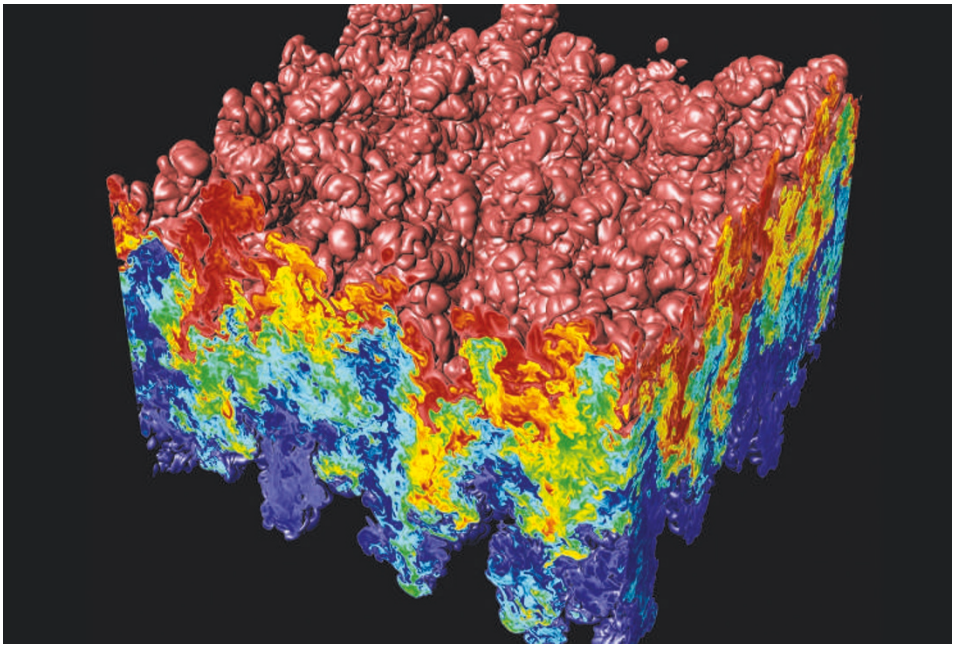
RESEARCH HIGHLIGHTS

Top heavy

Nature Phys. doi:10.1038/nphys361 (2006)
The swirling motion of turbulence has been simulated in unprecedented detail using the world's fastest supercomputer.

William Cabot and Andrew Cook of the Lawrence Livermore National Laboratory, California, used IBM's BlueGene/L to model what happens when a layer of heavy fluid (shown in red) sits above a lighter fluid (blue). This situation is described as Rayleigh–Taylor unstable: buoyancy effects mean that any bumps in the lower layer grow, setting up eddies that multiply until the entire fluid is seething (pictured).

Cabot and Cook report the surprise finding that the rate at which the eddies grow and the fluids mix depends on a property of the fluids known as the Reynolds number. This has implications for models of supernovae, which are turbulent stellar explosions.



CHEMISTRY

Solvent speed limits

Angew. Chem. Int. Edn **45,** 4824–4825 (2006)
While singing the praises of ionic liquids as 'green' solvents for industrial chemistry, advocates should not overlook the virtues of the original green solvent — water.

Ionic liquids are more environmentally friendly than organic solvents because they are not volatile. But Shraeddha Tiwari and Anil Kumar of the National Chemical Laboratory in Pune, India, have shown that an important class of ring-forming reactions in synthetic organic chemistry, known as Diels–Alder reactions, proceed faster in water than in ionic liquids. It was known already that Diels–Alder reactions can proceed faster in water than in organic solvents, but the new results clinch the case for water being the solvent of choice for this type of chemistry.

NEUROBIOLOGY

Monkey talk

Nature Neurosci. doi:10.1038/nn1741 (2006)
Brain-imaging studies performed on rhesus macaques are helping to trace the evolutionary origins of human speech.

Allen Braun of the National Institutes of Health in Bethesda, Maryland, and his colleagues monitored blood flow in the brains of three rhesus macaques as they listened to recordings of the coos and screams made by monkeys of their species. The flow of blood increased in regions of the brain similar to the principal human language centres. The results complement those of an earlier study (A. Poremba *et al. Nature* **427,** 448–451; 2004) that had focused on the temporal lobes of monkeys' brains.

These findings suggest that the evolution of language in humans may have involved the recruitment of prelinguistic centres in the common ancestor of macaques and humans more than 25 million years ago.

PHYSICS

Beating time

Phys. Rev. Lett. **97,** 020801 (2006)
Scientists have used a single mercury atom to build the world's most precise clock. Its time-keeping surpasses that of the caesium atomic clocks currently used to define the second.

The beat of the clock, built by Jim Bergquist and his colleagues at the National Institute of Standards and Technology in Boulder, Colorado, is defined by the oscillations of laser light that excite the mercury atom. Using an ultraviolet laser makes the clock about five times more precise than its caesium counterparts, which use a lower-frequency microwave laser. It is also more reliable: the clock is expected to drift by only 1 second in 400 million years compared with 1 in 60 million in caesium clocks.

According to the team, the mercury clock could be used to measure fundamental physics constants and, ultimately, to redefine the second.

PHARMACEUTICALS

Change of heart

Nature Med. doi:10.1038/nm1446 (2006)
A cancer drug hailed for its ability to rescue those dying from leukaemia could cause heart failure, a study suggests.

Imatinib mesylate (Gleevec) was carefully designed to target the tyrosine-kinase enzyme mutated in chronic myelogenous leukaemia. Thomas Force at Jefferson Medical College in Philadelphia, Pennsylvania, and his colleagues document ten patients with otherwise healthy hearts who developed heart failure after taking the drug. Gleevec, produced by Novartis, seems to stress a membrane system known as the endoplasmic reticulum in heart muscle cells, and can eventually trigger cell death.

S. PROCTER/REX FEATURES

Patients taking Gleevec should be monitored for heart problems, the authors say, as should those in clinical trials of the many tyrosine-kinase inhibitors under development.

BIOPHYSICS

Gibbons bounce about

J. Exp. Biol. **209,** 2829–2838 (2006)

Gibbons, known for their graceful skill at swinging from tree to tree, also occasionally travel by foot. Evie Vereecke and her two co-authors at the University of Antwerp, Belgium, have investigated this ground-based locomotion by filming white-handed gibbons (*Hylobates lar*, pictured right) and recording the pressure exerted by the gibbons' feet on a special mat at various speeds. Unlike humans, who walk and then break into a run, the gibbons' gait transition is not clear cut.

Walking humans swing their legs like pendulums, whereas the legs of people running act like springs, using their Achilles tendons to store energy. The researchers found that gibbons have a bouncing gait that works at all speeds, probably storing energy in their quadriceps muscles. Running gibbons reach speeds of 3.5 metres per second, but rarely have both feet off the ground at the same time.

CHEMISTRY

Gold winner

Science **313,** 332–334 (2006)

Avelino Corma and Pedro Serna of the Technical University of Valencia, Spain, have discovered a clean and selective way to make aromatic amines, compounds that are crucial to the production of herbicides, pharmaceuticals, dyes and pigments.

The researchers showed that gold nanoparticles, fixed to a titanium dioxide or iron oxide substrate, could catalyse the exchange of oxygen atoms for hydrogen in a nitro group (NO_2), forming an amine (NH_2). This chemical reduction, using hydrogen gas, proceeded without affecting other groups in the same molecule. Previous approaches required difficult-to-remove and toxic additives, such as the soluble heavy metal, vanadium. This new reaction also avoids the build-up of explosive intermediates that troubles some other schemes.

CELL BIOLOGY

Gene control on an RNA diet

Nature Cell Biol. doi:10.1038/ncb1439 (2006)

Clues to how cells gather gene-censoring molecules from their environment may lead to novel therapeutic strategies, suggest Raul Andino of the University of California, San Francisco, and his colleagues.

R. MAGNUSSON/ALAMY

The researchers studied the mechanism by which cells from the fruitfly *Drosophila* take up double-stranded RNA. Once in the cell, this RNA is chopped into pieces to silence the expression of specific genes, by a mechanism known as RNA interference.

They identified 23 genes involved in the RNA uptake, including some linked to endocytosis — the process by which external molecules are enclosed in vessels called vesicles. The team speculates that a family of 'pattern recognition receptors' detect the RNA, triggering its consumption.

MATERIALS SCIENCE

Property conversion

J. Am. Chem. Soc. doi:10.1021/ja0627996 (2006)

Even inert metals tend to have reactive surfaces, so nanocrystals with a large surface-area per unit volume can be persuaded to react in ways that bulkier bits of material will not.

Robert Cable and Raymond Schaak of Texas A&M University, College Station, have applied this principle to a class of metal alloys known as intermetallics, which have chemical properties distinct from those of their constituent metals. Heating intermetallic nanocrystals with solutions of metal salts yielded compounds that can be difficult to synthesize by other routes, the researchers report.

They showed, for example, that it was possible to fine-tune the composition of a nanocrystal containing platinum and tin through a reversible conversion between different alloys. Such materials are being tested as catalysts for fuel-cell reactions.

JOURNAL CLUB

Thomas Koop
Bielefeld University, Germany

A physical chemist describes how ice cream might be kept smooth for longer.

I am addicted to ice cream, so it is always a let-down to come across an old batch that has become gritty. The unpleasant texture develops as large ice crystals grow at the cost of smaller ones in a recrystallization process known as Ostwald ripening. Is there a way to prevent this happening?

Ice recrystallization is also a threat to organisms that live at subzero temperatures, because intracellular ice growth can damage their tissues. In response, plants, fish and insects synthesize antifreeze proteins. Such proteins inhibit recrystallization by adsorbing to certain faces of the ice crystals.

A recent article (Li *et al. J. Chem. Phys.* **124,** 204702; 2006) presents a new and promising model for understanding how the microscopic interactions between ice and protein translate to observable effects — a subject much discussed.

The model calcuates how much of the surface of the ice is covered by protein by describing a dynamic equilibrium between unbound and adsorbed protein. This depends on the concentration of the protein in solution, its size, the number of potential binding sites the protein has and its binding strength.

The model predicts the number of degrees below the equilibrium melting temperature at which the protein will inhibit ice growth. Its predictions are in good agreement with experimental data for several proteins.

A better understanding of the ice–antifreeze protein interaction should speed up development of mimetics for use in the cold storage of biological tissues or frozen food. Until then, I will use Ostwald ripening as a scientific argument for finishing off each batch of freshly prepared homemade ice cream in one go. I don't need to argue with my kids about this, as they follow the strategy intuitively.