RESEARCH HIGHLIGHTS

Selections from the scientific literature

CANCER BIOLOGY

How exercise helps to combat cancer

Mice that take exercise have fewer tumours than those that do not — thanks to more cancer-fighting immune cells finding their way into tumours.

Studies in humans have linked the effects of taking regular exercise to a reduced risk of developing cancer. To investigate the underlying molecular mechanisms, Pernille Hojman of the University of Copenhagen in Denmark and her colleagues compared tumour growth in sedentary mice and in those that had access to an exercise wheel over four weeks.

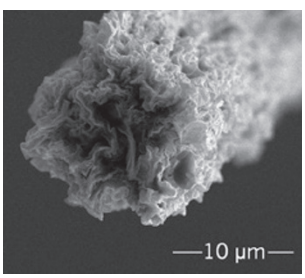
Animals that ran had about 60% fewer tumours, which were also smaller in size. Exercise was associated with an increase in the number of a particular type of immune cell — the natural killer cell — found in the tumours. An exercise-induced surge in the hormone adrenaline mobilized these cells.

Cell Metab. **http://doi.org/bcnk (2016)**

MATERIALS

Shells spark strong graphene fibre

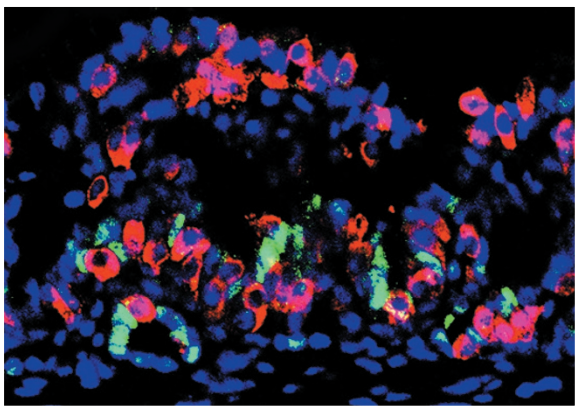
A composite thread with a structure inspired by nacre — the iridescent material found inside many seashells — is the strongest graphene-based fibre ever made.



Such fibres are typically produced by spinning together nanometre-thick sheets of graphene oxide. But they often have poor tensile strength, probably owing to weak interactions between the nanosheets. To strengthen the threads, Qunfeng Cheng of Beihang University in Beijing and his colleagues added two more ingredients: calcium ions and a flexible carbon compound called PCDO. These help to bind the nanosheets together, mimicking the strong interactions in nacre. The team produced a fibre roughly 20 micrometres wide (**pictured**) that could be tied in a knot without fracturing and could support a 2-gram weight.

The fibres also conduct electricity, making them a promising material for flexible electrodes or artificial muscles.

Adv. Mater. **http://doi.org/f3k23w (2016)**



CHAIYABOOT ARIYACHET

REGENERATIVE BIOLOGY

Insulin from mini stomach

Stomach tissue can be reprogrammed to mimic insulin-producing pancreatic cells and control diabetes when implanted into mice.

A certain type of cell in one part of the stomach has similar gene-expression patterns to β-cells, which make insulin in the pancreas. Qiao Zhou at Harvard University in Cambridge, Massachusetts, and his colleagues reprogrammed these cells using a mix of key DNA-binding proteins, and found that more than 40% formed insulin-producing cells. The reprogrammed cells developed into stomach mini-organs (pictured) that, when transplanted into mice lacking β-cells, prevented spikes in blood sugar levels and kept animals alive for 6 months compared to untreated mice, which died within 8 weeks.

The results suggest that the stomach could serve as a renewable source of β-cells to treat diabetes, the authors say.

Cell Stem Cell **http://doi.org/bcqc (2016)**

PALAEOECOLOGY

Habitats of ancient humans revealed

Some hominins may have preferred to live in shady glades near fresh water nearly 2 million years ago.

Clayton Magill at the Swiss Federal Institute of Technology in Zurich and his colleagues took samples from a layer of soil in Olduvai Gorge, Tanzania, where fossil remains for early *Homo* and *Paranthropus boisei* hominins have been found. This 1.8-million-year-old soil was covered by a layer of volcanic ash, which preserved the distinctive chemical signatures left behind by ancient plants. By analysing these 'biomarkers', the team was able to distinguish aquatic from terrestrial plants, grasses from non-grasses, and woody plants from herbaceous ones.

The biomarker analysis and fossil remains suggest that the hominins favoured a small wooded area near a freshwater wetland, presumably because it offered drinking water, edible plants and shade. The presence of fossilized butchered animal remains also implies that the hominins brought food back to their woodland home from the larger grassland area.

Proc. Natl Acad. Sci. USA **http://dx.doi.org/10.1073/pnas.1507055113 (2016)**

MICROBIOLOGY

Gut microbes help malnutrition

Manipulating the gut microbes of undernourished children could help them to gain weight, three laboratory studies in mice and pigs suggest.

Malnourished children can struggle to gain weight even on high-nutrient diets, and studies have suggested that under-nutrition stops their gut microbiomes from maturing. A team led by Jeffrey Gordon at Washington University in St. Louis, Missouri, transplanted gut microbes from undernourished and healthy children from Malawi into germ-free mice, and found

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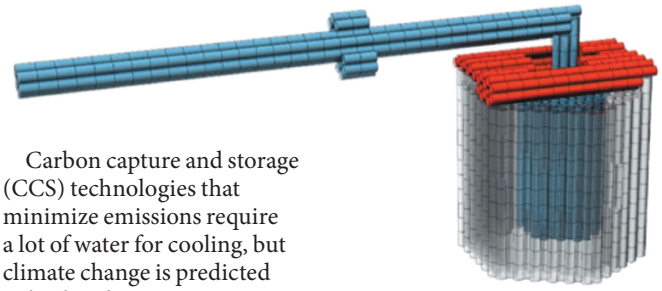


that mice given microbes from healthy children gained more weight and muscle than did mice with the malnourished microbiomes. The team identified microbial species associated with these gains, and delivering two species to the guts of mice that had malnourished microbiomes boosted the animals' growth.

Martin Schwarzer and François Leulier at the University of Lyons, France, and their team found that giving malnourished mice a strain of *Lactobacillus plantarum* bacteria helped the mice to gain weight by restoring their growth hormone production. In a third study, Gordon and his colleagues identified a sugar in breast milk that promoted growth in mice and piglets harbouring microbes from a malnourished child.

Science **http://doi.org/bcnr (2016);** ***Science*** 351, **854–857 (2016);** ***Cell*** **http://doi.org/bcqd (2016)**

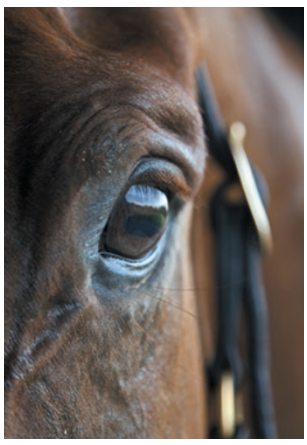
ANIMAL COGNITION

Horses read human emotions

Horses can differentiate between happy and angry human faces.

Researchers previously showed that dogs can identify emotions from human faces. To find out whether horses share this ability, Amy Smith, Karen McComb and their colleagues at the University of Sussex in Brighton, UK, tested the response of domestic horses (*Equus caballus*; **pictured**) to photographs of human faces with happy or angry expressions. Horses tended to view angry faces with their left eyes — a sign that they were processing the image using the brain's right hemisphere, which is thought to handle negative stimuli. The animals' heart rates also increased more rapidly in response to angry faces than to happy ones.

ALEX SHARP/GETTY



The ability of horses to recognize human expressions could have evolved during domestication, the authors say. They add that the animals probably also refine this skill during their lifetimes.

Biol. Lett. 12, **20150907 (2016)**

PLANETARY SCIENCE

First super-Earth atmosphere

The first gases to be identified around an exoplanet that is slightly larger than Earth show that its atmosphere is probably rich in hydrogen and carbon.

Angelos Tsiaras of University College London and his colleagues used a camera on the Hubble Space Telescope to probe the planet 55 Cancri e, which has a radius twice that of Earth, lies 12 parsecs (about 40 light years) away and orbits close to its host star.

The team found that the planet's atmosphere contains no water vapour but does have hydrogen, probably in the form of hydrogen cyanide, which is an indicator of carbon-rich atmospheres. The high level of carbon suggests exotic chemistry around the planet.

Astrophys. J. **in the press; preprint at http://arxiv.org/abs/1511.08901v2 (2016)**

CLIMATE CHANGE

Climate risks of low-carbon power

A transition to power plants that capture and store carbon could increase water use, probably leading to shortages in a major UK river basin as early as the 2030s.

Carbon capture and storage (CCS) technologies that minimize emissions require a lot of water for cooling, but climate change is predicted to lead to drier summers in the United Kingdom. Edward Byers of Newcastle University, UK, and his colleagues used climate and hydrology models to analyse scenarios in which electricity production rises by 55% by 2040 as CCS technologies are fully adopted in the River Trent basin — the largest UK inland source of cooling water for power generation. The team projected declining river flows alongside rising demand for water from the power sector.

The researchers found that CCS power plants might become less reliable in the future when the river runs low, unless the most water-efficient technologies are used.

Environ. Res. Lett. 11, **024011 (2016)**

NANOSCIENCE

Nanorotor made of DNA

Researchers have made a nanometre-scale rotor out of 3D fragments of DNA.

Hendrik Dietz and his colleagues at the Technical University of Munich, Germany, designed the fragments to self-assemble into a rotor that looks like a helicopter blade (**pictured**). It spins around on an axle and is clamped in place by two other DNA units. To stop the blade from rotating freely, the team used docking sites on the inside of the clamp units so that the rotor was held in place. When the ion concentration of the solution containing the rotor changed, the rotor was released and could spin owing to Brownian motion.

The researchers say this action mimics that of an enzyme in the body that acts like a rotary machine, and claim that their nanomachine is more structurally complex than previous ones.

Sci. Adv. 2, **e1501209 (2016)**

ROBOTICS

Microbots dance in the light

Tiny soft robots can swim, spin and make other complex motions in response to light.

Microbots — micrometre-scale robots — could one day be used to deliver medicines or to collect data inside the body. But most microbots are made of rigid materials, which limit them to simple back-and-forth motions, usually in response to chemical or magnetic forces. To develop microbots that are capable of more-versatile movement, Peer Fischer at the Max Planck Institute for Intelligent Systems in Stuttgart, Germany, and his colleagues designed soft, flexible ones using a liquid-crystal elastomer that was both rubbery and responsive to light.

By sweeping bands of light across disc- and rod-shaped microbots, the team induced wave-like swimming motions similar to those used by single-celled organisms. Different patterns of light also made the disc-shaped microbots spin, reverse their spinning direction or move around a path in the shape of a square.

Nature Mater. **http://doi.org/bcjk (2016)**

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