RESEARCH HIGHLIGHTS

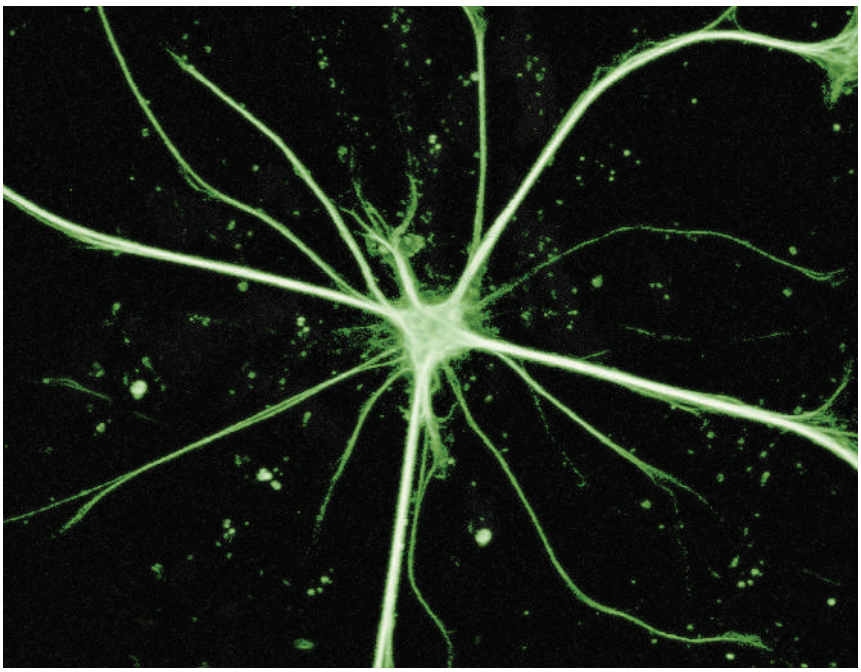
The poison next door

Nature Neurosci. doi:10.1038/nn1885 and doi:10.1038/nn1876 (2007)

The neurodegenerative disease amyotrophic lateral sclerosis (ALS) causes deterioration of muscle control by killing motor neurons. Now, two studies suggest that therapies should focus not on the motor neurons, but on neighbouring non-neuronal cells known as glia.

Roughly 2% of ALS cases are caused by a mutation in a gene known as superoxide dismutase-1 (*SOD1*). Serge Przedborski and his colleagues at Columbia University in New York found that a particular type of glial cell, an astrocyte (pictured), carrying the *SOD1* mutation releases an unknown factor that kills motor neurons.

Kevin Eggan and Tom Maniatis of Harvard University in Cambridge, Massachusetts, also found that mutant glial cells cause neurodegeneration. To perform their experiments, this team derived motor neurons with the SOD1 mutation from mouse embryonic stem cells. This provides a new system for rapidly screening candidate drugs.



SPL

GENETICS

Knockout round

Genome Res. doi:10.1101/gr.6080607 (2007)

Researchers in the Netherlands have developed an efficient approach to knocking out genes in the worm *Caenorhabditis elegans*, one of biology's favourite model organisms. Such knockout worms are used to study the disabled gene's function.

Edwin Cuppen and his colleagues at the Hubrecht Laboratory in Utrecht exposed worms to a chemical mutagen, then used high-throughput sequencing to look for mutations in 32 selected genes. They found, in more than 6,000 worms, mutations that inactivated 27 of the genes studied.

Their sequencing method is faster than existing techniques to identify knockouts, say the researchers, raising hopes that it could be extended to span all of the worm's nearly 20,000 genes.

TAXONOMY

Identity crisis

Proc. R. Soc. Lond. B doi:10.1098/rspb.2007.0248 (2007)

Many of the European medicinal leeches available commercially and marketed as *Hirudo medicinalis* are actually *Hirudo verbana*, according to a DNA study. *H. medicinalis* is approved by the US Food and Drug Administration (FDA) as a medical device, but *H. verbana* currently falls outside FDA approval.

Mark Siddall of the American Museum of Natural History in New York and his colleagues made the finding after analysing mitochondrial and nuclear DNA from 36 commercial and wild leeches from across Europe. They distinguish three species of European medicinal leech.

Research labs working with leeches — a popular model organism in neurobiology — will need to review their results if they find that their organisms have been misclassified.

ANIMAL BEHAVIOUR

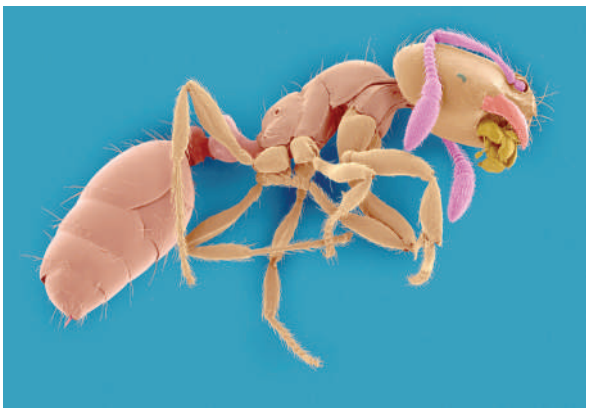
Handy legs

Naturwissenschaften **94**, 326–332 (2007)

Ants have opposable spines on their forelegs that allow them to manipulate objects, say researchers.

It was thought that ants used their legs for walking, and their jaws for carrying, nest-building, and so on. But Deby Cassill of the University of South Florida in St Petersburg and her colleagues saw queens of the fire ant *Solenopsis invicta* (pictured below) manipulating eggs and larvae with their forelegs. The team used electron microscopy to reveal the pincer-like paired spines on the limbs of several castes.

Ants join a short list of animals that use their forelimbs in this way, the team says, including crabs, koalas and primates. Seven of eight other ant species investigated had similar spines, suggesting that this might be a widespread feature.



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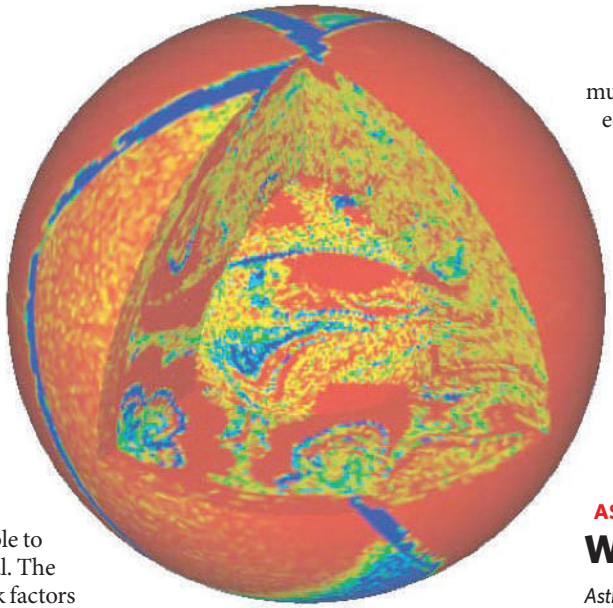
CHEMICAL BIOLOGY

Sensitive to shape

Angew. Chem. Int. Edn doi:10.1002/anie.200604995 (2007)

A simple chemical system can perform 'shape recognition', report Rustem Ismagilov of the University of Chicago, Illinois, and his colleagues.

Experiments with human blood plasma showed that blood clotting occurs when a chemical trigger, known as tissue factor, is deposited in patches with particular shape, but not when the same amount of tissue factor is laid down in other shapes. For example, clotting above rectangular patches only occurred when the ratio of the lengths of the rectangle's sides met a particular criterion.



G. DAVIES, AUSTRALIAN NATL UNIV.

The researchers reproduced this behaviour in a numerical simulation. They also demonstrated shape sensitivity in a chemical system that mimics the properties of the blood-clotting network. Further work is planned to determine the effect's biological relevance.

GENETICS

Change of heart

J. Am. Med. Assoc. **297,** 1551–1561 (2007)

A study looking at 85 genetic variations previously linked to heart disease — some of which are already used in clinical tests — has been unable to confirm that any of these links are real. The findings highlight the need to test risk factors in large populations, says the team that did the work.

Thomas Morgan of the Washington University School of Medicine in St Louis, Missouri, and his colleagues tested 1,461 Caucasian patients for genetic risk factors reported in the literature. They found no significant association in their patients between any of the specific gene variants and development of acute coronary syndrome. This does not rule out the variants as risk factors for some groups, but it emphasizes the need for caution in applying the findings of genetic studies.

GEOPHYSICS

Stirring things up

Geochem. Geophys. Geosyst. **8,** Q03017 (2007)

A three-dimensional model of melting and mixing in Earth's mantle confirms that all but about 3% of this rocky layer has been melted at some point in the past.

Mantle melts as it wells up at mid-ocean ridges to form new crust, which eventually sinks back into the mantle at deep ocean trenches and gets mixed back into the whole through a process known as convection. Understanding this cycle is important for understanding how Earth's interior and atmosphere evolved.

The computer model (pictured above) created by Jinshui Huang and Geoffrey Davies at the Australian National University in Canberra also shows how chemical patchiness in the mantle survives for about 2 billion years in spite of mixing.

STEM CELLS

Gender matters

J. Cell Biol. **177,** 73–86 (2007)

The differences between men and women may extend all the way down to their stem cells, report Johnny Huard of the University of Pittsburgh, Pennsylvania, and his colleagues.

The researchers found that female muscle-derived stem cells are better at regenerating muscle in a mouse model than their male equivalents. They saw that male stem cells differentiate into muscle more quickly when put under stress than female cells, which may limit the total number of muscle fibres that form because it leaves the stem cells little time to multiply. But the underlying mechanism remains unclear.

The team urges other researchers to report the sex of stem cells used in experiments, in case it turns out to influence the behaviour of other types of stem cell too.

ASTRONOMY

Water seen by starlight

Astrophys. J. (in the press) preprint at http://lanl.arxiv.org/abs/0704.1114 (2007)

An astronomer in the United States claims to have detected water in the atmosphere of a planet far, far away.

Travis Barman at Lowell Observatory in Flagstaff, Arizona, compared theoretical models of the atmosphere of the extrasolar planet HD209458b — a hot gas giant some 150 light years from Earth — with observations from the Hubble Space Telescope. The models best fit the data if water is present, he says, providing the first hints of water on a planet beyond our Solar System.

Earlier this year, researchers using a different technique to study the same planet reported no evidence of water (L. J. Richardson *et al. Nature* **445,** 892–895; 2007). But both teams say the results are not necessarily contradictory; Barman's models focused on the effect of the planet's atmosphere on starlight as the planet passed in front of its parent star, whereas the previous work looked at radiation emitted by the planet during its daytime, when water could be harder to detect.

JOURNAL CLUB

Pablo Debenedetti
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A chemical engineer is struck by the strange properties of 'patchy' colloids.

A recent paper about the behaviour of colloids makes an intriguing prediction — suggesting that they can adopt an 'empty' liquid state.

I study disordered states of matter, such as liquids and glasses. I find colloids interesting because they make phenomena such as crystal nucleation and the glass transition amenable to direct observation. Nanometre- or micrometre-sized particles suspended in liquids are wonderful model atoms. They arrange themselves in the same way that atoms and simple molecules do into solids, liquids or gases.

But controlling the interactions between colloidal particles provides a window into structural and thermodynamic behaviour beyond that found in atomic systems, as this recent theoretical paper shows (E. Bianchi *et al. Phys. Rev. Lett.* **97,** 168301; 2006).

It maps the phase diagrams of 'patchy' colloids. The particles in such colloids are decorated with sticky spots, which tend to bond them together. As the number of bonded neighbours per particle is reduced towards two, the phase diagrams predict liquid states with a vanishing packing fraction. This means the colloidal particles occupy a tiny fraction of the available space — but they still behave as a liquid that is distinct from the gas-like phase of still lower packing fraction.

The low-temperature behaviour of such 'empty' liquids is especially interesting. The calculations suggest that cooling the colloid can freeze in place the empty configuration to give a glassy state of arbitrarily low density.

These predictions have not been tested experimentally. But chemists have already developed techniques for making patchy particles, so the work of Bianchi *et al.* could guide experimentalists in their exploration of this fascinating form of matter.