# EDITORS' CHOICE

edited by Gilbert Chin

MATERIALS SCIENCE

## Laser Patterning Lightly

The deposition of thin films of reactive metals can damage or even melt the underlying substrate. One solution to this problem is to use a rare-gas "buffer layer" that can absorb and dissipate energy, and thereby allow a cooled film to "soft land" on the surface. Kerner and Asscher combine soft landing with laser-induced thermal desorption to create potassium nanowires that are less than 30 nm wide and 5 mm in length on a ruthenium substrate. Laser gratings are used to desorb regions of unwanted potassium and its xenon buffer layer. A slower thermal annealing step removes the remaining xenon buffer, and the potassium wires absorb gently onto the substrate. In a commentary, Weaver and Antonov argue that the buffer-layer approach should prove to be a general way of patterning "almost anything on anything." — PDS

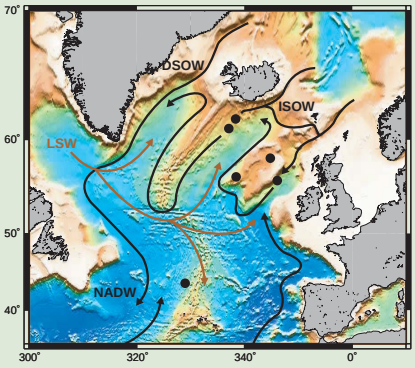
*Surf. Sci.* **557**, 5;1 (2004).

CLIMATE SCIENCE

## A Constant Conveyor

One of the most commonly accepted views of the relation between climate and ocean circulation is known popularly as the "global conveyer," meaning that deep water forms in the North Atlantic Ocean in large amounts during interglacial periods and in smaller volumes during glacial intervals, producing significant changes in the rate of large-scale ocean circulation. Much of the evidence for this belief is based on studies of the carbon isotopic composition of benthic foraminifera, i.e., those that lived on the sea floor over the last glacial/interglacial cycle.

Raymo *et al.* examine this proposition in more detail by comparing and contrasting carbon isotopic profiles from seven sites in the North Atlantic covering the last 27 glacial cycles, a time span of nearly 2 million years. They suggest that the production rate of North Atlantic Deep Water (NADW), the motive force behind the global conveyer, has not varied significantly on glacial time scales during most of that interval, despite dramatic differences in climate state and ice volume. Instead, they propose (i) that the variability of NADW production observed over the last deglaciation is not typical, (ii) that the carbon isotopic signature in the region where much of the NADW originates is unusual during this anomalously warm interglacial period, and (iii) that this possibility must be considered when using benthic carbon isotopic records to infer past ocean circulation changes. — HJS



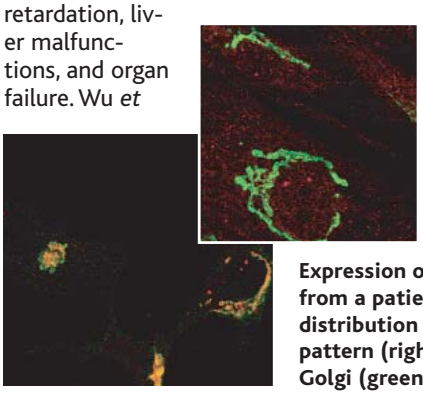

**Drill sites (black dots) and the major NADW components: Labrador Seawater (LSW), Denmark Strait Overflow Water (DSOW), and Iceland Sea Overflow Water (ISOW).**

*Paleoceanography* **19**,10.1029/2003PA000921 (2004).

BIOMEDICINE

## Missing COGs

Protein glycosylation is important for the function of many secretory and membrane proteins. In humans, congenital disorders of glycosylation (CDG) can result in problems in many physiological systems, leading to mental retardation, liver malfunctions, and organ failure. Wu *et al.* describe the cellular consequences of CDG in two siblings who were identified as having the same point mutation in a gene encoding the COG-7 subunit of the conserved oligomeric Golgi (COG) complex. The COG complex is involved in maintaining Golgi membrane traffic and thereby in promoting proper glycosylation. Fibroblasts from the patients were deficient in COG-7 and exhibited an aberrant distribution of COG complex components, and also showed altered membrane traffic through the Golgi and disrupted glycosylation patterns. The normal cellular phenotype could be restored by engineering the expression of COG-7. Thus, fatal forms of CDG may be the result of a Golgi trafficking defect, rather than the outcome of defects in specific glycosylation enzymes. — SMH



**Expression of COG-7 (left) in cells from a patient converts the COG-5 distribution (red) from a diffuse pattern (right) to localization in the Golgi (green).**

*Nature Med.* 10.1038/nm1041 (2004).

ECOLOGY

## No Shortcuts in Long-Term Study

Eutrophication—the effects of nutrient enrichment on ecosystems—has become a familiar phenomenon worldwide. Usually, it is a direct result of the use of fertilizers on agricultural land, and effects are especially noticeable in freshwater ecosystems, often leading to large changes in species diversity and composition. Eutrophication resulting from human activity can also occur indirectly. In the Arctic, for example, a warmer climate is likely to increase permafrost thawing, which in turn may release more nutrients into streams and rivers.

To investigate possible outcomes in Arctic rivers, Slavik *et al.* experimentally increased the phosphorus (P) loading in the Kuparuk River basin, Alaska, over 16 years. Changes were progressive, with increases in diatom biomass and productivity after 4 years, followed by replacement of diatoms by mosses after 8 years, with further effects on the entire habitat structure and the composition of insect communities. Thus, some of the consequences of nutrient enrichment are delayed and unpredictable and can only be understood and evaluated through long-term study. — AMS

*Ecology* **85**, 939 (2004).

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Carlsbad Cavern.

CREDIT: NEW MEXICO DEPARTMENT OF TOURISM

GEOCHEMISTRY

## Bacterial Spelunkers

Caves are typically formed in limestone deposits, made up primarily of calcium carbonate ($CaCO_3$), and cave formation is driven by carbonic acid dissolution of the carbonate rocks. In the Lower Kane Cave in Wyoming, the presence of a hydrogen sulfide–rich ($H_2S$) thermal spring and gypsum deposits ($CaSO_4$) suggested that volatilization of $H_2S$ from the spring water, oxidation of the $H_2S$ gas to sulfuric acid, and reaction of the sulfuric acid with calcium carbonate had produced gypsum and that dissolution of the gypsum by water would contribute to cave formation.

Engel *et al.* have found that sulfur-oxidizing bacteria, not aqueous geochemistry, actually control cave growth. The bacteria oxidize $H_2S$ either completely to sulfate for energy or partially to elemental sulfur that is stored intracellularly for later use. The locally produced sulfuric acid attacks the rock matrix on which the microbial mats live, converting the carbonate to gypsum. This sequence of reactions not only buffers the environmental pH of the microbial ecosystem but can occur over a wide range of conditions, potentially affecting porosity and conduit growth in deeper caves, oil field reservoirs, and aquifers. — LR

*Geology* **32**, 369 (2004)

MEDICINE

## A Stent (or Two) in Time Saves

Each year more than 900,000 patients with coronary artery disease are treated by angioplasty, followed by implantation of a coronary stent, a mechanical device designed to keep the artery open. Nevertheless, in 20 to 30% of the cases, the stented artery narrows over time and often requires further treatment to reduce blockage. This occurs because vascular smooth muscle cells migrate into the lumen of the stent and proliferate, forming scar tissue. To address this restenosis problem, a number of pharmaceutical companies have developed drug-eluting stents: devices coated with a thin polymer that slowly releases an antiproliferative drug.

Holmes *et al.* and Stone *et al.* report the results of two large randomized clinical trials designed to assess the efficacy of stents, releasing the drugs sirolimus (rapamycin) and paclitaxel, respectively. In both trials, after 1 year of patient follow-up, the drug-eluting stents performed significantly better than bare-metal stents, reducing the frequency of vessel retreatment to less than 5%. Although these results are encouraging, it remains unclear whether the drug-eluting stents are inhibiting or simply delaying restenosis—a question that can only be addressed through longer-term studies. — PAK

*Circulation* **109**, 634;1942 (2004).

APPLIED PHYSICS

## Intimacy Can Be a Blessing

When single-walled carbon nanotubes are synthesized, the end product typically consists of a bundled mixture of metallic and semiconducting tubes. For most applications, it would be preferable to isolate one of the nanotube types. In trying to solve an ongoing problem with gallium nitride light-emitting diodes (LEDs), Lee *et al.* show that this intimate mixture of tubes can be a blessing. Conductivity at the junction between two materials is governed by how well their band structures line up. For n-type GaN, direct contact with the metal works well, but this is not true for p-type GaN. By adding a 100-nm-thick transparent film of carbon nanotubes, they could reduce the contact resistance at the p-GaN junction by a factor of 3, when compared to the directly connected Ni/Au junction. The nanotube layer had the added advantage of increasing the thermal stability of the p junction, making it possible to anneal the n contact with the p junction already in place. This kind of nanotube junction should reduce problems caused by electromigration of atoms in high electric fields, due to the strong bonding of the carbon atoms within the tubes, and the use of this intermediary layer may find application in ZnO-based devices. — MSL

*Nano Lett.* 10.1021/nl0496522 (2004).