RESEARCH HIGHLIGHTS

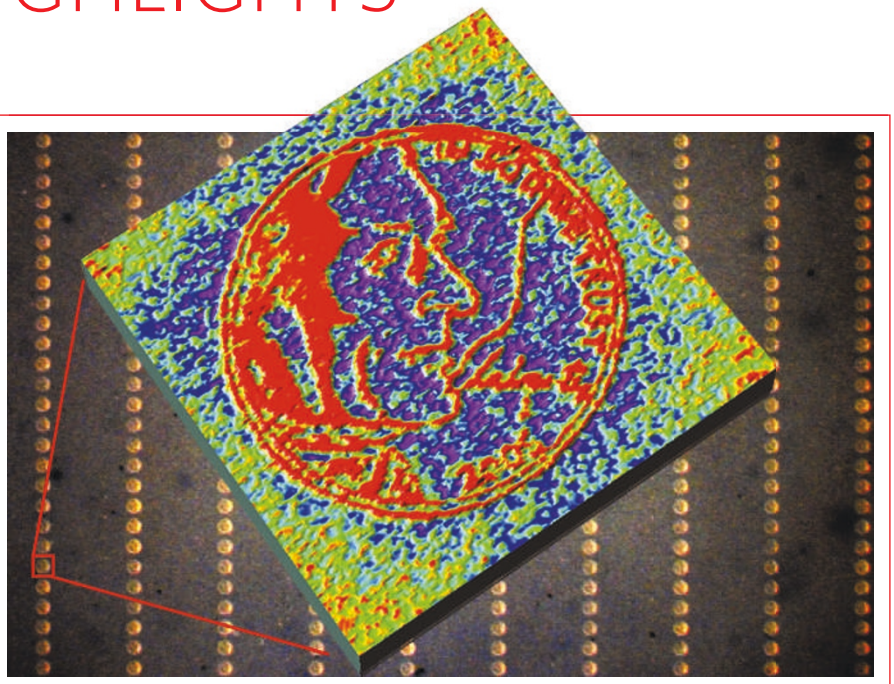
The big draw

Angew. Chem. Int. Ed. **45,** 1–4 (2006)

Fifty-five thousand pens, all writing at once, have been used to draw the same number of images of Thomas Jefferson in a square centimetre. Each portrait (pictured) is drawn with lines of dots 80 nanometres wide.

The 'pens' are silicon nitride tips attached to cantilevers and fixed side by side into a vast array by Chad Mirkin of Northwestern University in Evanston, Illinois, and his colleagues.

They used this equipment to perform massively parallel dip-pen nanolithography, in which 'ink' on the tips is transferred to a substrate at nanoscale resolution. This has a number of possible applications, and its use as a tool to build protein arrays for biological research is being explored.



ANGEWANDTE CHEMIE

CANCER BIOLOGY

A short-lived recovery

J. Clin. Invest. **116,** 2610–2621 (2006)

Some promising cancer therapies work by starving tumours of their blood supply, but what happens after treatment stops?

Donald McDonald of the University of California, San Francisco, and his colleagues treated tumours in mice with drugs that inhibit signalling by VEGF, a protein that promotes blood-vessel growth. Tumour blood vessels regressed, leaving behind an empty layer of connective tissue known as the basement membrane.

Unfortunately, only a week after therapy ceased, the tumours had been fully repopulated by active blood vessels. The authors speculate that the residual basement membrane acts as a scaffold, with new vessels growing through the tracks of the old ones. This tissue could be a worthwhile target for future therapies.

ECOLOGY

Flower arrangement

J. Evol. Biol. doi:10.1111/j.1420-9101.2006.01216.x (2006)

A project in California has unearthed hints that pollinators had a role in the divergence of the local monkey flower (*Mimulus aurantiacus*), which has red blooms near the coast and yellow blooms inland.

Evolutionary biologists Matthew Streisfeld and Joshua Kohn at the University of California, San Diego, studied the habits of hummingbirds and hawkmoths, which pollinate the flowers. They found that hummingbirds strongly preferred red flowers to yellow ones, whereas hawkmoths visited yellow flowers more than 99% of the time.

The researchers say that the inland range of red flowers may increase in future, because the hummingbird population, able to forage year-round in gardens, is thriving.

DRUG DISCOVERY

Pattern recognition

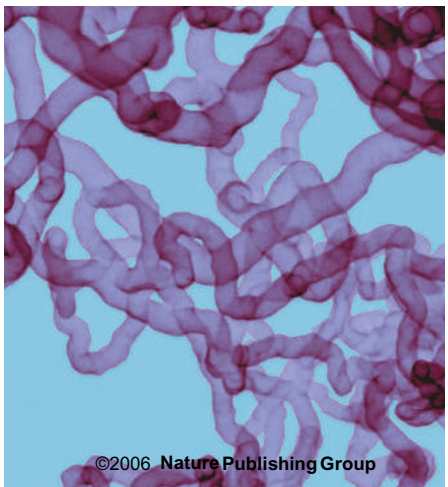
Science **313,** 1929–1935 (2006); *Cancer Cell* doi: 10.1016/j.ccr.2006.09.005 and 10.1016/j.ccr.2006.09.006 (2006)

Researchers have compiled a database of drug-associated gene-expression profiles to help in the search for new drugs.

Todd Golub of the Broad Institute in Cambridge, Massachusetts, and his colleagues used DNA microarrays, which reveal the level of activity of every known gene in a particular tissue, to measure the effects of 164 compounds on human cancer cells. Having input their results into a database, they designed software to make it possible to take any new microarray pattern and search the database for similar or opposite patterns.

This concept, reported in *Science*, has already proved its worth. Scott Armstrong at Children's Hospital Boston and his colleagues have used it to identify a possible way to counter drug resistance in acute lymphoblastic leukaemia. The database has also been used to reveal how certain compounds work, through similarities between the gene-expression profiles they evoke and those of compounds of known activity. Both findings are described in papers in *Cancer Cell*.

The team proposes expanding the database to feature signatures from cells treated with all approved drugs, and those from cells in which certain genes have been switched off.



NANOTECHNOLOGY

Sort it out

Nature Nanotech. **1,** 60–65 (2006)

Carbon nanotubes (pictured left) can be sorted by size and electronic type thanks to a method developed by chemists in the United States. Tubes of varying properties tend to be synthesized tangled up together.

The technology, developed by Mark Hersam's group at Northwestern University in Evanston, Illinois, is based on the centrifuge, in which rapid spinning causes objects of different density to separate. Its creators believe commercial opportunities abound for the method, because it can be easily scaled up.

PHOTOTAKE INC./ALAMY

The researchers added surfactants to separate the tubes by electronic type — sorting those with metallic properties from those that behave like semiconductors. The team suggests this works because a tube's conductivity determines how strongly the surfactants cling to its surface, which, in turn, affects density. The process can be repeated to obtain purer samples.

ANIMAL BEHAVIOUR

Thinking ahead

Nature Neurosci. doi:10.1038/nn1781 (2006)

Insight into how barn owls (pictured right) track their prey is provided by Eric Knudsen and his colleagues at Stanford University Medical School, California.

The researchers studied how an owl perceives a moving sound, presented through earphones. A part of the owl's brain known as the optic tectum is arranged to form a map of auditory space, with different neurons responding to sounds coming from different places. Electrical recordings of the activity of these neurons showed that the stimulus elicited a response in neurons corresponding not to the sound's current location, but to where its source would be about 100 milliseconds later.

This type of 'predictive perception' has previously been reported in humans. In owls, it should allow a bird to turn its head to spot the source of a noise — which might become its next meal.

MICROBIOLOGY

A toxin's accomplice

Proc. Natl Acad. Sci. USA doi:10.1073/pnas.0604865103 (2006)

Plants engineered to produce the *Bacillus thuringiensis* toxin kill the insects that feed on them. New research suggests that the toxin works by a previously unsuspected mechanism.

Jo Handelsman of the University of Wisconsin, Madison, and her colleagues found that moths fed antibiotics to sterilize their midguts are immune to *B. thuringiensis*, implying that the insects' natural gut bacteria underpin its potency. Restoring the gut bacteria reversed the effect.

It had been thought that the *B. thuringiensis* toxin might cause starvation, through damage done to cells lining the insect's gut. Instead, the team speculate that this damage triggers sepsis, because gut bacteria leak out. The researchers question whether similar synergies exist in some human diseases.

A. KNUDSEN

CHEMISTRY

Scent packing

J. Am. Chem. Soc. **128,** 11772–11773 (2006)

Isonitriles smell almost supernaturally bad, and one scientist has described their odour as "extremely distressing". As a result, their potential as tools in chemical synthesis has not been fulfilled.

Michael Pirrung and Subir Ghorai at the University of California, Riverside, have now synthesized isonitriles with pleasantly fragrant ester groups attached. These isonitriles retain their useful properties, but lose their stench. The resulting products, say the lab's 'smelling team', have various mild smells, from old wood to taffy.

In addition, the perfumed molecules deliver higher yields than the stinky versions in a common reaction — the Ugi conversion.

PARTICLE PHYSICS

Predictable flips

Preprint at http://arxiv.org/abs/hep-ex/0609040 (2006)

High-energy physicists have measured the oscillations of a particle that switches rapidly between matter and antimatter, bringing a 20-year effort to an end.

A team at Fermilab's Tevatron particle accelerator in Batavia, Illinois, studied the quick-switch nature of the B_s meson (which is composed of a bottom quark and a strange anti-quark) using a detector known as CDF II to track the decay of the mesons. They calculated that the particle oscillates between matter and antimatter three trillion times per second.

Previous work had only managed to set limits on the oscillation rate. This measurement pins down the properties of the particle, and agrees with the predictions of the standard model of particle physics.

JOURNAL CLUB

Michael Wagner
University of Vienna, Austria

A microbial ecologist discovers another benefit of sex.

Before studying microbiology I mostly associated bacteria with their negative effects, such as disease. So I was fascinated to learn that many bacteria live in eukaryotes such as humans, increasing the fitness or even securing the survival of their hosts. My interest in such symbioses has since shaped research in my lab.

My group investigates, among other things, the interactions between amoebae and their bacterial symbionts. But the research that most recently caught my eye was carried out in aphids — one of the best-studied model systems for symbiotic interactions between animals and bacteria.

Aphids not only harbour primary bacterial symbionts, which produce essential nutrients, but often also play host to secondary symbionts, which confer fitness benefits.

Both types of symbiont are known to be passed to offspring by the mother. But this alone cannot explain infection patterns in aphid populations, which suggest an additional mechanism for the transmission of secondary symbionts.

In a recent paper, Nancy Moran and Helen Dunbar at the University of Arizona in Tucson solved the riddle. They observed that secondary symbionts are abundant in the male aphid reproductive system and can stably infect the female during sex (N. A. Moran & H. E. Dunbar *Proc. Natl Acad. Sci. USA* **103,** 12803–12806; 2006).

Paternal symbiont transfer might be widespread — symbiont cells were recently observed in the sperm of a marine sponge (K. M. Usher *et al. Mar. Freshwater Res.* **56,** 125–131; 2005) and a nematode (G. R. Noel & N. Atibalentja *Int. J. Syst. Evol. Microbiol.* **56,** 1697–1702; 2006). Thus, at least for some animals, it seems that sex is not only about reproduction; it is also an opportunity to gain beneficial microorganisms.