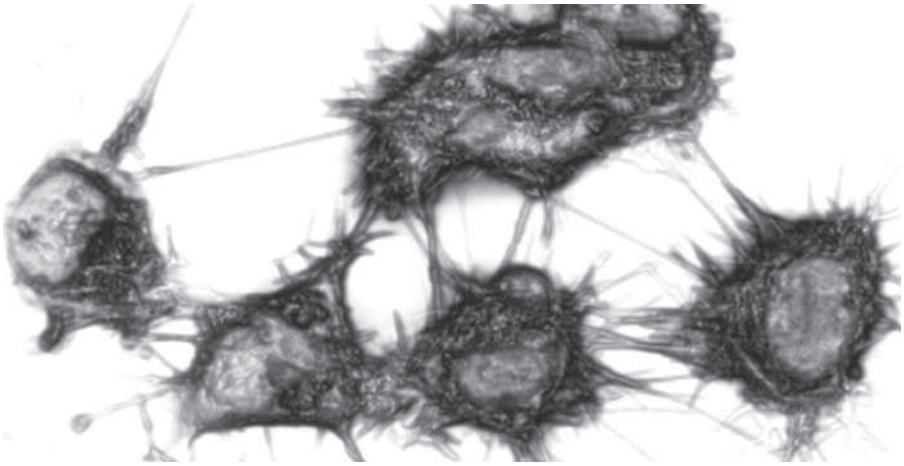
RESEARCH HIGHLIGHTS

Prion hijackers

Nature Cell Biol. doi:10.1038/ncb1841 (2009)
Prions that cause brain disease could spread between cells by hijacking a system cells may be using as a way of communicating, Chiara Zurzolo of the Pasteur Institute in Paris and her colleagues report. This may be how infectious prions infiltrate the central nervous system.

The researchers found that prions labelled with a fluorescent protein shuttled from one nerve cell to another by travelling inside nanotubes that connect these cells.

Treatment with a chemical that prevents nanotube formation halted the transfer of prions. Prions also moved from immune-system cells called dendritic cells to neurons.



K. GOUSSET *ET AL.*

PLANT SCIENCES

Rust resistant

Science doi:10.1126/science.1166453 (2009)
Why some rust-resistant plant genes maintain their potency as the fungus co-evolves has long baffled crop researchers. For instance, over the past 50 years leaf rust and stripe rust have become no more virulent against wheat plants carrying the gene *Lr34*. But other resistance genes are typically rendered useless by these pathogens within three to five years.

Lagudah Evans at CSIRO Plant Industry in Canberra, Beat Keller of the University of Zurich in Switzerland and their colleagues recently studied *Lr34*'s sequence. The team discovered that the crucial DNA sequence encodes a type of membrane protein called an ATP-binding cassette, or 'ABC' transporter.

Scientists who come across new resistance genes will be able to screen them for similar sequences and, on that basis, predict whether the resistance the new gene confers is likely to last, the authors say.

MOLECULAR BIOLOGY

Adaptation

Nature Biotechnol. doi:10.1038/nbt.1525 (2009)
A new way to silence gene expression has been devised. It differs from two common methods — antisense and RNA interference (RNAi) — in that it uses short synthetic nucleic-acid molecules known as U1 Adaptors that work inside the nucleus.

These tether another molecule called U1 snRNP splicing factor to messenger RNA molecules that have just been made. The splicing factor inhibits the processing necessary for messenger RNAs to move to a ribosome, where the genetic information they carry would be translated into proteins.

Sam Gunderson of Rutgers University in Piscataway, New Jersey, and his colleagues created U1 Adaptors that halved gene expression when added to cells at sub-nanomolar concentrations — a level of activity on a par with RNAi. Combining U1 Adaptors and RNAi further reduced gene expression.

ANIMAL BEHAVIOUR

The carriers' code

J. Exp. Biol. **212,** 499–505 (2009)
Although leaf-cutter ants leaving their nest often encounter leaf-laden colleagues coming the other way, the ant traffic never becomes gridlocked. Using an experimental nest of *Atta colombica*, Audrey Dussutour of the Paul Sabatier University in Toulouse, France, and her colleagues have determined the rules of the insect road.

When the ants were forced to cross a narrow bridge, they tended to form clusters of inbound and outbound foragers. Inbound clusters were headed by leaf-carrying ants and were almost always given priority; outbound ants tended to cross when there were no inbound ants.

The few inbound ants without loads followed behind slower, load-bearing members of their cluster. Had they raced ahead, head-to-head encounters would have caused twice the delay imposed by tailgating behaviour.

PHYSICS

Atomic quantum dots

Phys. Rev. Lett. **102,** 046805 (2009)
Assemblies of quantum dots — blobs of a few thousand atoms — with electrons shuttling between them could form miniature low-power computing circuits that do not require transistors. But these architectures are fragile and must operate at temperatures close to absolute zero to control the interactions of the electrons they confine.

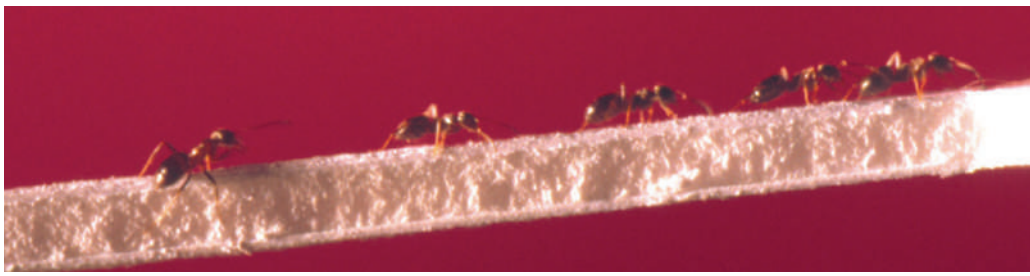
A team led by Robert Wolkow at Canada's National Institute for Nanotechnology in Edmonton, Alberta, has discovered that single silicon atoms, sitting in an electron-doped silicon lattice that is blanketed with hydrogen, provide electronic structures with better properties than quantum dots.

The atoms can be joined in assemblies much like the dots. Besides being smaller, these are much more robust to external disturbance and can tunnel electrons controllably at room temperature.

OCEANOGRAPHY

Sky view

Geophys. Res. Lett. doi:10.1029/2008GL036422 (2009)
The localized sinking of large volumes of surface water to great depth has a crucial role in global ocean circulation and so in climate



CNRS PHOTOTHÈQUE

regulation. Buoys and ship-based sensors are normally used to measure the amount of water that sinks and how fast it does so, but generating such data from satellite readings would provide more complete coverage.

Marine Herrmann of the CNRS in Toulouse, France, and her colleagues have gone some way towards this by comparing satellite measurements of sea-surface elevation for the years 1994–2007 to a simulation of the Western Mediterranean Deep Water convection.

Sea level is always lower where convection takes place. Herrmann's study shows that it is sufficiently so off the southern coast of France (and by implication, many other sites around the world) for altimetry measurements to determine year-on-year convection changes.

NANOTECHNOLOGY

Etch a circuit sketch

Science **323,** 1026–1030 (2009)

The difficulty in designing nanoscale circuit boards lies in keeping electrons from leaving the conducting material through which they flow. With this in mind, Jeremy Levy of the University of Pittsburgh in Pennsylvania and his colleagues have devised 2-nanometre-wide circuits that confine electrons to the two dimensions of the chip's 'wiring' by trapping a gas of them at the interface of polar and nonpolar metal oxides.

Their circuits are made using a conducting atomic force microscope tip with positive voltage on the polar oxide, which changes the electronic properties of the oxide. Passing a tip with a negative voltage back over the circuits erases them. These processes can be repeated hundreds of times. The authors demonstrated the concept by building electronic components such as field-effect transistors.

MATERIALS SCIENCE

Better coats

Phys. Rev. Lett. **102,** 045003 (2009)

Sputtering, a common industrial method for coating surfaces, uses ions in a gas to knock metal atoms from a solid that then fly off to coat a target in a thin film. 'Self-sputtering' is a way to coat targets without the presence of a gas; at higher voltages some of the metal atoms are themselves ionized and return to their solid source, where they dislodge yet more metal atoms.

Now Joakim Andersson and André Anders of Lawrence Berkeley National Laboratory in California have created a sort of runaway self-sputtering. It uses pulses of extremely high voltage to make the ion current of the metal atoms exceed the applied electric current.

PALAEONTOLOGY

Flower power

J. Evol. Biol. **22,** 446–459 (2009)

Many palaeontologists have long thought that flowering plants and dinosaurs co-evolved because many species of both appeared during the Cretaceous period, 145 million to 65 million years ago. This now seems unlikely.

Richard Butler and his colleagues at London's Natural History Museum have mapped the species diversity of fossil finds encompassing 407 species of dinosaur (including those of diplodocus, pictured below) and more than 2,300 species of plant. They found no overall geographical correlation between the two data sets.

Instead, they learned that stegosaur diversity was negatively correlated with the diversity of flowering plants and positively correlated with that of non-flowering cycadophytes, which hints that the spiny-backed group ate cycadophytes.

N. PARKER/NATURAL HISTORY MUSEUM, LONDON

NEUROSCIENCE

Mouse mapping

PLoS Biol. **7,** e1000032 (2009)

When neuroscientists measure parts of nervous systems, they do so statistically, pooling data about the activity of many neurons at once. But researchers based in Cambridge, Massachusetts, have painstakingly mapped every neuron involved in innervating six mouse interscutularis muscles — muscles that allow mammals to wiggle their ears.

Jeff Lichtman of Harvard University and his colleagues used these six 'connectomes' to compare the innervation of paired tissues on the left and right sides of the same creatures. The wiring was strikingly different, underscoring the flexible nature of mammalian neural development. Many of the neurons were also 25% longer than required to form the connections that they did. That is odd because nerve cells are metabolically expensive.

JOURNAL CLUB

Kishan Dholakia
University of St Andrews, UK

An optical physicist sees beyond fluorescent labels.

Many a molecular biologist likes to watch molecules move around inside living cells, particularly in real time. The job is usually done by tethering a fluorescent tag to interesting biological molecules and following their movements by means of the tag's glow. But fluorescent tags are often bigger than the molecules they label, so frequently perturb their movements. Better to watch intracellular dramas without millstones around the actors' necks. But how?

A twist on 'Raman scattering' may hold the answer. Normally, when a laser is shone at a molecule, the molecule scatters most of the light at the same frequency at which it was emitted by the laser. A tiny amount — Raman scattered light — is scattered at different frequencies. These frequencies indicate the chemical bonds in the molecule, and can thus identify it as a fingerprint identifies a person. If only Raman signals were stronger, they would be suitable for real-time microscopy on a molecular scale.

A second laser provides the twist — and the necessary amplification. Sunney Xie of Harvard University and his colleagues have found that another laser can enhance the contrast of an image, improving the sensitivity over previous studies by four orders of magnitude (C. W. Freudiger *et al. Science* **322,** 1857–1861; 2008). For this to work, the two lasers must coincide on the sample, and the difference in their frequencies must exactly match that of a specific molecular vibration of a certain chemical bond in the sample. The background noise is eliminated and the signal is amplified.

This method is both versatile and powerful; the authors used it to observe the uptake of omega-3 fatty acids by human lung-cancer cells and the changing distribution of two drugs as they were absorbed by mouse skin. I think this could spur the development of tag-free molecular movie machines for all.

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