

# RESEARCH HIGHLIGHTS

## Seismic storms

*Geophys. Res. Lett.* **34**, L14304 (2007)

Thunder really does make Earth move. The acoustic shockwaves unleashed by a thunderstorm can excite seismic tremors in the ground, say Ting-Li Lin and Charles Langston of the University of Memphis in Tennessee.

It is not the audible crash that does most of the shaking, however, but the associated rumble on the threshold of hearing, in the low-frequency infrasound range. Lin and Langston used a seismic sensor array housed in 0.2-metre-deep boreholes to pick up the tremors created by two thunderclaps in the spring of 2006. They say that thunder could provide a convenient natural source for mapping out the seismic vibration profile of an earthquake monitoring site.



## MEDICAL MODELS

### Humanized livers

*Nature Biotechnol.* doi:10.1038/nbt1326 (2007)

Scientists have constructed an improved mouse model for studying human liver cells.

The liver breaks down foreign substances such as drugs. Studying its cells gives insight into drug toxicity as well as liver diseases such as hepatitis. But it's difficult to culture human liver cells, so scientists have created mouse models whose own liver cells die to 'make space' for transplanted human cells.

Previously available models suffered from practical difficulties, so Markus Grompe of the Oregon Health and Science University in Portland and his colleagues set about making a better one. They bred mice deficient in a key liver enzyme, and then treated them with a protein that further damages their livers. In these mice, transplanted human cells taken from live patients or cadavers multiplied extensively. Cells harvested from these 'humanized livers' could then be cultured or serially transplanted into other mice for further expansion.

## NITROGEN CYCLE

### Attack of the nitrogen fixers

*Global Change Biol.* doi:10.1111/j.1365-2486.2007.01410.x (2007)

Scruffy green invaders have colonized the islands of Hawaii and are boosting their production of greenhouse gases, new research confirms.

The invader is a tree named *Morella faya* (pictured right). This plant's ability to convert

atmospheric nitrogen into biologically useful compounds has given it a competitive edge over many native species. Previous work has suggested that *M. faya* has been increasing local soil nitrogen cycling and the concentration of nitrogen in the forest canopy.

Sharon Hall of Arizona State University in Tempe and Gregory Asner of the Carnegie Institution in Stanford, California, expanded on this work by coupling measurements of soil nitrogen with remote sensing of upper-canopy nitrogen oxide concentrations in Hawai'i Volcanoes National Park. These concentrations imply that the tree has pushed up regional nitrous and nitric oxide emissions 16-fold since its first occurrence in the park 40 years ago.



## CHEMISTRY

### Getting the right version

*Science* **317**, 496–499 (2007)

Mirror-image versions of some molecules — called chiral — are not structurally identical, and ensuring that only one version is produced in a chemical reaction is often a problem. One way is to use a metal catalyst attached to a ligand molecule that is also chiral.

Ligands are normally attached to metal catalysts by strong covalent bonds, but Dean Toste and his colleagues at the University of California at Berkeley have successfully used negatively charged ligands that are only weakly ionically attracted to the positively charged metal. This means that a small group of charged ligands could make a vast number of existing metal-catalysed reactions chiral selective.

Toste reports three different gold-catalysed transformations that gave more than 90% yield of one chiral product.

## BIOMEDICINE

### Be still my beating heart

*Cell* **130**, 247–258 (2007)

Heart-pounding action may pack a thrill, but researchers have shown that getting rid of a protein involved in adrenaline's control of heart rate allows mice to live longer and have healthier hearts. This protein, known as type 5 adenylyl cyclase (AC5), could become a new target for anti-ageing therapies.

Together with their colleagues, Stephen Vatner and Junichi Sadoshima at the New

Jersey Medical School in Newark found that mutant mice lacking AC5 lived, on average, 30% longer, weighed less, and exhibited less age-induced heart stress and bone loss. Mutant mice also produced more of the antioxidant enzyme superoxide dismutase.

#### BOTANY

### At the root of it all

*Science* **312**, 507-510 (2007)

In plants, ethylene responds to environmental signals such as being touched. Now, ethylene has also been discovered to relay these signals to the very heart of the root's stem-cell production factory.

Inside the root tip (pictured right), a group of four cells known as the quiescent centre (QC) gives rise to all the cells in the tissue systems of the root. Liam Dolan at the John Innes Centre in Norwich, UK, and his colleagues, compared wild-type *Arabidopsis thaliana* (thale cress) with mutants that had defective synthesis of ethylene. They found that ethylene promotes cell division in the QC to create further stem cells. But it does not induce them to differentiate. The latter task is more closely associated with the hormone auxin, and the two chemicals work in concert to orchestrate root growth.

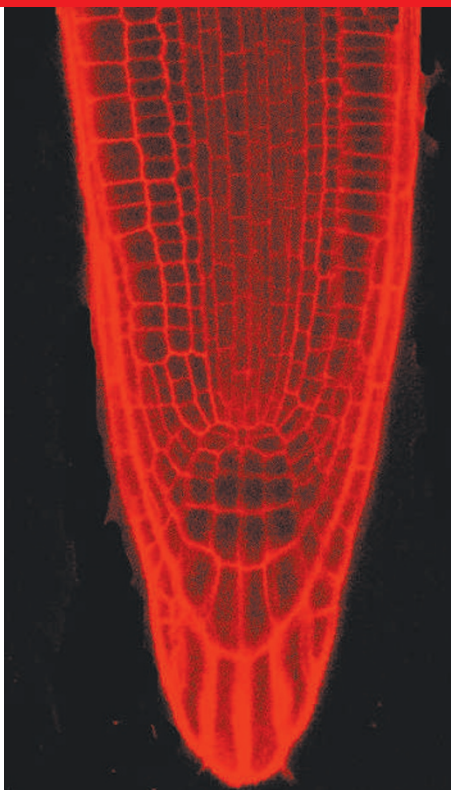
#### ASTROCHEMISTRY

### Anions in space

*Astrophys. J.* **664**, L43-L46 (2007);

*Astrophys. J.* **664**, L47-L50 (2007)

Astronomers using a 100-metre radio telescope have found the largest negatively charged molecule yet in space. According to the researchers, the discovery of octatetraynyl anion ( $C_8H^-$ ) and three other anions in the past year offers intriguing



evidence for a suite of chemical reactions and products not yet observed — including molecules similar to amino acids and other precursors of life.

A team at the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts, spotted the compound in the dark molecular cloud TMC-1 in the constellation Taurus. And researchers at the National Radio Astronomy Observatory in Charlottesville, Virginia, have found it in the halo of IRC+10 216, a dying star in Leo.

#### SEX DETERMINATION

### Old sperm sires sons

*Biol. Lett.* doi:10.1098/rsbl.2007.0196 (2007).

Older sperm are more likely than fresh sperm to produce males, at least in lizards.

The discovery comes from a species in which females store sperm after copulation for later use, and it may explain why this species' sex ratio skews towards males as the reproductive season progresses. Sperm stored in the females' reproductive tract often outcompetes sperm from more recent inseminations.

A team of zoologists, led by Mo Healey of the University of Wollongong, Australia, set up breeding pairs of a small lizard called the Australian painted dragon (*Ctenophorus pictus*) in the laboratory. Stored sperm produced 55% sons, whereas fresh sperm sired only 32%.

#### NANOTECHNOLOGY

### The look and feel of nano

*Nature Nanotechnol.* **2**, 407 (2007)

Ozgur Sahin of Harvard University and his colleagues have developed a specialized atomic-force microscope (AFM) that 'feels' a surface's softness. Existing AFMs create images by passing a vibrating cantilever with a sharp tip across a material. Sahin's team used a T-shaped cantilever that twisted as it vibrated up and down. The twisting changed in response to the material's softness, providing more detailed information than conventional tools allow.

Sahin says the technique shows promise for a variety of nanotechnology and biotechnology procedures, such as probing the mechanical properties of proteins and DNA.

#### Correction

In the Research Highlight 'Assorted fungi' (*Nature* **447**, 1034; 2007) there was an error in the reference. The correct details are: *Mycol. Res.* **111**, 509-547 (2007).

### JOURNAL CLUB

**Paul Kenrick**  
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**A palaeobotanist finds answers to the origin of roots in the genes of a living moss.**

Roots have been called the hidden half of plant diversity. Confined mainly to the subterranean, their unseen influence extends well beyond the plant that they sustain to form an integral component of soil ecosystems and a significant link in the carbon cycle.

In my research, I use fossils

to piece together how the fundamental organs and basic lifecycles of plants evolved, and roots are one of the key systems. The fossil record shows that roots were an early innovation in the colonization of the land, and that they evolved remarkably rapidly, developing a diversity of forms comparable to those of the aerial shoots, stems and leaves. Comparative morphology is good for documenting how roots evolved, but are there any underlying molecular developmental similarities among the rooting structures of early plants?

An elegant piece of recent research shows that a similar transcription factor encoded by the gene *ROOT HAIR DEFECTIVE 6* regulates root-hair development in the flowering plant *Arabidopsis thaliana* and rhizoid development in the moss *Physcomitrella patens* (B. Menand *et al.* *Science* **316**, 1477-1480; 2007). Because flowering plants and mosses diverged more than 400 million years ago, this surprising result implies that the cells with a key role in nutrient acquisition and anchorage in most land plants share a molecular developmental pathway that is very ancient indeed.

More surprising still is the notion that these genes are expressed in both haploid and diploid plants — that is, those whose cells have one or two sets of chromosomes, respectively. Many plants cycle between haploid and diploid forms during their lifecycles. Menand *et al.* propose that genes expressed in early haploid plants were turned on in many tissues during the evolution of plants with diploid phases. Pending further testing, this interesting model is plausible for components of the vascular system, cortex, epidermis, shoot and root.