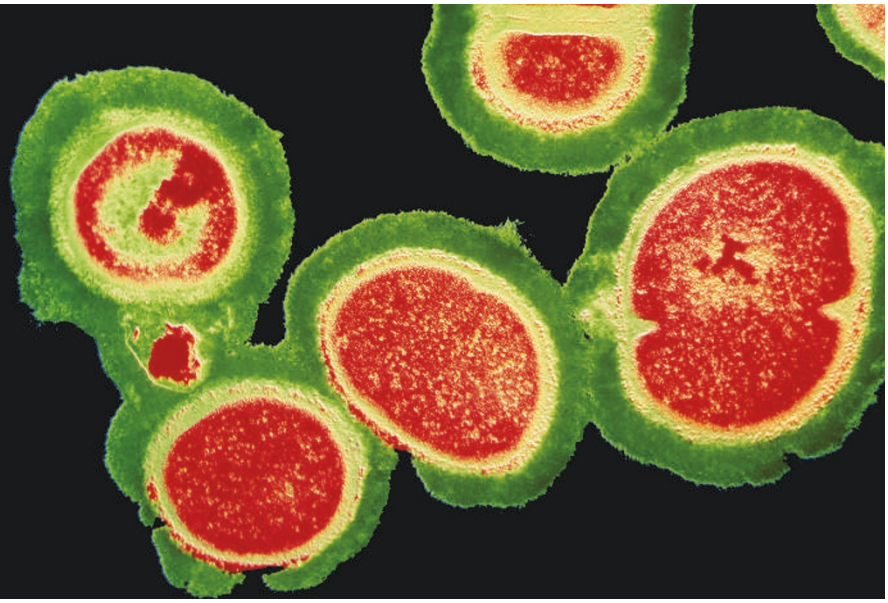
RESEARCH HIGHLIGHTS

MRSA toxin characterized

Science doi:10.1126/science.1137165 (2007)
Researchers have characterized a toxin secreted by some strains of the menacing bacterium methicillin-resistant *Staphylococcus aureus* (MRSA, pictured).

Antibiotic-resistant *S. aureus* has plagued hospitals for decades and is now showing up more frequently outside hospitals too.

A team led by Gabriela Bowden of Texas A&M University in Houston, and François Vandenesch of the University of Lyon, France, studied the toxin 'Panton Valentine leukocidin', which is produced by some MRSA strains that cause a severe form of pneumonia. The toxin alone could cause pneumonia in mice. The team found that it also stimulates expression of two bacterial proteins: one that promotes inflammation, and another that may increase the bacterium's ability to stick to injured airways in the lungs.



K. LOUNATMAA/SPL

OPTICS

Stability is everything

Phys. Rev. A **75,** 011801 (2007)
Even the tiniest vibration can upset the time-keeping of an atomic clock, so physicists endeavour to make its parts stable against acceleration. Stephen Webster of the UK National Physical Laboratory in Teddington and his colleagues report progress for one component: the 'optical cavity'.

The optical cavity helps to fix the frequency of the laser light that interrogates the atoms of the clock. It consists of a cylinder with a mirror positioned at each end. The researchers analysed the mechanics of this set-up, finding that they could minimize a cavity's sensitivity to vibrations by slicing some material from the cylinder's lower side and by carefully positioning the cylinder's supports. This helped them to build a cavity 15 times less sensitive to vertical accelerations than the best existing design.

MOLECULAR BIOLOGY

Through the tunnel

Nature Struct. Mol. Biol. doi:10.1038/nsmb1197 (2007)
Cholesteryl ester transfer protein (CETP) works to lower levels of 'good' cholesterol and raise levels of 'bad' cholesterol; in theory, blocking its action should help boost the good stuff. But in December 2006, Pfizer pulled the plug on trials of a drug (torcetrapib) designed to do this, because of concerns about patient safety.

Xiayang Qiu and his colleagues, working at Pfizer in Groton, Connecticut, have now determined the crystal structure of CETP. The protein contains a tunnel through which, they propose, cholesterol and other lipids are shunted. They want to understand how torcetrapib blocks this process. This may help researchers to find other CETP inhibitors that avoid torcetrapib's problems.

NUTRIENT CYCLING

It's simple, really

Science **315,** 361–364 (2007)
The complex world of biogeochemistry does at least contain some simplicity. A ten-year study has shown that the rate at which nitrogen is released from decomposing plant matter depends on just a couple of variables, regardless of climate or ecosystem type.

J. SEXTON

A team led by William Parton of Colorado State University in Fort Collins placed leaves (pictured below) from seven different ecosystem types at 21 sites worldwide, and left them to decompose. They found that the rate at which nitrogen compounds are released to the soil depends almost entirely on the initial concentration of nitrogen in the plant matter, and the leaf and root mass remaining at a given time. Only in arid grasslands did other factors come into play.

QUANTUM COMPUTATION

Slow down a bit

Phys. Rev. Lett. **98,** 020501 (2007)
Will quantum computers work if they take a long time to read the data?

In modelling the operation of quantum computers, physicists have tended to assume that a quantum bit's state can be read as quickly as the value of the state could be changed. But it seems likely that measurements in real devices will be comparatively slow. Might this derail the error-correction procedures needed to keep a quantum computer running by allowing noise to swamp the data?

Happily, David DiVincenzo of IBM's T. J. Watson Research Center in Yorktown Heights, New York, and Panos Aliferis of the California Institute of Technology in Pasadena have devised a new error-correcting protocol that can tolerate slow measurements. With this protocol, even measurements that take 1,000-fold longer than state manipulations will have little effect on the computer's accuracy.

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BIOTECHNOLOGY

Looks good on paper

Angew. Chem. Int. Edn doi:10.1002/anie.200603817 (2007)

Paper printed with polymer channels could form a cheap and portable testing lab for biological samples, say scientists led by George Whitesides at Harvard University in Cambridge, Massachusetts.

To make the simple bioassay device, the researchers first soaked chromatography paper in a solution that forms a water-repellent polymer when exposed to ultraviolet light. They then used a mask to expose only certain regions to the ultraviolet light, defining channels and test areas. In the demonstration device (pictured right), the test areas were primed with colour-changing reagents to detect glucose (left) and protein (right). Liquid is drawn through the channels by capillary action when the edge of the paper is dipped into the sample.

NANOTECHNOLOGY

Reinventing the wheel

Nature Nanotech. doi:10.1038/nnano.2006.210 (2007)

Efforts to build machinery on the nanoscale are rolling forward, with new work reporting a molecular wheel.

Leonhard Grill of the Free University of Berlin, Germany, and his colleagues show that triptycene groups, which resemble three-bladed paddlewheels, can act as wheels only 8 angstroms wide. They fixed one triptycene to each end of a rigid axle, then pushed this primitive molecular vehicle over a copper surface using the tip of a scanning tunnelling microscope.

Evidence that the wheels could 'roll' came from looking closely at how the vehicle

moved. When one of its three-armed wheels rotated by 120°, the molecule jumped and its axle reoriented. Nanowheel rotation has been claimed before, but never shown directly.

GENETICS

Hand-me-down cells

Proc. Natl Acad. Sci. USA doi:10.1073/pnas.0606169104 (2007)

The idea that a mother would give anything to protect her child has been extended by new research.

J. Lee Nelson of the Fred Hutchinson Cancer Research Center in Seattle, Washington, and her colleagues found that children with type 1 diabetes have higher levels of their mother's DNA in their blood than do their unaffected siblings, implying that they inherit more maternal cells. They also found small populations of female insulin-producing cells in male pancreases.

Putting the two observations together suggests that a mother's insulin-producing cells, transferred to the fetus in the womb, could contribute to the regeneration of her child's damaged pancreatic cells.

GEOLOGY

Fast movers

Geology **35,** 29–32 (2007)

Plate tectonics was more changeable in the past than once believed, a new study suggests.

Earlier work indicated that the rate of new crust being born at seafloor spreading ridges has stayed relatively constant over the past 100 million years or so. To check this, Clinton Conrad of the Johns Hopkins University in Baltimore, Maryland, and Carolina Lithgow-Bertelloni of the University of Michigan in Ann Arbor analysed afresh the ages of sea floors in different ocean basins.

They find that, globally, rates of seafloor spreading increased by about 20% between 60 million and 30 million years ago. Since then, because a fast-spreading system in the Pacific has been recycled into Earth's depths, the average spreading rate has dropped by 12%.

CELL BIOLOGY

A protective pair?

Neuron **53,** 233–247 (2007)

A molecular link between two signalling pathways in the central nervous system has been uncovered by Stephen Moss of the University of Pennsylvania in Philadelphia and his co-workers.

The team shows that an enzyme known as AMPK, implicated in appetite signalling, interacts with the neuronal receptor $GABA_B$. AMPK seems to add a phosphate group to the receptor, modifying its activity.

The finding may help to pin down AMPK's role in the brain's response to injury. The enzyme is activated in stressed tissue, but there is conflicting evidence about whether it prevents or exacerbates neuronal damage. Moss's group suggests that $GABA_B$ mediates a neuroprotective effect.

JOURNAL CLUB

Daniel Pauly
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A marine biologist dives into the history of the Gulf of California.

A decade ago, I coined the term 'shifting baselines' to describe how society perceives environmental change. The concept has caught on: there's even a website, at www.shiftingbaselines.com, featuring short, explanatory films.

The films push the idea that the standards by which society assesses change are themselves changing. We tend to use the state of affairs that prevailed when we first became aware of an issue as our reference point for evaluating future change — a baseline that shifts with each generation.

A set of three brilliant papers illustrates how this can shape our understanding of ecosystems.

The most recent paper (A. Sáenz-Arroyo *et al. Fish Fish.* **7,** 128–146; 2006) reconstructs from historical sources, such as pirates' logs, details of the Gulf of California's ecosystem stretching back to the sixteenth century. The researchers argue that the past abundance of creatures such as marine mammals, turtles and oysters recounted in these sources should be considered when setting conservation targets today.

Their previous work examined records of Gulf groupers, fish that once dominated the area's reefs (A. Sáenz-Arroyo *et al. Fish Fish.* **6,** 121–133; 2005), concluding that fishery statistics didn't go back far enough to accurately map the species' decline.

Further, they quizzed three generations of artisanal fishers (A. Sáenz-Arroyo *et al. Proc. R. Soc. Lond. B* **272,** 1957–1962; 2005), and found that fishers' knowledge of the location or habits of species disappeared within one generation, if the species became rare.

We are all affected by this kind of collective amnesia. It allows us to handle change. But it is also the reason why we accept losses that would be intolerable, were we aware of them.