# RESEARCH HIGHLIGHTS

OLFACTION

## Map-reading makes sense

*Cell* **125,** 143-160 (2006)

Understanding how animals perceive smells is hard, particularly because aromas often comprise complex mixes of molecules that vary in concentration and duration. But scientists may make headway with a new map.

Elissa Hallem and John Carlson of Yale University systematically analysed the response of the odorant receptors in the fruit fly *Drosophila*'s antennae to different compounds. This produced the first multidimensional map of an entire olfactory system.

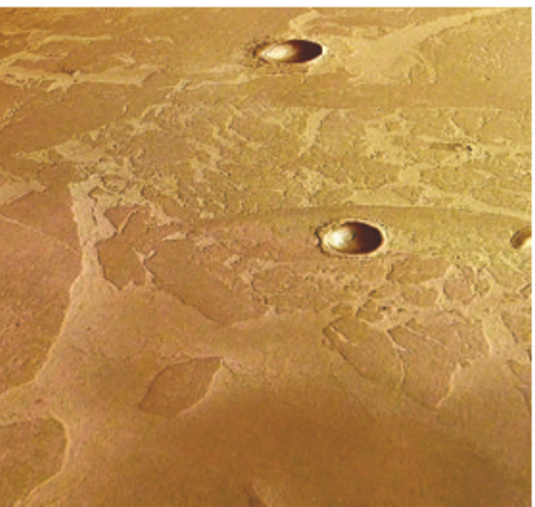
The scientists found the receptors produced both excitatory and inhibitory responses to a diverse range of smells. They also found that receptors with similar odour sensitivity often project to different brain areas.

PLANETARY SCIENCE

## Martian mudpack

*Icarus* **181,** 363-374 (2006)

Last year, high-resolution images of Mars revealed features strikingly similar to pack-ice (pictured). Scientists argued that the pictures showed a frozen lake, and speculated that ice might persist beneath the dust (*Nature* 434, 352–356; 2005). A new model of how ice sublimes in the arid Martian atmosphere suggests that it would take only tens of thousands of years for the ice content of a thick layer of frozen mud at the site to fall to a few percent. This lingering ice might have cemented in place the pack-ice features, estimated to be about 5 million years old. Konrad Kossacki of the University of Warsaw, Poland, worked with John Murray of the Open University, UK, lead author on the first paper, and others to do the analysis.



ESA/DLR/FU BERLIN

## Fuel for the future?

*Science* **312,** 257 (2006)

Researchers in the United States have found a new way to convert small hydrocarbons, which can be obtained from coal or biomass, into the larger molecules needed for transportation fuel.

The process, called alkane metathesis, employs two catalysts to cleave the molecules' ends, and then bond the larger fragments together. For example, hydrocarbons with six carbon atoms yield a mixture enriched in molecules with ten carbons — useful in fuels such as diesel, report Alan Goldman at Rutgers University, New Jersey, Maurice Brookhart at the University of North Carolina at Chapel Hill, and their colleagues

While the oil holds out, the reaction could also be run in reverse to replace the 'cracking' procedure used in oil refineries (pictured) to break down large hydrocarbons.

AGSTOCKUSA/ALAMY

MICROBIOLOGY

## Bug outed

*PLoS Pathogens* **2,** e28 (2006)

A new disease-causing bug has been found in the lymph nodes of a human patient with a rare immune disorder.

Researchers often struggle to identify bacteria, because most will not grow in the lab. But Steven Holland at the National Institute of Allergy and Infectious Disease in Bethesda, Maryland, and his colleagues managed to culture a bug from a patient with chronic granulomatous disease, where it was underlying a persistent infection.

The bacterium is in the Acetobacteraceae family, which was thought to be harmless. Other family members live in plants and soil. The team is investigating whether it might cause more common infections — and have christened it *Granulobacter bethesdensis* after the disease and where it was found.

GENETICS

## From 7 to 11

*Science* 312, 269–272 (2006)

Geneticists are just beginning to realize that regulatory regions on one chromosome can control the activity of genes on another. Jian Qun Ling of Stanford University and his colleagues report a compelling example.

By tracking down interacting DNA segments, the team found that a control region between the *insulin-like growth factor 2* and *H19* genes on mouse chromosome 7 meets up with a region between the *Wsb1* and *Nf1* genes on chromosome 11. The interaction, which requires a protein called CTCF and controls the activity of the genes on chromosome 11, may help the genes take advantage of transcription-control proteins by bringing them into the same neighbourhood.

MATERIALS

## Poke it and see

*Nature Mater.* doi: 10.1038/nmat1632 (2006)

There's no better way to understand the mechanics of a material than to poke it with a sharp tip. So say materials scientists who have used nanoindentation experiments to discover unexpected atomic-scale behaviour.

Graham Cross of Trinity College, Dublin and his colleagues used a technique called field ion microscopy to make a sharp tungsten tip, then observe how pressing the tip into gold deformed a region containing a few thousand atoms. This is roughly the number of atoms that can be modelled in simulations, allowing the first direct comparison between theory and experiment.

One surprise was seeing the crater heal itself when the tip was withdrawn, a behaviour that simulations do not predict.

CANCER BIOLOGY

## Invasion fleet

*Cancer Cell* **9,** 261–272 (2006)

Groups of tumour cells can invade healthy tissue without cutting ties with their neighbours, say biologists.

Until now, most cancers were thought to become invasive when individual tumour cells reduced their production of a protein called E-cadherin that connects them to other cells and tissue. Like ships casting off their moorings, these single cells take on a form that allows them to migrate and invade other tissues in the body.

Now Gerhard Christofori of the University of Basel and his colleagues have found a new mechanism, where tumour cells producing E-cadherin can also invade. They do so as a group, if cells in the outer edge of the tumour mass also express a protein called podoplanin.

MICROFLUIDICS

## Warp speed

*Phys. Rev. Lett.* **96,** 134502 (2006)

The velocity of fluid in micron-sized channels can be measured by repeatedly trapping and releasing tiny spheres suspended in the flow, physicists in Italy and Britain have shown.

Roberto Di Leonardo of the University of Rome 'La Sapienza' and colleagues at the University of Glasgow used focused laser beams, or optical tweezers, to trap silica spheres suspended in microfluidic channels. By holding and releasing the spheres, and tracking the intervening motion using digital image processors, the team mapped the velocity field around a larger spinning sphere and a channel outlet. The researchers say the technique could be extended to map velocity fields in three dimensions.

DEVELOPMENT

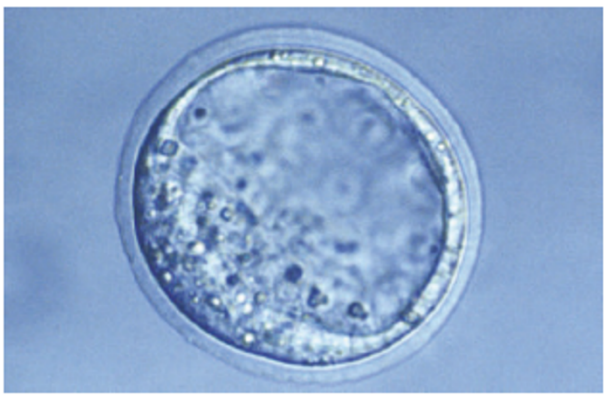
## Assume the position

*Dev. Biol.* **292,** 317–332 (2006)

Researchers in Europe have watched chromosomes dance around the cell nucleus as mouse embryos go through the earliest stages of growth and development.

Daniele Zink of the Ludwig-Maxmilians University of Munich, Pascale Debey of the National Museum of Natural History in Paris, and their colleagues found that chromosomes adopt a characteristic pattern in the nucleus of one-cell embryos (pictured) after fertilization. The chromosomes underwent two phases of rearrangement as the embryos grew, which may mirror changes in gene activity.

The researchers also showed that transferring the nucleus from an embryonic stem cell into a fresh egg made the chromosomes reorganize into the configuration of a one-cell embryo. This suggests the three-dimensional organization is a necessary part of 'reprogramming' the genome during cloning.



CLOUDS HILL IMAGING/CORBIS

DRUG DELIVERY

## Acid put-down

*Proc. Natl Acad. Sci. USA* **103,** 6460–6465 (2006)

A peptide that spontaneously inserts across plasma membranes can act as a 'nanosyringe' to deliver drugs into cells, researchers led by Donald Engelman at Yale University have shown.

The researchers attached a cargo molecule to the carboxy terminus of the peptide — the end that pokes through to the far side of the membrane. When the peptide inserted itself across the membranes of living cells, the reducing environment inside the cell broke down the linking bond (a disulfide), releasing the cargo into the cell's cytoplasm.

The peptide was derived from the membrane protein bacteriorhodopsin. It was christened pHLIP, for pH (Low) Insertion Peptide, because it inserts only in acidic conditions. Such a property could be useful in treating conditions associated with low pH, such as tumours and stroke damage.

## JOURNAL CLUB

**Reta Beebe**
**New Mexico State University, Las Cruces**

**Having worked on two generations of spacecraft sent to Saturn, a planetary scientist puzzles over its moon, Enceladus.**

When I began working on the Voyager 2 craft, all we knew about the Saturnian moon Enceladus was what could be observed through telescopes. It appeared small and as bright as fresh snow.

Then, in 1981, Voyager 2 passed near the moon and returned pictures of its surface. As a member of the imaging team, I was surprised by what I saw.

In addition to the craters that we expected, some areas seemed to have been resurfaced by flooding. It wasn't clear how this could happen. Conditions at such a distance from the Sun had to be frigid, and the moon was too small for tidal heating — heat generated by tidal forces stretching and squeezing a body — to produce liquid water.

I liked the theory that an ammonia–water mixture might act as antifreeze and well up to create a slushy flood. I recall explaining it to a third-grade class. The New Mexico students were already fascinated by the moon whose name looked very much like enchiladas, and the idea of oozing antifreeze drew shivers of glee.

Nearly 25 years later, I am still working for NASA, and have been deeply involved in planning the Cassini–Huygens mission to Saturn. Now its results, published in a March special issue of *Science* (311, 1388–1428; 2006), present me and the children of my 1980s students with new problems to consider.

Cassini–Huygens, having made three flybys of Enceladus, detected ice particles but no ammonia gas, wiping out the antifreeze idea. It has also seen puzzling hot spots that are spewing gas. But how do you make geysers on a cold moon? I hope the Cassini mission will be extended beyond the next scheduled flyby, in 2008, to give us the best chance of finding out.