

# RESEARCH HIGHLIGHTS

Selections from the  
scientific literature

## PARTICLE PHYSICS

### Two mesons make an exotic atom

Scientists have discovered an exotic atom formed from two specific types of meson, which consist of only a quark and an anti-quark, instead of the three quarks found in constituents of normal matter.

Mesons are unstable particles produced in high-energy collisions and can be used to test the quantum theory of the strong force, which holds quarks together. To generate dimesonic atoms, physicists working on the DIRAC experiment, based at CERN, the European particle-physics laboratory near Geneva, fired a proton beam at thin sheets of platinum or nickel. The team detected roughly 350 atoms consisting of a  $\pi$  meson and a  $K$  meson, the first statistically significant detection of such an exotic atom.

*Phys. Rev. Lett.* 117, 112001 (2016)

## ANTHROPOLOGY

### Same sounds for similar meanings

Unrelated languages often use the same sounds when referring to particular concepts, such as the 'n' sound for 'nose'.

Researchers have tended to assume that spoken language is arbitrary, with no link between a word's sound and meaning. Damián Blasi at the University of Zurich in Switzerland and his colleagues statistically analysed the phonetic sounds in common words from 62% — more than 4,000 — of the world's languages. The team found evidence for 74 sound–meaning associations. For instance, the term for 'round' was often linked to the sound 'r', and tongue with 'l' or 'e'. These associations were found

across continents and language families, suggesting that they emerged independently.

During language evolution, humans have intuitively linked sounds with certain key concepts, the authors suggest. *Proc. Natl Acad. Sci. USA* <http://doi.org/bqnd> (2016)

## NEUROSCIENCE

### Neurons' roles vary by sex

A class of nerve cell has different effects on social and anxiety-related behaviours in male and female mice in response to a hormone

involved in social interaction.

Many social and emotional disorders seem to disproportionately affect a particular gender — anxiety disorders, for example, are more common in women. To investigate this, Nathaniel Heintz and his colleagues at the Rockefeller University in New York City activated neurons that are sensitive to the hormone oxytocin in the medial prefrontal cortex of the mouse brain. This did not affect males' sociality, but did reduce anxiety-related behaviours. In females, however, it made the animals more social without lowering anxiety-related

behaviours. The female mice also had more of a key stress hormone in the brain, which probably blocked the anti-anxiety effects of oxytocin that were seen in males.

Further studies could lead to gender-specific therapies for social disorders.

*Cell* <http://doi.org/bqpp> (2016)

## BIOENGINEERING

### Yeast makes diesel-like fuels

A yeast has been engineered to produce industrially important oils, including some similar to diesel.



KEITH BEDFORD/REUTERS

## CONSERVATION

### Legal ivory trade would be unsustainable

Legal ivory harvesting from African elephants would never meet consumer demand and could not resume in a sustainable way.

Despite an international trade ban in 1989, poaching for ivory remains rampant and is even increasing, triggering heated debates about whether legal trading could help to reduce illegal harvesting (seized illegal ivory charms pictured). David Lusseau at the University of Aberdeen and Phyllis Lee at the University of Stirling, both in the United Kingdom, modelled how much

ivory could sustainably be removed from a population of 1,360 elephants. They found that a population of this size could feasibly support an annual take of 100–150 kilograms of ivory. However, roughly 600 kg per year would be needed for such a population to meet its share of global demand, based on the current estimated illegal poaching level.

Conservation efforts should focus on curbing consumer demand for ivory, the authors say.

*Curr. Biol.* <http://doi.org/bqn6> (2016)

Gregory Stephanopoulos and his colleagues at the Massachusetts Institute of Technology in Cambridge rewired key metabolic pathways and tweaked the structure and expression of certain enzymes in the yeast *Yarrowia lipolytica*. This allowed the organism to convert low-value carbon compounds into fatty molecules similar to transport fuels and other chemicals that are used in various industries.

Some diesel-like fuels were produced at higher concentrations than similar approaches have achieved, taking the yeast 'refineries' a step closer to cost-efficient industrial applications, the authors say.

*Proc. Natl Acad. Sci. USA* <http://doi.org/bqn8> (2016)

## QUANTUM PHYSICS

## City-wide teleportation

Two groups have demonstrated quantum teleportation — the remote exchange of quantum states — across cities using ordinary fibre-optic links.

In quantum teleportation, pairs of particles — typically photons — are created that share a common quantum state. Each particle is sent to a different location, and manipulating one affects the measurable properties of the other, so enabling the transfer of information. The teams, one led by Jian-Wei Pan at the University of Science and Technology of China in Shanghai and the other by Wolfgang Tittel at the University of Calgary in Canada, demonstrated data transfer between devices that were several kilometres apart in Hefei, China, and Calgary, respectively. Although such a feat had been achieved before with visible-light photons, the current work used infrared photons, which are compatible

with existing communications networks.

Teleportation could enable future quantum computers to exchange data.

*Nature Photon.* <http://dx.doi.org/10.1038/nphoton.2016.179>; <http://dx.doi.org/10.1038/nphoton.2016.180> (2016)

## NEUROSCIENCE

## Cone cells see white too

Light-sensing cells in the eye that have long been associated with colour vision could also be involved in non-colour vision.

The retina is lined with colour-sensing cone cells, and with rod cells, which are responsible for night vision. Ramkumar Sabesan at the University of California, Berkeley, and his colleagues used light to stimulate individual cone cells in two male volunteers and asked them to report the colour they saw. The team found that one group of cones was involved in sensing red and green, whereas another, larger group allowed the participants to see white.

The findings may reflect an evolutionary trade-off that favoured high-resolution non-colour vision over the ability to see fine-grained colour.

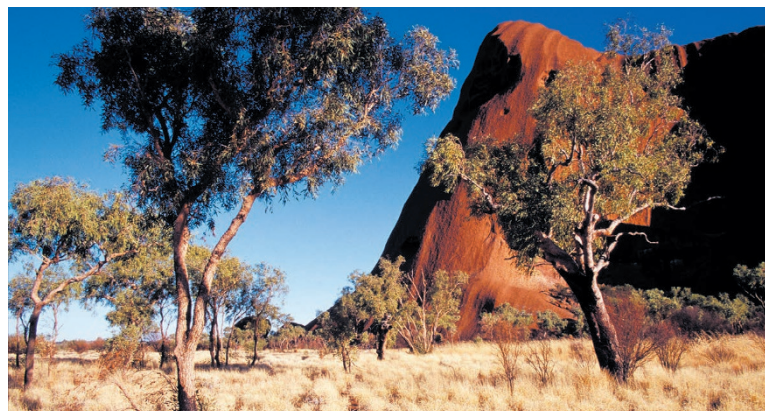
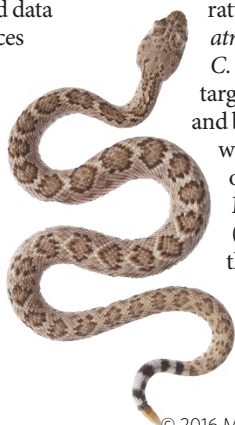
*Sci. Adv.* 2, e1600797 (2016)

## EVOLUTION

## How snakes lost venom genes

The ancestors of rattlesnakes had — and then lost — key genes involved in producing prey-paralysing venom.

The venom of North American diamondback rattlesnakes (*Crotalus atrox*, pictured), and *C. adamanteus* targets the muscles and blood of victims, whereas the venom of the closely related Mojave rattlesnake (*C. scutulatus*) attacks the nervous system. To determine how these venoms evolved, a team led by Noah



Dowell and Sean Carroll at the University of Wisconsin–Madison analysed the genomes of the three rattlesnakes and more distantly related snakes. Comparisons of venom genes suggest that the last common ancestor of rattlesnakes, which lived some 22 million years ago, had various toxin genes. The two diamondback lineages then independently lost the neurotoxin genes, and Mojave rattlers lost the genes to make muscle-attacking venom.

Shifting diets that included prey that were more resistant to a particular toxin may explain these losses, the authors say.

*Curr. Biol.* <http://doi.org/bqpn> (2016)

## CLIMATE-CHANGE ECOLOGY

## Australian tree range threatened

Climate change could shrink the geographic range of most of Australia's eucalyptus species within the next 60 years.

Eucalypt trees (*Eucalyptus*, *Corymbia* and *Angophora*) are abundant in Australia (*Eucalyptus terminalis* and *Corymbia opaca*, pictured). Carlos González-Orozco, now at the Colombian Organisation for Agricultural Research in Meta, Bernd Gruber at the University of Canberra and their team used models to predict the distribution of some 650 tree species under various climate-change scenarios. They found that a 3°C rise over the next 60 years would, on average, reduce the climatically suitable habitat for 91% of the species by half. And some 90%

of suitable habitats that host a high concentration of rare and evolutionarily old species could disappear or move south.

These losses could seriously threaten the diversity of the trees and their genetic ability to adapt to climate change.

*Nature Clim. Change* <http://dx.doi.org/10.1038/nclimate3126> (2016)

## ASTRONOMY

## Universe much richer in galaxies

The observable Universe is populated by between 1 trillion and 3 trillion galaxies, almost 10 times more than previously estimated.

A team led by Christopher Conselice at the University of Nottingham, UK, estimated this number using various telescope surveys that revealed evolving galaxy abundances since the time when the Universe was only about 600 million years old. The count included rare massive galaxies and smaller dwarf galaxies that can be impossible to see in the distant Universe with current telescopes.

The findings suggest that many more galaxies, especially faint and small ones, remain to be detected by projects such as the European Space Agency's upcoming Euclid mission.

*Astrophys. J.* in the press; Preprint at <http://arxiv.org/abs/1607.03909> (2016)

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