

searchers as participants. But Steneck and others say that it's hard to measure the effectiveness of such training, and that the meager results to date are disheartening.

A study of 172 University of Texas students enrolled in a "responsible conduct of research" course, for example, found "no significant change" in attitudes after training, says Elizabeth Heitman of the University of Texas School of Public Health in Houston. The finding is consistent with what Steneck has seen, including a 1996 study that found that people who had gone through a training course were actually more willing to grant "honorary authorship" to colleagues who had not performed research than were those who had not been trained.

ORI director Chris Pascal says his office has received several favorable comments about the new grants program and that 70 scientists interested in the topic showed up last month for an ORI workshop on how to apply for biomedical research grants. The first round of winners will be announced next year.

—ELIOT MARSHALL

CLIMATE POLICY

Too Little, Too Late, at The Climate Talks

Under pressure from too many complex issues, too many divergent views, and too little time to forge consensus, international negotiations aimed at reducing greenhouse gas emissions collapsed last week. The most obvious bone of contention was whether the United States, the world's biggest source of humanmade greenhouse gases, should be allowed to meet much of its obligation without actually cutting its own emissions. The United States softened its controversial stance in the final hours, but European negotiators found even the scaled-back U.S. position unacceptable. Although the negotiators headed for home with nothing tangible to show for their efforts, they say the rule-setting process is not over, just suspended.

Filling in the details of the Kyoto Protocol crafted by governments in 1997 was obviously going to be tough (*Science*, 3 November, p. 920). "The fundamental problem is that you have several intersecting issues and a complicated set of coalitions," says economist Henry Jacoby of the Massachusetts Institute of Technology. The mix becomes even more daunting when you add

in an agreement on targets for reducing greenhouse emissions in developed countries—an average 5% reduction of emissions below their 1990 level—that was reached before anyone established how those reductions could be made. The United States found itself in a particularly tight spot, facing the need for a two-thirds majority in the U.S. Senate to ratify the treaty and a hot economy that would require a 30% re-



A valiant effort. Dutch environment minister Jan Pronk, chair of the conference negotiating the climate treaty, lent a hand to protesters building a mock dike but was unable to build a consensus among negotiators.

duction in emissions over the next 10 years relative to business as usual.

To lessen the economic pain, the U.S. negotiators latched onto several "flexibility" opportunities allowed by the protocol. One is to let growing forests and soils soak up carbon dioxide emitted by burning fossil fuels. Initially, U.S. negotiators proposed that almost 310 million tons of carbon—about half of the U.S. reduction target—be accounted for by its forest and soil "sinks" (*Science*, 3 November, p. 922). Not fair, countered E.U. negotiators as well as observers from some environmental groups, claiming that such generous use of sinks amounted to "rewriting the Kyoto targets." Many of those same forests and soils were soaking up carbon dioxide in 1990, they pointed out, without any effort on the part of the United States government. The Europeans insisted that the United States must actually reduce its greenhouse emissions rather than rely largely on sinks or another Kyoto option involving trading credits for emission reductions made in other countries.

By the final hours—actually, during a last-minute extension of negotiations—the

U.S. team agreed to let sinks account for just 50 million tons of its mandated 620-million-ton reduction. But by then, "there was a lack of time and a lack of trust," says Jennifer Morgan of the World Wildlife Fund in Washington, D.C. A compromise on sinks carefully crafted by the U.S. team and a small group of European negotiators was rejected by the full European contingent as time ran out.

In several other problem areas, progress was made but nothing settled. Left undecided, for instance, was the extent to which a country can buy emission-reduction credits from another country—such as Russia, where a sagging economy has resulted in large emission reductions since 1990. Nor did the negotiators agree on how compliance might be enforced. And it remains unclear how much help developing countries would get to cope with climate change. The protocol mandates that developed countries transfer mon-

ey and technology to help these countries make the transition to cleaner energy production. But developing countries did not even have the opportunity to weigh in before the talks ended.

They may get another chance in a few months. In an unusual move, the parties to the protocol agreed to meet again, probably in Bonn in May, to take another stab at setting rules. "The parties aren't letting the protocol fail," says economist Michael Toman of Resources for the Future in Washington, D.C. "They're still far apart, but these things don't come easily."

—RICHARD A. KERR

CHEMICAL TESTING

Sweden to Get Tough on Lingerin Compounds

STOCKHOLM—For generations the Orrefors Kosta Boda glassworks has earned international acclaim for its fine leaded crystal art glass. But its handiwork may soon go the way of gasoline: lead-free. A Swedish government panel has called for banning from commerce any substance that persists in the

environment and accumulates in organisms. The guidelines also place a heavier burden on industry to prove that a chemical is safe, whether it's a new compound or one that has been on the market for decades. "Today, substances are treated as if they were suspects in court: They are regarded as innocent until their harm is proven beyond reasonable doubt," says pollutants expert Bo Wahlström, a senior scientific adviser at the United Nations Environment Programme in Switzerland. Sweden, he points out, "wants to change this by proposing that chemicals prove their innocence before they are marketed."

In January, the administration of Prime Minister Göran Persson will present the guidelines to the Swedish parliament, which is widely expected to approve the new chemical policy. But the guidelines could have an impact far beyond Sweden. On 18 and 19 December, the European Union's (E.U.'s) environmental ministers will meet to begin planning a new pan-European chemical policy. To date the E.U. has promoted the risk-analysis principle, meaning that a chemical must be proven harmful to be banned from use. But Sweden will be in a strong position to argue for its approach, which is grounded in the so-called precautionary principle, because Sweden assumes the rotating E.U. presidency in January. Although Swedish environmental minister Kjell Larsson insists he will not impose his country's cautious stance upon his E.U. colleagues, he says Sweden will place a high priority on bringing a new E.U.-wide chemical policy into force during its presidency.

Established by the government in April 1999, the Swedish Chemicals Committee, a 15-member panel composed of representatives from government, industry, and academia, heard testimony from scientific experts before drafting its report highlighting the dangers posed by chemicals that linger in the environment and accumulate in bodily tissues. A classic example of this threat is polychlorinated biphenyls (PCBs), a family of compounds used for insulating electrical lines. In 1971, Sweden was among the first countries to ban PCBs after they were linked to reproductive problems

in eagles and seals that preyed upon PCB-tainted fish in the Baltic Sea. But the report goes a step further, arguing that a chemical need not be proven toxic—as PCBs are—to be drummed out of commerce: It need only be proven persistent and bioaccumulative. If a compound meets these two criteria, "we can be pretty sure that it will also be harmful in the long run," says environmental chemist Bo Jansson of the Institute of Applied Environmental Research at Stockholm University.



Getting the lead out. Proposed Swedish guidelines would drum lead out of commerce, forcing the Orrefors Kosta Boda glass-works to change its time-honored recipe.

The new guidelines call for banning from commerce any compound that has a half-life of more than 8 weeks in tests simulating an aqueous environment and is 2000 times more likely to accumulate in fish tissue than in seawater—a standard measure of biological uptake. The panel also calls on the government to hold all 100,000-odd chemicals in the European Inventory of Existing Commercial Chemical Substances to the same standards as new chemicals entering the market. Currently, only about 1 in 10 chemicals now in commerce has been tested for persistence

and bioaccumulation. The onus will fall on companies that market products containing these chemicals. "We believe that [the chemical industry] should be carrying out the testing," says committee chair Arne Kardell, former director-general of the Swedish National Food Administration. According to Kardell's panel, the government should mandate that the most abundant chemicals—the 2500 or so that are imported or produced at a level of 1000 tons or more each year—be tested for persistence and bioaccumulation by 2005. Less used chemicals would have an additional 5-year grace period. Any chemical that survives this testing must run the standard gauntlet of toxicology tests.

Industry can see the writing on the wall. Even before the committee got going, the International Council of Chemical Associations launched a program in 1998 in which, as a first step, participating companies share the costs of testing the 1000 most commonly used chemicals for persistence, bioaccumulation, and toxicity. The companies are footing the testing bill—as much as \$220,000 per chemical—to "gain

ScienceScope

Global Vision Australia's national research agency, CSIRO, has a new chief. Metallurgist Geoff Garrett, currently head of South Africa's science agency, will succeed Malcolm McIntosh, who died this year.

Garrett says he will put a priority on expanding the reach of CSIRO's \$450 million research program by forging alliances with multinational companies and sister institutes in other nations. Such partnerships could bring a particular payoff in technology transfer to industry, as "there are simply not enough large Australian companies to take advantage of what CSIRO has to offer," says acting CEO Colin Adam.

Garrett also takes a dim view of suggestions to break up CSIRO. The institute employs 6700 people and tackles everything from running the Southern Hemisphere's largest radio telescope to developing new mining and farming techniques. Keeping CSIRO intact, he says, will be essential to producing the multidisciplinary innovations—such as new bioinformatics software—that will help Australia keep pace in the new global economy.

Microbes for Peace Former Soviet bioweapons researchers are teaming up with a young U.S. biotech firm to hunt for exotic organisms in Russia. Fueled by \$1 million in start-up money from the U.S. Department of Energy (DOE), the partners will set up the Ecological Biotrade Center to scour Russian ecosystems for interesting organisms in such locations as Lake Baikal (right), the Volga River, and the Kamchatka Peninsula. The players include Diversa Corp. of San Diego, the Institute of the Biochemistry and Physiology of Microorganisms in Pushchino, south of Moscow, and three other Russian institutes. Diversa, known for collecting the DNA of a heat-tolerant microbe found in a hot spring at Yellowstone National Park, has sent or plans to send bioprospectors to Alaska, Australia, Bermuda, Costa Rica, Iceland, Indonesia, and Mexico. The potential applications span everything from pharmaceuticals, to agriculture, to industrial chemistry, says spokesperson Hillary Theakston. DOE's William Toth says the department wants to keep potential bioweapons experts employed in peaceful work and help them find a sustainable source of income. The work will start next month.



Contributors: Elizabeth Finkel, Eliot Marshall

credibility and confidence from the public," says Rainer Koch of Bayer, which is leading the industry task force. And, of course, to get a jump on complying with any new Swedish rules.

The guidelines represent a long-sought victory for scientists who have fought to see the rules adopted. "When we tried to express this view 5 years ago, we were called 'fundamentalists,'" says Jansson. Now that the view is about to be adopted as government policy, outside experts are cheering Sweden on. "The committee's proposal makes a tremendous amount of sense," says Linda Birnbaum, research director of experimental toxicology at the U.S. Environmental Protection Agency in Research Triangle Park, North Carolina. "Extreme persistency and extreme bioaccumulative properties go hand in hand with toxicity." Birnbaum, however, doubts that Sweden's approach will be adopted any time soon by the United States, which follows the risk-analysis approach.

Whether Sweden can persuade the rest of the E.U. to adopt such an aggressive policy is unclear. "The political desire for starting this work ... will not happen as long as the public doesn't demand a change," predicts environmental scientist Finn Bro-Rasmussen of the Technical University of Denmark in Copenhagen. But for some companies in Sweden, at least, their products will never be the same. With lead striking out under the new paradigm—it's persistent, bioaccumulative, and toxic—Orrefors Kosta Boda will have to devise new recipes for its crystal. Barium, for instance, gives the same luster as lead, but it is lighter. Says Orrefors spokesperson Karin Lindahl, "We will have to educate our customers not to choose their glass by weight but only by its beauty."

—LOTTA FREDHOLM

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SOLAR SYSTEM EXPLORATION

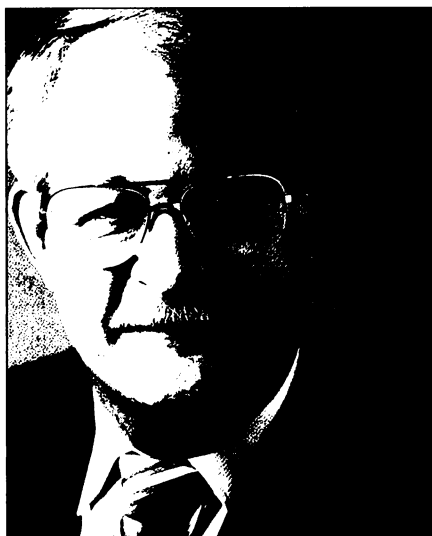
NASA Blasted for Rising Costs, Cancellations

When NASA cancelled a project last month that would have sent a tiny rover crawling over an asteroid, planetary researchers went into orbit. In a rare public statement, several senior scientists said that the cancellation is symptomatic of larger problems in the U.S. planetary science program. They warned that spiraling costs are threatening a fleet of planned missions and also called for a sweeping reexamination of the outer solar system effort.

The nanorover was scheduled to ride aboard Japan's Muses-C mission, which will return samples of an asteroid to Earth. But cost estimates tripled in the past year, to

\$60 million, prompting its manager, the Jet Propulsion Laboratory in Pasadena, California, to recommend canceling it. NASA headquarters concurred. The news comes just 3 months after NASA put a Pluto mission on hold because of rising costs (*Science*, 17 November, p. 1270). Earlier this year, NASA also abandoned a 2001 Mars lander and bowed out of a European comet mission.

"The cancellations and delays never seem to stop," says Wesley Huntress, director of the Carnegie Institution of Washington's Geophysical Laboratory, NASA's former space science chief, and vice chair of the American Astronomical Society's (AAS's) 1200-member planetary sciences division. "The planetary exploration program is in a crisis mode."



Unmerry-go-round. Wes Huntress and AAS deny pattern of delayed and canceled missions.

In a public statement issued on 14 November, the AAS division blamed the financial problems on "a pattern of underbidding" and an overemphasis on the "cheaper" portion of NASA's commitment to launching faster, cheaper, better spacecraft. To control the cost growth, the division recommends increased competition and external peer review. "We understand NASA is trying to wrestle with this beast," says division chair Mark Sykes, a planetary scientist at the University of Arizona in Tucson. "But there is the prospect for more cancellations."

Agency officials acknowledge the problem. "This is an unusual set of circumstances," says Jay Bergstrahl, NASA's acting science director of the planetary exploration effort. "And there is anxiety in the community." The 1999 failures of two Mars missions have made for more conservative—and therefore more costly—estimates, he says, citing a report earlier this year that attributed the Mars failures in part to a lack of

money for adequate testing.

AAS isn't the only outside group calling for changes. This week NASA's own space science advisory committee planned to send a letter to Ed Weiler, the agency space science chief, backing increased competition and reiterating the importance of missions like Pluto and Europa. "It's time to take a very careful look at the entire [planetary] program and fix it," says Steven Squyres of Cornell University, who chairs the panel. Huntress and Sykes also want an outside study of NASA's outer planetary program, but agency officials say that a NASA-led inquiry might come up with better solutions more quickly.

Bergstrahl admits that officials at Japan's Institute for Space and Astronomical Studies in Tokyo are "not very happy" with NASA's decision on the nanorover. A proliferation of scientific instruments, he says, drove up costs on what began as a small technology demonstrator. However, it's possible that NASA may want to provide communications and navigation support in exchange for some data.

—ANDREW LAWLER

NUCLEAR SCIENCE

DOE Drops Plan to Restart Reactor

The U.S. Department of Energy (DOE) has abandoned the idea of restarting a controversial nuclear reactor at the Hanford Nuclear Reservation in Washington state. Some biomedical researchers are applauding the decision to pull the plug on the Fast Flux Test Facility (FFTF), which they feared would drain scarce resources from other DOE research programs. "It's the right decision," says Kenneth Krohn, a radiation oncologist at the University of Washington, Seattle, about the department's 21 November announcement. "The FFTF is just too costly."

The reactor was opened in 1980 as a breeder test reactor but was shuttered in 1993 after an independent review found that the facility was too expensive to operate. DOE officials later considered using it to produce radioactive isotopes for cancer treatment and plutonium for deep-space probes, both of which DOE feared could face future supply concerns. But last week officials decided that the cost of the restart, at \$314 million over 5 years plus about \$80 million a year to operate, was too high and support too thin. Regional environmental groups had been active in opposing any restart.

Instead, DOE plans to make do with existing facilities and to build a less expensive neutron accelerator that could produce tritium, a short-lived isotope of hydrogen critical to nuclear weapons, and meet other

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