EDITORS' CHOICE

edited by Gilbert Chin

CHEMISTRY

NO More than Needed

Nitric oxide (NO) is implicated in many physiological processes. Hou *et al.* have developed a method that allows controlled generation of nanomolar amounts of NO. Their approach is based on self-assembled monolayers of organic compounds that contain an NO donor and that are bound to a gold electrode via a thiol linkage. When an electric potential is applied, one-electron electrochemical oxidation leads to the release of NO. The relationship between the amount of NO generated and the area of the electrode was found to be linear, indicating that the amount of released NO could be controlled easily by selecting an appropriately sized electrode surface area. This approach may be used in microelectrode arrays for biochemical applications. — JU

Chem. Comm. 2000, 1831 (2000).

GEOPHYSICS

Thicker Ice Sheets

The amount of water stored as ice in the major ice sheets in the Northern Hemisphere and Antarctica during the Last Glacial Maximum has been uncertain. More ice means higher elevations for the ice sheets, which alters global wind patterns and thus global climate, and lower sea levels. The weight of the great ice sheets also deformed Earth's entire surface; mapping this deformation and the gradual recovery in elevation of areas formerly covered by ice is the main method for reconstructing the ice mass (and also for determining the viscosity of Earth's interior).

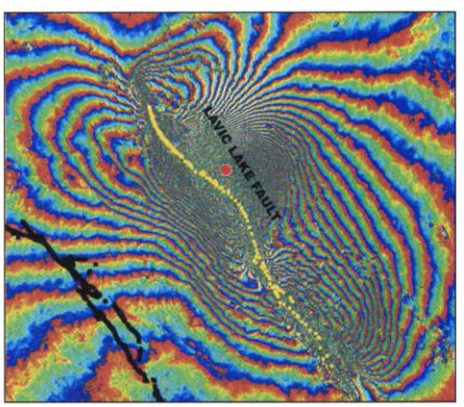
The problem is that records of post-glacial rebound in areas formerly covered by the large ice sheets are incomplete, extending back only about half way to the Last Glacial Maximum, about 20,000 years ago. On the basis of these records, several recent models have suggested that the ice sheets were relatively thin, for example, only about 2 kilometers high across Scandinavia. Lambeck *et al.* show, however, that the short rebound records still can be fit with thick ice sheets in both the Northern Hemisphere and Antarctica (extending to 3 kilometers or more in Scandanavia) if a portion of the ice sheets were to have melted quickly about 19,000 years ago, as some records imply. — BH

Earth Planet Sci. Lett. **181**, 513 (2000).

GEOLOGY

More Slip than Meets the Eye

The magnitude 7.1 Hector Mine earthquake ruptured about 45 kilometers (yellow trace) of the Mojave Desert in October 1999, about seven years after the nearby magnitude 7.3 Landers earthquake. These events occurred in the eastern California shear zone, an area that accommodates about 12 millimeters per year of strike-slip motion between the Pacific and North American plates. Determining the amount and spatial distribution of deformation associated with earthquakes is necessary to understand how stresses are distributed within the plates.



Interference fringes indicating ground motion around the epicenter (red circle).

SOURCE: SANDWELL *ET AL.*, *GEOPHYS. RES. LETT.* **27**, 3101 (2000).

Sandwell *et al.* obtained synthetic aperture radar interferometry (InSAR) images of the surface before and after the Hector Mine earthquake. The observations indicate about 1 to 2 meters more strike-slip offset than was mapped by geologists in the field. The additional slip probably derives from small offsets on nearby faults; their analysis also indicates triggered slip along nearby parallel faults on the west side of the main rupture, which may be a distributed zone of extension. — LR

Geophys. Res. Lett. **27**, 3101 (2000).

CELL BIOLOGY

Hidden Benefits

Prion diseases like the neurodegenerative disorder vCJD can be devastating. Two questions of interest are, why did prions evolve, and how are they maintained in the genome? True and Lindquist looked at yeast prions and discovered that they can be important in generating phenotypic diversity. One of the best-studied yeast prions is known as [*PSI*$^{+}$]. When switched on via a conformational change, it allows ribosomes to read through translational stop codons, which results in the synthesis of proteins with extra amino acids attached. These changes in protein expression profiles are capable of producing a phenotype conducive to fitness, depending on the particular environment within which the yeast cells grow. It is this potential for phenotypic variation that is thought to maintain the prion trait in the yeast genome and that may help it adapt to exploit environmental conditions. — SMH

Nature **407**, 477 (2000)

ECOLOGY

Diversity & Ecosystem Resilience

The relationship between biodiversity and ecosystem function has been a subject of intense debate among ecologists, especially in recent months. Most of the experimental work on this subject has compared the functional attributes of artificial plant communities constructed with different numbers of species. Griffiths *et al.* extend these studies to soil microbial communities, in which—rather than constructing communities of different species number—they compare function after reducing diversity by fumigation with chloroform.

After recovery of the populations of the remaining species, Griffiths *et al.* assessed community attributes such as nitrification, denitrification, decomposer activity, and response to added nutrients. No clear pattern emerged: some functions (decomposition) were enhanced by decreased diversity, while others (nitrification) were depressed. However, the low-diversity communities were consistently less able to recover from an applied perturbation. The implications are that there is some redundancy with respect to function among species in the higher-diversity communities, but that loss of species leads to loss of stability in these soils.

In a theoretical study, Ives *et al.* examine how such increased resilience to perturbation might arise from increased diversity in complex ecological communities. Their

CONTINUED ON PAGE 235

models indicate that such stability arises not from species number *per se*, but from the diversity across species of responses to environmental fluctuations. — AMS

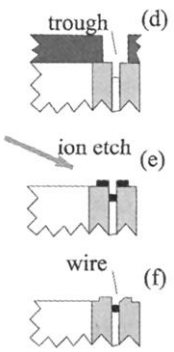
OIKOS **90**, 279 (2000); *Ecol. Lett.* **3**, 399 (2000).

APPLIED PHYSICS

Thin Metal Lines

As the dimensions of electronic circuitry shrink, so too does the need to understand the conduction mechanisms of the circuitry itself. Testing conduction behavior on this scale would require the availability of metal wires measuring only several nanometers in diameter and several micrometers in length. However, reproducible fabrication of such wires has been challenging, mainly due to limitations of lateral patterning techniques.

Natelson *et al.* demonstrate how molecular beam epitaxy, with its ability to grow layers with atomically precise thickness, can be utilized as a robust method for the fabrication of such wires. Cleaving a multilayer structure followed by masking and preferential etching forms a narrow and well-defined trench in the single quantum-well layer, into which the AuPd alloy is deposited by sputtering. This technique offers a test-bed for fabricating and measuring a variety of nanoscale structures. — ISO.



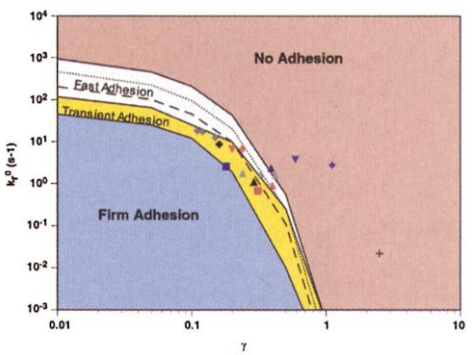
Constructing a metal nanowire in a trench.

Appl. Phys. Lett. **77**, 1991 (2000).

BIOPHYSICS

Slow Down, Stay Awhile

Cells that circulate through the body via blood vessels must, when appropriate, stop moving and attach to the endothelial cells lining the vessels, as when traveling leukocytes arrive at sites of inflammation. Previous work has identified many of the participant molecules (selectins and integrins) and measured the physical properties thought to be involved. Chang *et al.* now incorporate these data into their Adhesive Dynamics model in order to characterize the general relationship between molecular function and cellular behavior. They describe three main regions of cell interactions – no adhesion, transient adhesion, and firm adhesion – in terms of two influential parameters, the dissociation rate in the absence of stress k_r^o and the bond interaction length γ. The critical transition zone can be subdivided into fast and transient adhesion regimes, where a slight change in either parameter shifts the predicted behavior from that of a rolling cell to one that moves in spurts. — GJC



A state diagram for adhesive interactions.

Proc. Natl. Acad. Sci. U.S.A., in press.

HIGHLIGHTED IN *SCIENCE'S* SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

Science's stke
www.stke.org

Survival of the Fattest

After proliferation is complete, many mature cells require persistent stimulation by growth factors to ward off apoptosis. How cell death is avoided in such circumstances has not been elucidated. Stimulation by growth factors could block one or more events in a constitutive death pathway, or could simply maintain cellular metabolism at a level that supports cell survival.

Rathmell *et al.* studied the stimulatory requirements of a lymphoid cell line that requires interleukin-3 (IL-3) for survival, and of primary T cells that require stimulation of antigen receptors. They found that survival factors appear to function by altering basic nutrient uptake. In the absence of receptor stimulation, cells lost the glucose transporter Glut1 and showed diminished mitochondrial function. When glucose was removed from the culture medium, survival factors no longer prevented cell death. These results indicate that mature unstimulated lymphocytes do not inherently achieve metabolic homeostasis, but rather operate under dynamic regulation by extracellular signals. — LBR

Mol. Cell **6**, 683 (2000).

CREDITS: (LEFT) NATELSON *ET AL.*, *APPL. PHYS. LETT.* **77**, 1991 (2000); (RIGHT) CHANG *ET AL.*, *PROC. NATL. ACAD. SCI. U.S.A.*, IN PRESS.