

RESEARCH HIGHLIGHTS

Selections from the scientific literature

QUANTUM INFORMATION

Qubit control in a 3D matrix

Qubits — quantum bits which store and process information in quantum computers — can be controlled individually in a 3D structure without disturbing nearby atoms.

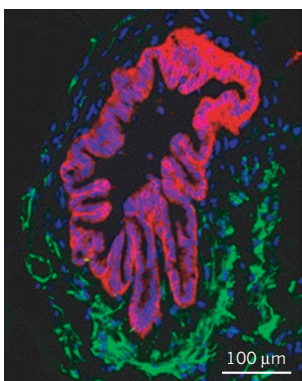
Neutral atoms show promise as qubits when they are cooled and trapped by light, but manipulating one atom without disturbing its neighbours is difficult. David Weiss and his team at Pennsylvania State University in University Park controlled a single atom in a $5 \times 5 \times 5$ array of trapped caesium atoms by firing two beams of circularly polarized light so that they intersected at the target atom. This caused the energy levels of electrons in the atom to shift, allowing the researchers to change its quantum state by hitting it with microwaves.

The method should make it easier to scale up quantum computers that use this kind of qubit, the researchers say. *Phys. Rev. Lett.* 115, 043003 (2015)

STEM CELLS

Stomach tissue made in a dish

Mouse embryonic stem cells can develop into 3D 'mini stomachs' in the lab.



Researchers have previously used stem cells to make parts of the stomach, but not the whole organ. Taka-aki Noguchi, Akira Kurisaki at the University of Tsukuba in Japan and their team made stomach tissue — including the main food-containing part — by adding several key growth factors to the stem-cell culture after six days. These turned on expression of the *Barx1* gene, which is essential for stomach development. After about 60 days, the cells developed into stomach tissue (pictured) that contained several specialized types of stomach cell. The mini stomach also secreted a digestive hormone

and acid, and had a similar gene-expression profile to that of adult stomach tissue.

This system could be used to study stomach diseases, the authors say. *Nature Cell Biol.* <http://doi.org/6gf> (2015)

For a related News Feature on organoids, see page 520.

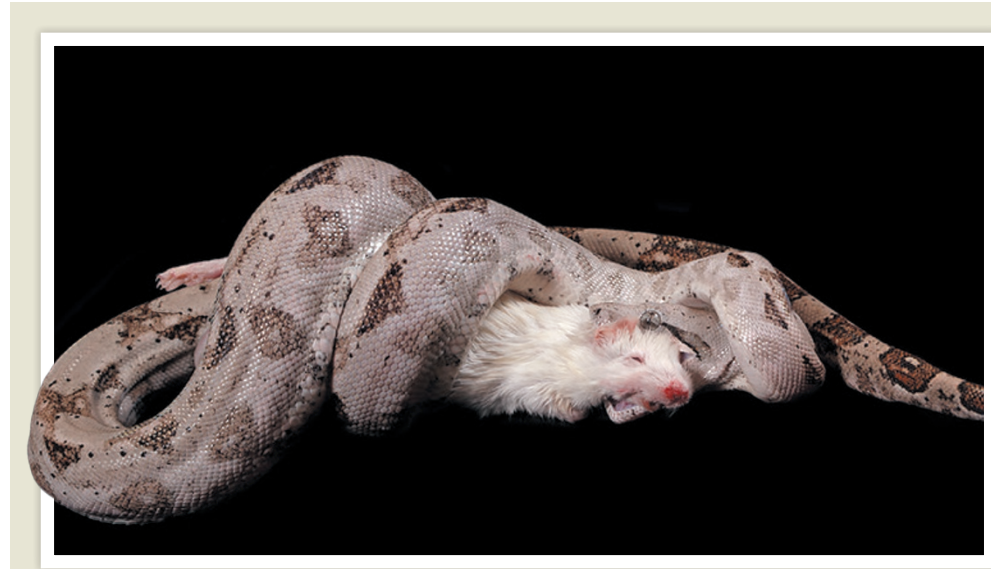
NEUROBIOLOGY

Marijuana's good without the bad

Mice treated with marijuana's active component, THC, along with other key molecules, can experience its pain-relieving benefits

without the usual memory impairments.

THC binds to the CB1 cannabinoid receptor in the brain, causing negative effects such as poor memory and anxiety. However, it also affects behaviours that are regulated by the serotonin 2A receptor. Patricia Robledo at Pompeu Fabra University in Barcelona, Spain, and her colleagues gave THC to mice lacking the serotonin receptor, and found that the animals did not show signs of memory loss but could still tolerate painful stimuli. Studies of cells expressing both types of receptors revealed that the receptors physically



ANIMAL BEHAVIOUR

How boa constrictors really kill

Animals that have been squeezed to death by snakes probably die of circulatory arrest rather than of suffocation as was thought.

Scott Boback at Dickinson College in Carlisle, Pennsylvania, and his team anaesthetized rats and implanted probes and catheters to measure their heart rate, blood pressure and blood chemistry as the animals were being squeezed by a boa (*Boa constrictor*; pictured). Constriction lasted an average of 6.5 minutes,

but the rats' peripheral blood pressure dropped by half as early as 6 seconds in. By the end of constriction, the rats' blood chemistry showed signs of system-wide circulatory problems and there was evidence that the heart had undergone significant electrical dysfunction.

The authors suggest that snakes may release their prey only after detecting that it has experienced irreversible heart failure. *J. Exp. Biol.* 218, 2279–2288 (2015)

SCOTT M. BOBACK

TAKA-AKI K. NOGUCHI ET AL./NATURE CELL BIOL.

interact. Mice that were given THC and peptides that stop the receptors interacting in the brain did not show memory problems, but still experienced pain relief.

The findings suggest a way to minimize the negative effects of medical marijuana, the authors say.

PLoS Biol. 13, e1002194 (2015)

ASTRONOMY

Telescope spies early galaxy's birth

Astronomers have spotted the glow from one of the most distant galaxies ever seen in the early Universe.

Roberto Maiolino at the University of Cambridge, UK, and his colleagues used the high-resolution Atacama Large Millimeter/submillimeter Array (ALMA) telescope in Chile to observe three faint galaxies that began forming less than one billion years after the Big Bang. In one galaxy they detected clouds of cold ionized carbon that was shifted away from the bright, star-forming centre. This matches models of early galaxy formation, which predict that active young stars disperse such clouds.

The data will help to test theories about how the Universe's first stars and galaxies formed, the team says. *Mon. Not. R. Astron. Soc.* 452, 54–68 (2015)

NEUROBIOLOGY

A critical period for brain health

Disrupting a signalling molecule in week-old mice prevents their neurons from altering connections with other neurons in adulthood.

Cognitive problems can result from an inability to strengthen or weaken these connections, called synapses, in the brain in response to external triggers — a process known as plasticity. Neil Hardingham of Cardiff University, UK, and his colleagues blocked signalling by the DISC1 protein in

7-day-old mice for 6–48 hours. When the animals reached adulthood, their synapses failed to adapt in response to signals generated by stimulating one of their whiskers.

In humans, changes to DISC1 signals during this critical period soon after birth could underlie psychiatric symptoms that emerge during adolescence, the authors suggest.

Science 349, 424–427 (2015)

MICROBIOLOGY

Microbe war waged with biofilms

Sticky films of microbes form as the result of competition, not cooperation, between bacterial strains.

Scientists had thought that biofilms form cooperatively, with multiple strains of bacteria growing to protect one another. But when Kevin Foster of the University of Oxford, UK, and his colleagues mixed two different strains of the opportunistic pathogen *Pseudomonas aeruginosa*, they found that the strains competed with each other, with one producing antibiotics called pyocins to kill its opponent. This mixture produced greater amounts of biofilm than did the individual strains, and introducing other antibiotics into the mix further stimulated biofilm formation.

The results suggest that the clinical use of antibiotics could be causing bacteria to make more biofilms, making the microbes harder to stamp out. *PLoS Biol.* 13, e1002191 (2015)

ENGINEERING

Origami for thick materials

Origami patterns designed for thin pieces of paper can be extended to thicker materials as well.

Previous attempts to fold 3D materials required adding layers of material or changing their geometry. To avoid this, Zhong You at the University of Oxford, UK,

SOCIAL SELECTION

Popular topics on social media

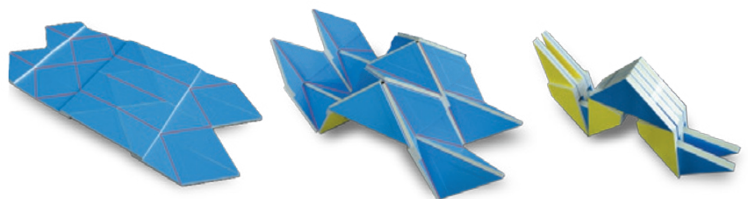
Science reporting flaws exposed

Researchers often complain about inaccurate science stories in the popular press, but few air their grievances in a journal. Samuel Mehr, a PhD student at Harvard University in Cambridge, Massachusetts, discussed in a *Frontiers in Psychology* article some examples of media missteps from his own field — the effects of music on cognition. The opinion piece gained widespread attention online. “A very nice review of how media communicates science badly,” tweeted Arseny Khakhalin, a neuroscientist at Bard College in Annandale-on-Hudson, New York. Seeing room for blame on both sides, Terry Hébert, a pharmacologist at McGill University in Montreal, Canada, posted on Facebook: “Journalists and scientists should both strive for accuracy in their claims.”

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Front. Psychol. 6, 00988 (2015)



and his colleagues developed a method of assembling thick materials so that the hinges where they meet move in a limited number of ways. The researchers showed how carefully choosing the placement of the hinges and creases allows the structures to move and fold (pictured) in identical ways to origami patterns that use 2D materials.

The method could eventually improve the construction of foldable structures such as solar panels or aircraft wings, the authors report.

Science 349, 396–400 (2015)

METABOLISM

Reroute bile for better metabolism

Altering the flow of bile in the mouse gut achieves the same weight-loss benefits as gastric-bypass surgeries.

In a gastric bypass, the stomach pouch is made smaller and connected to the

middle of the small intestine. Naji Abumrad at Vanderbilt University Medical Center in Nashville, Tennessee, and his team tested whether the success of such procedures can be replicated by redirecting bile fluids, which break down dietary fat in the upper gut to enable fat absorption. Rerouting the bile duct to the ileum (the lower part of the small intestine) in obese mice resulted in weight loss and other metabolic improvements that were similar to those seen after a gastric bypass. The bile diversion reduced fat absorption and shifted the composition of gut microbes to be similar to that of lean mice.

Redirecting the bile duct in humans would be simpler than gastric bypass, but long-term safety studies are needed, the researchers say.

Nature Commun. 6, 7715 (2015)

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