RESEARCH HIGHLIGHTS

Selections from the scientific literature

NEUROSCIENCE

Alzheimer's drugs make brains buzz

Several candidate drugs for Alzheimer's disease have failed to improve cognition in human clinical trials. One reason could be that they worsen neuronal defects, at least in mice.

The drugs are antibodies that have been designed to bind to and reduce levels of amyloid-β protein, which builds up in the brains of people with Alzheimer's. Marc Aurel Busche and Arthur Konnerth at the Technical University of Munich in Germany and their colleagues used high-resolution imaging of mouse brains to monitor how the antibodies affect neuronal activity. In two mouse models of Alzheimer's, two different antibodies increased the number of cells in the cortex that were electrically hyperactive, further impairing brain function, compared with untreated animals.

The results suggest a greater need to test how molecular therapies affect neuronal function in the brains of living animals, the authors say.

Nature Neurosci. **http://dx.doi.org/10.1038/nn.4163 (2015)**

MATERIALS

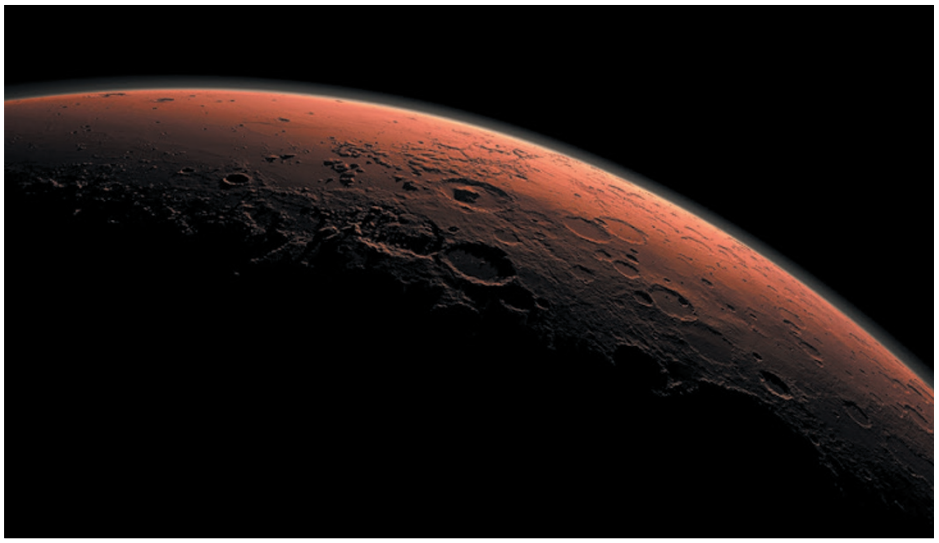
Boron made into 2D sheet

Researchers have created a 2D form of boron and shown that it behaves as a semiconductor.

Materials such as graphene (the atomically thin form of carbon) and others made of silicon and phosphorus have desirable electrical properties that could be useful in electronics, and 2D forms of boron have shown promise in theoretical work. To make a 2D boron crystal monolayer, Guoan Tai at the Nanjing University of Aeronautics and Astronautics in China and his collaborators deposited boron atoms onto a copper surface.

They showed that the 2D material has electronic and optical properties that could be useful for building devices such as lasers and thin-film photovoltaic panels.

Angew. Chem. Int. Edn **http://doi.org/f3jsqh (2015)**



NASA/JPL-CALTECH

PLANETARY SCIENCE

How Mars loses its atmosphere

Solar storms have blasted much of Mars's tenuous atmosphere into space over billions of years, making the planet the barren world it is today.

A series of papers has outlined the first results from NASA's Mars Atmosphere and Volatile Evolution (MAVEN) spacecraft, which has been orbiting Mars since September 2014. In one paper, Bruce Jakosky of the University of Colorado Boulder and his colleagues report MAVEN data showing that when protons and electrons from a solar eruption slammed into the planet in March 2015, they increased the rate at which Mars loses its atmosphere by roughly an order of magnitude.

A second paper concludes that only about 10% of the atmospheric particles that leave Mars are recaptured by its gravitational pull; the rest are lost to space permanently, find David Brain of the University of Colorado Boulder and his co-workers.

And when MAVEN flew within 130 kilometres of the Martian surface, it discovered new populations of charged and neutral particles, including oxygen, nitrogen and carbon dioxide. These were found at unexpectedly low altitudes in the Martian atmosphere, say Stephen Bougher of the University of Michigan in Ann Arbor and his team in a third paper. Together, the findings show that Mars's atmosphere is more complex and dynamic than scientists had thought.

Science **http://doi.org/83k (2015);**
Geophys. Res. Lett. **http://doi.org/83p (2015);**
Science **http://doi.org/83m (2015)**

REGENERATIVE BIOLOGY

How mice regrow ear tissue

Blocking a specific cell-signalling pathway in mice boosts the regeneration of ear tissue without any scarring after injury.

Some amphibians and fish can regrow organs and appendages. To investigate the process in mammals, Thomas Leung, Seung Kim and their colleagues at Stanford University in California studied an engineered mouse model that is adept at regrowing injured ear tissue with no scarring. They found that certain cells in the skin's outer layer produced lower levels of a cell-signalling

molecule called Sdf1 than seen in normal animals. This resulted in reduced recruitment of specific white blood cells that are involved in scar formation.

A compound that inhibits the signalling between Sdf1 and these white blood cells enhanced scar-free regrowth of ear tissue in normal mice.
Genes Dev. 29, **2097–2107 (2015)**

PHYSICS

Balloon-popping patterns probed

When balloons burst, they either split open along a single line or, if inflated to a high pressure, shred into many pieces.

Sébastien Moulinet and Mokhtar Adda-Bedia at the École Normale Supérieure in Paris punctured rubber balloons and used a high-speed camera to film the popping process, which lasts for less than 0.1 milliseconds. The stress within the membrane depends on the balloon's internal pressure and on the membrane's thickness and curvature. The authors found that as membrane stress increased, a single crack propagated at higher speeds. Above a threshold level, the crack branched out into as many as dozens of cracks to quickly dissipate the stress, leading to many balloon fragments.

The researchers say that similar principles might cause the tree-like propagation of cracks in processes ranging from the breakup of atomic nuclei to the collisions of asteroids.
Phys. Rev. Lett. 115, **184301 (2015)**

MATERIALS

Ancient art spurs thin batteries

Ink on paper can act as an electrode in a thin, flexible battery.

Inspired by Chinese brush painting, a team led by Xin-Bo Zhang at the Chinese Academy of Sciences' Changchun Institute of Applied Chemistry fabricated a flexible lithium-air battery using lithium foil and paper with a carbon-based ink (**pictured**). Electrons are stripped from the foil, creating lithium ions that flow to the inked paper electrode, where they combine with oxygen from the air. The resulting battery can hold a charge even after it has been bent 1,000 times. A foldable pack of four batteries, which weighs less than 2 grams, can supply current for 100 hours.

The technique paves the way for cheap and easily manufactured flexible batteries, the authors say.
Adv. Mater. **http://doi.org/f3js75 (2015)**

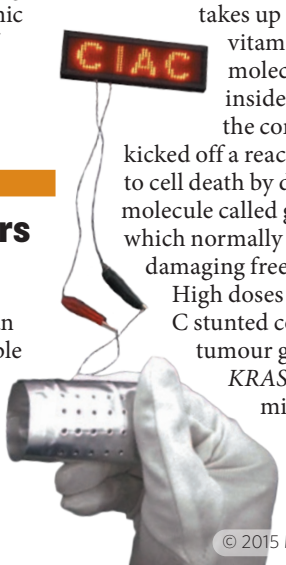
ADV. MATER./XIN-BO ZHANG *ET AL.* (COLOUR VERSION)

CANCER

Vitamin kills colon-cancer cells

High levels of vitamin C can slow the growth of colorectal tumours in mice.

Lewis Cantley at Weill Cornell Medical College in New York and his colleagues studied human colorectal cancer cells with mutations in either the *KRAS* or the *BRAF* genes, which are commonly mutated in people with this type of cancer. High levels of oxidized vitamin C killed the cells. The authors found that the cancer cells make unusually large amounts of a receptor that takes up the oxidized vitamin C molecule. Once inside the cell, the compound kicked off a reaction that led to cell death by depleting a molecule called glutathione, which normally mops up damaging free radicals.



High doses of vitamin C stunted colorectal tumour growth in *KRAS*-mutant mice.

With more research, the vitamin could be used to treat some colon cancers, the authors suggest.
Science **http://doi.org/83w (2015)**

SOCIAL SELECTION

Popular topics on social media

Debate over microbiome initiatives

Researchers studying communities of microbes need to up their game. That was the argument made by two articles published on 28 October in *Science* and *Nature*, which called for national and international initiatives that would unite microbiome researchers and move the field forward. The initiatives would help researchers to develop better, standardized ways of studying microbial communities so that scientists can make meaningful comparisons of data sets across different studies. Some scientists were sceptical, however. Nick Loman, a bacterial geneticist at the University of Birmingham, UK, tweeted: "Just calling for standards and unified data sharing ain't going to make it happen."

But the proponents say that the two articles are just starting points for broader discussion in the field. Microbial ecologist Jack Gilbert at the University of Chicago in Illinois, a co-author of the *Science* article, hopes that the proposals — and the online back and forth — will stimulate further discussion and the creation of new research programmes. "No one is saying that we're going to fundamentally transform the way you do science. We're saying we're going to fundamentally transform the way science is funded and the way multidisciplinary science can be implemented," he says. "This is starting a conversation."
Science 350, **507–508 (2015);**
Nature 526, **631–634 (2015)**

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AUSTRALIAN NATL FISH COLL., CSIRO

ANIMAL BEHAVIOUR

Fish bring death from above

Needlefish can leap from the sea and dive back down to attack small fish prey from above, the first time such behaviour has been seen in fish.

Ian Tibbetts at the University of Queensland in Australia and his colleagues observed *Tylosurus gavialoides* needlefish (**pictured**) pursuing prey that were in tightly packed shoals in two locations off the Queensland coast. Needlefish normally strike at prey found within about 50 centimetres of their body, but aerial strikes extended their range to more than 2 metres. And such air strikes prevented fish prey from fleeing to the surface and leaping to escape, which they do when they are attacked from below the surface of the water.

The authors suggest that needlefish could be exploiting an optical effect called Snell's window — which limits vision through the water's surface — to mask their approach.
J. Fish Biol. **http://dx.doi.org/10.1111/jfb.12799 (2015)**

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