RESEARCH HIGHLIGHTS

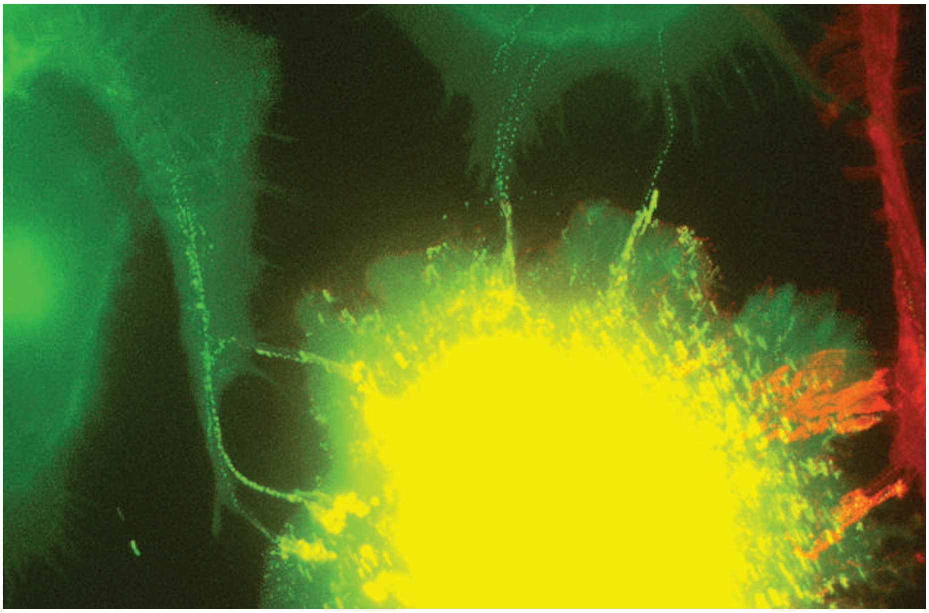
Bridge traffic

Nature Cell Biol. doi:10.1038/ncb1544 (2007)

Videos showing how retroviruses invade cells have revealed that some use an unexpected tactic: they can establish 'bridges' to cross from one cell to an uninfected neighbour.

Walther Mothes of Yale University in New Haven, Connecticut, and his colleagues fluorescently labelled three retroviruses, including HIV, and tracked their movement between cells. Compressing a video of the process into a single picture reveals the tracks of viral particles (which appear green in the image) crossing cytoplasmic bridges. Interactions between a viral envelope protein and proteins on the uninfected cell surface seem to stabilize the bridges.

The experiments were performed in cell culture, but if the findings hold *in vivo* they could suggest new therapies to limit retroviral spread.



W. MOTHES

PHYSICS

Forces of attraction

Phys. Rev. Lett. **98,** 063201 (2007)

For the first time, researchers have measured temperature's influence on the Casimir effect — the attractive force between two objects created by virtual waves that exist in quantum mechanics.

In the 1950s theorists predicted that the Casimir force would show some temperature dependence, but experimentalists have struggled to measure the force between two solid bodies precisely enough to detect the effect. John Obrecht of JILA in Boulder, Colorado, and his colleagues tried a different approach. They measured the force between one solid body — a glass plate — and a small cloud of rubidium atoms held close to the plate. The team saw the force almost treble in strength when the glass plate was heated from room temperature to about 330 °C, in line with expectations.

CELL BIOLOGY

Muscling in

Nature Cell Biol. doi:10/1038/ncb1542 (2007)

Hopes of developing a cell-based therapy for muscular dystrophy have been boosted by work carried out by Giulio Cossu at the Stem Cell Research Institute in Milan, Italy, and his colleagues.

Previously, researchers have turned to muscle-precursor cells known as satellite cells for experimental therapies, but these cells are not able to pass through blood vessel walls, so cannot be conveniently delivered to muscles.

Cossu's team harvested a different type of cell from the blood vessels of human skeletal muscle. The team showed that when these 'pericyte-derived' cells are injected into the arteries of mice with muscular dystrophy, they are incorporated into the muscle and give rise to new, healthy muscle fibres.

MICROFLUIDICS

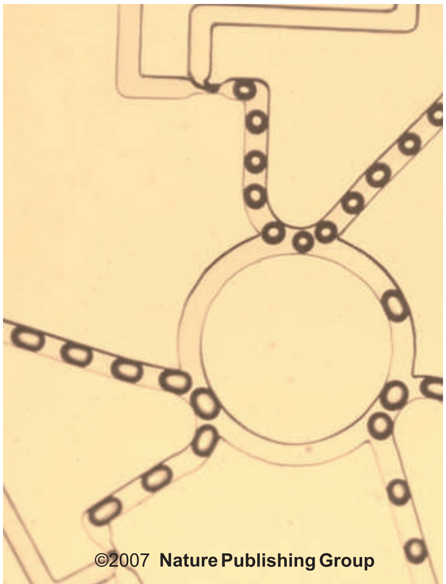
Bubble brain

Science **315,** 832–835 (2007)
Appl. Phys. Lett. **90,** 054107 (2007)
Science doi:10.1126/science.1134514 (2007)

Three independent teams report that they have made simple 'bubble computers'.

Manu Prakash and Neil Gershenfeld at the Massachusetts Institute of Technology in Cambridge, and Levent Yobas and co-workers at the Institute of Microelectronics in Singapore have made logic gates in which binary data are encoded in a fluid flow by the presence or absence of a bubble or an immiscible droplet. The fluid is carried in microscopic channels. At a channel junction, the path a droplet takes depends on the position of droplets in the other channels, making it possible to implement logic operations (the picture, below, shows channels configured as logic gates). Exploiting the same principle, George Whitesides and his colleagues at Harvard University in Cambridge, Massachusetts, designed networks that can encrypt and then decode a signal.

This kind of logic might be used to place microfluidic networks under autonomous control, avoiding the need for externally operated gates and valves.



M. PRAKASH

BACTERIOLOGY

Anchors and ooze

Science **315,** 853–856 (2007)

The 'slime gun' hypothesis put forward to explain how bacteria glide across surfaces has acquired a slime-free rival.

Researchers have previously proposed that bacterial gliders that move without assistance from external structures such as flagella are propelled by the slime they exude. Tâm Mignot and David Zusman of the University of California, Berkeley, and their colleagues suggest that the bacterium might also push against anchor points to move forwards.

The researchers monitored the location of a protein known as AglZ, which is required for gliding, in *Myxococcus xanthus* cells. The protein formed clusters that remained stationary relative to the surface across which the cells moved. When the cell's lagging end ran into a cluster, the protein dispersed and reorganized at the advancing end. The observations suggest that AglZ defines an anchor point. It's not yet clear whether slime also has a role in this system.

IMMUNOLOGY

Killer speed

Proc. Natl Acad. Sci. USA **104,** 1599–1603 (2007)

Immune cells may sweep up virus-infected cells faster than was thought, according to new research.

Roland Regoes and Rustom Antia of Emory University in Atlanta, Georgia, and their colleagues analysed data from experiments in mice, which measured how quickly virus-laden cells were cleared from the animals' spleens. The experiments compared the response of mice relying on effector killer T cells, produced on exposure to the virus, to the response of those equipped with memory killer T cells, which are associated with long-term immunity.

The researchers found that the two types of killer T cell are equally efficient at reducing the number of infected cells, and calculated a 'rate constant' that expresses how quickly they do so. This constant was up to 100-fold higher than previous studies had suggested — a discrepancy that the team says will need further work to resolve.

CANCER BIOLOGY

Guardian gene

Cell **128,** 459–475 (2007)

Researchers in the United States have teased out the secret of a chromosomal region that is deleted in many human cancers.

Alea Mills from Cold Spring Harbor Laboratory, New York, and her colleagues have identified within the region, known as *1p36*, a gene that protects against cancer. Scientists have for decades assumed that the region harbours such a tumour suppressor, but until now its identity had eluded them.

Mills and her co-workers pinned down the gene by engineering mice to express different numbers of copies of the region corresponding to human *1p36*, then blocking the genes that it contains one by one.

The team thinks that the tumour-suppressor gene, known as *CHD5*, may act as a sort of master switch, remodelling the chromatin that packages DNA to control the cell's complex of tumour-suppressing networks.

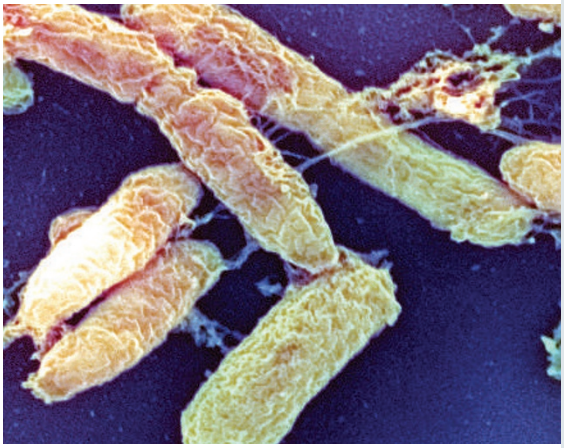
MICROBIOLOGY

Plague aided by phage

Mol. Microbiol. **63,** 1145–1157 (2007)

The bacterium responsible for plague (*Yersinia pestis*, pictured below) ravaged medieval Europe and is resurgent in areas of Africa and Asia. Anne Derbise of the Pasteur Institute in Paris, France, and her colleagues present genetic evidence that helps to explain the microbe's virulence.

The genome of *Y. pestis* has previously been shown to incorporate a sequence encoding an elongated virus, known as a filamentous phage. The presence of such phages in other pathogens is associated with virulence. The researchers confirm that the phage plays a part in the pathogenicity of *Y. pestis* — showing that it is absent from the genome of a less virulent ancestor, and that removal of the phage DNA makes *Y. pestis* less infective.



G. GAUGLER/SPL

MATERIALS SCIENCE

How memories melt away

Phys. Rev. Lett. **98,** 055505 (2007)

Commercial rewriteable DVDs and prototype memory devices record information in phase-change materials such as germanium antimony telluride ($Ge_2Sb_2Te_5$ or GST) that switch rapidly between crystalline and amorphous states when heated with a laser. The speed of the phase change, which can occur in nanoseconds, is crucial to the perfomance of such devices, but no one knows quite how it happens.

Zhimei Sun of Uppsala University in Sweden and co-workers say that the melting of GST is decidedly odd. Their computer simulations suggest that the atoms form chains and tangled clusters as the crystals melt in two dimensions, whereas in the third dimension the atoms remain in orderly layers. They believe this accounts for the material's quick phase change.

JOURNAL CLUB

Galina Khitrova
University of Arizona, Tucson, USA

An expert on instabilities jumps from optically bound plastic beads to the brain.

It's not often that reading scientific papers turns my mind to the melancholic work of great Russian writers, but a recent one did.

The paper reports observations of 'bistability' in a simple optical system. Bistable systems have two stable output states for the same input. In this case, the researchers had studied the behaviour of two plastic spheres, trapped side-by-side in a pair of counter propagating laser beams (N. K. Metzger *et al. Phys. Rev. Lett.* **96,** 068102; 2006). They found that the beads could adopt two stable arrangements, differing in the beads' separation.

Bistability arises in optical systems that show nonlinear responses to changes in light intensity and include some kind of feedback process. Here, one bead feels the position of the other because each affects the light field around it, creating the necessary feedback.

The researchers modelled how the two stable states come about, combining equations that describe the propagation of the light with others that predict the forces on the beads. I was impressed by how many physical effects are taken into account in the model.

And this is what turned my thoughts away from the physics of my research to the literature of my homeland. It is believed that some Russian authors, including Leo Tolstoy, may have suffered from what is now known as a bipolar disorder, characterized by states of euphoria and depression.

I have wondered before whether bistability in optical systems might serve as a simple model to help understand the mechanisms that underlie bistability in the human brain. Papers such as this one put that challenge in perspective — modelling a system that involves just two beads is already nontrivial.