

RESEARCH HIGHLIGHTS

Selections from the scientific literature

CHEMISTRY

Power from deep-sea vents

Researchers have harnessed deep-sea hydrothermal vents to produce electricity.

Masahiro Yamamoto of the Japan Agency for Marine-Earth Science and Technology in Yokosuka and Ryuhei Nakamura of the RIKEN Center for Sustainable Resource Science in Wako and their team exploited the differences in chemistry between sea water and fluids that leak from hydrothermal vents. Steep concentration gradients of chemicals such as hydrogen sulphide allowed the researchers to generate more than 21 milliwatts of power from a fuel cell based on a platinum cathode and an iridium anode.

This successfully powered three light-emitting diodes 1,000 metres below the surface, both at an artificial vent created by deep-sea drilling and a natural vent. *Angew. Chem.* <http://doi.org/f2dtrm> (2013)

GEOLOGY

Meet the world's largest volcano

A submarine mountain in the northwest Pacific could be the largest single volcano on Earth, rivalling even the mighty Olympic Mons on Mars.

Tamu Massif, situated 1,500 kilometres east of Japan, is roughly the size of the British Isles. Seismic-profiling studies penetrated its depths and revealed that its lava flows dip away from the volcano's summit in all directions. This suggests that all the lava came from a single eruptive vent, say William Sager of the University of Houston in



ANIMAL BEHAVIOUR

Clumping caterpillars

Entomologists sometimes see caterpillars clumping together, but the reason for this behaviour has defied explanation.

Researchers had proposed that the aggregations conserved water or energy, but John Terblanche of Stellenbosch University in South Africa and his colleagues have dispatched those ideas. They collected Cape Lappet moth caterpillars (*Eutricha capensis*) and reared them as individuals and in groups of up to 100. Metabolic rates and water use did not decrease with group size.

Given that aggregating caterpillars did not conserve energy, the researchers suggest that the behaviour may confer other advantages, such as faster growth rates or safety in numbers. *J. Exp. Biol.* <http://doi.org/npp> (2013)

Texas and his colleagues.

The dome-shaped mountain probably formed in a single eruptive blast that began some 140 million years ago.

Nature Geosci. <http://doi.org/nqd> (2013)

For a longer story on this research, see go.nature.com/beeqp4

ECOLOGY

US forests grow to be different

Trees have made a major comeback in the northeastern United States, but the regrown forest is in some

ways markedly different from that of 400 years ago, when European colonists started clearing trees for agriculture.

Jonathan Thompson of the Smithsonian Conservation Biology Institute in Front Royal, Virginia, and his colleagues examined land-survey records from 1620 to 1825 in nine northeastern states. Colonial surveyors often divided up plots of land using 'witness trees' to mark the corners, generally noting the genus, so the authors were able to compare these data with modern forest inventories.

Although most of the same tree species were present in both time periods (with the exception of the now-rare American chestnut, *Castanea dentata*), their relative abundances differ greatly. Colonists removed a forest dominated by species such as beech and hemlock conifers, but today's trees form a canopy of mostly maple and birch.

PLoS ONE 8, e72540 (2013)

TECHNOLOGY

A cheaper, quieter MRI machine

Magnetic resonance imaging (MRI) is expensive, noisy and requires bulky equipment. It can also have side effects, such as stimulating nerves in patients. These problems arise from the constant switching between positive and negative magnetic-field gradients used to manipulate the spin of hydrogen nuclei throughout the patient's body. The energized nuclei produce radiofrequency signals, which carry the information used to build up an image.

By exploiting the radiofrequency pulses used to prepare the nuclei, Jonathan Sharp at Alberta Innovates Technology Futures in Calgary, Canada, and his

HENNO GOUS

colleagues removed the need for switched magnetic fields. Instead, they manipulated the nuclei of resonant radiofrequency fields twisted in opposing directions and a static magnetic field. The technique could make MRI cheaper, accessible and quieter. *NMR Biomed.* <http://doi.org/nqf> (2013)

LANGUAGE

Babies hear a primate's call

Babies listen to lemur vocalizations in the same way that they listen to human speech.

A baby's language skills develop rapidly during the first year, and previous research has shown that by three months, hearing human speech while viewing objects helps infants to group objects into categories. Alissa Ferry at the International School for Advanced Studies in Trieste, Italy, and her colleagues examined how recordings of calls from a lemur (*Eulemur macaco flavifrons*; pictured) influenced how infants performed when they were asked to discriminate between images of dinosaurs and fish.

The team found that lemur calls helped three- to four-month-old infants to categorize objects but did not help six-month-olds. The study suggests that the link between language and the capacity to categorize objects is initially broad enough to include calls from non-human primates, but quickly becomes tuned to human language. *Proc. Natl Acad. Sci. USA* <http://doi.org/nqx> (2013)



TERRY QUINN

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SYNTHETIC BIOLOGY

Forcing fluorine into molecules

Researchers have discovered a pathway for introducing fluorine atoms into naturally occurring molecules.

Fluorine is present in up to 30% of pharmaceuticals and can expand the usefulness of natural products by, for example, increasing the time they take to break down in the body. But until now, chemists have been using a single method — the fluoroacetate pathway — to insert fluorine into organic molecules.

Michelle Chang of the University of California, Berkeley, and her colleagues have found a different way to insert atoms of the element into a useful group of molecules called polyketides. Their method enlists a soil bacterium (*Streptomyces cattleya*) for the first steps. The bacterium binds fluorine to carbon, making building blocks such as fluoroacetate monomers that can then be inserted into polyketides in the place of acetate.

The team demonstrated the method in the laboratory and in living cells, in which they were able to control where the fluorine atoms ended up in the polyketide molecules. *Science* 341, 1089–1094 (2013)

PHYSICS

A startling value for gravitation

The quest to pin down the fundamental constants of nature usually results in increased precision over time, but knowledge of the Newtonian constant of gravitation (G), known among physicists as Big G , has not improved much in recent years because different measurement methods continue to disagree.

Now, Terry Quinn and his colleagues at the International

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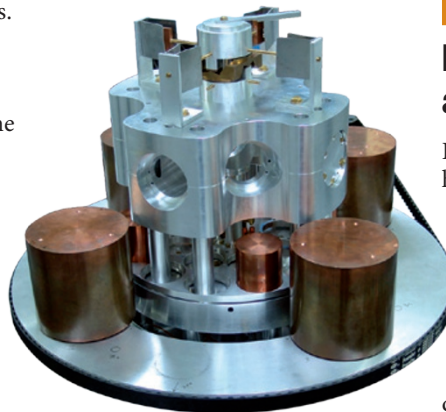
CELL BIOLOGY

Nuclear receptor linked to fitness

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8 Aug–4 Sept

Would-be dopers may have a new target: the Rev-erb- α protein. Known to regulate sugar and fat metabolism, the nuclear receptor has now been linked to the production and function of mitochondria — the cell's metabolic powerhouses.

A team led by Bart Staels and H el ene Duez, jointly at the Lille II University of Health and Law and the Pasteur Institute in Lille, France, showed that mouse muscle cells lacking Rev-erb- α contain dysfunctional mitochondria, and that mice lacking the gene encoding it, *Nr1d1*, could not run as fast as normal mice. The reverse occurred when the protein was overexpressed or when a synthetic agonist was given, suggesting that Rev-erb- α could be targeted by drugs to improve exercise capacity by boosting mitochondrial number and function in muscle cells. *Nature Med.* 19, 1039–1046 (2013)



Bureau of Weights and Measures in Paris have added to the uncertainty by finding a value for G of $6.67545 \times 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2}$. This is significantly larger than several other measurements from the past decade, but is in agreement with a 2001 result by the same group using a similar but independent experimental set-up.

The researchers used a torsion balance (pictured), in which a thin metal strip changes orientation in response to test masses. The authors say that they do not know why their apparatus gives a different result from other approaches. *Phys. Rev. Lett.* 111, 101102 (2013)

PRIMATE COGNITION

Monkeys raise the alarm on predators

For the first time, researchers have shown that non-human primates emit calls in specific sequences to convey the type and location of the threat.

Non-human primates are known to produce calls that signal different kinds of danger. Richard W. Byrne at the University of St Andrews, UK, and his colleagues conducted an experiment on five groups of titi monkeys (*Callicebus nigrifrons*) living in a reserve to find out whether monkey vocalization encoded predator type (raptor or snake), elevation (tree or ground) or both.

A raptor in the air elicited only calls of type A; a raptor on the ground, calls of type A, followed by B. Conversely, a predator on the ground elicited pure B calls, but a ground predator in the trees brought forth B calls, followed by A. *Biol. Lett.* 9, 20130535 (2013)

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