# RESEARCH HIGHLIGHTS

*Selections from the scientific literature*

PHYSICS

## Tractor beam pulls in objects

An array of ultrasound beams can drag centimetre-sized objects towards it.

Mike McDonald at the University of Dundee, UK, Gabriel Spalding at Illinois Wesleyan University in Bloomington and their colleagues sculpted interference patterns in the array so that much of the acoustic energy bounced off the sides or rear of an object in front of the array. This drove the object towards the ultrasound sources. The effect has been previously shown with light waves, but sound waves can move larger objects.

Such control might prove useful in non-invasive surgery: for example, it could be used to manipulate drug-delivery packages inside the body or to precisely cut out tumours.

***Phys. Rev. Lett.*** 112, **174302 (2014)**

ROGER T. HANLON

ANIMAL BIOLOGY

## Injury shapes squid behaviour

Squid that are sensitized to pain by injury are quicker to flee from predators, showing an adaptive benefit to injury and pain.

Robyn Crook and Edgar Walters of the University of Texas Medical School at Houston and their colleagues took several squid (*Doryteuthis pealeii*; pictured) and inflicted a minor injury on one arm of each animal. When exposed to black sea bass, the previously injured squid fled or hid from these predators earlier than uninjured animals. But squid that were treated with anaesthetics before the injury, and so did not develop neural sensitization, failed to change their behaviour. As a result, these animals were less likely to survive encounters with the predator than injured individuals that were not anaesthetized. This is the first experimental evidence that pain-like neural sensitization is an adaptive response to injury, the authors say.

***Curr. Biol.*** **http://doi.org/sp8 (2014)**

GEOPHYSICS

## How El Niño slows the planet's spin

The El Niño Pacific weather event affects how long the day is, but two types of El Niño do this in two different ways.

Weather changes affect the planet's rotation speed, and thus day length, by changing the atmosphere's pressure over topographical features. A team led by Olivier de Viron, now at the University of La Rochelle in France, studied atmospheric behaviour between 1948 and 2013.

The researchers found that when El Niños make Pacific waters warmer in the east, they set up strong pressure gradients above big mountain ranges (such as the Andes) that increase the time it takes the planet to spin by slightly more than 0.1 millisecond. By contrast, El Niños with warmer central Pacific waters produce only about half as much Earth-changing drag.

***Geophys. Res. Lett.*** **http://doi.org/snq (2014)**

ECOLOGY

## Longlines better for deep seas

Fishing with longlines has little effect on the vulnerable ecosystems of the deep sea, according to Telmo Morato and his team at the University of the Azores in Horta, Portugal.

Deep-sea fishing practices such as trawling have proved controversial owing to concerns about damage to slow-growing species at the bottom of the ocean. The researchers studied data from longline fishing, a technique that uses one main line with many shorter, hooked lines attached, around the Azores islands, and compared them to published data on the effects of bottom trawling. They estimate that between 4,000 and 23,000 longline deployments would be needed to remove 90% of cold-water corals in a given area, compared with just 13 trawls.

Regulated longline fishing could be a more sustainable method of deep-sea fishing than trawling, the authors suggest.

***Sci. Rep.*** 4, **4837 (2014)**

ATMOSPHERIC SCIENCE

## Detecting rainfall from the bottom up

A method that allows researchers to estimate global rainfall levels using soil-moisture data could help to improve hazard planning for floods and landslides.

To estimate rainfall in places that lack ground-based rain gauges, researchers rely on satellite data of atmospheric moisture, but this is notoriously inaccurate. Luca Brocca at the National Research Council in Perugia, Italy, and his colleagues developed an algorithm that calculates rainfall amounts on the basis of satellite data on soil moisture. They compared their estimates with rain-gauge data and found that their method accurately estimates rainfall in several regions around the world.

Moreover, their algorithm is better than a state-of-the-art method at detecting light rainfall events and precipitation at high latitudes.

***J. Geophys. Res. Atmos.*** **http://doi.org/sp7 (2014)**

MATERIALS

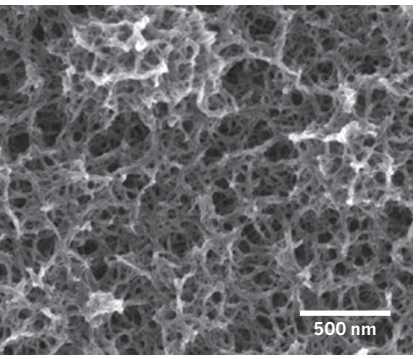
## Graphene analogue carries current

A self-assembling polymer that forms thin films and conducts electricity could beat graphene as a candidate material for flexible electronics.

Graphene, made of an atom-thick sheet of carbon, is flexible but cannot be used as a semiconductor in transistors because it lacks a 'band gap'. Mircea Dincă at the Massachusetts Institute of Technology in Cambridge and his colleagues mixed nickel with an organic compound called HITP and ammonia in water to produce a graphene-like structure with the important band gap.

The ingredients self-assemble into a flat, honeycomb-like structure (**pictured**) that has excellent electrical conductivity, unlike most other self-assembled organic–inorganic systems. The team studied the material only in bulk form, but say that the results could be even better if the polymer was in two-dimensional sheets, perhaps leading to more efficient solar cells and supercapacitors.

***J. Am. Chem. Soc.*** **http://doi.org/spj (2014)**




NAWAZISH NAQVI

DENNIS SHEBERLA

GENOMICS

## When brown and polar bears split

Polar bears evolved adaptations specific to the Arctic in fewer than 20,500 generations, and diverged from brown bears much more recently than is sometimes claimed.

Rasmus Nielsen at the University of California, Berkeley, and his colleagues sequenced the genomes of 79 polar bears (*Ursus maritimus*) and 10 brown bears (*Ursus arctos*) and found that the two species diverged between 343,000 and 479,000 years ago.

Many of the genes under the greatest selection pressure in the polar bear are associated with the cardiovascular system. In particular, this bear seems to have evolved modifications in its vascular system that allow the animal to tolerate an extremely fatty diet made up mostly of blubbery seal meat.

***Cell*** **http://doi.org/sp3 (2014)**

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

ASTROPHYSICS

## Big planets could alter star rotation

Massive planets with close-in orbits — also known as hot Jupiters — may influence the rotation and surface activity of their host stars.

Katja Poppenhaeger and Scott Wolk at the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts, analysed the emissions of binary-star systems, in which only one of the two stars in the system hosted an exoplanet. Comparing the differences between the emissions of the stars in each pair allowed the authors to measure the influence of the exoplanet on its host star. Using X-ray data from the Chandra and XMM-Newton space telescopes, the researchers found that the stars hosting hot Jupiters showed more magnetic activity than their planet-free companions.

Magnetic activity increases with rotation, so the authors suggest that the gravitational influence of the hot Jupiters may have counteracted the natural slowing of their host stars' spin over time.

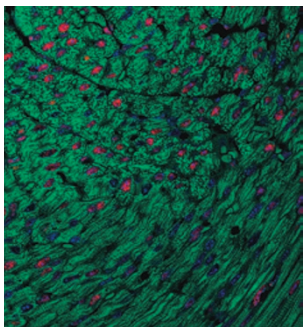
***Astron. Astrophys.*** 565, **L1 (2014)**

BIOLOGY

## Thyroid makes young hearts grow

A surge of thyroid hormone just before adolescence causes mouse hearts to grow drastically, suggesting that the organ may be easier to regenerate than previously thought.

Ahsan Husain of Emory University School of Medicine in Atlanta, Georgia, and Robert Graham of the Victor Chang Cardiac Research Institute in Sydney, Australia, and their colleagues labelled heart muscle cells of baby mice with a chemical. When the mice were 15 days old, the number of cardiomyocytes (**pictured**, red) increased by about 40%.



It had previously been thought that cardiomyocytes stopped replicating just after birth. The findings suggest that giving thyroid hormone to babies with heart defects might help to repair the organ.

***Cell*** 157, **795–807 (2014)**

**NATURE.COM**
For the latest research published by *Nature* visit:
www.nature.com/latestresearch

## SOCIAL SELECTION

### Maths reality check resonates online

Biologists of all stripes are sharing an essay by Harvard University mathematician-turned-biologist Jeremy Gunawardena that makes a sobering observation: the mathematical equations at the core of many biological models fail to reflect nature. He argues that the components of all quantitative models should be verifiable and, most of all, the conclusions should be falsifiable. Or, in his words: "Stick the model's neck out." Jason Moore, a geneticist at Dartmouth College in New Hampshire, tweeted: "This paper is so good I am actually printing it out"— high praise in the paperless age.

***BMC Biol.*** 12, **29 (2014)**

Based on data from altmetric.com. Altmetric is supported by Macmillan Science and Education, which owns Nature Publishing Group.

**NATURE.COM**
For more on popular papers:
go.nature.com/mpqjve