

RESEARCH HIGHLIGHTS

MATERIALS SCIENCE

Carbon on display

Nano Lett. doi:10.1021/nl080649i (2008)

Lumps of graphite are sooty; its constituent layers of graphene, however, are transparent, a property that researchers have used in a liquid-crystal device. Kostya Novoselov at the University of Manchester, UK, and his co-workers have shown that an electrode made from a thin graphene film can switch a device from opaque to transparent.

Most optical display devices have indium tin oxide as the transparent conductor, but this compound is apt to degrade because its ions are mobile. Graphene films, by contrast, are chemically stable and strong. The researchers find that the films can be cheaply spray-deposited onto glass from a suspension in an organic solvent.

ORGANIC CHEMISTRY

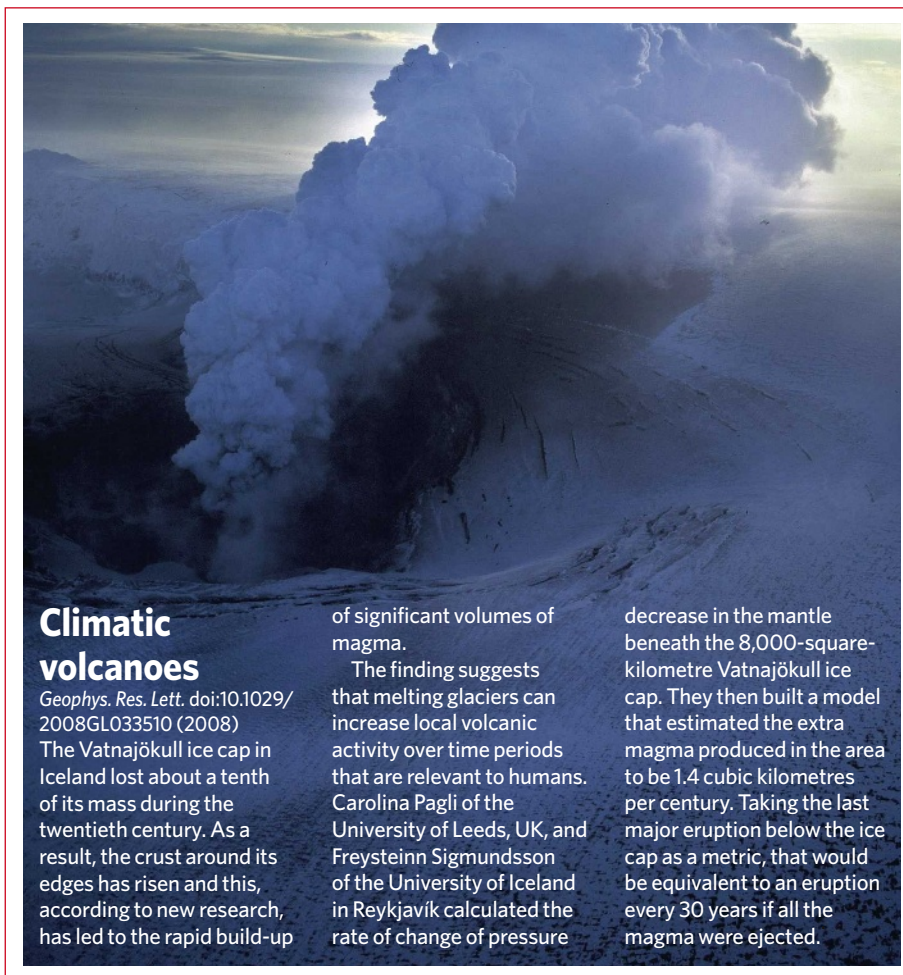
Flushing out HIV

Science **320**, 649–652 (2008)

The possibility of adding prostratin to antiretroviral therapies has been held back because it is scarce in nature, an impediment that the chemical's laboratory synthesis has just removed. Prostratin activates latent HIV viruses even in patients with undetectable viral loads, flushing out viruses that would otherwise be hidden. Including it in drug regimes might make patients who stop treatment after a few years less likely to experience 'viral rebound'.

Paul Wender and his colleagues at Stanford University in California found that they could make prostratin by first cleaving and then re-establishing the ring of three carbon atoms in phorbol, which is readily available. The process of putting the ring back together involves four steps that can be tweaked to produce various similar chemicals.

M. LANE/NHPA WRITEIMAGESPECS



P. STEFANSSON/REUTERS

Climatic volcanoes

Geophys. Res. Lett. doi:10.1029/2008GL033510 (2008)

The Vatnajökull ice cap in Iceland lost about a tenth of its mass during the twentieth century. As a result, the crust around its edges has risen and this, according to new research, has led to the rapid build-up

of significant volumes of magma.

The finding suggests that melting glaciers can increase local volcanic activity over time periods that are relevant to humans. Carolina Pagli of the University of Leeds, UK, and Freysteinn Sigmundsson of the University of Iceland in Reykjavik calculated the rate of change of pressure

decrease in the mantle beneath the 8,000-square-kilometre Vatnajökull ice cap. They then built a model that estimated the extra magma produced in the area to be 1.4 cubic kilometres per century. Taking the last major eruption below the ice cap as a metric, that would be equivalent to an eruption every 30 years if all the magma were ejected.

DEVELOPMENTAL BIOLOGY

Antler insight

PLoS One **3**, e2064 (2008)

Hans Rolf of the University of Göttingen in Germany and his colleagues report that they have found evidence of stem cells in the antler 'growth zones' of fallow deer (*Dama dama*; pictured left). They hunted for stem-cell 'markers' such as STRO-1 in several tissues located inside regenerating antlers and in regions called pedicles at the antlers' bases, pinpointing their quarry in several tissues.

The annual regrowth of antlers has long been considered the only case of complete appendage regeneration in mammals, and so this finding may prove useful in regenerative medicine.

NEUROSCIENCE

Bird brains

Science **320**, 630–634 (2008)

The babbling calls of baby songbirds involve separate brain circuitry from that used to generate more complex adult song, report

neuroscientists at the Massachusetts Institute of Technology in Cambridge.

Michale Fee and his team gave adult zebra finches a drug that stopped the "high vocal centre" — a brain region that enables birds to sing melodious 'syllable' sequences — from working. The birds reverted to the stereotypical babblings of one-month-old chicks within 20 minutes, but regained their tuneful adult song when the drug wore off. Another brain region called the lateral magnocellular nucleus of the nidopallium proved necessary for juvenile babbles but not for adult song.

MICROBIOLOGY

A genetic monster

Proc. Natl Acad. Sci. USA **105**, 6730–6734 (2008)

A gargantuan bacterium carries tens of thousands of copies of its genome, researchers have found.

One species of the cigar-shaped bacterium *Epulopiscium* lives in the intestines of the unicornfish *Naso tonganus*, and can grow to more than half a millimetre in length. Esther

Angert of Cornell University in Ithaca, New York, and her colleagues have found that *Epulopiscium* cells also contain up to 250 picograms of DNA, compared with a human cell's 6 picograms, and have 50,000–120,000 copies of genes believed to occur only once in each genome.

Other bacteria contain multiple copies of their genomes, but so far none has been found to have nearly as many as *Epulopiscium*.

NANOTECHNOLOGY

Tiny carbon workers

Nature Nanotech. doi:10.1038/nnano.2008.98 (2008)

Micromechanical devices are most commonly made from silicon; now it is time to welcome carbon-based wafers to the party. Kenji Hata at the Nanotube Research Center in Tsukuba, Japan, and his co-workers say wafers such as those that they have built could provide an inexpensive approach to making these microstructures.

The researchers constructed the wafers by growing an array of widely spaced, vertically aligned carbon nanotubes. These were then 'squeezed' together by introducing an alcohol solution; the surface tension of the liquids and strong interactions between the nanotubes pulled the tubes into a densely packed arrangement.

These wafers can be processed using the same lithographic techniques that are used to work on silicon. The team has made mini-cantilevers and a range of other structures.

CHEMICAL BIOLOGY

Maths and malaria

Nature Chem. Biol. doi:10.1038/nchembio.87 (2008)

A 'guilt by association' test can correctly pinpoint the function of proteins, reports a team led by Elizabeth Winzeler of the Scripps Research Institute in La Jolla, California. An algorithm the researchers wrote found that the malaria-causing parasite *Plasmodium falciparum* expresses a gene encoding CDPK1 — a protein with an unknown role — at the same time as some other genes involved in cell invasion and movement. These all become active as the parasite prepares for its sexual stage.

The authors then screened a chemical library for compounds that block CDPK1. One of these inhibited the protein and also prevented *P. falciparum* from entering its sexual stage, indicating that the bioinformatics algorithm had provided accurate clues to CDPK1's role.

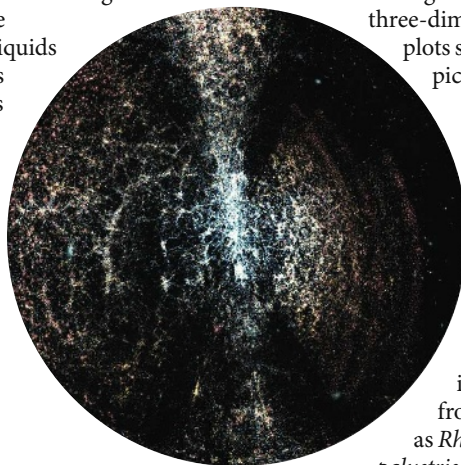
ASTRONOMY

Galactic mapping

Astrophys. J. 678, 144–153 (2008)

Astronomers measure distance to galaxies in terms of 'redshift' — the far-off reddening of a galaxy's light as it zooms away from us. Current spectroscopic techniques measure at most a few hundred redshifts at once, but a new computer code can analyse larger batches of galaxies from digital images. It was developed by James Wray of Cornell University in Ithaca, New York, and Jim Gunn of Princeton University in New Jersey.

The algorithm works with general properties such as the colour and distribution of light across each galaxy. It gives good estimates of redshift when tested on 221,617 galaxies from the Sloan Digital Sky Survey, and could soon be used in the Sloan and other digital surveys to create three-dimensional galactic plots such as the one pictured left.



MICROBIOLOGY

Fuel cell

Environ. Sci. Technol. doi:10.1021/es800312v (2008)

Hydrogen is a useful and clean energy source, and it can be obtained from bacteria such as *Rhodospseudomonas palustris*. Bruce Logan of

Pennsylvania State University, University Park, and his collaborators have found that this bacterium has another potentially useful skill: it can produce an electric current.

The researchers extracted *R. palustris* from a microbial fuel cell — a device in which bacteria deliver electrons derived from the oxidation of foodstuffs to an electrode, thus producing current. After culturing, this strain did the job more efficiently on its own than it had in the mixed bacterial population from which it came. The work might lead to the development of systems that capture electricity or hydrogen from the same cultures.

JOURNAL CLUB

François Balloux
Imperial College London

A population geneticist looks back in time in search of human origins.

When and where anatomically modern humans evolved is arguably one of the most fundamental scientific questions. The issue also has philosophical and possibly even moral implications because it influences our definition of humanity. But I became involved in the subject for much more prosaic reasons. I was trying to make sense of the distributions among human populations of different versions of genes that imbue resistance to infectious diseases. It struck me that attempting to do this without a clear understanding of humans' past demography was bound to end in a muddle.

Despite decades of research, the origin of modern humans is still hotly debated. In a recent paper, Laurent Excoffier and his colleagues provide the first formal statistical evaluation of the likelihood for the various schemes that have been proposed (N. J. R. Fagundes *et al. Proc. Natl Acad. Sci. USA* 104, 17614–17619; 2007). They conclude that a recent expansion from a single African origin is better supported by the current geographical spread of human genes than a multi-regional scenario. The multi-regional hypothesis proposes that modern humans hybridized with archaic humans, such as *Homo erectus*, as they spread.

This result may seem unsurprising because most genetic evidence points to an African origin some 60,000 years ago with no or negligible hybridization with archaic humans. However, there is a twist. By far the best supporting evidence for hybridization between modern and archaic humans has been the observation that, looking back, the amount of time it takes to reach the most recent common ancestor of some genes largely predates the age of our species. The extensive simulations in this paper debunk that argument by demonstrating that such cases can arise if modern humans had a recent and single African origin.

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

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