

RESEARCH HIGHLIGHTS

Selections from the scientific literature

INFORMATION TECHNOLOGY

Long-term data storage in DNA

A DNA-based system could safely store data for millennia.

Today's digital systems can store information for only around 50 years, but encoding it in DNA could greatly extend its lifetime. Robert Grass at the Swiss Federal Institute of Technology in Zurich and his colleagues have devised a system that encapsulates and protects DNA strands in silica glass. The team also included redundancy codes to correct errors that arise when writing, storing and reading the data.

Using the technique, the authors recovered 83 kilobytes of data — including the full Swiss Federal Charter from 1291 — by sequencing nearly 5,000 pieces of DNA that were kept under conditions simulating storage at around 10°C for 2,000 years.

Angew. Chem. Int. Edn <http://doi.org/f23gmf> (2015)

EVOLUTION

Fern hybrid does not mind the gap

Two ferns that last shared an ancestor more than 60 million years ago have interbred — showing that this can still happen even after a long evolutionary gap.

As populations separate and evolve over time, they lose the



ZHE-XI LUO, UNIV. CHICAGO

PALAEONTOLOGY

Ancient mammals displayed diversity

Two fossils show that early mammals had a more varied anatomy and behaviour than was thought.

A team led by Zhe-Xi Luo at the University of Chicago, Illinois, and Qing-Jin Meng at the Beijing Museum of Natural History analysed a 160-million-year-old fossil from China.

The creature, *Docofossor brachydactylus*, had short, wide digits for burrowing underground, similar to those seen in moles. Some of the team

members studied another fossilized mammal of about 165 million years old, *Agilodocon scansorius* (pictured; US cent shown for scale). It seems to have been adapted to tree-climbing, and its teeth bear hallmarks of a diet of tree gum and sap.

The two species, which belong to an extinct group called docodonts, show that the earliest mammals lived in diverse habitats, the team says.

Science 347, 760–764; 764–768 (2015)

ability to cross-breed. So Carl Rothfels, now at the University of California, Berkeley, and his team were surprised to find a fern (*Cystocarpium roskamianum*; pictured) from the French Pyrenees that is a hybrid of *Gymnocarpium* and *Cystopteris*, two dissimilar genera. DNA analysis showed that its two parents diverged roughly 60 million years ago, the biggest known evolutionary gap in a plant or animal hybridization. This is comparable to a human interbreeding with a lemur. The findings suggest that

new species of fern evolve more slowly than many other plants, in part because they rely on wind and water for fertilization, making it harder for eggs and sperm of different species to remain separate.

Am. Nat. 185, 433–442 (2015)

AGRICULTURAL ECONOMICS

Trade disruptions hit the poor

Countries that cut back on food trade to protect against domestic price fluctuations can disrupt the global food system

— a sign of the increasing connectedness of the market.

Michael Puma of Columbia University in New York and his team used data on wheat and rice agriculture from 1992 to 2009 to analyse how price shocks resulting from large-scale weather anomalies, crop diseases or war affect worldwide trade in staple foods. They found that the global market has become more vulnerable to temporary trade restrictions as international connections have doubled and the volume of traded goods has increased since 1992.

HARRY C. ROSKAM

Export restrictions lead to higher global food prices, which can lead to more trade restrictions. Poor countries suffer most from the drop in food imports, the authors note. *Environ. Res. Lett.* 10, 024007 (2015)

PALAEOHYDROLOGY

Drying lakes linked to extinctions

Climate change in Australia may have played a part in the extinction of many large animals some 50,000 years ago.

The cause of the mass die-off is debated, with some saying that ecological collapse was sparked by human use of fire 40,000 to 60,000 years ago. Climate-related factors had been dismissed because there seemed to be little change in Australia's climate at that time. However, Tim Cohen of the University of Wollongong in Australia and his colleagues looked at sediments along the shores of two huge lakes, Eyre and Frome, and found that their water levels decreased drastically around the time when megafauna went extinct.

Lakes that shrank under a changing climate could have led to the demise of plants and herbivorous animals, the authors say.

Geology <http://doi.org/z8n> (2015)

ECOLOGY

Traps target tricky toads

Habitats that attract invasive species can be turned into 'ecological traps' that wipe out the invaders.

In Australia, invasive cane toads (*Rhinella marina*; pictured) are devastating native wildlife, and they have proved difficult to eradicate. To survive the dry season, the toads flock to ponds that store water for livestock, and then use these 'invasion hubs' as staging posts to invade more

areas during the rains.

To trap the toads, Mike Letnic at the University of New South Wales in Sydney and his colleagues used fences to exclude them from the ponds in Australia's Northern Territory.

Toads that were attracted to the water but unable to access it died in their hundreds at the fenced sites, and populations remained suppressed a year later. The authors suggest that other species that rely on invasion hubs could be controlled in a similar way.

J. Appl. Ecol. <http://doi.org/z8p> (2015)

NEUROSCIENCE

Breathe in to boost brain-fluid flow

An inwards breath drives the flow of fluid that bathes the human brain.

Cerebrospinal fluid cushions the brain, flushes out waste and in rodents seems to be controlled by pulsating blood flow. To find out how the fluid is regulated in humans, Steffi Dreha-Kulaczewski at the University Medical Center Göttingen in Germany and her colleagues used real-time magnetic resonance imaging to scan the brains of ten healthy volunteers while they did breathing exercises. The researchers found that an intake of breath had a stronger effect on fluid flow than the heartbeat did.

The approach could be used to study disorders that result in disruptions to the flow of cerebrospinal fluid.

J. Neuro. 35, 2485–2491 (2015)

PARTICLE PHYSICS

New particles found at collider

High-energy collisions between protons have unearthed two new particles.

SOCIAL SELECTION

Popular articles on social media

Science in 200 words or less

Even in this age of texts, tweets and sound bites, most scientific papers remain long and dense. But a new online journal promises to bring a little brevity to science by accepting submissions of 200 words or less. *The Journal of Brief Ideas* (<http://beta.briefideas.org>) has published only a few papers so far, but has already generated a buzz on social media. Katie Mack, an astrophysicist at Melbourne University in Australia, urged her many Twitter followers to check it out, noting that

➔ **NATURE.COM**

For more on

popular papers:

go.nature.com/uzrwqb

the journal was effectively "reducing the minimum publishable unit to 200 words". But she also cautions that it could turn into a collection of preliminary ideas that are not ready for scientific consumption.

Named Ξ_b^- and Ξ_b^* , the particles were discovered by the LHCb experiment team at the Large Hadron Collider at CERN, Europe's particle-physics laboratory near Geneva, Switzerland. Like protons, the particles are made up of three quarks, but they each include a heavyweight 'beauty' or 'bottom' quark, making the particles six times heavier than the proton. Although consistent with the standard model, these particular arrangements of quarks have never previously been observed.

Studying the properties of these particles could help scientists to better understand the strong nuclear forces that bind protons and neutrons together in an atom.

Phys. Rev. Lett. 114, 062004 (2015)

OCEANOGRAPHY

Arctic ice warms from below

Shrinking Arctic sea ice could cause more-vigorous mixing of ocean heat in northern waters, eventually leading to further melting.

Tom Rippeth of Bangor

University, UK, and his colleagues measured water temperatures at different depths and locations across the Arctic Ocean. They found that heat rose more quickly from warm, deep layers of water that ran into rough patches on the sea floor than from areas that have a more even floor.

Such mixing might become more common in a warming world, the authors say. As sea ice disappears, the atmosphere can transfer more of its energy into the ocean, which drives ocean mixing. The rising heat from this mixing could cause sea ice to decline even more.

Nature Geosci. <http://dx.doi.org/10.1038/ngeo2350> (2015)

CORRECTION

The Research Highlight 'Capsules collect carbon dioxide' (*Nature* 518, 140; 2015) stated that all authors are at Harvard University. In fact, Jennifer Lewis and a co-author are at Harvard; her collaborators are at Lawrence Livermore National Laboratory, California, and at the University of Illinois at Urbana-Champaign.

➔ **NATURE.COM**

For the latest research published by Nature visit:

www.nature.com/latestresearch

