pectations for students. "I think they're perfect," says Michael Morgan, a chemistry teacher and chair of the science department at Francisco Bravo Medical Magnet School in Los Angeles, who helped to draft the document. "The average student with a caring teacher can get through this."

At the heart of the debate is the role of the state standards. Should they represent a realistic goal for all students, or should they be a challenge for even the brightest ones? Supporters say the new standards set high expectations and will prepare students for tomorrow's technology-driven economy. The California standards "are not designed to be a description of basic literacy," says biologist Stan Metzenberg of California State University in Northridge, one of the lead consultants on the writing committee. "It's obviously much more than what you might expect every student to leave high school with." But the standards will provide a basis for tests that will allow school districts and parents to gauge how well students are doing, he adds.

In contrast, detractors fear that the quantity of material required by the standards will drive students away from science by making it unappealing. "These standards are so chock-full of factoids," says American Physical Society President Andrew Sessler, "the only way you can get them across is by rote learning." Critics also complain that abstract concepts are introduced too early (see figure). "When you start teaching first- and third-graders about abstract things like atoms and molecules," says Alberts, "what we actually do is not have kids understand anything."

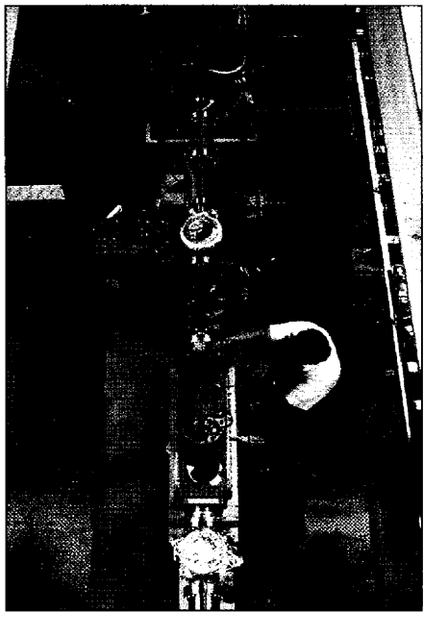
The state board is expected in the next few weeks to form a committee that will draft a set of curriculum frameworks based on the standards. But opponents are clinging to one last hope. "My hope is that the next governor takes care of this" by commissioning a major overhaul of the standards, says Alberts. Such a decision, say political observers, might well set a new standard for controversy. —GRETCHEN VOGEL

NUCLEAR PHYSICS

Tight Budget Could Shut Down MIT Accelerator

Unless the U.S. government finds more money for medium-energy physics research, the Siberian Snake may never slither into the Massachusetts Institute of Technology's (MIT's) Bates Linear Accelerator. Last week, a government advisory panel recommended that the MIT accelerator be shut down in 2 years and that other nuclear physics experiments elsewhere be abandoned if the Department of Energy (DOE) and the National Science Foundation do not boost funding for the field. DOE officials plan to use the report* to convince the Administration to do exactly that in its upcoming 2000 budget. If they succeed, physicists at the suburban Boston laboratory will be able to complete studies that require installation of the snake, a ring of magnets that organizes the accelerator's beam of electrons.

The Bates facility, which has operated since 1968, has been a training ground for many medium-energy physicists, who explore the properties of the atomic nucleus, including the forces that bind it together. However, 2 years ago DOE opened the $600 million Continuous Electron Beam Accelerator Facility at the Thomas Jefferson National Accelerator Facility in Newport News, Virginia, a larger facility that provides researchers with higher energy electron beams.



Scattered to the wind? Researchers won't be able to finish electron scattering experiments unless Bates lab gets funding boost.

Despite the increased capacity, DOE funding for the $116 million program has failed to keep pace with inflation over the last few years and has fallen at least 10% below levels suggested in a 1996 plan. "The budget pressure has been building—not everything can continue under a flat [funding] scenario," says James Symon, a physicist at the Lawrence Berkeley National Laboratory in California. In June, Symon was appointed head of an 11-member Nuclear Science Advisory Committee (NSAC) charged with recommending how scarce DOE funds should be spent.

Symon and others hope their report will help the department win a 10% to 15% in-

* "Scientific Opportunities and Funding Priorities for the DOE Medium Energy Nuclear Physics Program" (http://www.er.doe.gov/production/henp/nucphys.html)

CREDIT: (TOP) MIT/BATES LINEAR ACCELERATOR; (BOTTOM) NASA

ScienceScope

DOE Mulls Restarting Spacecraft Fuel Production

In a proposal that promises to spark further furor over the use of nuclear power aboard spacecraft, the U.S. Department of Energy (DOE) wants to begin making radioactive spacecraft fuel at home again. Department officials announced on 5 October that they are considering restarting production of plutonium-238—used to produce heat and electricity aboard some of NASA's planetary probes—at government reactors.

The move comes amid worries that future political instability in Russia could threaten NASA's supply of plutonium, which has come mainly from Russia since domestic production ceased in the early 1990s. It also follows protests against launches of several NASA craft carrying plutonium-powered generators, such as last year's Cassini mission to Saturn, which activists say could shower Earth with radioactive debris in the event of an accident (*Science*, 12 September 1997, p. 1598).

DOE officials estimate that the United States needs to make 2 to 5 kilograms of Pu-238 a year over the next 25 years to fuel NASA spacecraft. Before production can begin, however, DOE must complete an environmental study, which is due next spring.

X-ray Telescope Delayed Again

In a move that could scramble space shuttle schedules, NASA has again delayed the launch of its $2 billion x-ray observatory. Last week, space agency officials announced that flight software troubles will prevent manufacturer TRW Inc. from shipping the Advanced X-ray Astrophysics Facility from its California plant to the Kennedy Space Center in Florida in time for a planned launch aboard the shuttle next January. That launch date was set following a 5-month delay announced last January (*Science*, 16 January, p. 318).

NASA officials say that this time, they don't know when the troubled satellite will finally fly. While TRW tries to exterminate software bugs, NASA Chief Engineer Dan Mulville will lead a top-to-bottom review of the program aimed at producing a realistic schedule. But the report isn't due until January, and some scientists worry that reshuffling launch plans will delay missions critical to assembling the international space station and maintaining the Hubble Space Telescope.

versity of British Columbia, who has done studies of the sea lion declines sponsored by the fishing industry, says he's scrutinized the timing of the declines and the fisheries buildup and "I don't see a connection." Dayton tends to agree that overfishing "is too simplistic. ... The cause of the killer whale shift is probably very complicated."

Estes, however, believes overfishing is the most likely suspect—and he warns that the lesson applies far beyond Alaska. Fisheries are collapsing around the world, he notes, and as with the otters, if scientists looked more closely they might find the effects "very widely manifested in coastal ecosystems. We were lucky just to have been sitting on this and seen it when it happened. But very likely, they're the sorts of things we should be worrying about elsewhere." **–JOCELYN KAISER**

ATMOSPHERIC CHEMISTRY

Deep Chill Triggers Record Ozone Hole

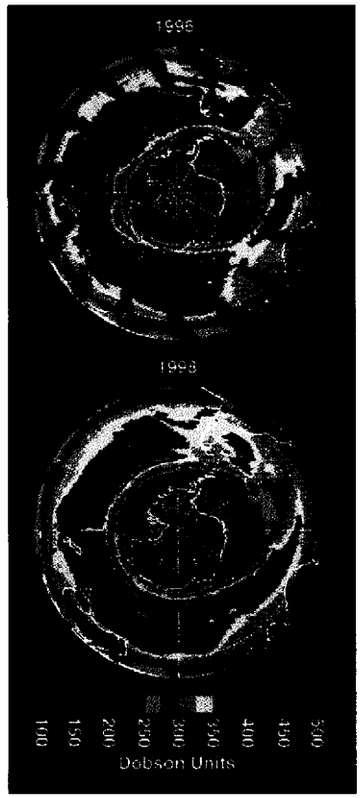
In theory, the ozone hole that reopens each year over Antarctica should gradually heal as international regulations choke off the flow of ozone-destroying chlorine compounds into the stratosphere. But little about atmospheric chemistry is that simple, as this year's Antarctic ozone hole testifies. It is almost as severe as any seen before, and it stretches over an area larger than North America, a new record. Unprecedented stratospheric cold is driving the extreme ozone destruction, say researchers. Some of the high-altitude chill, they add, may be a counterintuitive effect of the accumulating greenhouse gases that seem to be warming the lower atmosphere.

This year's Antarctic ozone hole is a whopper in every sense. Seen from a National Oceanic and Atmospheric Administration (NOAA) satellite, the area of depleted ozone extends over about 26 million square kilometers, the largest observed since annual holes first appeared in the late 1970s. Measured by balloon-borne instruments ascending from the South Pole, the layer of total ozone destruction extends from an altitude of 15 kilometers to 21 kilometers. That's higher than ever seen before, says ozone researcher David Hofmann of NOAA in Boulder, Colorado. And by 5 October, the total amount of ozone over the South Pole had dropped to 92 Dobson units, Hofmann says; only in 1993 was the ozone hole deeper, when the catalytic effect of debris from the 1991 eruption of Mount Pinatubo in the Philippines helped drive ozone down to 88 Dobson units. (Normally there are about 280 Dobson units of ozone over the pole.)

The deep chill that gripped the Antarctic stratosphere this past austral winter is to blame, say Hofmann and other scientists. Every winter, it gets cold enough there—below –78°C—to form the icy stratospheric clouds that catalytically accelerate the destruction of ozone by the chlorine from chlorofluorocarbons (CFCs). This year, the area cold enough to form polar stratospheric clouds "is larger than anything we've seen to date" for the same time of year, says meteorologist Melvyn Gelman of NOAA's Climate Prediction Center in Camp Springs, Maryland. "There's much less heat being pumped up into the stratosphere than usual," he says.

No one knows just why, but an underlying cooling trend in the stratosphere—induced by, of all things, greenhouse gases—is probably aggravating the situation, researchers say. Although greenhouse gases warm the lower atmosphere, they cool the stratosphere by radiating heat to space, creating an "icehouse effect." Recent computer modeling has suggested that greenhouse cooling might greatly worsen the nascent ozone hole over the Arctic (*Science*, 10 April, p. 202). And a new modeling study, published in the 1 October *Geophysical Research Letters* by M. Dameris of the German space agency DLR in Oberpfaffenhofen and colleagues, points to effects on Antarctic ozone, too. By 2015, their model says, ozone at lower latitudes will begin recovering as CFC controls take effect, but the chilling effect of greenhouse gases will have kept the Antarctic ozone hole as severe as ever.

–RICHARD A. KERR



One of the worst. The 1998 Antarctic ozone hole (bottom, inside the blue) is the biggest ever and is deeper than most, as shown by a comparison of the gray area with 1996 (top).

CREDIT: (TOP) GREG VAUGHN/ALLSTOCK/PNI; (BOTTOM) NASA/GSFC

ScienceScope

BILLFISH PLAN NOT SHARP ENOUGH?

A new plan to protect Atlantic billfish such as marlin and sailfish doesn't go far enough to protect dwindling stocks from accidental catches, fisheries experts say. The guidelines, released last week by the National Oceanic and Atmospheric Administration (NOAA), are the first of 39 new conservation plans covering key fish species required by a 1996 law designed to prevent overfishing.

It has been illegal for commercial fishers to sell Atlantic billfish since 1988, but the fish are still legally caught in tournaments and accidentally snared by longlines intended for swordfish and other species. Russell Nelson of the Florida Marine Fisheries Commission says localized bans on longline fishing would reduce the accidental "bycatch" by more than 25%, while causing only a 5% loss in swordfish catches. He hopes such statistics convince NOAA to impose such a ban. The plan is open to public comment until early next January.

WHITE HOUSE ORDERS STUDY OF INTERNATIONAL ENERGY R&D

President Clinton is seeking expert input on global energy research. To get the most from U.S. spending on international collaborations aimed at understanding global warming and other issues, he has asked the President's Committee of Advisers on Science and Technology (PCAST) to review U.S. involvement in international energy R&D projects.

The request follows a PCAST study of domestic energy R&D issued a year ago. Led by Harvard environmental policy professor John Holdren, it helped boost the president's 1999 budget request for energy research. Now, Holdren will produce a sequel with an international flavor. The report, due in April, will tally what various U.S. and international agencies already do and offer advice for the coming decades. White House official Sam Baldwin says the panel will focus on applied research, but could comment on anything from fusion research to clean coal technology in China.

Contributors: David Malakoff, Gretchen Vogel, Jocelyn Kaiser