RESEARCH HIGHLIGHTS

Monsoon forecasting

Science doi:10.1126/science.1131152 (2006)
Detailed measurements of sea surface temperatures may improve predictions of India's monsoon, say Martin Hoerling of the National Oceanic and Atmospheric Administration in Boulder, Colorado, and his colleagues.

The crop-watering rains are known, from historical records, to be prone to fail when a climatic event known as El Niño warms the surface waters of the Pacific. Hoerling and his team compared El Niño events that led to drought with those that did not. They conclude that the risk of monsoon failure depends on where the waters warm most: elevated temperatures in the central Pacific seem to be more strongly associated with drought than elevated temperatures in the eastern Pacific. Better predictions of monsoon failure would allow rural communities to prepare in advance.

STRDEL/AFP/GETTY

NANOTECHNOLOGY

Short straws

Nano Lett. doi:10.1021/nl061786n (2006)
An approach to building complex pillars from polymers and gold, devised by chemists at Harvard University in Cambridge, Massachusetts, could find application in solar cells and light-emitting diodes.

George Whitesides and his team used the pores of an aluminium oxide membrane as a template to make arrays of columns some 200 nanometres wide and a few micrometres long. They produced an assortment of composite structures: some with a hollow polymer core surrounded by a gold shell electrode, others containing adjoining gold and polymer segments. The researchers suggest it would be possible to create efficient light-collecting or light-emitting devices from these structures by filling their hollow parts with a conducting polymer.

EVOLUTIONARY GENETICS

One small hop for a gene...

Science **313,** 1448–1450 (2006)
Genes relocating from one chromosome to another could underlie a defining event in the origin of species, say researchers.

A new species arises when populations within an existing species have diverged so far that their members can no longer interbreed to produce fertile offspring. John P. Masly of the University of Rochester, New York State, and his colleagues identify a novel molecular mechanism by which this can happen.

They identified a gene essential for male fertility, *JYAlpha*, on the third chromosome of the fruitfly *Drosophila simulans*, but on the fourth chromosome of *Drosophila melanogaster*. *JYAlpha* hopped between the chromosomes at least 300,000 years ago. They show that this was responsible for making some of the male offspring bred from a cross between the two species sterile.

PLANT BIOLOGY

Plants shut out invaders

Cell **126,** 969–980 (2006)
Researchers in the United States report that plants batten down their hatches to protect against invaders, by closing the small pores on their leaves that are known as stomata (pictured below).

Previously it was thought that stomata were simple portholes, which open to allow carbon dioxide uptake and close to prevent excessive water loss. But a team led by Sheng Yang He of Michigan State University in East Lansing has shown that the kidney-shaped guard cells around the pores on *Arabidopsis* leaves use receptors that detect bacterial compounds and trigger the stomata to close.

The researchers also show that, to get around this defence mechanism, the plant pathogen *Pseudomonas syringae* manufactures a compound that forces the stomata to re-open after 3 hours.

J. BURGESS/SPL

VIROLOGY

Deadly response to bird flu

Nature Med. doi:10.1038/nm1477 (2006)
A comparison of patients infected by the avian influenza virus H5N1 with those suffering from human flu adds weight to arguments that H5N1's deadliness is linked to the strength of the immune response that it provokes.

Menno de Jong of the Hospital for Tropical Diseases in Ho Chi Minh City, Vietnam, and his colleagues characterized 18 cases of H5N1 and 8 of regular flu. Those patients killed by H5N1 showed the highest loads of the virus. The researchers also found elevated levels of inflammatory molecules known as chemokines and cytokines in H5N1-infected individuals, consistent with earlier results from *in vitro* and animal studies. The inflammation response may contribute to respiratory failure.

MATERIALS SCIENCE

Hydrogen's happy medium

Angew. Chem. Int. Edn doi:10.1002/anie.200601991 (2006)
Fuel tanks for the hydrogen-powered cars of the future could be made from sponge-like materials known as metal organic frameworks. A new study reveals how tweaking the materials' pore size might maximize the amount of hydrogen they can store.

Although larger pores would in theory accommodate more hydrogen, researchers

at the University of Nottingham and the University of Newcastle upon Tyne, UK, found that bigger pores have a smaller affinity for the gas. They conclude that the optimum pore size is obtained when increasing capacity is balanced with decreasing affinity. In the materials the team studied, the optimum pores had a diameter of about 0.7 nanometres.

NEUROSCIENCE

Guided trips in the brain

Nature Neurosci. doi:10.1038/nn1764 (2006)

The thin layer of tissue that surrounds the brain, known as the meninges, has an unexpected role in brain development, say Victor Borrell and Oscar Marín of the Institute of Neuroscience in Alicante, Spain.

Their discovery comes from a study of Cajal-Retzius cells, a transient population of cells that sits at the edge of the brain and guides the development of neuronal layers in the cerebral cortex. The authors tracked the migration of Cajal-Retzius cells in mice, and found that the cells move to their positions by travelling along the meninges. CXCL12, a cell-signalling molecule secreted by the meninges, seems to play a key part.

ASTRONOMY

When the giant has passed

Science **313,** 1413–1416 (2006)

Earth-like planets could exist in as many as a third of the planetary systems that have been found to harbour giant planets, new simulations suggest, despite the havoc wrought when the giants wander.

In many of these systems, giant planets that formed in the outer reaches appear to have migrated inwards, forming 'hot Jupiters'. Researchers thought such migrations were likely either to disrupt the formation of terrestrial planets in the star's neither-too-hot-nor-too-cold 'habitable zone', or to scatter such planets into unsuitable orbits.

Now researchers in the United States report simulations that suggest that Earth-like planets can form in the habitable zones after the giant has passed. Such planets, the model predicts, would be peculiarly water-rich and iron-poor compared with Earth.

CELL BIOLOGY

A twist in the tail

Cell **126,** 905–916 (2006)

Researchers have discovered a novel type of histone modification. This structural change to the proteins that package DNA can affect gene regulation.

Tony Kouzarides and his team at the University of Cambridge, UK, studied an enzyme called Fpr4 in yeast. They found that it switches the amino acid proline, found in the protruding 'tail' of histone H3, between two different mirror-image forms known as *cis* and *trans*.

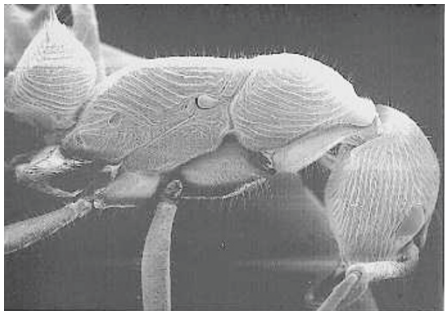
The *cis* form bends the tail sharply and allows another enzyme, Set2, to chemically alter a neighbouring amino acid, which affects the activity of genes in the surrounding DNA. The team suggests that these tail changes could also alter the structure of chromatin, the larger-scale packaging of DNA and proteins, which is known to control gene behaviour.

ANIMAL BEHAVIOUR

Once bitten

Anim. Behav. **72,** 305–311 (2006)

In queenless ant colonies, one or a few workers nevertheless corner the mating and egg-laying market. In most *Diacamma* species (pictured below), they do so by mutilating every other ant. They bite off an appendage necessary for mating soon after the ant emerges from the cocoon.



C. PEETERS

Christian Peeters of the Pierre and Marie Curie University in Paris, France, and his colleagues wondered whether the newborns fight back. It turns out they don't when the attacking ant has reproduced and might therefore be their mother, but do when the attacker is young and so probably a sibling.

The researchers reason that this makes genetic sense. The mutilated ant would only have passed on half its genes to any of its offspring, the same fraction that it shares with the offspring of its mother. But a sibling's offspring share only around a third of the ant's genes, so the victim would do better by reproducing itself.

Correction

In the Research Highlight "Changing the code" (*Nature* **442,** 960; 2006), DNA should have been described as a template that is transcribed, not translated, into RNA.

JOURNAL CLUB

Henrik Stapelfeldt
Aarhus University, Denmark

A chemist tries to see things from the molecule's perspective.

One research goal in my laboratory is to watch, in real time, how atoms exchange and electrons rearrange during a chemical reaction.

A promising technique is the femtosecond version of photoelectron spectroscopy. In the traditional version, ultraviolet light knocks 'photoelectrons' from the target molecule, revealing the molecular electronic structure.

A few years ago, Albert Stolow of the National Research Council Canada in Ottawa and his colleagues married this method with a laser whose pulses last less than 100 femtoseconds, or 10^{-13} seconds. This provided the time resolution needed to follow the flow of charge and energy during reactions (V. Blanchet *et al. Nature* **401,** 52–54; 1999).

One key element was missing, however. Scientists want to observe these processes from the molecule's frame, rather than from the laboratory. This requires that we measure the electrons' emission directions with respect to the parent molecule, a fundamental experimental problem because the molecule tends to orient randomly.

Recently, Stolow's group found a way around this problem for one process: the photoinduced cleavage of the nitric oxide dimer (O. Geßner *et al. Science* **311,** 219–222; 2006). In this reaction, the molecule breaks up, which allows its initial orientation to be determined by detection of the fragments. Combining these data with photoelectron measurements gave a picture of the electron clouds in the molecular frame — a most important milestone.

My lab recently developed a complementary solution, using laser-based techniques to hold molecules in fixed orientations. Either approach, or both combined, should get us closer to understanding reaction dynamics from the most natural point of view: the molecule's!