RESEARCH HIGHLIGHTS

Food for thought

Biol. Lett. doi:10.1098/rsbl.2006.0566 (2006)
If you stuffed yourself over the festive break, you probably felt the urge to sleep off your heavy meal straight after eating. Grey seals, on the other hand, seem able to postpone digestion until they're ready to rest.

Carol Sparling and her team at the University of St Andrews in Fife, UK, monitored the breathing and heart rate of seals in captivity as they foraged over varying distances. These measurements give the seals' metabolic rate.

The team observed that seals on long expeditions showed peaks in metabolic rate when resting at the surface and overnight, suggesting that this was when digestion happened. The trick may help the seals to juggle the different physiological demands of diving and digestion.

C. SPARLING

OPTICS

Invisibility cloak in sight

Opt. Lett. 32, 53–55 (2006)
The first material with a negative refractive index for visible light has been constructed.

Light entering a negative-index substance bends in the opposite direction to that entering a conventional material, such as glass. Such materials could be used in new kinds of lenses or even 'invisibility cloaks'.

Metamaterials have already been built to have a negative index for infrared light, with a shortest wavelength of 1,400 nanometres. Gunnar Dolling of the University of Karlsruhe, Germany, and colleagues push down this limit with a metamaterial that works at a wavelength of 780 nanometres, which falls at the red end of the visible spectrum. The researchers built the material by etching an array of holes into layers of silver and magnesium fluoride on a glass substrate.

GENETICS

Pain in the genes

Science 314, 1930–1933 (2006)
Your sensitivity to pain depends in part on which form you have of a gene that encodes a protein called catechol-*O*-methyltransferase. Luda Diatchenko at the University of North Carolina in Chapel Hill and her colleagues unpick how two common variants of the gene produce differing pain sensitivity, even though they encode the same protein.

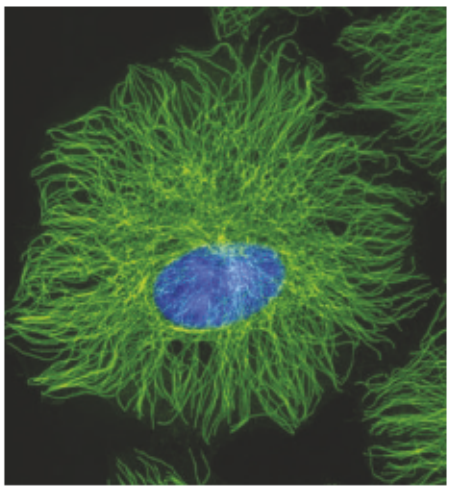
The researchers show that RNA transcribed from the variant associated with high pain sensitivity forms a looped structure that inhibits the RNA's translation into protein. This affects pain sensitivity because the protein metabolizes neurotransmitters such as dopamine. Their findings demonstrate one way that a 'silent' genetic variation can affect protein expression.

CELL BIOLOGY

Stitched up

Cell doi:10.1016/j.cell.2006.11.025 (2006)
It seems that cells know a few tailoring tricks. Experiments performed by Damian Brunner and Andreas Hoenger of the European Molecular Biology Laboratory in Heidelberg, Germany, and their co-workers suggest that a protein associated with the cell's cytoskeleton acts as both seam tape and a zip.

The researchers studied how a protein from fission yeast known as Mal3p — a homologue of the human EB1 protein — binds to structures called microtubules (pictured below, green). Electron-microscopy images show the protein lined up along the tube's length, following the seam created when the microtubule rolled up from a flat sheet. The researchers show that the protein stabilizes the seam, and speculate that it also helps the tube to curl up, zipping it shut.



T. DEERINCK, NCMIR/SPL

BIOTECHNOLOGY

Meet the VelociMouse

Nature Biotechnol. doi:10.1038/nbt1263 (2006)
Laser surgery can make short work of generating mutant mice, say David Valenzuela and his colleagues at the company Regeneron Pharmaceuticals in Tarrytown, New York.

Mutant mice with deliberately altered genes have become an essential part of the modern scientist's toolkit. But making mice with specific genes 'knocked out' is a laborious process, involving injection of a mouse blastocyst with mutant cells, then several rounds of breeding. The new report describes a short cut: mutant cells are injected into an eight-cell mouse embryo through a perforation opened by a laser. The resulting mice have a greater percentage of mutant cells than those produced by the traditional technique, eliminating the need for breeding. The team dub the method 'VelociMouse'.

NUCLEAR PHYSICS

A double dose of magic

Phys. Rev. Lett. 97, 242501 (2006)
Unnaturally heavy elements made in particle accelerators tend to fall apart in an instant. Unless they're stabilized by magic, that is.

Jan Dvorak of the Technical University Munich, Germany, and colleagues have confirmed predictions of magic stability for hassium-270, the heaviest 'doubly magic' nucleus seen so far. The 'magic' lies in the

number of protons and neutrons, which are organized into shells like those of electrons in atoms. A filled shell confers relative stability, and hassium-270 is doubly magic because it has filled shells of both protons and neutrons.

The team detected four atoms of hassium-270, created by bombarding a curium target with magnesium ions. They estimate its half-life to be 22 seconds, which is remarkably long for such a superheavy atom.

OPTICS

Two goes into one

Phys. Rev. Lett. **97**, 243003 (2006)

An optical trap uses a highly focused laser beam to confine atoms to a cell known as a potential well. Yevhen Miroshnychenko and his colleagues from the University of Bonn, Germany, have now contrived to squeeze two atoms into a well designed for one.

They achieved this unnatural intimacy through deft manoeuvring of two laser beams: one horizontal, used as a conveyor belt to shunt atoms to and fro; and one vertical, that, like a pair of tweezers, plucks an atom out of one well in the horizontal beam and sets it down in another. The two atoms could form a bound molecule, say the authors, or prove to be a useful resource for quantum information processing.

C. J. GERRITS

SEISMOLOGY

Traits of tsunami quakes

Geophys. Res. Lett. **33**, L24308 (2006)

The earthquake that caused a deadly tsunami in Indonesia in July 2006 was a classic 'tsunami earthquake', according to a new analysis of seismic records. Such quakes generate tsunamis much larger than some measures of the quakes' size would predict.

The earthquake near the Java trench sent a wave between 5 and 8 metres tall towards the beaches of Java, killing hundreds. Charles Ammon of the Pennsylvania State University, University Park, and his colleagues show that the rupture that caused it propagated slowly over 170–200 kilometres with an average slip of around 8 metres. The relatively long duration of the event (185 seconds) and the geometry of the slip are features shared with previous tsunami earthquakes.

MOLECULAR BIOLOGY

RNA taken to extremes

Proc. Natl Acad. USA **103**, 19490–19495 (2006)

By comparing the genetic sequences of many bacteria, Ronald Breaker and his colleagues at Yale University in New Haven, Connecticut, have identified a bizarre piece of RNA that they have christened an 'ornate, large, extremophilic RNA'.

The name describes its properties: ornate because the RNA appears to adopt an elaborate three-dimensional structure; large because it is 610 nucleotides long, which is sizeable for a stretch of RNA that does not code for protein; and extremophilic because it crops up mainly in bacterial species that live at extremes of temperature, salt concentration or pH.

The weird RNA may contribute to the membranes of these extreme bacteria and help them to live in such harsh environments. Other similar RNAs could turn up now that people know to look for them.

MICROFLUIDICS

Quick route to crystals

Proc. Natl Acad. Sci. USA **103**, 19243–19248 (2006)

X-ray crystallography can determine the structure of biological molecules, but only if high-quality crystals of the molecule can

be grown. Rustem Ismagilov and his co-workers at the University of Chicago, Illinois, present a microfluidics approach to screening crystallization conditions.

Conventional methods can be time-consuming and require large amounts of the target protein. By contrast, using the new scheme one researcher was able to set up 1,300 crystallization trials in 20 minutes using only 10 microlitres of a protein solution.

The team injected droplets of the solution into a capillary along with another reagent in a way that allowed the reagent and its concentration to be varied in each 'plug' (the picture above shows a 1-metre-long capillary containing around 1,000 plugs). The plugs were then screened to see which conditions gave the best crystals.

JOURNAL CLUB

Pulickel Ajayan
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Childhood memories cause a nanotechnologist to go nuts for plant-derived nanomaterials.

As a child growing up in Kerala, southern India, I marvelled at the unusual cashew fruit, with its kidney-shaped nut dangling from a swollen apple.

Since then, nanotechnology has become my passion. So it was with a curious mix of scientific interest and childhood memories that I read a recent paper describing how nanomaterials could be derived from plant sources such as the cashew nut.

I had never thought of a cashew nut as anything more than a food item. However, a little research reveals that cashew-nut-shell liquid, rich in natural long-chain phenols, already has applications ranging from hydrophobic coatings to anti-ageing creams.

George John and Praveen Kumar Vemula at the City College of New York, in their recent article (G. John & P. K. Vemula *Soft Matter* **2**, 909–914; 2006), show how cashew-nut-shell liquid can also serve as a starting material for a variety of nanostructures.

The oil contains molecules that have phenol groups for heads, and long hydrocarbon tails. These can form structures such as lipid nanotubes and twisted nanofibres.

To make this happen, the molecules' structure is first modified by attaching water-loving sugar groups to the phenols. The cooperative effect of head groups hydrogen bonding and the hydrophobic interactions of the tails leads the molecules to self assemble into bilayers. These then further organize into the fibres and tubes.

Using a similar strategy, it should be possible to develop a wide range of novel soft nanomaterials from other plant resources. The breadth of precursors available in our plants and crops should inspire all nanotechnologists — not just those fond of cashew nuts.