RESEARCH HIGHLIGHTS

Silica soufflé

Nature Mater. doi:10.1038/nmat1757 (2006)
Mousse, soufflé or powder? All are on the silica-based materials menu developed by Bernard Binks and Ryo Murakami of the University of Hull, UK.

The researchers devised a series of silica nanoparticles that differ in their affinity for water. They chemically modified the particles' surfaces to give properties that vary from completely hydrophilic to very hydrophobic.

When mixed with water, the most hydrophilic particles stabilized a foam. The hydrophobic particles, by contrast, coated water droplets, turning them into 'liquid marbles', which act like a fine powder. The results are pictured.

Nanoparticles with intermediate properties generated powders, foams or sticky, spongy 'soufflés', depending on the amount of water mixed with them. Applications in food technology and cosmetics beckon.

CHEMISTRY

Antibiotic mixed up

Angew. Chem. Int. Edn doi:10.1002/anie.200603892 (2006)
A potent antibiotic, which is effective against 'superbugs' that have developed resistance to other antibiotics, has been synthesized for the first time.

Platensimycin is produced naturally by the bacterium *Streptomyces platensis* and was shown earlier this year to belong to a new class of antibiotic (J. Wang *et al. Nature* 441, 358–361; 2006).

K. C. Nicolaou and his co-workers at The Scripps Research Institute in La Jolla, California, made a racemic mixture of the compound, meaning that their product contained two mirror-image structures, or enantiomers, of the molecule. Future syntheses may improve on this by giving a single enantiomer.

CELL BIOLOGY

Protein makes a good point

J. Cell Biol. doi:10.1083/jcb.200605012 (2006)
Epithelial cells (pictured right), such as those of the skin, arrange themselves in a honeycomb-like pattern to minimize contact with each other. Researchers in Japan have unearthed a clue as to how such cells manage to maintain their angular shapes.

Masatoshi Takeichi at the RIKEN Center for Developmental Biology in Kobe and his colleagues point the finger at the protein Tuba. They suggest that Tuba controls the shaping of junctions between cells by modulating local activation of CDC42, an enzyme required for organizing the protein skeleton that supports the cell membranes.

When the team used RNA interference to reduce the activity of the gene for Tuba, the epithelial cells looked "curved and slack".

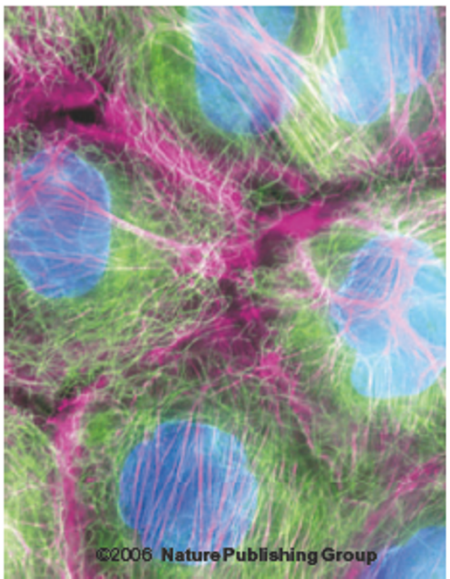
DEVELOPMENTAL BIOLOGY

Gender switch

Nature Genet. doi:10.1038/ng1907 (2006)
Researchers have discovered a gene in humans that, when mutated, causes embryos with a female complement of sex chromosomes to develop as males.

Giovanna Camerino of the University of Pavia in Italy and her colleagues studied a family in which four brothers each had two Xs instead of the normal male complement (XY). Most female-to-male sex reversals result when the X chromosome inherited from the father accidentally acquires a part of his Y chromosome, carrying a gene called *SRY*. But the brothers had no copies of *SRY* at all. Instead, they had a mutation in a gene called *RSPO1*.

The team suggests that *RSPO1* normally helps to drive the developing gonad to become an ovary. In its absence, genes promoting the formation of a testis take over.



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ASTRONOMY

In good company

Astrophys. J. 650, L41–L44 (2006)
Swarms of small, faint galaxies are being discovered in the Milky Way's neighbourhood using data from the Sloan Digital Sky Survey. The latest detection, confirmed by astronomers at the University of Cambridge, UK, and their co-workers, with follow-up observations from Japan's Subaru telescope, is a dwarf spheroidal galaxy in the constellation Ursa Major. Dubbed Ursa Major II, it is about 100,000 light years away.

Simulations of how galaxies form in the presence of dark matter predict that many such dwarf galaxies will exist as companions to their bigger cousins. Discoveries like this one are closing the gap between the number of such galaxies known and the much larger number expected if the models are correct.

J. W. SHULER/SPL

CRYPTOGRAPHY

They do it with mirrors

Phys. Rev. Lett. 97, 140502 (2006)
Cryptography's thorniest problem is how sender and receiver can securely share the 'key' — the string of 1s and 0s — they use to encrypt their messages. Some people pursue

quantum solutions; Jacob Scheuer of Tel-Aviv University, Israel, and Amnon Yariv of the California Institute of Technology in Pasadena propose a classical approach that could work over longer distances.

In their scheme, sender and receiver encode bits in laser light that bounces between them. Each party selects one of two mirrors, which have peak reflectivities at slightly different frequencies, to reflect the beam. Knowing their own choice of mirror, one party can work out the other's choice from the returning light's spectrum. The sender's mirror choice gives the 1s and 0s of the key.

The scheme has yet to be tested, but in principle it can be made arbitrarily difficult for an eavesdropper to determine which bit was sent.

BIOTECHNOLOGY

Joined from birth

J. Am. Chem. Soc. 128, 13030–13031 (2006)

Fusing two enzymes together can improve the efficiency of biosynthesis of useful compounds, say Oliver Yu of the Donald Danforth Plant Science Center in St Louis, Missouri, and his co-workers.

They selected, from three different plants, genes encoding enzymes that are involved in the synthesis of the antioxidant resveratrol — the compound credited with imbuing red wine with health benefits. The researchers then engineered the genes into yeast cells.

Cells in which two genes were placed back to back, so that the resultant enzymes were linked together, were more efficient at making resveratrol than those in which the enzymes were separate molecules. The same trick worked in human kidney cells, implying that it could be useful in engineering human tissues to make such health-promoting substances.

ANIMAL BEHAVIOUR

On the scent

Curr. Biol. 16, 1956–1961 (2006)

A pheromone that helps newborn rabbits (pictured right) to find their mother's milk can also teach them to respond to new smells, say researchers in France.

G. COUREAUD/CNRS

The mammary pheromone in rabbit milk typically prompts pups to root for their mother's nipples. Gérard Coureaud of the European Centre for Taste Science in Dijon and his colleagues tested more than 950 rabbit pups to explore the pheromone's potency.

In one experiment, they wafted a chemical odour over two-day-old pups, while exposing them to the pheromone at the same time. Several hours later, pups started seeking a nipple when they smelt the odour alone. The researchers suggest that the pheromone may help pups to learn the scent of their mother.

CELL BIOLOGY

Assessing affinity

Nature Chem. Biol. doi:10.1038/nchembio823 (2006)

Two difficulties in measuring and modelling receptor activation in live cells are tackled in research by Adrian Whitty and his colleagues at Biogen Idec, a biopharmaceutical company in Cambridge, Massachusetts.

One problem is finding a way to modulate the number of receptors to study the effect of receptor concentration. They dealt with this, in experiments on a receptor complex from a group known as the GDNF family, by adding different quantities of an antibody that blocks free receptors.

The next hurdle is to understand how the receptor is activated, requiring models of the reversible associations of the receptor and its signalling molecules on the two-dimensional cell surface. The researchers developed a mathematical model that captured this complex process.

IMMUNOLOGY

Enzymes tell good from bad

Science doi:10.1126/science.1132998 (2006)

An enzyme that helps cells to detect viral infection responds not to the double-stranded RNA produced when the virus replicates, as previously thought, but to the single-stranded RNA of the virus's genome.

This is the conclusion that Caetano Reis e Sousa of Cancer Research UK, London, and his colleagues reached after studying how the RIG-I enzyme interacts with the influenza A virus. They found that RIG-I recognizes viral genomes that are 'uncapped', meaning they lack the end structures usually found on RNAs made by the host cell. This may have evolved as a way for the immune system to tell self from non-self.

The team also showed that a protein called NS1, produced by the flu virus to suppress its host's immune response, targets RIG-I.

JOURNAL CLUB

Norman H. Sleep
Stanford University, California

A geophysicist sees the positive effects of flood basalt eruptions.

Some people blame massive outpourings of lava for mass extinctions in Earth's history. I have been sceptical of the idea that such events could cause deadly climate change, but quantifying what happened during flood basalt eruptions is the only way to be sure.

Stephen Self of the Open University, Milton Keynes, UK, and his colleagues have done this for one episode in the Deccan province, India. It began to vent around 66 million years ago, just before the Cretaceous/Tertiary (K/T) extinction (S. Self *et al. Earth Planet. Sci. Lett.* 248, 518–532; 2006).

The K/T extinction is linked to an asteroid impact, but some argue that the Deccan eruptions contributed to its beginnings.

Self's team compared the Deccan rocks with the more recent flood basalts in the northwestern United States and modern basalts in Iceland. They conclude that individual eruption events were huge compared with volcanic eruptions that are known to have affected climate, spewing as much as 10,000 cubic kilometres of lava in a decade. The team also estimated outputs of carbon dioxide and sulphur dioxide.

Carbon dioxide outgassing was insignificant — less than current industrial rates. On the other hand, intense fire fountains carried huge quantities of sulphur dioxide into the stratosphere, blotting out sunlight globally and triggering volcanic winter.

Volcanic winter would wipe out some species. But a mass extinction? I think not. The episodes recurred over a long enough time period — roughly a million years — for evolution to act.

I wonder whether the Deccan eruptions might even have diminished the effects of the K/T impact, which would have thrown huge amounts of dust into the atmosphere, by 'preadapting' organisms for unexpected cold.

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