EDITORS' CHOICE

edited by Stella Hurtley

GEOLOGY

Ice Shelf Retreat

Several small ice shelves around the Antarctic Peninsula retreated during the late 20th century due to regional climate warming. Did similar retreats occur through natural climate variability during the past 10,000 years?

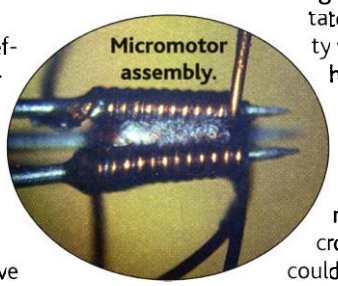
Pudsey and Evans have now addressed this question by studying the history of the Prince Gustav Channel ice shelf. During periods when the shelf had retreated and the channel was open for at least part of the year, ice-rafted debris from icebergs would be deposited in the sediment at the bottom of the channel. Such debris was found in sediment cores from the channel that were between about 5000 and 2000 years old. Before and after this period, the channel remained closed. The period when the channel was open coincides with a period of local warming. With the return of colder conditions about 1900 years ago, the Prince Gustav ice shelf reformed until its recent retreat. Thus, ice shelves are sensitive indicators of regional climatic change, and recent warming is exceptional for at least the past 1900 years. — JU

Geology **29**, 987 (2001).

MICROFLUIDICS

Stir Bars in Miniature

Mixing fluids at micrometer size is challenging because of the increasing importance of surface effects on fluid motion and because of difficulties associated with the miniaturization of mechanical systems.



Barbic *et al.* have added another option to the microfluidics designer's toolbox by devising a small-scale analog of the magnetic stirrer. They created a long cylindrical stir bar using electrodeposition of nickel into a porous substrate. The rotor retained its magnetization parallel to its long axis and thus did not need to be magnetized by an outside source. The stator assembly was made from three soft ferromagnetic core wires, each of which was manually wound with a current-carrying wire and etched in order to focus the magnetic field. The cores were positioned in an equilateral triangle arrangement, and the sinusoidal current in each wire was 120° out of phase with its neighbors, thus causing the rotor to rotate. Lower viscosity fluids allowed higher rotation rate but with less control over the lateral motion of the rotor. Such a micromotor system could be used to form a micro pump, stirrer, or flow control valve. — MSL

Appl. Phys. Lett. **79**, 1399 (2001).

BIOMEDICINE

Mobilizing the Rescue Squad

Certain cytokines such as G-CSF mobilize hematopoietic progenitor cells (HPCs), releasing them from the bone marrow. These cells can be collected from the blood of cytokine-treated leukemia patients before chemotherapy and reinfused after treatment to restore the patient's bone marrow. However, it is still not clear how cytokines elicit HPC mobilization.

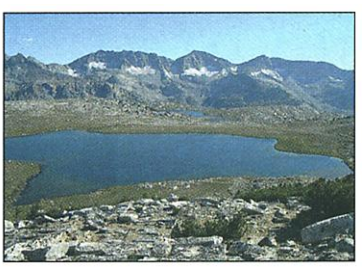
Lévesque *et al.* report that G-CSF severs the connection between HPCs and the bone marrow stromal cells to which they are tethered. Apparently, G-CSF induces mouse bone marrow neutrophils to release two enzymes—neutrophil elastase and cathepsin G—which clip an adhesion molecule, VCAM1, from the surface of bone marrow stromal cells. VCAM1 binds to a β-integrin, VLA4, on the surface of HPCs, and thus cleavage of VCAM1 frees HPCs from their connection to the bone marrow stroma. Only bone marrow–derived neutrophils release proteases in response to cytokines. In patients before and after cytokine therapy, the increase in peripheral blood HPCs after treatment was mirrored by an increase in soluble VCAM1 in serum. Thus, G-CSF also promotes VCAM1 cleavage in humans, and this cleavage is directly related to HPC mobilization. — OMS

Blood **98**,1289 (2001).

ECOLOGY

Resistance and Resilience

The "resistance" of an ecosystem to a perturbation, such as the introduction of an alien species, is a measure of how much the system changes. Its "resilience" is the extent to which it can recover after the source of change is removed.



Alpine lakes in the Sierra Nevada.

Knapp *et al.* have studied the effects of fish introductions and removals on the biota of hundreds of naturally fishless alpine lakes in western North America. The resistance of the lake faunal assemblages to trout stocking was low; the abundance of amphibians and larger invertebrates decreased dramatically, whereas the abundance of smaller planktonic invertebrates often increased. More surprisingly, the resilience of the lakes turned out to be high. In lakes where trout stocking ceased and where there was no suitable trout spawning habitat, the animal assemblages recovered to compositions characteristic of undisturbed lakes, depending on the length of fish occupancy. Thus, further fish removals may be required to protect the fauna of alpine lakes in U.S. national parks and forest wilderness areas, most of which still contain trout. — AMS

Ecol. Monogr. **71**, 401 (2001).

GEOCHEMISTRY

Shielding Bacteria

Archean bacteria living about 2.5 billion years ago needed to be able to withstand high levels of UV irradiation because of the lack of atmospheric oxygen as a UV screen. Many early bacteria may have survived in a deep marine environment where the water provided UV shielding. However, there is evidence in the geological record of microbial mats and stromalites that inhabited shallow water environments, which would require some other means of UV protection.

Phoenix *et al.* placed cultures of cyanobacteria isolated from the Krisuvik hot springs, Iceland,

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SOURCE: (TOP) BARBIC *ET AL.*, *APPL. PHYS. LETT.* **79**, 1399 (2001); (BOTTOM) ROLAND A. KNAPP/SIERRAN NEVADA AQUATIC RESEARCH LABORATORY/UNIVERSITY OF CALIFORNIA

in a silicon- and iron-rich solution. Rims of iron-enriched silica formed around the cells, and the cultures were then exposed to UV irradiation. Cells continued to grow within the mineralized rims even under intense UV. Thus, biomineralization may have helped the simplest forms of life to thrive in the intense sunshine of the Archean. — LR

Geology **29**, 823 (2001).

MEDICINE

Swings and Roundabouts

Although introduced only 2 years ago, cyclooxygenase-2 (COX-2) inhibitors are already commonly prescribed in place of aspirin and nonsteroidal anti-inflammatory drugs (NSAIDs). These new drugs offer similar therapeutic benefits but have greatly reduced gastrointestinal side effects.

A new study by Mukherjee *et al.*, however, suggests that the benefits of COX-2 inhibitors may come hand in hand with some unexpected risks. Analyzing the published results of randomized clinical trials that compared COX-2 inhibitors with NSAIDs for treatment of arthritis and musculoskeletal pain, the authors found that thrombotic cardiovascular problems were more likely to occur in individuals taking the COX-2 inhibitors. Whether this is because the COX-2 inhibitors do not provide the antithrombotic effects of NSAIDs and aspirin or because they are prothrombotic is unclear. In animal studies, COX-2 has been shown to limit the extent of damage in ischemic heart tissue. Consistent with this, Dowd *et al.* show that COX-2 inhibition in rats exacerbates the heart damage caused by doxorubicin, a commonly used chemotherapeutic drug for cancer. — PAK

JAMA **286**, 954 (2001); *J. Clin. Invest.* **108**, 585 (2001).

BIOCHEMISTRY

Baseless Allegations?

The elucidation of high-resolution structures of RNA enzymes has fueled discussion about the catalytic abilities of ribonucleotides, specifically of the purine and pyrimidine bases. Because their pK_a's lie outside the physiological pH range, recent work has focused on whether the pK_a's have been shifted to enable the enzymes to function as general acid-base catalysts. Three recent reports examine these issues.

Bayfield *et al.* examined the pH dependence of dimethylsulfate modification of adenosine 2451 (A2451) in the 23*S* ribosomal RNA of the *Escherichia coli* large ribosomal subunit. The differential reactivity of A2451, which had been interpreted to reflect a shift of the pK_a from very acidic values to almost neutral pH, appears instead to be the result of a conformational change due to the loss of a critical monovalent cation. Thompson *et al.* explored the role of A2451 by making mutations at this position and assessing protein synthesis activity in vivo and in vitro of ribosomes containing these ribosomal RNA variants. All three mutated ribosomes (to C, G, or U) displayed diminished translational fidelity; nevertheless, all possessed peptidyl transferase activity, suggesting a largely functional catalytic apparatus. Lupták *et al.* used ^{13}C NMR to probe the active site cytosine in the hepatitis delta virus ribozyme. Its pK_a was about 5.0 in both product and precursor states, and thus a transient shift toward neutral pH would need to occur during the enzyme's trigonal bipyramidal transition state in order to accord with existing kinetic data. — GJC

Proc. Natl. Acad. Sci. U.S.A. **98**, 10096; 9002 (2001); *J. Am. Chem. Soc.* 10.1021/ja016091x.

ASTROPHYSICS

The Life and Times of SagDeg

The Sagittarius dwarf elliptical galaxy (SagDeg) is on a collision course with the Milky Way and in the next few billion years will be tidally disrupted by its larger neighbor. The SagDeg galaxy has had a long history (about 10 billion years) of star formation; however, the details of SagDeg's stellar life are poorly understood.

Using the photometric uniformity and precision of the Two Micron All Sky Survey, Cole has derived a new color-magnitude diagram of about 1400 red giant stars in the center of SagDeg that shows a large spread in the mean metallicity. A larger fraction of high-metallicity–to–low-metallicity stars was found, indicating a longer history of star formation than previously suggested. This enhanced stellar history is also surprising given SagDeg's current lack of gas. It is possible that SagDeg used to be a larger galaxy that is now in the last stages of tidal disruption or that it captured some Milky Way gas on a previous close passage. — LR

SagDeg (red) and the Milky Way.

CREDIT: G. GILMORE & R. SWORD

Astrophys. J., in press.