

bridges reach more of the beads' surfaces, which helps the particles stay together. These opposing effects cancel out, so the sand's stiffness remains more or less constant whether a cupful or a bucket load of water goes into the castle.

ONCOLOGY

Melanoma mystery

Cell doi:10.1016/j.cell.2007.12.032 (2008)

Researchers have identified a protein that seems to underlie the paradoxical activity of a cancer-causing gene called *BRAF*. This gene can lead to melanoma but also causes pigment-producing skin cells to stop dividing and die.

The research group, led by Michael Green of the University of Massachusetts in Worcester, screened the entire human genome for other genes that could explain the mystery. They turned up 17, each of which could trigger *BRAF*'s killer activities. To their surprise, they found that a secreted protein, IGFBP7, is produced in cells with permanently activated *BRAF* genes, and acts to mute other signals induced by *BRAF* telling the cells to divide rapidly. Injecting IGFBP7 into mice with human melanomas slowed the growth of the tumours. The authors propose that loss of IGFBP7 allows *BRAF* to revert to its cancer-causing ways.

SPECTROSCOPY

Surface glance

J. Am. Chem. Soc. doi:10.1021/ja710099c (2008)

By combining a spectrographic technique with a pulsed laser, researchers have developed a way to probe molecular interfaces such as biological membranes in real time.

To access very thin layers that are constantly moving, Jens Bredenbeck and his co-workers at the FOM Institute for Atomic and Molecular Physics in Amsterdam, the Netherlands, added a non-resonant laser pulse to two-dimensional infrared spectroscopy, which can be used to measure the properties of molecules in solution. The modification deletes the response from the bulk of a sample, leaving only information from molecules of interest — in their experiment, a thin layer of fatty alcohols in water.

Nuclear magnetic resonance spectroscopy has also been used to look at biological membranes, but it requires samples to be solid. The technique allows the molecular structure and behaviour of membranes in solution to be studied with femtosecond resolution.

IMMUNOLOGY

Primitive immunity

Nature Immunol. doi:10.1038/nri1562 (2008)

The kidneys and gills of lampreys — which, along with hagfish, are the only living jawless vertebrates — contain lots of cells that produce antibodies, researchers have found.

Max Cooper and his colleagues of the University of Alabama at Birmingham studied cells that carry antigen-binding molecules on their surfaces. The levels of these cells surged when anthrax spores were injected into the lampreys, but not when the creatures were injected with bovine serum albumin, to which more 'evolved' immune systems react.

After proliferating, the cells, which are thought to represent ancient B lymphocytes, differentiate and secrete a soluble, antibody-like protein, showing that lampreys are among the most primitive forms of life to express an adaptive immune response.

POPULATION ECOLOGY

Tabling more birds

Biol. Lett. doi:10.1098/rsbl.2007.0622 (2008)

Households that regularly sprinkle a few breadcrumbs and nuts on a bird table during winter are probably having a massive impact on bird breeding success in spring.

Gillian Robb and Stuart Bearhop at Queen's University Belfast in Northern Ireland and their team paired ten patches of deciduous woodland according to ecological and landscape features. They then simulated garden feeding (pictured below) in one of each pair by hanging wire mesh peanut feeders from trees from the start of November until early March. On average, birds at the supplemented sites laid their eggs earlier and raised nearly one extra surviving chick per nest than those in the unsupplemented sites, even though clutch sizes were the same.



PHOTOLIBRARY

JOURNAL CLUB

John Shepherd
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An oceanographer sees potential in accelerating rock weathering to soak up carbon dioxide from the air.

With CO₂ emissions increasing by more than 2% per year, rather than decreasing by the 3% or so needed to effectively mitigate climate change, I am not surprised that many scientists are seeking alternative solutions to simply

cutting greenhouse-gas outputs.

Various geoengineering schemes have been proposed — such as fertilizing the oceans with iron, a limiting resource for planktonic algae that take CO₂ from the atmosphere — but these are unlikely to sequester large amounts of carbon in the long-term and may have serious ecological side effects. The thermodynamics of enhancing geochemical weathering look feasible, but the reactions are too slow to be really practicable.

Geochemists and engineers at Harvard University in Massachusetts and Pennsylvania

State University recently suggested a kinetically preferable idea. They propose using the electrolysis of sea water to produce sodium hydroxide and hydrochloric acid, in a variant of the well-known industrial 'chloralkali' process, (K. Z. House *et al. Environ. Sci. Technol.* **41**, 8464–8470; 2007).

Sodium hydroxide could either be used to scrub CO₂ directly from the air, producing sodium bicarbonate, which is neutral and could be discharged into the sea, or be pumped directly into the ocean, increasing sea water's alkalinity and so its ability to

absorb CO₂. The hydrochloric acid could be neutralized fairly easily, because it reacts rapidly with both carbonate and silicate rocks.

The scheme House *et al.* outline looks promising if it were operated using a solar or geothermal electricity source near a supply of basic rocks. A mid-ocean volcanic island would be good. And the environmental consequences of the scheme's discharges should be less severe than those of the ocean acidification that humans are already causing.

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