RESEARCH HIGHLIGHTS

Selections from the scientific literature

PHARMACOLOGY

Painkiller kills the bad effects of pot

Marijuana's undesirable effects on the brain can be overcome by using painkillers similar to ibuprofen, at least in mice.

Chu Chen and his colleagues at Louisiana State University Health Sciences Center in New Orleans treated mice with THC, marijuana's main active ingredient. They found that THC impaired the animals' memory and the efficiency of their neuronal signalling, probably by stimulating the enzyme COX-2.

The authors reversed these negative effects — and were able to maintain marijuana's benefits, such as reducing neurodegeneration — when they also treated the mice with a drug, similar to ibuprofen, that inhibits COX-2.

The authors suggest that the benefits of medical marijuana could be enhanced with the use of such inhibitors.

Cell 155, **1154–1165 (2013)**

PALAEOECOLOGY

Dung reveals goats' last days

Climate change, rather than human actions, probably drove the Balearic mountain goat (*Myotragus balearicus*) extinct.

This small goat, unique to Spain's Balearic Islands in the western Mediterranean, disappeared soon after humans arrived on the islands, about 5,000 years ago. Some researchers have proposed that disease or hunting by humans killed off the goats.

ALINE NIEMAN/NATURALIS BIODIVERSITY CENTER

Frido Welker and Barbara Gravendeel of the Naturalis Biodiversity Center in Leiden, the Netherlands, and their colleagues analysed plant DNA found in the goats' fossilized faeces (**pictured**). The results suggest that the goats were dependent on *Buxus balearica*, a local species of shrub. Further analysis indicated that the shrub's abundance on the islands declined sharply 4,000–5,000 years ago because of a drier climate. This is likely to have contributed greatly to the goats' extinction.

Quat. Res. **http://doi.org/p6b (2013)**

NICK CALOYIANIS

CLIMATE SCIENCES

Crusty alga uncovers sea-ice loss

Like tree rings, layers of growth in a long-lived Arctic alga may preserve a temperature record of past climate. Specimens from the Canadian Arctic indicate that sea-ice cover has shrunk drastically in the past 150 years — to the lowest levels in the 646 years of the algal record.

Satellite records of the Arctic's shrinking sea-ice cover date back only to the late 1970s. Jochen Halfar of the University of Toronto at Mississauga, Canada, and his colleagues have found a new palaeoclimate proxy in the coralline marine alga *Clathromorphum compactum* (**pictured**). It can live for hundreds of years and builds a fresh layer of crust each year.

The thickness of each layer, and the ratio of magnesium to calcium within it, are linked to water temperature and the amount of sunlight the organism receives. The discovery suggests a new way to calculate how much polar sea ice existed hundreds of years ago.

Proc. Natl Acad. Sci. USA **http://doi.org/p6g (2013)**

NEUROSCIENCE

Satiety signal from the mouth

A human hormone might be a potent treatment for obesity, but only if it is taken orally.

The peptide hormone PYY is made primarily by cells in the gut as a satiety signal to the brain. When it is injected into humans, however, it causes nausea and ruins the taste of food. Sergei Zolotukhin at the University of Florida in Gainesville and his colleagues sprayed PYY into the mouths of mice and found that although the animals stopped eating, as expected, they did not become nauseous.

PYY in saliva seems to use a different signalling pathway from gut PYY to tell the brain when it is time to stop eating. Targeting molecules in this pathway with oral PYY or

other compounds could reduce overeating without inducing nausea.
J. Neurosci. 33, **18368–18380 (2013)**

VIROLOGY

A more predictable flu

Influenza viruses may have fewer routes for escaping vaccines than previously thought.

Flu vaccines target a viral protein called haemagglutinin, which mutates frequently, rendering vaccines ineffective. Derek Smith of the University of Cambridge, UK, and Ron Fouchier of Erasmus Medical Center in Rotterdam, the Netherlands, and their colleagues studied how the haemagglutinin protein has mutated to evade vaccines — a process called antigenic drift — over a 35-year period from 1968 to 2003.

They found that seven of the ten antigenic drift events in the past three decades were caused by a change in just one amino acid in the protein. These changes occurred at only seven places in the protein, all of which cluster near a region that binds to host cells. The results could one day lead to more-effective flu vaccines.
Science 342, **976–979 (2013)**

ECOLOGY

Mother frogs arm their tadpoles

Some animals make chemical defences against predators; others obtain them from their food. Researchers have now found the first example of parents chemically arming their young after birth.

Ralph Saporito of John Carroll University in University Heights, Ohio, and his colleagues analysed specimens of the strawberry poison frog *Oophaga pumilio* (**pictured**) from all stages of the life cycle. Newly hatched tadpoles had no defensive alkaloids, but after their mothers began producing unfertilized 'nutritive eggs' for them to eat, tadpole alkaloid concentrations rose. Adult frogs obtain the alkaloids from ants and mites in their diet.

Hand-reared *O. pumilio* that were fed nutritive eggs from another frog species lacking chemical defences remained alkaloid-free.
Ecology **http://doi.org/p59 (2013)**

PHYSIOLOGY

Smells maintain blood cells

Fruitfly larvae need to sense odours to maintain a pool of the cells that give rise to blood cells.

A team led by Utpal Banerjee at the University of California, Los Angeles, studied mutants of *Drosophila melanogaster* to identify molecular signals connecting odour sensing to blood progenitor cells. They found that smells prevent the cells from specializing, or differentiating, before they are required.

When the team activated olfactory neurons in the fly's brain, the neurons secreted a chemical called GABA into the blood, triggering blood progenitors to let in calcium ions. Calcium maintains the cells as undifferentiated progenitors. Larvae raised in environments with few odours had low levels of GABA, and their blood progenitor cells differentiated earlier.

Whether similar links exist between sensory perception and progenitor cells in more complex organisms is not clear.
Cell 155, **1141–1153 (2013)**

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COMMUNITY CHOICE

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PHYSICS

Pinch of salt makes for bumpy icicles

HIGHLY READ on iopscience.iop.org 20 Oct–19 Nov

Impurities in water are behind the ripples seen around an icicle's circumference.

Ripples or ribs form naturally in icicles, an effect that previous theories attributed to surface tension in the thin film of water that flows over the ice. Antony Szu-Han Chen and Stephen Morris at the University of Toronto, Canada, analysed 67 icicles grown under a broad range of conditions in the laboratory. They found that whereas icicles made from pure water were ripple-free, even small amounts of salt dissolved in the water — less than is found in most tap water — caused ripples to emerge. The ribs also grew faster in saltier water.

Existing theories do not account for the effects of impurities in ripple formation, leaving salt's role in the process a mystery.
New J. Phys. 15, **103012 (2013)**

GLACIOLOGY

Anatomy of an ice shelf's demise

The sudden drainage of thousands of small lakes on the surface of Antarctic glaciers seems to have triggered the spectacular collapse of the Larsen B ice shelf in March 2012.

Some 3,000 small ponds of liquid water had emerged over the course of a decade on top of glaciers surrounding the ice shelf on the Antarctic Peninsula. These ponds disappeared in striking synchronicity a few days before the shelf's collapse.

When recreating the events in a computer simulation, Alison Banwell of the University of Chicago in Illinois and her colleagues found that the initial drainage of a single lake would have produced fractures in the ice that were capable of sucking dry neighbouring lakes, kicking off a catastrophic chain reaction.

The spread of fractures across the ice shelf may have ultimately caused its sudden demise, the authors suggest.
Geophys. Res. Lett. **http://doi.org/p6c (2013)**

ORGANIC CHEMISTRY

Fast and easy fluorine fix

Many drug compounds and agrochemicals are fluorinated, but adding fluorine atoms to organic molecules can be dangerous and expensive. Patrick Fier and John Hartwig at the University of California, Berkeley, report a way to fluorinate one class of molecules at room temperature and without the need for harsh reagents.

They showed that silver(II) fluoride can swap a hydrogen atom for a fluorine atom on molecules containing nitrogen as part of a ring of carbon atoms. The reaction replaces only the hydrogen attached to carbons next to the nitrogen in the ring. It occurs quickly and uses only commercially available reagents.
Science 342, **956–960 (2013)**