

RESEARCH HIGHLIGHTS

Selections from the scientific literature

CONDENSED-MATTER PHYSICS

Frozen bismuth superconducts

Bismuth crystals can act as superconductors — but only at temperatures approaching absolute zero.

Researchers have long been searching for new superconducting materials, which have the ability to maintain an electric current with no power source. A team led by Srinivasan Ramakrishnan at the Tata Institute of Fundamental Research in Mumbai, India, showed that bismuth crystals become superconducting if they are brought down to 0.5 millikelvin. This extreme cooling is necessary because, unlike other superconductors, bismuth has a very low density of charge carriers, with just 1 electron per 100,000 atoms.

The standard theory of superconductivity can explain the phenomenon in other metals, such as lead and aluminium, but not in bismuth, so further study is needed, the authors say.

Science <http://doi.org/bvbj> (2016)

VACCINES

New way to tame a virus

A live, genetically modified flu virus can infect animals and trigger a strong immune response, but cannot multiply

in its host's cells. Such modified viruses could one day be used to improve on current vaccines (**pictured**).

Vaccines made of live viruses elicit stronger protective immune responses than inactivated vaccines, but, because they can replicate, have the potential to cause disease. To overcome this, Demin Zhou and his colleagues at Peking University in Beijing genetically altered the influenza A virus so that it

could be produced efficiently by special transgenic cells, but could not replicate in normal cells or in infected animals. When compared with a commercially available inactivated flu vaccine, the modified virus stimulated stronger immune reactions in mice, ferrets and guinea pigs. Mice given the new vaccine and then infected with the unmodified flu virus survived, whereas all unvaccinated mice died. *Science* 354, 1170–1173 (2016)

MICROBIOLOGY

Gut bacteria linked to Parkinson's

Bacteria living in the gut may contribute to movement problems seen in disorders such as Parkinson's disease.

Timothy Sampson and Sarkis Mazmanian at the California Institute of Technology in Pasadena and their team generated mice that lacked their own bacteria and had been genetically engineered so



PALAEANTHROPOLOGY

Early burials had mutilation rituals

Ancient humans in South America used complex funeral rituals and manipulated the bodies of their dead as early as 10,000 years ago.

André Strauss at the University of Tübingen in Germany and his colleagues analysed bones from 26 human burials, discovered during 15 years of archaeological excavations in a cave in east-central Brazil (pictured). They found that the remains were treated before and during burial in a variety of ways, including defleshing

and tooth removal. Bones dating to roughly 9,500 years ago showed signs of dismemberment and burning before being carefully arranged, suggesting a ceremonial burial. Similar practices were known in the Andes from this period but not in eastern South America.

The authors say these ritualized burials may have been important in maintaining social cohesion in times of stress and conflict. *Antiquity* 90, 1454–1473 (2016)



MAURICIO DE PAIVA

BRIAN SNYDER/REUTERS

that their brains overproduce α -synuclein — a protein that forms clumps in the brains of people with Parkinson's. They found that these germ-free mice moved more freely and accumulated less α -synuclein in their brains than animals with gut microbes. When the team transplanted microbes from the faeces of people with Parkinson's disease into the guts of the mice, the animals showed more movement dysfunction than those that received bacteria from healthy humans.

The authors think that molecules made by gut microbes could activate certain immune cells and boost inflammation in general, which then enhances the clumping of α -synuclein in the brain. *Cell* 167, 1469–1480 (2016)

CANCER

Relapse-inducing cancer cells found

Cancer can return after seemingly successful treatment, and researchers have isolated a small population of dormant cancer cells that could cause this in a type of leukaemia.

Irmela Jeremias at the Helmholtz Center Munich in Germany and her colleagues isolated tumour cells from people with acute lymphoblastic leukaemia (ALL) and monitored their growth in mice. The authors pinpointed a small fraction of ALL cells that rarely divided, survived chemotherapy treatment and later gave rise to new tumours. The cells' gene-expression profiles were similar to those of cancer cells that had resisted previous treatments in mice and humans. When the cells were removed from the bone marrow and cultured in a lab dish, they became sensitive to chemotherapy drugs.

Blocking the interactions between these cells and their protective niche could offer a way to eradicate the cells and prevent cancer relapse. *Cancer Cell* <http://doi.org/bvbn> (2016)

ANTHROPOLOGY

Lucy was a climber

X-ray scans of the remains of a 3.2-million-year-old human relative known as Lucy suggest she was built for climbing trees.

Members of Lucy's species, *Australopithecus afarensis*, walked upright, but researchers have long debated whether they routinely climbed trees. Christopher Ruff at Johns Hopkins University in Baltimore, Maryland, and his colleagues used computed tomography X-ray scans to gauge the strength of Lucy's arm and leg bones. Compared with the fully bipedal and ground-dwelling *Homo sapiens* and *Homo erectus*, Lucy would have put more weight on her arms than her legs. The authors say this shows that she actively climbed trees, despite walking on two legs on the ground. A study published earlier this year argued that damage to Lucy's arm, leg and shoulders were caused by a fatal fall from a tree. *PLoS ONE* 11, e0166095 (2016)

GLACIOLOGY

Antarctica warmed up fast in the past

As Earth emerged from the last ice age more than 10,000 years ago, West Antarctica (pictured) warmed two to three times faster than the rest of the planet.

A team led by Kurt Cuffey at the University of California, Berkeley, measured

temperatures along the length of a 3.4-kilometre-deep borehole in the West Antarctic ice sheet. The temperature profile indicates how the ice warmed over time, and provides a more direct measurement than other methods that rely on data from isotopes in ice cores.

The work shows that Antarctica had mostly finished warming by about 15,000 years ago — several thousand years earlier than the Northern Hemisphere. Climate models that show the Antarctic responding late to shifting temperatures can be discarded, the authors say. *Proc. Natl Acad. Sci. USA* <http://doi.org/bt24> (2016)

QUANTUM PHYSICS

Photons in two colours at once

Single light particles can be manipulated to form a mixture or 'superposition' of two colours at the same time.

Quantum computing requires particles to be simultaneously in two quantum states, but the creation of two-colour photons requires individual light particles to interact, which they rarely do. To increase the chances of such interactions occurring, Stéphane Clemmen at Cornell University in Ithaca, New York, and his colleagues encouraged a stream of single photons to combine with photons from two strong laser pumps by channelling them all through a cryogenically

cooled 100-metre-long optical fibre. The lasers simultaneously bumped each photon's frequency up and down, producing particles in a superposition of two colours — something the team proved experimentally.

Such bichromatic photons could be used to encode information in quantum computers, or to connect systems in a quantum network, say the authors. *Phys. Rev. Lett.* 117, 223601 (2016)

GENETICS

Heart-health variants found

Mutations in a gene targeted by a new wave of medicines for lowering cholesterol levels may protect against heart attacks, but perhaps also increase the risk of diabetes.

Drugs that inhibit a protein called PCSK9 lower cholesterol, but have not yet been shown definitively to reduce the risk of heart disease. Brian Ference of Wayne State University School of Medicine in Detroit, Michigan, and his colleagues, gathered data from 112,772 participants in 14 studies, focusing on DNA sequence variants that are associated with lowered cholesterol. The variants were in the *PCSK9* gene and in *HMGCR*, which encodes the target of commonly used statin drugs.

Variants in both genes were associated with nearly equal protection from cardiovascular events such as heart attacks, and this effect seemed to be additive. The results suggest that drugs targeting PCSK9 could improve heart health, and may work together with statins for even greater benefit. The increased risk of diabetes seems to be limited to certain patients, the authors say.

N. Engl. J. Med. 375, 2144–2153 (2016)

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