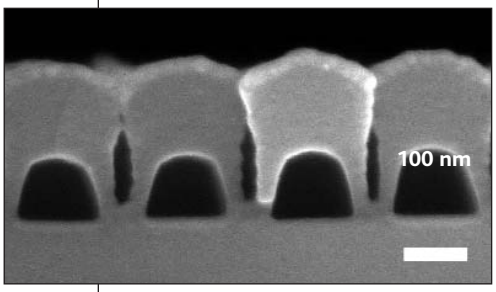
EDITORS' CHOICE

edited by Gilbert Chin

APPLIED PHYSICS

Channels Writ Small

With the goal of looking at molecules that bind at specific sites on a strand of DNA, Li *et al.* have begun to fabricate chips that orient single DNA molecules within nanofluidic channels and allow for near-field optical analysis. Self-sealing channels were made by patterning (via photolithography) sacrificial materials, which are then stripped away after a capping layer has been deposited. Polynorbornene (PNB) was used because it can be tailored to decompose over a wide range of temperature. For very small channels, the authors used nanoimprint lithography because the imprint master could be used rapidly and efficiently over many square centimeters. Channels with 20- to 100-nm cross sections were readily obtained, and refining the reactive ion-etching step of the process yielded tapered channels that connected submicrometer channels with those of much larger size. — MSL



A row of nanoteeth.

Nanotechnology **14**, 578 (2003).

ASTROPHYSICS

Squeezing a Cluster from a Dwarf

The ω Centauri globular cluster is the most massive and enigmatic cluster in the Milky Way Galaxy. It contains a mix of metal-poor stars with an east-west elongation and metal-rich stars with a north-south elongation, and it rotates faster than a typical cluster, giving it a more elliptical shape. Most clusters are modeled as forming from mergers of galaxies; however, ω Centauri can be modeled more consistently by capture and accretion.

Two N-body simulations suggest that ω Centauri is the nuclear remnant of a dwarf galaxy that fell into the Milky Way and had its outer components stripped by Galactic tides. Tsuchiya *et al.* modeled the evolving orbit and decreasing mass of the nuclear core as the dwarf galaxy was gravitationally captured by the Milky Way. The core settled into a radial, low-inclination orbit consistent with recent observations of ω Centauri. Mizutani *et al.* modeled the evolving orbit of the tidal debris: the streams of stars that were stripped from the dwarf. The tidal debris is consistent with a recently observed, large relative radial velocity stream with retrograde motion. — LR

Astrophys. J. **589**, L29; L89 (2003).

CANCER GENOMICS

Myc's Global Reach

Myc is an oncogenic transcription factor that contributes to more than 70,000 deaths annually in the United States. When expressed inappropriately, Myc causes uncontrolled cell proliferation, but the precise mechanism by which this occurs remains unclear. An early hypothesis that Myc regulates a small number of target genes crucial to cell cycle control has been called into question by recent gene expression profiling indicating that Myc affects the transcription of several hundred genes.

Genome-wide analyses of Myc binding sites by Orian *et al.* and Fernandez *et al.* are consistent with the revisionist view that Myc regulates the expression of a large and diverse set of target genes. Using different strategies and different organisms (fruit fly and human, respectively), the two groups independently conclude that Myc binds to several thousand coding sequences—or about 10% of all cellular genes. These surprising results raise the possibility that Myc malfunction may cause cancer through perturbation of multiple metabolic pathways in the cell—a hypothesis that will interest systems biologists. — PAK

Genes Dev. **17**, 1101; 1115 (2003).

GEOLOGY

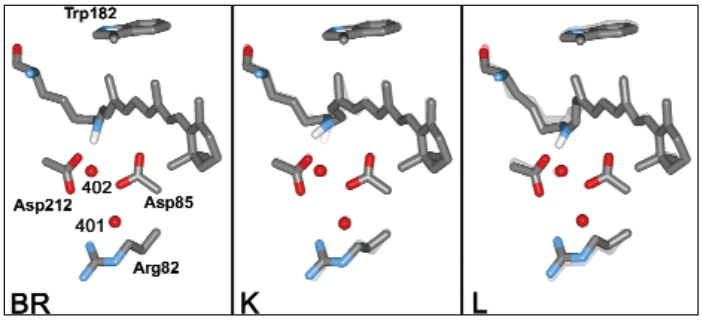
The Hazards of Overbuilding

Many oceanic volcanic islands subside after they form (and eventually become atolls) or sink and become seamounts. Some volcanic islands are still undergoing uplift, and these have the potential to generate tsunamis as a result of landslides that occur when part of an overbuilt island becomes too steep and collapses. Ancient slides have been observed around Hawaii in the Pacific and the Canary Islands off Africa in the equatorial Atlantic. The future hazard posed by the Canary Islands has been uncertain because its current and past dynamics have been less clear than for the Hawaiian Islands. Hildenbrand *et al.* stud-

BIOCHEMISTRY

Pushing H from K to L

The active transport of ions across cell membranes establishes electrochemical gradients that are then used to take in nutrients. Recently, atomic structures of membrane transporters have become available, and Lanyi and Schobert provide a close-up look at one of the early intermediates in the reaction cycle of bacteriorhodopsin. This protein catalyzes the conversion of light (a single photon) into the uphill transport of one proton from the inside to the outside of the cell. Absorption of the photon isomerizes the C13=C14 bond from trans to cis (the K state), which has the detrimental effect of rotating the proton (attached to the nitrogen of the Schiff base) away from nearby water molecule 402. Relaxation leads to the L state, in which the N-H rotates back toward water 402, which serves as a stepping-stone for the proton on its way to aspartate 85 and thence to the extracellular space. The angular and translational movements are small indeed, but they suffice to push a proton around. –GJC



Bacteriorhodopsin ground state (BR) and intermediates K and L; nitrogen atoms, blue; oxygen, red; mobile proton, white.

J. Mol. Biol. **328**, 439 (2003).

CONTINUED ON PAGE 1057

CREDITS: (LEFT) LI *ET AL.*, *NANOTECHNOLOGY* **14**, 578 (2003); (RIGHT) LANYI AND SCHOBERT, *J. MOL. BIOL.* **328**, 439 (2003)

ied the morphology and uplift age of La Palma, the westernmost Canary island. Their observations of slope and valley morphology and their dating of uplifted lava flows and sediments imply that this island has been (and still is) rising at a surprisingly constant rate of about 0.5 mm/year during the past 4 million years. — BH

Earth Planet. Sci. Lett. 10.1016/S0012-821X(03)00133-X (2003).

ECOLOGY/EVOLUTION

Not a One-to-One Mapping

One of the best examples of mutualism—evolved interdependence between two species of organism—is the relationship between figs and their pollinating wasps. Female wasps pollinate some of the fig's flowers, which are contained within a globular inflorescence (synconium), while laying eggs in others; the developing larvae feed on the floral tissues while seeds develop from the pollinated flowers; newly developed females then fly off to a new synconium, bearing pollen from their birthplace.

Female (winged) and male wasps.

Hitherto, most of the 700-plus species of fig have been thought to partner with their own species of wasp, in a remarkably stable pattern of coevolution between animal and plant spanning some 90 million years. Molbo *et al*. describe genetic data from fig wasps collected in Panama and suggest that there may be at least two previously undetected cryptic species of wasp in many fig species. Hence, rather than representing the classical paradigm of mutualistic coevolution in which a pair of taxa evolve in parallel, the fig-wasp relationship may be more evolutionarily labile. — AMS

Proc. Natl. Acad. Sci. U.S.A. **100**, 5867 (2003).

CHEMISTRY

Dendrimer-Coated Nanoparticles

Most polymers are synthesized by adding units to one end of a growing chain, but other architectures can be created by adding several monomer units at sites around a growing core. Dendrimers are the most ordered type of these polymers, in which each round of synthesis (or "generation") geometrically increases the number of units added. A relatively open structure after one or two generations is converted to an almost spherical structure after about five generations. Gopidas *et al*. adapted a synthesis route for gold nanoparticles that assembles dendrimer "wedges" (which grow out in a limited number of directions) into a spherical structure. Polyaryl ether wedges that are linked initially via disulfide bonds react with a stabilized solution of $HAuCl_4$ and sodium borohydride. A gold core about 2 to 3 nm in diameter forms. For low–generation number wedges (less than three), this spherical core gives the final structure more dendrimer-like properties. The fifth-generation wedges, however, still retain some openness that allows access to the gold core from solution. — PDS

J. Am. Chem. Soc. 10.1021/ja029544m (2003).

HIGHLIGHTED IN *SCIENCE*'S SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

Science's stke www.stke.org

An Inability to Stop Movements

Parkinson's disease, which results from degeneration of dopaminergic neurons projecting to the striatum, is treated with the dopamine precursor L-dihydroxyphenylalanine (L-DOPA). Although this treatment initially alleviates many of the motor symptoms, prolonged therapy leads to serious side effects, including dyskinesias. Picconi *et al*. used 6-hydroxydopamine to lesion dopaminergic neurons in a rat model of Parkinson's disease and administered therapeutic doses of L-DOPA. About half the rats recovered from the motor deficits produced by the lesion; the rest developed dyskinetic effects, meaning their motor performance actually worsened. Striatal long-term potentiation (LTP) was not seen in lesioned rats, but was rescued by chronic L-DOPA administration in both dyskinetic and nondyskinetic rats. Low-frequency stimulation reversed striatal LTP ("depotentiation") in nondyskinetic rats but not in dyskinetic rats. Pharmacological analysis indicated that depotentiation could be blocked by stimulation of the D1 dopamine receptor. Thus, the development of L-DOPA–dependent dyskinesias appears to reflect an abnormal persistence of striatal LTP. — EA

Nature Neurosci. **6**, 501 (2003).

CREDITS: (PHOTO) HERBERT STADELMANN