

# RESEARCH HIGHLIGHTS

## NEUROSCIENCE

### Relief from pain

*Neuron* 66, 149–160 (2010)

Healthy people and those with chronic back pain perceive similar levels of discomfort from a hot rod placed on their backs. But, subconsciously, their brains send different signals.

Vania Apkarian of Northwestern University in Chicago, Illinois, and his colleagues used functional magnetic resonance imaging to look at two brain areas: the cortex, where conscious thought occurs, and the nucleus accumbens, which monitors reward. The hot rod induced similar responses in the cortex. However, when the heat was removed, activity in the nucleus accumbens increased in the healthy volunteers — signalling rewarding relief — but decreased in those with chronic back pain, indicating disappointment.

When asked, members of the latter group reported a lessening of their chronic back pain when subjected to the acute pain.

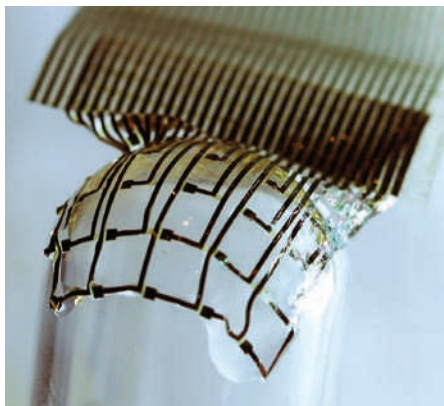
## BIOMATERIALS

### Electronics on the brain

*Nature Mater.* doi:10.1038/nmat2745 (2010)

Implanted electronic or medical devices can damage tissue or jostle themselves loose. The development of ultrathin electronics mounted on a flexible and dissolvable silk film could help to resolve this problem.

John Rogers of the University of Illinois at Urbana-Champaign, Brian Litt at the University of Pennsylvania in Philadelphia and their colleagues have fabricated thin electronics and transferred them to a layer of silk (pictured below). They placed their device on the surface of the exposed brain of an anaesthetized cat and show that, after application, the biocompatible silk dissolves, leaving the electronics layer tightly wrapped around the tissue. Its electrodes were able to detect brain activity.



### Moon grab

*Icarus* doi:10.1016/j.icarus.2010.03.026 (2010)

Of the more than 150 moons orbiting the Solar System's four giant planets, about two-thirds have distant, eccentric orbits. This suggests that, rather than coalescing from their respective planets' building materials, these moons were captured by their planets.

So far, however, modellers have struggled to recreate the conditions required for this capture, say Catherine Philpott at the University of Maryland in College Park and her colleagues. Proposing a new model, they show how a giant planet's strong gravitational tides can exaggerate small differences in the relative speeds of pairs of asteroids that stray too close. The slower of the two is left in the planet's grasp, while the faster one continues its orbit of the Sun.

Testing their model with the parameters of Jupiter (pictured), the team finds that 100-kilometre-wide binary objects would be captured about 10 times as often as single bodies.



NASA/JPL/SPACE SCIENCE INSTITUTE

## CULTURAL EVOLUTION

### High fidelity

*Biol. Lett.* doi:10.1098/rsbl.2010.0165 (2010)

In Darwin's finches, males learn to sing from their fathers. Song types can persist from one generation to the next, but for how long?

Eben Goodale and Jeffrey Podos at the University of Massachusetts, Amherst, compared song recordings from medium ground finches (*Geospiza fortis*) on Santa Cruz Island in the Galapagos made in 1961 and 1999. They found that, despite copy errors and other modifications, several song types persisted over almost four decades with remarkable fidelity. Certain parameters, such as trill rate, number of notes and song duration remained unchanged.

Male offspring that fail to reliably copy their father's song might be less successful at mating, the researchers suggest.

## CELL BIOLOGY

### Toxin tackle

*Cell* 141, 231–242 (2010)

The plant toxin ricin is a potential bioterror agent for which there is no treatment. Researchers in France used high-throughput screening to look for small molecules that

could protect cells against this compound *in vitro*. They found two, one of which markedly increased the survival rate of ricin-intoxicated mice.

Daniel Gillet at the Atomic Energy and Alternative Energies Commission in Gif-sur-Yvette, Ludger Johannes at the Curie Institute in Paris and their colleagues found that the small molecules blocked a key step in the trafficking of the toxin in the cell. This prevents it from reaching an organelle called the endoplasmic reticulum and moving on to inhibit protein biosynthesis.

They also found that the two molecules conferred similar beneficial effects on cells exposed to Shiga-like toxins, which are produced by certain disease-causing bacteria.

## CHEMISTRY

### Plumbing carbon rings

*Science* 328, 339–342 (2010)

Many organic compounds contain atoms arranged in aromatic or 'ring' structures, which often confer stability. Now Masaichi Saito at Saitama University in Japan and his colleagues have slipped lead into a ring of carbon atoms without disrupting its stable structure.

Aromatic compounds are stabilized

when the electrons in atomic orbitals are shared across the rings in a particular way to form bonds with unusual properties. Incorporating other atoms into these structures while maintaining these properties has proved difficult.

The researchers made a lead-containing analogue of an aromatic five-membered ring — the cyclopentadienyl anion — and used it to create a dilithioplumbole, another aromatic five-membered ring molecule. They say this could lead to new catalysts and materials.

#### CANCER BIOLOGY

### Cells combat chemo

*Genes Dev.* doi:10.1101/gad.1897010 (2010)

Resistance of tumours to a common chemotherapy drug called cisplatin is linked to improved DNA repair in mouse models of lung cancer, researchers have found.

Cisplatin damages DNA and is used to treat various cancers. However, most tumours that respond to the drug eventually become resistant. Tyler Jacks at the Massachusetts Institute of Technology in Cambridge and his colleagues found that tumours that had been treated with cisplatin over 12 weeks cleared damaged DNA more quickly than previously untreated cancers. Long-term cisplatin use was also associated with higher expression of genes involved in DNA repair.

#### NEUROSCIENCE

### Sharpening social skills

*J. Neurosci.* doi:10.1523/jneurosci.5538-09.2010 (2010)

Giving people the hormone oxytocin enhances their socially reinforced learning and improves their capacity to emotionally empathize with others. The findings support the idea of using the hormone — known for stimulating uterine contraction during childbirth — to treat disorders such as schizophrenia.

René Hurlemann at the University of Bonn in Germany, Keith Kendrick at the Babraham Institute in Cambridge, UK, and their colleagues asked male volunteers to perform a learning task. A nasal squirt of oxytocin improved the volunteers' performance when their choices were reinforced by images of smiling or angry faces, but not when their cue was a red or green light. In an empathy test, those treated with the hormone also scored similarly to untreated women, who normally score higher than men on such tests. The authors suggest that the amygdala — a brain region linked to emotional learning — helps to mediate oxytocin's effects.

#### CLIMATE CHANGE

### Fewer, taller, fiercer

*Geophys. Res. Lett.* doi:10.1029/2010GL042518 (2010)

Using a climate simulation with greater resolution than conventional models, researchers have found that tropical cyclone clouds will grow taller in a warmer world. This could explain the increased intensity of storms predicted by this and other models.

Yohei Yamada of the Japan Agency for Marine-Earth Science and Technology in Yokohama and his colleagues used a prototype global cloud-system-resolving model with 14-kilometre resolution. They simulated spring-to-autumn cyclone activity for climate conditions in 2004 and those in which carbon dioxide concentration is twice the present level. They predict that, although storm clouds will heighten, global storm frequency will decrease by 40% by 2100, which is consistent with previous findings.



#### IMMUNOLOGY

### Inflammatory good guys

*J. Exp. Med.* doi:10.1084/jem.20100050 (2010)

Inflammation is getting the blame for a growing number of ills, including tumour development. An oft-cited example is the link between ulcerative colitis and colon cancer. But new findings complicate the picture: three key proteins that form part of the inflammasome — a protein complex that triggers inflammatory responses — actually protect against colitis and the cancer it can induce.

Jenny P.-Y. Ting and her co-workers at the University of North Carolina at Chapel Hill induced colitis in mice in which the gene for the protein NLRP3, PYCARD or caspase-1 had been knocked out. The mice showed heightened disease and a greater incidence of cancer.

W. MCNAMEE/GETTY

## JOURNAL CLUB

Kevin Mitchell  
Trinity College Dublin

**A neurodevelopmental geneticist explores how one mutation can lead to multiple diseases.**

Work in psychiatric genetics has revealed that certain deletions or duplications of small chromosomal regions — termed copy-number variants (CNVs) — drastically increase the risk of disorders such as autism and schizophrenia. The findings are contributing to a shift in how we think about the cause of disease: away from a model involving a combination of common gene variants in each individual to one in which single, rare mutations in any of a large number of genes lead to disease in a high proportion of people.

However, it has come as a major surprise that many such mutations increase the risk not just of one disorder but of many — suggesting that primary insults to neural development may manifest themselves differently from one individual to another.

Evan Eichler at the University of Washington in Seattle and his colleagues investigated one possible reason: genetic background effects (S. Girirajan *et al. Nature Genet.* 42, 203–209; 2010). Previous studies had identified CNVs at a specific location on chromosome 16 in patients with autism or schizophrenia. Eichler *et al.* found that such mutations are also enriched in patients with developmental delay or cognitive disabilities.

Interestingly, among these cases, the researchers found a sixfold increase in the occurrence of a second CNV in other parts of the genome. Notably, these patients had a different set of symptoms from those with either single CNV alone.

This kind of modifying effect — due to additional, rare mutations in the background — is probably typical in human biology. With a growing understanding of the observable effects of mutations, it will be important and, in the near future, feasible to take each individual's entire genetic make-up into account when studying the roots of psychiatric disease.

Discuss this paper at <http://blogs.nature.com/nature/journalclub>