passed between electrodes during charge and discharge; the electroactive organic materials store the extra charge that accumulates. However, the additional charge tends to localize to certain parts of the organic molecule. In high-capacity batteries, this can cause free radicals to form, making the molecule unstable and vulnerable to side reactions. But in the new polymer (PVMPT), a strong intermolecular force effectively delocalizes the accumulated charges, stabilizing the whole molecule and preventing unwanted side reactions. Moreover, the electrical conductivity of the polymer is enhanced, leading to faster battery charging and discharging. Remarkably, Kolek and colleagues found that a PVMPT-containing battery cell could operate stably for 10,000 charge–discharge cycles with quick battery charging (148 seconds per charge).
Original research: *Energ. Environ. Sci.* **10,** 2334–2341 (2017).

CHROMOSOME BIOLOGY

HOW TO BUILD A COHESIVE GENOME IN 3D

Rachel Patton McCord (*Nature* 551, 38–40; 2017)

Mammalian chromosomes are partitioned into structural units called topologically associating domains (TADs), which help to control the timing of gene activation. Groups of TADs associate to form larger domains called compartments, in which transcriptionally active and inactive chromosomal regions are spatially separated. Researchers have debated whether compartmentalization depends on the integrity of TADs. The available data are consistent with a model in which a protein complex called cohesin helps to form TADs. However, attempts to determine whether removing cohesin from DNA causes TADs to fall apart have been frustratingly inconclusive. Schwarzer *et al.* have finally succeeded in breaking TAD structure by generating mice whose liver cells lack the gene *Nipbl*, which encodes a protein that loads cohesin onto DNA. The authors' work provides the first convincing evidence that cohesin is essential to building TADs. Even though TADs are lost in *Nipbl* mutants, compartments are maintained. Thus, TADs and compartments are formed by independent mechanisms.
Original research: *Nature* **551,** 51–56 (2017).

PAUL COLANGELO/GETTY

BIOMECHANICS

HOW FISH FEEL THE FLOW

John O. Dabiri (*Nature* 547, 406–407; 2017)

Although many fish exploit visual cues to escape harm, the greatest danger that lurks in the water is largely invisible: the persistent and unpredictable churning of currents, which can carry an unsuspecting fish far off course or cause it to crash into underwater objects. Oteiza and colleagues observed that when a fish swims towards a region of increasing difference between the flow speeds on either side of its body, the fish turns in the same direction as the local rotation of the water, which is also the direction that will carry the fish away from obstacles. As the full repertoire of these sensing and control skills becomes apparent, we might gain inspiration for new types of biorobotic navigation in both water and air.
Original research: *Nature* **547,** 445–448 (2017).

ASTRONOMY

THE STAR THAT WOULD NOT DIE

Stan Woosley (*Nature* 551, 173–174; 2017)

When a star that has more than about eight times the mass of the Sun dies, it either collapses to a black hole or explodes as a supernova. In the latter case, a blast at the centre of the star ejects the surrounding material at high speed. The expansion of this material releases trapped energy, providing a nearly constant luminosity (equivalent to that of about 100 million Suns) for roughly 100 days, before fading. Supernovae lasting more than 130 days are extremely rare. Arcavi *et al.* report that a supernova known as iPTF14hls glowed brilliantly for more than 600 days, making it the longest-lived bright supernova ever observed. The authors suggest that the event could be explained by a model known as a pulsational pair-instability supernova, whereby violent thermonuclear instabilities in the final stages of nuclear fusion lead to repeated supernova-like outbursts (see animation).
Original research: *Nature* **551,** 210–213 (2017).

ATMOSPHERIC SCIENCE

SEVERE WEATHER IN A WARMING CLIMATE

Chuntao Liu (*Nature* 544, 422–423; 2017)

One of the most frequently asked questions regarding climate change is how a warming climate will affect weather in the future. Many

BRENT STIRTON/GETTY

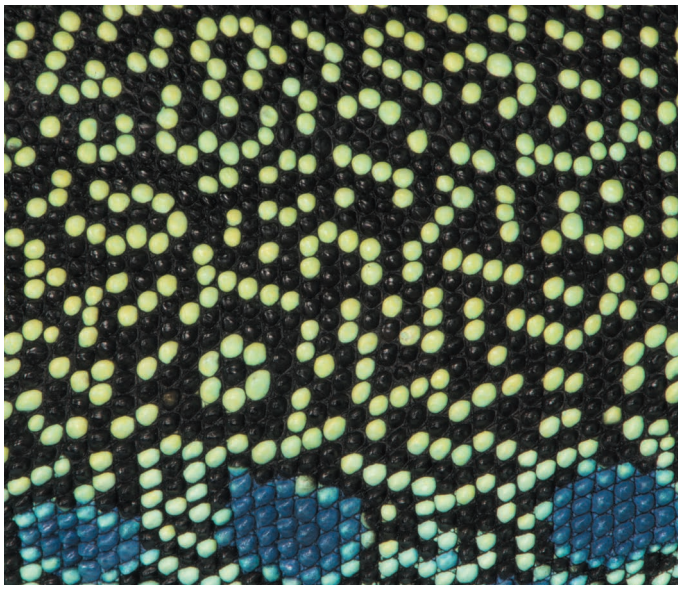
disastrous weather events in the past few decades, including Hurricane Katrina (2005) and Hurricane Sandy (2012), have driven scientists to seek a better understanding of the occurrence, frequency and intensity of such events. A major obstacle in reaching a conclusion from these discussions is that extremely destructive weather events are rare, making it difficult to obtain robust statistics. Taylor *et al.* make progress in this direction. They use 35 years of satellite observations to show that there has been a persistent increase in the frequency of extreme storms called mesoscale convective systems in the Sahel — the semi-arid region to the south of the Sahara Desert. The authors' conclusions confirm the complicated nature of how regional weather patterns respond to climate change.
Original research: *Nature* **544,** 475–478 (2017).

DEVELOPMENTAL BIOLOGY

HOW THE LIZARD GETS ITS SPECKLED SCALES

Leah Edelstein-Keshet (*Nature* 544, 170–171; 2017)

In 1902, Rudyard Kipling wrote the *Just So Stories*, which provided fanciful accounts of how, for example, the leopard got its spots. Manukyan *et al.* tell an even more intriguing tale. The authors describe a strikingly beautiful biological pattern-forming system that spans the development of the ocellated lizard (*Timon lepidus*), which changes from a drab brown youngster with white polka dots (ocelli) to an adult whose skin is a rich black and green tapestry. The authors call this patterning system a living cellular automaton. Originally conceived in the 1940s, a cellular automaton is a system of spatially discrete but interconnected units that switch between different states depending on their own state and the states of their neighbours. As the authors conclude, a cellular automaton is not just an abstract concept, but corresponds to a process generated by biological evolution.
Original research: *Nature* **544,** 173–179 (2017).



MICHEL C. MILINKOVITCH

CANCER TREATMENT

BACTERIAL SNACK ATTACK DEACTIVATES A DRUG

Christian Jobin (*Nature* 550, 337–339; 2017)

Writing in *Science*, Geller *et al.* report that bacteria within a tumour can metabolize the anticancer drug gemcitabine into an inactive form and thereby render it ineffective. The authors used a mouse model system to study the relationship between the presence of Enterobacteriaceae bacteria and the effectiveness of gemcitabine in targeting tumour cells. If antibiotic treatment was used to kill the bacteria, gemcitabine treatment destroyed colonic tumour cells. The authors analysed samples isolated from human pancreatic cancer and found that the tumours contained bacteria from the Enterobacteriaceae family. Such bacteria contain a long version of the cytidine deaminase enzyme that can deactivate gemcitabine. Although more data will be needed to firmly establish whether microbial metabolism within tumours normally affects the success of tumour treatment, the findings reveal a potential new therapeutic strategy for anticancer treatment.
Original research: *Science* **357,** 1156–1160 (2017).

READERS' CHOICE

We asked readers to vote for a News & Views article to be included as part of our round-up of the year. This is what they chose.

REGENERATIVE MEDICINE

INTERSPECIES PANCREAS TRANSPLANTS

Qiao Zhou (*Nature* 542, 168–169; 2017)

There is a severe shortage of transplantable human organs. One conceptually simple, albeit challenging, solution would be to grow human organs in animals. Yamaguchi *et al.* grew mouse pancreases in rats by injecting mouse pluripotent stem cells, which can give rise to every cell type in the body, into early-stage rat embryos. The authors genetically suppressed growth of the rat pancreas such that the main body of the organ was made up entirely of mouse cells. Next, the researchers isolated cell clusters called endocrine islets, which contain insulin-secreting β-cells, from the pancreas. They transplanted the islets into mice that model type 1 diabetes. The islets survived and replaced the native β-cells, secreting insulin and returning high blood-sugar levels to within a normal range. Before such a strategy could be used to grow human organs in animals, many technical challenges would need to be overcome, and ethical and legal questions addressed. But given the pressing need for organs for transplantation, this line of research must continue.
Original research: *Nature* **542,** 191–196 (2017).