

RESEARCH HIGHLIGHTS

Selections from the scientific literature

PALAEOCLIMATE

Lake cores support legend of typhoons

Geoscientists have found possible evidence of two typhoons that, according to Japanese legend, wiped out invading Mongol fleets in the years 1274 and 1281.

Jon Woodruff of the University of Massachusetts, Amherst, and his colleagues collected a 2,000-year-old sediment record from a coastal lake on Japan's Kyushu island, where the Mongol attack was aimed. The cores contain flood deposits that show two instances of flooding in the late thirteenth century, which may have come from the pair of 'Kamikaze' typhoons.

Such storms could have been more common at the time, thanks to the presence of an El Niño, which causes changes in temperature and precipitation worldwide.

Geology <http://doi.org/xqp> (2014)

METEOROLOGY

Lopsided hail hits harder

Hail storms can cause billions of dollars' worth of damage, but until now scientists have known little about the precise mass and shape of hail. A study has found that hailstones that are not perfectly spherical can sometimes travel faster and hit objects with greater force than



spherical hailstones, potentially causing severe damage to homes and cars (pictured).

Andrew Heymsfield of the National Center for Atmospheric Research in Boulder, Colorado, and his colleagues measured nearly 2,300 hailstones that fell across the US Great Plains between 2012 and 2014. Most hailstones were smaller than 3 centimetres in diameter, but those that were bigger tended to be more lopsided than the smaller ones. Calculations suggest that the non-spherical hailstones occasionally hit objects with greater force than would be expected if they were round.

The findings could help

to improve weather and hail-damage predictions, the authors say.

Geophys. Res. Lett. <http://doi.org/xqq> (2014)

MOLECULAR EVOLUTION

How bacteria and host fight for iron

A study of primate and bacterial proteins involved in capturing iron from the blood has revealed an evolutionary arms race in the battle over this important nutrient.

Matthew Barber and Nels Elde at the University of Utah in Salt Lake City focused on transferrin, a protein that

they exposed species of coral-inhabiting crabs to the odour of fish that ate that same coral species, the crabs preferred those fish to animals that ate another coral. This suggests that the filefish's diet influences its scent.

Moreover, a filefish predator, cod, had difficulty detecting the fish when they were near the coral on which they were fed. The study provides the first evidence for chemical-based camouflage in a vertebrate.

Proc. R. Soc. B <http://dx.doi.org/10.1098/rspb.2014.1887> (2015)



ANIMAL BEHAVIOUR

Fish adopt chemical camouflage

A coral-reef fish can match its scent to the odour of the surrounding reef, masking itself from predators.

Harlequin filefish (*Oxymonacanthus longirostris*; pictured) live around reefs in the Pacific and Indian oceans and feed on particular species of coral. A team led by Rohan Brooker at James Cook University in Queensland, Australia, tested whether aquarium-dwelling fish conceal themselves by emitting a scent that is similar to those generated by the corals that they consume. The authors found that when

transports iron from the blood into cells. Pathogenic bacteria compete for this mineral by using their own protein, called TbpA, to bind transferrin. The researchers sequenced transferrin from 21 primate species to trace its 40-million-year evolutionary history, and tested the molecules' interactions with TbpA from two common human pathogens. They found specific amino-acid changes in a rapidly evolving region of transferrin that prevent TbpA from binding to it.

They also pinpointed transferrin-binding sites in TbpA that are genetically diversifying under selection,

DAVID FLEETHAM/OCEANWIDEIMAGES.COM

MIKE DREW/QMI/ORBIS

showing how competition for a nutrient can drive primate and pathogen evolution. *Science* 346, 1362–1366 (2014)

ANTHROPOLOGY

How a Maya city rose and fell

One of the major Maya cities thrived in a tropical forest by using sophisticated agricultural, forestry and water-management techniques.

David Lentz at the University of Cincinnati in Ohio and his colleagues surveyed modern forests at the site of Tikal in Guatemala, which was a bustling city roughly 1,400 years ago. By analysing archaeological plant and soil specimens, the authors concluded that the people of Tikal intensively farmed the land, using irrigation and terraces, for example. They also developed a complex system for collecting and distributing rainwater.

However, by around AD 850, as drought set in, the Tikal systems could not keep up with the growing population, probably leading to the demise of the great city.

Proc. Natl Acad. Sci. USA <http://dx.doi.org/10.1073/pnas.1408631111> (2014)

PHYSICS

Record-breaking electron boost

Physicists have used lasers to increase the amount of energy that electrons gain per metre by more than two orders of magnitude compared with traditional accelerators.

Conventional colliders can accelerate particles to much greater energies, but over many kilometres. Wim Leemans at Lawrence Berkeley National Laboratory in California and his colleagues used extremely intense laser pulses and an ionized gas to boost electrons over much smaller distances.

By guiding the pulses through channels in the plasma, the researchers

generated strong electric fields that increased injected electrons to 4.2 gigaelectronvolts — the highest energy ever achieved in a laser-based system — over just 9 centimetres.

The authors say that the technique could be used to make smaller high-energy linear accelerators, and to create table-top systems that use X-rays emitted by electrons to probe materials. *Phys. Rev. Lett.* 113, 245002 (2014)

CHEMISTRY

Painkillers made in minutes

Ibuprofen can be produced in minutes by mixing reagents as they flow through a series of connecting tubes.

Synthesizing a substance in a continuous-flow process offers more control over reactions and allows less solvent to be used than batch production in flasks. But solid by-products can accumulate, blocking the flow. By varying the width of connecting tubes and using specially designed pumps, David Snead and Timothy Jamison at the Massachusetts Institute of Technology in Cambridge built an apparatus that produces ibuprofen in three minutes with minimal fouling. The five-stage process has three reactions — one of the most complex applications of flow chemistry yet.

A wide variety of other drugs could be synthesized in this way, the authors say.

Angew. Chem. Int. Edn <http://doi.org/10.1002/anie.201408631> (2014)

AGRICULTURAL ECOLOGY

Pesticide moves up food chain

An insecticide banned in some areas for its effect on bees not only fails to kill certain pests, but also harms the predators that feed on them.

Neonicotinoid insecticides are used on many crops, including soya-bean plants, on which pest slugs (*Derocera reticulatum*) feed. Margaret

SOCIAL SELECTION

Popular articles on social media

When press releases go bad

Researchers love to blame the news media when reports about science are misleading or even wrong. But a study making the rounds online suggests that much of the hype and misinformation about health-related research in the news has its roots in university press releases — which are often approved in advance by the researchers themselves. “Academics should be accountable for the wild exaggerations in press releases of their studies,” tweeted Catherine Collins, a dietitian who works for the National Health Service in London. But some say that others are to blame. “Exaggerated academic hype leads to bad news stories. Why don’t reporters do their jobs?” tweeted Steve Usdin, editor and co-host of *BioCentury This Week*, a US public-affairs show covering the biopharma industry. *Br. Med. J.* 349, g7015 (2014)



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ASTRONOMY

Exoplanet seen from Earth

Using a modest-sized ground-based telescope, astronomers have spotted a planet twice the size of Earth passing in front of its host star.

Researchers typically study planets outside the Solar System using space telescopes or much larger telescopes on Earth, but studies with space telescopes are expensive and access to large facilities on the ground is limited. A team led by Ernst de Mooij, now at Queen’s University Belfast, UK, used a smaller telescope in La Palma, Spain, to investigate the Sun-like star 55 Cancri. The scientists’ size measurements of one of the star’s known planets were similar to those obtained using orbiting telescopes.

Such ground-based studies can complement those using space telescopes, the authors say.

Astrophys. J. Lett. 797, L21 (2014)

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Douglas at the Pennsylvania State University in University Park and her colleagues exposed the slugs in the lab to soya-bean plants grown from seeds coated with the neonicotinoid thiamethoxam. They found that the slugs were unaffected, but that more than 60% of ground beetles (*Chlaenius tricolor*, pictured), which feed on the slugs, died or suffered impairments such as paralysis. In field studies, thiamethoxam also lowered the number of predators on slugs, and reduced soya-bean yields by 5%.

The results indicate unintended indirect effects of neonicotinoids on non-target species in addition to known direct effects, the authors say. *J. Appl. Ecol.* <http://doi.org/10.1111/1365-3113.12111> (2014)

