Varmus, and payments for many extramural grants that were to have gone out in December have been delayed. NIH's deputy director for extramural affairs, Wendy Baldwin, estimates that "it will take us 6 to 9 months to dig out" and get grants fully on track.

This delay has already resulted in frustration for researchers like radiation biologist Joseph Dynlacht of the University of Oklahoma. Officials at the National Cancer Institute (NCI) told him in November that his proposal to study the effects of heat and radiation on the nuclear structure of mammalian cells would be funded. But the shutdown prevented NCI from making good on its word. "You're supposed to obtain extramural funding" after 2 to 3 years of academic support, Dynlacht notes. "Right now I'm on life support from my university."

NIH's intramural researchers were also starting to feel the pinch. Anthony Fauci, director of the National Institute of Allergy and Infectious Diseases, says storage cabinets were running short of radioisotopes, culture media, and labware. "It's extraordinarily frustrating," Fauci says. "You're fighting a retreat game where you say, 'Let's just pack up and keep the cultures alive or freeze them down.' "

NSF officials report a similar backlog caused by the shutdown and the ban on spending any money for programs. An estimated 250 proposals a day have piled up in the foundation's mailroom in Northern Virginia, and each day of the shutdown meant about 80 scheduled awards were put on hold. In addition, principal investigators on some 156 continuing grants did not get expected payments on 1 January, and NSF officials face the task of processing an additional 266 grants with a 1 February continuation date.

Larger projects also suffered. The San Diego Supercomputing Center missed a $5.5 million lease payment last month on a $22 million Cray C-90 machine and faces a penalty of $23,000 for every 15 days the check is late. NSF officials, with only a 3-week window between the first and second government shutdowns, failed to process and send the center its quarterly payment on time. "We're hoping to work out something that is fair to both sides," says Peter Arzberger of the center, one of four supported by NSF. Several of NSF's 25 multimillion-dollar university-based Science and Technology Centers are now anxious about their next infusion of funds on 1 February. The Antarctic program is expected to be able to operate normally through its summer season, which ends in late February, but the lack of a final appropriation could seriously jeopardize preparation for the 1996–97 season.

Another problem whose effects will linger for months was the forced cancellation of meetings in which outside experts were to review plans for upcoming programs or make scientific judgments on proposals already submitted. NSF officials reluctantly pulled the plug last week on a meeting in which more than 100 reviewers were to sift through some 600 preproposals sent in last fall for a new $12 million initiative in optical science and engineering that spans several directorates, says Bill Harris, assistant director for the mathematical and physical sciences. Some 50 to 60 projects would have received further consideration, Harris says, of which about half would receive awards ranging from $200,000 to $500,000. "We're not certain we can do that any more in FY '96," he says.

For physical oceanographer Breck Owens of Woods Hole (Massachusetts) Oceanographic Institution, NSF's shutdown is likely to delay a multimillion-dollar collaborative project he hoped to run this fall in the North Atlantic. The project, which examines heat transfer cycles as the water cools in the fall, sinks and heads south before warming up in the spring and moving northward, was supposed to be the capstone of a 6-year international effort to understand world ocean circulation. "We know more about the North Atlantic than most other oceans, so we wanted to take the next step and explore some important drivers of the overall system," says Owens. But the project is on hold because a meeting of the NSF panel to review some 60 proposals was canceled twice—once during each shutdown.

If nothing else, the events of the past month have forced federal science administrators to roll with the punches. Surprisingly, many still feel good about their jobs. "I still think it's a great opportunity to keep up with the latest research and have an impact on my field," says mathematician Sallie Keller-McNulty, an NSF program manager on leave from Kansas State University. She sweated through 2 weeks of a threatened loss of medical and life insurance benefits when the shutdown prevented NSF from making a necessary payment to her university. Andrew Lovinger, the new head of NSF's polymer science program, knows what it's like to cope with uncertainty. The 47-year-old Lovinger, who spent 19 years at Bell Laboratories before starting work at NSF on 10 November, just in time for the first shutdown, says "What happened was unique, and I don't think it will occur again." But Lane expects to hear "a combination of anger, disbelief, and disappointment," when he walks down NSF's halls. "It's shaken their faith in government."

–Jeffrey Mervis and Eliot Marshall

With reporting by Andrew Lawler and Jocelyn Kaiser.

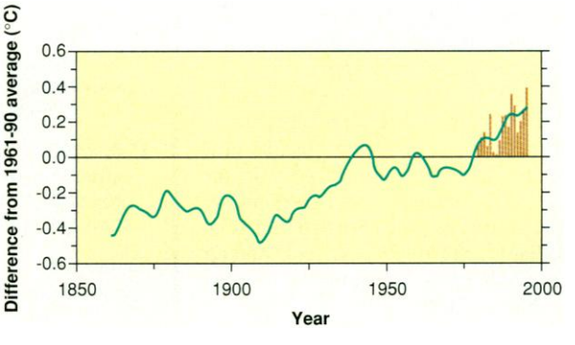
CLIMATOLOGY

1995 the Warmest Year? Yes and No

A month after a United Nations panel declared that the climate record of the last century shows subtle signs of greenhouse warming (*Science*, 8 December 1995, p. 1565), the alarm bells rang again. " '95 the Hottest Year on Record ..." said the headline at the top of the front page of the *New York Times* last week. Just 3 days into the new year, one leading group of climatologists had crunched its numbers to discover that 1995 had placed first in the global warming sweepstakes, shattering the previous record for warmth, set in 1990. "Global Trend Keeps Up," the headline continued, referring to the warming of the past 20 years, attributed by many to greenhouse warming. But this time, even the climatologists whose data prompted the claim agreed that there was less to the news than met the eye.

"I wouldn't read too much into the fact that last year was the warmest or even that 1990 was," says Philip Jones of East Anglia University, in the United Kingdom, whose numbers the *Times* used. Last year failed to exceed 1990 by a statistically significant amount both in Jones's data and in data analyzed by James Hansen of the Goddard Institute for Space Studies in New York City. In any case, says Jones, no one year, no matter how warm, can be taken as a sign of greenhouse warming: "It's the underlying trend on the decadal time scale that's key." And on that scale, climatologists have seen just one big push upward lately, in the late 1970s; nothing comparable has happened since.

According to Jones's preliminary data, which he compiled with the U.K.'s Meteorological Office in Bracknell, the 1995 global temperature was 0.04°C higher than that of 1990. Jones estimates that only a difference



U.K. METEOROLOGICAL OFFICE/UNIV. OF EAST ANGLIA

A new record, sort of. Last year's temperature *(far-right-hand bar)* nosed out 1990's for the warmest since 1860, but not by a statistically significant margin.

of about 0.1°C would be statistically significant. Likewise, the temperature of the half decade 1991–95 was comparable to, but did not clearly exceed, that of 1986–90—the warmest such period in the 135-year record. Still, Jones notes, the latest half decade managed its tie for the warmest ever in spite of the cooling effect of Mount Pinatubo's eruption in 1991. And 1995 finished in a dead heat with 1990 even though the latest El Niño, which warms the tropics, had faded early in the year.

But Thomas Karl, science director of the National Climatic Data Center in Asheville, North Carolina, cautions that the whole business of trying to declare record-breaking years "is a dangerous game." It gives greenhouse doubters an opening to come back the first year the world cools by more than a few hundredths of a degree—as it inevitably will from time to time even if the overall trend is upward—and claim greenhouse warming has been oversold, he says. "What we really need to see to [convince the contrarians]," says Karl, "is another jump like the one we saw in the 1970s, when the global temperature goes up a tenth of a degree in any given year and then sustains that level. That's what would be a page-one story."

–Richard A. Kerr

BIOMEDICAL RESEARCH

Med Schools Receive Hughes Windfall

While most biomedical researchers face budgetary uncertainty and U.S. medical schools are struggling to cope with shrinking income, one biomedical research organization, at least, is sitting pretty: the Howard Hughes Medical Institute (HHMI). The stock market boom of 1995 has swollen its $8 billion endowment, and HHMI finds itself with record funds to disburse. This week, Hughes announced that it will transfer some of that bonus to 30 medical colleges, giving them a booster shot of $80 million. Hughes will award the money in 4-year grants of $2.2 million to $4 million for faculty salaries, infrastructure, and other projects designed to bolster research in tough financial times. And it is also providing a separate grant to increase the availability of transgenic mice to researchers around the world.

HHMI officials say they're responding to two factors that are pinching medical school budgets: limits on health insurance coverage, which restrict income from academic clinics, and the growing difficulty of getting grants from the National Institutes of Health (NIH). "It's obvious to everybody who's watching the medical school scene that this is a terribly crucial time in their history," says HHMI President Purnell W. Choppin. Herbert Pardes, dean of medicine at Columbia University and chair of the council of deans of the Association of American Medical Colleges, calls HHMI's response "extraordinary. I think people should applaud Hughes for its sensitivity."

HHMI invited applicants last spring to apply for grants for new faculty, upgrading facilities, pilot projects in research, or emergency needs. A panel of administrators and scientists not now affiliated with medical schools ranked proposals from 117 schools, and an internal HHMI committee, with approval of the Hughes Trustees, chose 30 winners.

The successful schools range from some familiar powerhouses—such as Columbia, the University of California, San Francisco, and Johns Hopkins—to the country's smallest medical school, the University of Vermont College of Medicine. Most will use the funds to recruit new faculty, improve facilities for transgenic animals, and buy research equipment. Vermont, for example, expects to use part of its $2.4 million award to help attract 10 new faculty members in structural biology and molecular genetics, helping to "sustain a medical school in a rural setting of very high quality," says John Evans, Vermont's executive dean.

THE FAVORED 30

$2,200,000
- Duke University School of Medicine
- Harvard Medical School
- Northwestern University Medical School
- Oregon Health Sciences Univ. School of Medicine
- Univ. of Florida College of Medicine
- Univ. of Massachusetts School of Medicine
- Univ. of Pennsylvania School of Medicine
- Univ. of Southern California School of Medicine
- Univ. of Texas Medical School at San Antonio

$2,400,000
- Case Western Reserve Univ. School of Medicine
- Univ. of Alabama School of Medicine
- Univ. of Colorado School of Medicine
- Univ. of Iowa College of Medicine
- Univ. of North Carolina, Chapel Hill, School of Medicine
- Univ. of Utah School of Medicine
- Univ. of Vermont College of Medicine
- Vanderbilt University School of Medicine

$2,600,000
- Univ. of California, San Diego, School of Medicine
- Univ. of Chicago Pritaker School of Medicine

$2,800,000
- Univ. of New Mexico School of Medicine
- Univ. of Washington School of Medicine
- Univ. of Wisconsin Medical School

$3,000,000
- Albert Einstein College of Medicine
- Univ. of California, Los Angeles, School of Medicine
- Washington University School of Medicine

$3,400,000
- Johns Hopkins University School of Medicine
- Stanford University School of Medicine

$3,600,000
- Columbia University College of Physicians and Surgeons

Medical school deans weren't the only ones smiling this week: Hughes also announced a 4-year, $2 million award to the Jackson Laboratories (JL) in Bar Harbor, Maine, the world's main supplier of specialized research mice. The grant's purpose, according to Choppin, is to help JL "handle this flood of transgenic and knockout mice that are being developed across the country." John Sharp, supervisor of induced mutant resources at JL, says the Hughes money will be used to speed up the process of taking in new strains and to build a new facility for cryopreserving embryos. The lab now accepts about 100 new strains of genetically engineered mice a year, but hopes to double that number, Sharp says.

Hughes's grants program—which is separate from its funding of individual investigators—has given out more than $500 million over the last 7 years to schools for education, to research institutions such as JL, and to researchers abroad. However, Choppin says, this is the first set of awards given to U.S. medical institutions to shore up their research capabilities. HHMI's grants budget grew from $56.2 million last year to $80.7 million in 1996, part of an increase in the institute's overall budget from $365 million to $413 million, Choppin says. He explains that HHMI is now spending more partly because the number of Hughes investigators grew in 1994, but also because "our endowment has done well in the past year."

The institute hasn't decided whether it will make another round of institutional awards after these run out, Choppin says. And that raises a question: What will the schools do when this booster injection wears off? Other funding sources aren't growing any more generous, and cost-containment pressures will continue to increase. Jeremy Berg, HHMI program officer at Johns Hopkins, says: "The needs are not going to go away in 4 years."

–Jocelyn Kaiser