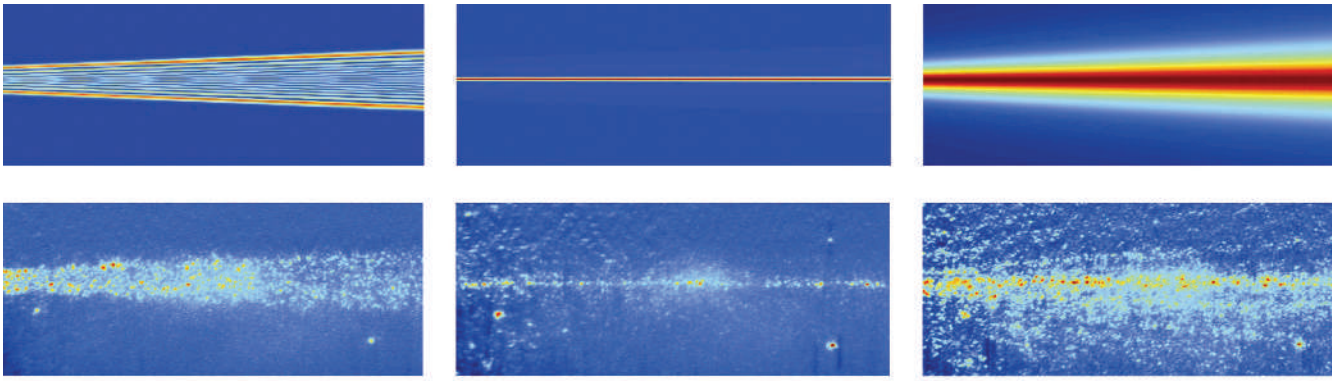
RESEARCH HIGHLIGHTS



NATURE MATER.

Ray of light

Nature Mater. 10.1038/nmat1568 (2006)
The spreading of a beam of light as it propagates has made using optics to shuttle information across silicon chips problematic. But now a team at the Massachusetts Institute of Technology in Cambridge has stopped diffraction over a distance of one centimetre.

Researchers have previously used photonic crystals, which are drilled with holes that influence their optical properties, to control diffraction over very short distances. By optimizing the arrangement of holes in a silicon chip, Peter Rakich, Marcus Dahlem and their colleagues created a straight, or 'supercollimated', beam 100 times longer than achieved in the past.

The experimental results (bottom) matched theoretical predictions (top) for how different wavelengths of light travel through the crystal.

CHEMISTRY

Weird water

J. Phys. Chem. B doi:10.1021/jp056198x (2006)
In work that bravely ventures into the realms of pseudoscience, researchers have shown that magnetic fields can affect the properties of water containing dissolved oxygen.

Ichiro Otsuka and Sumio Ozeki of Shinshu University in Nagano, Japan, performed a series of experiments on distilled water in a vacuum and on water exposed to oxygen, before and after the application of magnetic fields. The magnetic treatment did not change the properties of distilled water but it did change the behaviour of the oxygenated water, including introducing a new feature to its absorption spectrum. The results do not, of course, endorse the weird and wonderful claims made by purveyors of magnetized water, but they do raise questions about how magnetic fields affect water's structure.

NEUROBIOLOGY

Forgetful flies

Cell **124,** 191–205 (2006)
Researchers have homed in on a molecular pathway in the junctions between nerve cells, known as synapses, that regulates the formation of long-term memory.

Sam Kunes of Harvard University in Cambridge, Massachusetts, and his colleagues targeted a protein complex called RISC. This forms part of the RNA interference mechanism, helping short RNAs known as microRNAs to switch off genes.

Working in the fruitfly *Drosophila*, they showed that one of the RISC proteins, Armitage, has to be destroyed at particular synapses for the protein synthesis that underpins memory to occur. Furthermore, Armitage-mutant flies had impaired long-term memory. The RISC pathway is also found in mammals, so the same mechanism may operate in humans.

A. NARENDRA

ANIMAL BEHAVIOUR

One-way street

Curr. Biol. **16,** 75–79 (2006)
Foraging insects such as bees and ants have a remarkably developed sense of where they are going and how to get home again. But new research shows that for ants, at least, this ability does not extend to knitting knowledge of routes into maps: ants rely on memorized routes that only work in one direction.

Rüdiger Wehner and his colleagues at the University of Zürich, Switzerland, studied Australian desert ants (*Melophorus bagoti*, pictured). Using artificial barriers, they forced the ants to learn different routes to and from a food source. Homeward-bound ants that were transferred to a point along their outward route could not follow it in reverse, but instead began searching behaviour.

CELL BIOLOGY

Centrefold proteins

Cell **124,** 75–88 (2006)
Efficient machinery for protein origami may have allowed eukaryotes to evolve more complex proteins than prokaryotes such as bacteria.

Prokaryotes are thought to use a single set of molecular chaperones to help fold up both newly synthesized proteins and ones that have lost their shape due to heat or other stress. Judith Frydman of Stanford University in California and her team now show that eukaryotic cells have distinct networks for each of these tasks.

They found that in eukaryotic cells some chaperones are dedicated to folding newly made proteins. This may have facilitated the evolution of multidomain proteins.

ASTRONOMY

Phantom galaxy

Astrophys. J. **636,** 575–581 (2006)
A galaxy thought to be the most distant ever observed was a mirage, according to results from the orbiting Spitzer Space Telescope.

Abell 1835 was identified in data from the Very Large Telescope in Chile, using a technique that relied on its light being gravitationally magnified by a massive galaxy cluster. It appeared to have formed just 500 million years after the Big Bang, at a redshift of ten.

The Spitzer observations from Graham Smith of the California Institute of Technology, Pasadena, and his colleagues follow other non-detections of Abell 1835, sealing the case against the galaxy. However, Smith's team says this failure does not invalidate the lensing technique.

IMAGE UNAVAILABLE FOR COPYRIGHT REASONS

D. FERGUSON, ISM/SPL

IMMUNOLOGY

Irresistible infection

Nature Immunol. doi:10.1038/ni1300 (2006)

The puzzling observation that people with malaria or systemic blood infections have suppressed immune systems may be explained by new data.

A team led by researchers at the Walter and Eliza Hall Institute of Medical Research in Parkville, Australia, traces the effect to dendritic cells — the sentinels of the immune system (pictured above, surrounded by malaria-infected blood cells).

Dendritic cells capture and present viral antigens to prime other immune cells. But this process, known as cross-presentation, was inhibited in mice infected with the malaria parasite. The work links immunosuppression to over-stimulation of the dendritic cells, via their Toll-like receptors, causing the cells to mature to a stage at which they can no longer cross-present.

SYNTHETIC BIOLOGY

Absolute minimum

Proc. Natl Acad. Sci. USA **103,** 425–430 (2006)

Researchers have revised their estimate of the minimal set of genes needed to sustain bacterial life. The findings will guide scientists hoping to build a cell from scratch.

In 1999, a team led by J. Craig Venter announced that they had mutated every gene in the bacterium *Mycoplasma genitalium* — which has the smallest genome of any free-living organism — and estimated that it needs between 265 and 350 of its 517 genes to grow (*Science* **286,** 2165–2169; 1999).

But their estimate was approximate because they did not isolate and study each mutant strain individually. Now, follow-up research led by Hamilton Smith at the J. Craig Venter Institute in Rockville reveals that the minimum genome consists of 387 protein-coding and 43 RNA-coding genes.

NETWORKS

Exclusive clubs exposed

Nature Phys. doi:10.1038/nphys209 (2006)

"The rich are different from you and me," said F. Scott Fitzgerald. But do the rich — the well connected and highly influential — really form an exclusive club?

In network theory, 'rich' nodes are the most highly connected, and the 'rich-club' phenomenon, where rich nodes are preferentially connected to one another, has been proposed to exist in many systems.

Alessandro Vespignani and his colleagues at Indiana University in Bloomington report a new approach to measuring rich-club ordering. They find that rich clubs genuinely exist among scientists, but for the Internet and protein networks there is actually less communication among rich nodes than expected by chance.

IMMUNOLOGY

Antibodies run amok

Proc. Natl. Acad. Sci. USA **103,** 281–286 (2006)

The cellular damage that underlies multiple sclerosis could be caused by an 'abzyme' — an antibody that acts as an enzyme — say researchers.

Multiple sclerosis is characterized by degradation of the myelin sheath, an insulating layer of protein that helps brain cells to transmit electrical signals. Alexander Gabibov of the Shemyakin and Ovchinnikov Institute of Bioorganic Chemistry in Moscow, Russia, and his colleagues ran *in vitro* tests of antibodies to myelin, isolated from the blood of multiple sclerosis sufferers, and found that the antibodies are able to cleave myelin protein.

The authors suggest that inhibiting the antibodies' activity could form a previously unrecognized approach for treating multiple sclerosis.

JOURNAL CLUB

John P. Moore
Weill Medical College of Cornell University, New York, USA

An HIV researcher finds hope in a study of male circumcision.

Many of us working on HIV have acquired 'long-term non-progressor' status over the past 10–20 years. We have failed to make an effective vaccine, we don't yet have a microbicide, and global access to antiretroviral drugs is still problematic. So it's good to read of anything that could help to reduce the global spread of this virus.

I was therefore intrigued by a report of a trial conducted in South Africa, involving 3,274 men, which showed that circumcising males significantly reduced their susceptibility to HIV-1 infection (B. Auvert *et al. PLoS Med.* **2,** e298; 2005).

The underlying mechanism remains to be determined, although I think it is likely to have a biological basis that is related to the presence in the foreskin of target cells that are particularly susceptible to HIV infection.

Could there be a behavioural explanation? After hearing a presentation of this work, a Jewish friend commented that following his circumcision, he desisted from risky sexual practices for about 20 years. But in the trial, sexual activity actually increased slightly in the circumcised group.

Seriously, though, any practical intervention that could reduce HIV transmission is to be welcomed. And I was encouraged by the editorial and commentary that accompanied the paper. These articles discuss the background to the study and counter any criticisms that it has ethical flaws.

Sometimes Western ethicists feel the need to pontificate on how studies should be carried out in Africa. Their ivory-tower ethics can be very unhelpful given the scale of the AIDS epidemic nowadays.

Local scientists and review boards are capable of deciding for themselves what is right and wrong.