MEETING AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Globe-Girdling Science in The Golden Gate City

SAN FRANCISCO—Amid halls abuzz with talk of the human genome, the American Association for the Advancement of Science's annual meeting (16 to 20 February) covered topics ranging from the nuts and bolts of international S&T policy to the resilient wiring of the brain.

Lake Vostok: Stirred, Not Shaken

The world's biggest hidden lake may not be as quiet as scientists thought. New analysis of the geologic setting of Lake Vostok, a vast crescent of fresh water beneath 4 kilometers of ice in Antarctica, suggests that its waters may churn vigorously enough to feed a suspected ecosystem of microbes. Furthermore, seismic activity in the area means that mineral-rich fluids—and possibly heat—may seep into the lake from below.

"Every time we go to Lake Vostok, we learn something new," says Karl Erb, director of the National Science Foundation's (NSF's) Office of Polar Programs. The latest work, he says, adds impetus to efforts to penetrate the lake's thick mantle of ice, which has shielded its waters from the surface for millions of years.

Lake Vostok, one of at least 76 lakes trapped under Antarctica's ice pack, is the size of Lake Ontario. Russian seismic studies show that it plunges up to 1000 meters deep within a rugged valley. Last year, glaciologist Martin Siegert of the University of Bristol, U.K., and his colleagues used three airborne radar surveys to analyze the profiles of ice layers above the lake. The slopes of the layers hinted that 10 centimeters of ice melts each year at the northern and western margins of the lake, where the melting temperature is lower because of pressure from the thicker overlying ice. Water then refreezes onto the base of the ice at the lake's other end. This slow circulation, Siegert's team deduced, would replace the lake's volume every 50,000 years to 100,000 years.

CREDIT: EDWARD ADAMS *ET AL*./MONTANA STATE UNIVERSITY

Icy manna. Bacteria-rich sediments in antarctic ice may seed life in the dark waters of Lake Vostok, which lies under 4 kilometers of ice in the heart of the continent.

Fresh fieldwork now paints a more detailed picture. A team led by geologist Robin Bell of Columbia University's Lamont-Doherty Earth Observatory in Palisades, New York, spent 33 days at Vostok in December and January. The scientists crisscrossed the lake more than 60 times with an NSF Twin Otter aircraft packed with radar equipment. They saw dramatic variations in the thicknesses of ice layers above the water, caused by melting and refreezing during the 15,000 to 20,000 years it takes the ice to traverse the lake.

The team hasn't yet analyzed its data thoroughly, but Bell thinks the melting-refreezing cycle is about three times faster than what Siegert estimated. The overlying ice sheet also buckles and deforms as it drifts over the lake and nearby mountains. That probably spawns local patches of faster water circulation, Bell notes.

The researchers also put two seismometers on the ice at the start of their field season. They caught a magnitude 3 earthquake in the area on 5 January, Bell reported. Three other quakes have struck the region in the last century, with likely magnitudes between 4 and 5, according to historic records. The motions make sense, Bell says, because radar images of steep topography along one side of the lake suggest that Vostok sits at a restless geologic boundary: "It's not a piece of quiet old crust. The earth is actively moving."

Bell doubts the crustal jigglings are enough to sustain geothermal vents under Lake Vostok. Still, even a seepage of cold fluids into the lake could yield energy for the cold and isolated ecosystem that Vostok may harbor, says ecologist John Priscu of Montana State University in Bozeman. Faster circulation would make those mineral nutrients waft throughout the lake.

As for the biological seeds, Priscu notes that carbon-rich sediments and bacteria blown onto Antarctica should take about 450,000 years to migrate down through the ice and enter the water. Indeed, Russian ice corings that came within 120 meters of the lake are riddled with bacterial cells in refrozen Vostok water, Priscu and others have claimed (*Science*, 10 December 1999, pp. 2138, 2141, 2144).

Based on his studies of the ecology of other antarctic lakes, Priscu suspects that Vostok's waters host a million bacterial cells per milliliter. "It's an extrapolation, but there should be a thriving community," he says. However, Erb thinks it will take a decade for scientists to develop the sterile drilling tools needed to sample the lake without contaminating it. Part of the delay, he explains, is that Vostok belongs to no one. "It's an international treasure," Erb says. "We cannot act unilaterally." **–ROBERT IRION**

Stem Cells Make Brain Cells

As the future of stem cell research teeters on the unsteady ground of political controversy, the case for its potential benefit grows more solid. At the meeting, neurotransplant researcher Ole Isacson of Harvard Medical School in Boston reported that embryonic stem cells implanted in the brains of rats and mice grow into the types of cells that wither in Parkinson's disease.

"This is interesting, because it implies that all the instructive mechanisms [for these cells' maturation] are present in the adult brain," says neuroscientist Ron McKay of the National Institute of Neurological Disorders and Stroke in Bethesda, Maryland. The results raise hopes that researchers will learn to fix the nerve damage that causes Parkinson's without transplanting fetal nerve cells—a technique beset by practical and ethical concerns.

Parkinson's disease, which afflicts 1 million people in the United States, kills a class of brain cells that produces dopamine, one of the brain's chemical messengers. Drug therapy helps for a while, but it provokes side effects and ultimately can't keep up with the progressive disease.

Testing an alternative, clinicians have implanted fetal neurons into the brains of dozens of Parkinson's patients. In many cases, this procedure has produced long-lived, dopamine-producing cells and reversed symptoms of the disease, such as rigidity, slowness, and tremor. But fetal tissue is scarce.

Stem cells—unspecialized cells that have not yet committed to a particular fate—may help overcome that problem. Each fetal transplant requires material from several fetuses, whereas the types of cells Isacson used can be mass-produced in a test tube from a single embryo.

Isacson and colleagues found that stem cells can compensate for some Parkinson's-like damage in animals. The researchers implanted cells originally taken from mouse embryos into the brains of rats and mice whose dopamine-producing neurons had been obliterated by a toxin. Inside the part of the brain that Parkinson's disease targets, the immature cells developed into neurons that made dopamine-producing enzymes. They also connected with nearby brain cells, just as transplanted fetal nerve cells do, Isacson says.

Renewed connections. Mouse embryonic cells implanted into a rat's damaged brain develop into neurons (golden brown) that hook up with host cells.

"We hope that we can do with stem cells what we've done with fetal dopamine-producing cells," he says. "All these things together imply that these cells will be able to do the job of reversing symptoms."

To see whether that is so, Isacson has undertaken studies of brain activity that probe possible symptomatic benefits to the animals. Although he's not yet ready to present the experiments, "they show some very, very encouraging results," he says.

If these results pan out and extend to humans, they could uncork a serious bottleneck to Parkinson's treatment. Embryonic stem cells can be gathered from unused embryos, which fertility clinics discard by the thousands each year. McKay and other researchers have figured out how to grow dopamine-producing cells from mouse embryonic stem cells in culture dishes, but with Isacson's method, "you just take cells and put them in the brain," McKay says. "You don't need to purify them, you just shove them in."

If organs other than the brain show a similar knack for programming cells, therapies based on simple stem cell transplantation might provide cures for cardiovascular disease, diabetes, and multiple sclerosis, McKay says: "Parkinson's disease may stop being the poster child for [the stem cell] field."

But serious political obstacles may lie ahead, researchers said, as antiabortion groups pressure President Bush to ban federal funding for research on stem cells derived from embryos. However, one commentator at the meeting—Jeffrey Martin, a private-sector Republican lawyer with Parkinson's who advises the National Institutes of Health (NIH) about the disease—was optimistic that the president is keeping an "open mind."

Instead of issuing a ban immediately after his inauguration, Martin pointed out, Bush has ordered Secretary of Health and Human Services Tommy Thompson to review the NIH guidelines affecting such research. Thompson has commended stem cell research in the past, Martin says. "He's antiabortion, but he sees the distinction. Because he gets it, I think that's a hopeful sign."

—EVELYN STRAUSS

The Melting Snows of Kilimanjaro

"As wide as all the world, great, high, and unbelievably white in the sun, was the square top of Kilimanjaro." Those evocative words by Ernest Hemingway describe a scene that could vanish within 20 years, according to new field research reported at the meeting. More than 80% of the ice on Africa's highest peak has melted since the early 20th century, joining other glaciers that are ebbing from the world's tropical mountains at an accelerating rate.

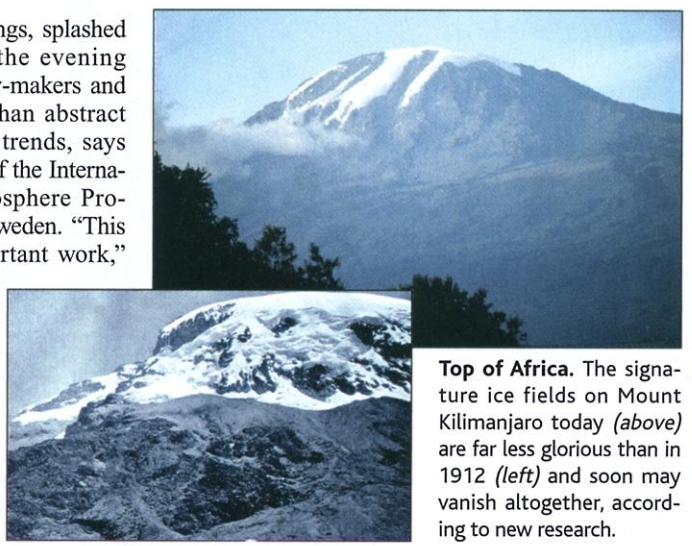
The dramatic findings, splashed on front pages and the evening news, may spur policy-makers and the public far more than abstract warnings of climatic trends, says Will Steffen, director of the International Geosphere-Biosphere Program in Stockholm, Sweden. "This is exceptionally important work," Steffen says. "Tropical glaciers are a bellwether of human influence on the Earth system." The past decade's warm years, it seems, have sounded that bell with unexpected force.

Ice in the tropics sits at the knife edge of climate change. Slight temperature increases push the snowline to ever-higher altitudes, saturating fields of ice with water. Glaciers, which normally drain slowly from an ice cap and maintain a steady size, begin to melt and retreat. Researchers have observed ice waning on peaks in Kenya, Venezuela, New Guinea, Ecuador, and elsewhere. The famous ice fields on Kilimanjaro and in Peru appear especially frail.

Aerial mapping of Kilimanjaro's summit in February 2000 revealed a 33% loss of ice since the last map in 1989 and an 82% decline since 1912, says geologist Lonnie Thompson of Ohio State University's Byrd Polar Research Center in Columbus. Just 2 weeks ago, Thompson's colleagues measured the levels at survey poles that they inserted into the ice pack last year. More than a meter of ice had melted in 12 months, out of a total thickness of 20 to 50 meters. "It won't take many more years like that to completely melt the ice fields," Thompson says.

Moreover, Thompson's group has documented runaway melting at Quelccaya, a massive ice cap in the Andes of Peru. Surveys reveal that Qori Kalis, Quelccaya's main drainage glacier, has retreated 155 meters per year since 1998. That's 32 times faster than the rate between 1963 and 1978. The area of the ice cap itself has shrunk from 56 square kilometers in 1976 to 44 square kilometers today. The hastening pace suggests that it too may dribble away within 20 years, says Thompson.

These mass meltings have both scientific and social consequences, Thompson says. Without corings from tropical ice packs, climatologists will soon lose a valuable way to reconstruct El Niño histories and other patterns in the tropics for the last several thousand years. Already, he adds, water is flowing through the porous ice and smearing out the annual chemical signals.



Top of Africa. The signature ice fields on Mount Kilimanjaro today *(above)* are far less glorious than in 1912 *(left)* and soon may vanish altogether, according to new research.

CREDITS (LEFT TO RIGHT): O. ISACSON/HARVARD MEDICAL SCHOOL; E. OEHLER (1912); LONNIE THOMPSON *ET AL.*/OHIO STATE UNIVERSITY (2000)

Citizens will feel different impacts. As Quelccaya and other Peruvian ice fields disappear, sources of irrigation and hydroelectric power will dry up. Peru and other nations may need to burn more fossil fuels to compensate, exacerbating the warming trend. And in Tanzania, government officials worry that a denuded Kilimanjaro will lose tourist appeal. "One of the attractions is to see ice at

3 degrees [latitude] south of the equator," Thompson observes.

Steffen praises Thompson's team for its long timeline of 20 years or more at sites around the globe. "That's essential for the data to have a public policy impact," he says. He envisions one other ice-related signal that might resonate as strongly: large-scale melting of Arctic sea ice (*Science*, 19 January, p. 424). "The question has been, 'How fast will the Earth system respond to these changes in heat?' " Steffen says. From the top of Africa to the top of the world, the answer appears to be very fast indeed. **–ROBERT IRION**

The Flip Side of Obesity Research

In recent years, researchers have learned a lot about how the body regulates its weight. The findings are driven in part by the prospect of developing "thin pills" for people who crave calories but loathe exercise. But the same research may help patients who need to gain weight but can't.

At the AAAS meeting, researchers showed how a brain pathway that holds promise for obese people may also be key to battling the devastating weight loss seen in some patients suffering from cancer, rheumatoid arthritis, and AIDS.

Those patients' bony limbs and ghostly faces are caused by a combination of increased metabolism and decreased appetite, resulting in a rapid breakdown of body fat and muscle protein. This condition—which goes by the little-known name of cachexia—is a serious medical problem itself: It weakens patients, undermines their ability to be treated, and often hastens their death.

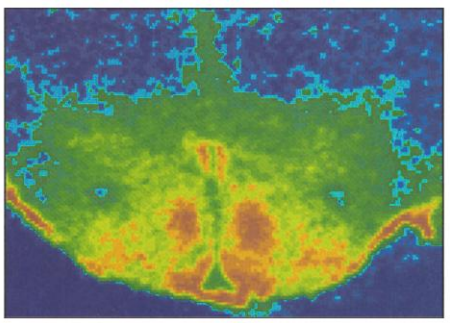
To prevent this, researchers are looking at various newfound drug targets. Since the 1994 breakthrough discovery of leptin, a hormone produced by fat cells that helps control the body's metabolism, researchers have begun unraveling the brain circuitry through which leptin exerts its effects (*Science*, 10 March 2000, p. 1738).

One of the main players is the so-called melanocortin 4 (MC4) receptor in the hypothalamus. When MC4 is stimulated by a neuropeptide called α-MSH, appetite appears to go down and energy use up—exactly what you want to stay slim. That's why MC4 is now one of the prime candidates for antiobesity drugs.

But what if you block the receptor, so that it can no longer be stimulated? In 1999, Jeffrey Tatro of Tufts University and the New England Medical Center in Boston and colleagues did just that. Tatro's team injected rats with a lipopolysaccharide (LPS) from the cell wall of gram-negative bacteria, a common technique to induce cachexia and fever in the animals. When they then injected α-MSH in the animals' brains, they found that their food intake decreased, but when they injected a compound that blocked the MC4 receptor, the rats started eating normally.

At the meeting, Roger Cone of Oregon Health Sciences University in Portland presented the results of a broader study in mice that also has direct relevance to cancer. Cone's postdoc Daniel Marks confirmed Tatro's results with the MC4 receptor and then, to clinch the case, showed that genetically engineered mice that lacked the receptor altogether didn't waste away when injected with LPS. Marks also showed that blocking the receptor could prevent cachexia induced by two different types of cancers.

"It's a nice study," Tatro says. "It's interesting that this also seems to work in cancer models." Harvard obesity researcher Joel Elmquist agrees and says MC4 makes "a very interesting target" for anticachexia drugs.



Food chain. By blocking melanocortin receptors (red to green) in the hypothalamus, researchers restored the appetites of mice.

CREDIT: J. TATRO

Cone has teamed up with Neurocrine Biosciences, a company in San Diego, to produce and test small-molecule drugs that block the MC4 receptor in mice. At a Keystone meeting this week, the team was scheduled to present the results on one interesting candidate. "It works really well," Cone says. **–MARTIN ENSERINK**

Fighting Diplomatic Technophobia

The first science and technology (S&T) adviser to the U.S. Secretary of State says that his strategy of building a "superconducting bus-bar" between the scientific community and foreign policy-makers is well under way—against the odds.

Norman Neureiter, who got the job 5 months ago after a long campaign by the R&D community to establish the position (*Science*, 8 December 2000, p. 1893), has persuaded government agencies, industry organizations, and scientific societies to fund S&T-related slots at embassies overseas and at State headquarters in Washington. On 16 February, he told an audience at the meeting that this approach is vital, given State's constrained budget and lack of in-house S&T expertise.

"To be effective we must penetrate, and demonstrate our value to, the regional bureaus," he said. "They are the real heart of the department, but they are also places where, traditionally, technophobia is pandemic." He noted that most S&T counselors and officers are Foreign Service officials with little or no technical background.

To help fill that gap, NASA Administrator Dan Goldin has promised to pay for five of his agency's staff scientists to work at State, both in Washington and abroad, on 2-year assignments, according to Neureiter. The National Science Foundation, meanwhile, has agreed to support staff members willing to go abroad to an embassy for 1- to 3-month stints. Some three dozen embassies have responded favorably to the idea. "The embassies are on the front line" and are desperate for advice on research-related areas ranging from climate change to genetic engineering, Neureiter said.

The American Institute of Physics also has set up the first paid science diplomat fellowship program among professional societies, and Neureiter indicates that the American Physical Society and other societies may follow suit. The Association of American Universities, a Washington-based organization that represents research universities, put out a call to its members for volunteer State Department summer interns to work on S&T issues. More than 30 students have responded. Some of those, Neureiter hopes, will remain in the Foreign Service—a first step "in building a more scientifically literate Foreign Service officer corps for the future."

Neureiter also is trying to drum up interest in industry. The Industrial Research Institute of Washington, which represents 180 companies in the United States, last week approved plans for diplomatic fellows: up to five industry scientists who would work in embassies abroad for lengthy tours.

Despite the transition of power at State, the S&T adviser's position seems safe for the moment. He met recently with Secretary of State Colin Powell, who told him, says Neureiter, that "everything is fine for now, and we will be taking a look at this down the road."

Neureiter's appointment lasts until September 2003. So far, he is getting high marks from people who have been pushing for greater S&T input into State. "We're impressed with the rapidity with which [he has] moved," said Mary Good, a former Clinton Administration official now at the University of Arkansas, Little Rock. Adds William Golden, a former government adviser who led the push for a stronger science presence at the department: "The tradition has been to bash State, but now there's hope for the future—and the changes already are remarkable." **–ANDREW LAWLER**