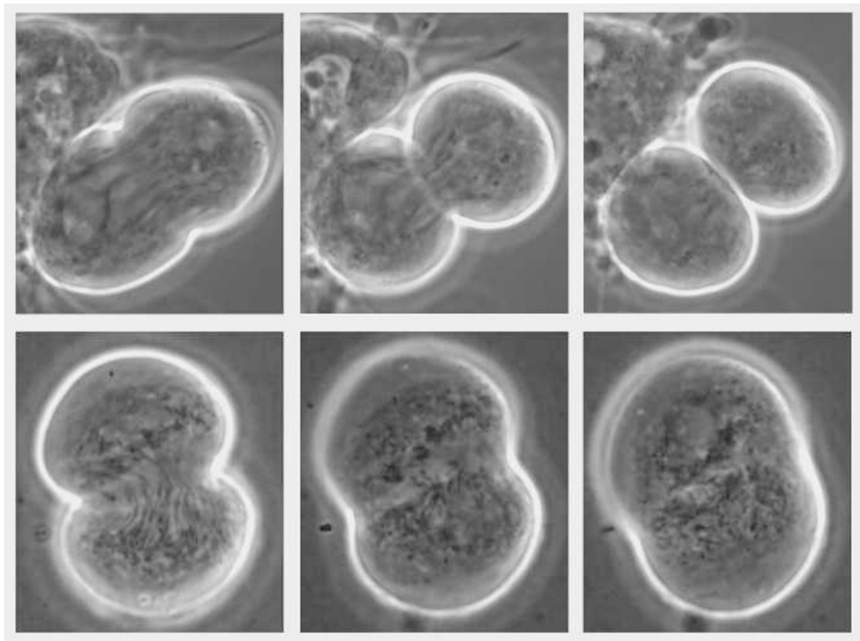
RESEARCH HIGHLIGHTS

Getting good cleavage

Curr. Biol. **15,** 1401–1406 and 1407–1412 (2005)
The composition of the cell membrane and signalling via calcium ions are key to controlling the final step of cell division, according to two independent studies.

Julie Brill and her colleagues at the Hospital for Sick Children in Toronto, Canada, found an important component of the calcium signalling pathway, the phosphoinositide PIP2, in the dividing cell's membrane. Sperm cells from the fruitfly *Drosophila* deprived of either calcium or PIP2 (pictured bottom right, compared with control, top right) can begin cytokinesis, but not complete it, the researchers found.

Meanwhile, a group of researchers led by Seth Field of Harvard Medical School in Boston has shown that PIP2 accumulates at the cleavage furrow in mammalian cells, where the molecule helps the cell membrane to stick to the contracting ring of proteins that divides the cell.



R. WONG/J. BRILL/ELSEVIER

BIOTECHNOLOGY

Made to order

Nature Biotechnol. doi:10.1038/nbt1128 (2005)
Escherichia coli bacteria have been engineered to make novel polyketides — molecules that can kill bacteria and inhibit cancer cells — using a modular approach.

Typically, soil microorganisms make polyketides using hefty enzymes encoded in genetic sequences up to 50,000 bases long. To make these genes more wieldy, researchers headed by Daniel Santi from Kosan Biosciences in Hayward, California, divided the sequences into modules about 5,000 base pairs long. They then engineered modules from different enzymes to combine inside *E. coli*, allowing the bacterium to synthesize polyketides not found naturally. Such compounds could help fight drug-resistant pathogens.

PROSTATE CANCER

RNA interference delivers

Proc. Natl Acad. Sci. USA doi:10.1073/pnas.0501753102 (2005)
Small interfering RNA molecules have been shown to shut down disease-causing genes in many animal models, but an obstacle has been delivering the RNA to where it is needed. Takahiro Ochiya at the National Cancer Center Research Institute in Tokyo and his colleagues have pioneered one possible solution by combining small interfering RNAs with a modified form of the natural protein collagen.

The group used such a mixture, injected into mice's bloodstreams, to shut down the genes implicated in the spread of prostate cancer to bone. This inhibited the cancer's spread, without the side-effects or inflammation that have plagued other approaches — providing the first hints that small RNAs could treat advanced prostate cancer.

COMPUTER SIMULATION

Cracked it

Phys. Rev. Lett. **95,** 060202 (2005)
Warming news for materials scientists: a way to simulate the behaviour of solids that previously worked only when the temperature of the material was set to absolute zero has been adapted to work at higher, more realistic temperatures.

Laurent Dupuy of the Lawrence Livermore National Laboratory in California and his colleagues have made this improvement to the quasicontinuum method, which combines atomic-scale simulations of crucial regions with cruder treatment of the rest. This technique speeds the simulation of phenomena such as fracture, which involve processes at scales from the atomic to the macroscopic. The team showcases its work by simulating the formation of dislocations in a flat nickel crystal at different temperatures.

METABOLISM

Melting fat

Dev. Cell **9,** 271–281 (2005)
The insulin signalling pathway controls whether the body burns or stores fat. Stephen Cohen's group at the European Molecular Biology Laboratory in Heidelberg, Germany, have now found that a protein called Melted is involved in regulating this pathway

The researchers found that Melted, which resides in the cell membrane, binds to proteins from two different branches of the insulin pathway. Mutating the gene for Melted in the fruitfly *Drosophila* reduced the activity of the TOR pathway but activated FOXO, producing flies with 40% less body fat than normal. Giving the mutants the human version of the gene restored their fat, suggesting that Melted is involved in human fat metabolism, too.

ELECTRONICS

Y NOT?

Nature Mater. doi:10.1038/nmat1450 (2005)
The first electrical switch made entirely from carbon nanotubes has been unveiled by Prabhakar Bandaru of the University of California, San Diego, and his colleagues. They report that a current

IMAGE UNAVAILABLE FOR COPYRIGHT REASONS

flowing across two branches of a Y-shaped nanotube can be switched on and off by applying a voltage to the third branch. Although the details of the switching process are not yet well understood, it should be possible to use the Y-shaped nanotube to create a NOT gate, which inverts its input, and to implement other logic operations.

ANTIBIOTIC RESISTANCE

TB's second secret

Proc. Natl Acad. Sci. USA doi:10.1073_pnas.0505446102 (2005)

One reason for the spread of tuberculosis is the remarkable ability of its causative agent, *Mycobacterium tuberculosis*, to resist antibiotics. This stems, in part, from the low permeability of the cell envelope, a membrane inside the organism's cell wall. Now a gene that coordinates a second line of defence within the cell's cytoplasm has been discovered.

Charles Thompson from the University of British Columbia in Vancouver and his team spotted that a mutation in the gene whiB7 made the bacterium *Streptomyces lividans* more vulnerable to antibiotics. *Mycobacterium* also carries this gene, and mutating it had the same effect. The researchers analysed gene activity to study the protection mechanism.

QUANTUM PHYSICS

It must be glove

Phys. Rev. A **72,** 022304 (2005).

Information about handedness can be transmitted by a physical object such as a glove, because the left hand is different from the right. But what would a pair of 'quantum gloves' look like?

Daniel Collins, formerly of the University of Geneva, Switzerland, and his colleagues point out that four entangled particles can assume one of two configurations that are, like gloves, mirror images of each other.

IMAGE UNAVAILABLE FOR COPYRIGHT REASONS

But these gloves are much more economical than a classical glove, they argue, because they are burdened with less of the extra information that comes from knowing the position of every part of a classical glove with certainty.

In contrast, the absolute positions of the particles in their quantum glove are unknown, so they only carry information about handedness.

CELL BIOLOGY

Nuclear escape

Cell **122,** 379–391 (2005)

The editing of messenger RNA, or splicing, was assumed to occur only in a cell's nucleus. But now splicing has been seen in human platelets, which have no nucleus.

Mature mRNA molecules, which are used to synthesize proteins, are made by splicing of pre-mRNA. Andrew Weyrich's group at the University of Utah in Salt Lake City identified components of the splicing apparatus in platelets (pictured below, surrounded by red blood cells), and showed that external signals

IMAGE UNAVAILABLE FOR COPYRIGHT REASONS

D. SCHARF/SPL

could set the machinery going. This prompted them to examine bone-marrow cells called megakaryocytes, which spawn platelets. Parts of the splicing complex were also found in these cells' cytoplasm.

GENETICS

Surprise connection

Mol. Cell **19,** 381–391 (2005)

Inside the cell nucleus, DNA wraps around proteins called histones. Chemical modifications of these proteins are thought to switch genes on and off. A study of the histone H3 provides clues to how sophisticated this control may be.

Adding methyl groups to the ninth amino acid in this protein's chain had been thought to deactivate genes. Gerd Blobel of the Children's Hospital of Philadelphia and his colleagues were therefore surprised to find di- and tri-methylation of this region in active genes. These modifications disappear when the gene is repressed. Other histone modifications must also be influencing the gene's status.

DORLING KINDERSLEY/GETTY IMAGES

JOURNAL CLUB

Douglas Hamilton
University of Maryland

Now you see them, now you don't, but at least this researcher knows why his favourite features of Saturn's rings have gone missing.

Images from the Voyager spacecraft in the 1980s revealed dark streaks across Saturn's rings, dubbed spokes. They grew rapidly to span thousands of kilometres, sheared apart, and then faded over a few hours.

These unusual structures are known to be composed of micrometre-sized dust grains, made by meteoroid impacts on large ring particles, but their evolution is not well understood. I had been working on this problem, and had come up with some very promising leads, based on models of the motions of charged dust grains. However, the late 1990s brought data that threatened to make my theory redundant.

Colleen McGhee from Wellesley College in Massachusetts and her colleagues were using the Hubble Space Telescope to monitor Saturn's rings. They found, mysteriously, that spokes lessened in number and intensity over several years, then disappeared altogether in late 1998. I learnt about these observations at meetings, and was left wondering what had happened to the spokes.

McGhee *et al.* now offer an elegant explanation for the spokes' remarkable disappearing act (*Icarus* **173,** 508–521; 2005). They suggest the spokes form a dusty scattering layer above the thin main rings. Until the mid-1990s, Saturn's rings were seen edge-on, so sunlight had to travel a long distance through the dusty layer before reflecting from the rings, making the spokes look dark.

Now, Saturn's rings are tilted towards the Sun. This geometry makes the spokes invisible to Earth-based telescopes, and even to the Cassini spacecraft currently orbiting Saturn. But the dusty spokes still exist, and so my budding theory survives.