from a special interest group. Only about half the members of the committee were professional mathematicians, David noted. The other half were representatives of institutions and disciplines that rely heavily on mathematics, including physics.

The committee's report was based on a 3-year study coordinated by Kenneth Hoffman, professor of mathematics at MIT. The report traces the deterioration in mathematics funding to the Mansfield amendment of 1970, which barred the Pentagon from supporting research unless it directly related to defense needs. Pentagon cuts in the early 1970s affected pure mathematics especially adversely. There were supposed to be compensating increases in NSF support, but NSF funding for mathematics research declined in the 1970s and early 1980s, while funding for physics and chemistry increased substantially. The number of mathematics students who received NSF fellowships or traineeships fell 90% from 1179 to 116 between fiscal 1969 and fiscal 1974, the committee found.

According to the committee's report, the mathematics community did not make more of a fuss about the Federal spending cuts in the early 1970s because "(a) mathematicians were extremely worried about an oversupply of PhDs in their field, and (b) at that time, the universities needed more teaching assistants and young faculty, and had the resources to hire them." Demand for undergraduate teaching continued to increase through the late 1970s and into the 1980s (see box at right). During the last 8 years alone, demand for college mathematics instruction rose 60%, the report says.

In addition, the severity of cuts in Federal support for graduate study and research in mathematics was obscured by a tendency until the late 1970s to lump funding for the expanding computer sciences together with support for basic research in mathematics. From 1976 to 1984, Federal funding for basic mathematical research grew at an average annual rate of 9%, while funding for computer science increased an average of 17% a year.

Even now, Hoffman says, there is no satisfactory way to disaggregate all the data for pure mathematics and computer science for the 1970s. But the committee was able to make a rough comparison between funding in the early 1980s and 1968 spending largely because of a special analysis memo done for that year at NSF. Hoffman doubts that the probable error in his 1968 baseline estimate of support for mathematics is more than 10%.—ws

### College students take much more math

Despite the shortage of Federal funds for higher mathematics, basic math literacy appears to be rising rapidly among undergraduates, judging from data issued by the American Mathematical Society and the Conference Board of Mathematical Sciences. The data reveal startling enrollment increases in college mathematics classes during the 1970s and 1980s and, consequently, a growing teaching burden on mathematics instructors. The data also indicate unmet demand for mathematics faculty with PhDs and suggest that demand will continue to grow in the years ahead.

In 1981, the Board reported that the number of undergraduates in mathematics per full-time-equivalent faculty member had increased from 77 in 1970 to 83 in 1975 and 98 in 1980. In other words, the teaching burden for the average college math teacher became 27% heavier in one decade. Between 1975 and 1980 alone, course enrollments increased 33%, the Board found. According to a report published by the AMS in February 1984, enrollments have continued to rise rapidly in recent years. The Society estimated that nearly 2.5 million students were enrolled in college math courses in fall 1983, while the Board estimated total enrollments at around 2 million in 1980.

Why the surprising interest in mathematics among the millions? Required remedial math courses, demand for math and statistics in engineering, business, management and environmental studies, along with the booming popularity of computer science, are the principal reasons for increased enrollments, according to authorities on the trends. Harry Lustig, provost at the City College of the City University of New York, explains that remedial courses mushroomed during the 1970s because a growing proportion of high-school graduates were going to college at a time when high-school math requirements had been sharply reduced in many places. Demand for remedial instruction may now be leveling off, says Donald Rung, a Penn State mathematics professor who prepares the reports issued by the American Mathematical Society. Rung expects demand from computer, engineering, business and management programs to remain strong.

Rung thinks that "the signals are improving" for pure mathematics. From 1982 to 1983, he reported in February 1984, there was an 8% increase in the number of full-time graduate students in mathematics, and the numbers of juniors and seniors majoring in math at institutions with doctoral programs climbed by a hefty 20%. Moreover, Rung believes, the prospects of luring math majors into graduate programs seem favorable, provided adequate resources become available, because considerable unmet demand for math PhDs already is apparent. The Mathematical Society's 1984 survey data indicated that US colleges and universities filled 724 full-time mathematics positions with people lacking PhDs in fall 1983 and that they would have preferred PhDs for 401 of the positions—more than half.

The Board, anticipating a large increase in retirements among tenured mathematics professors in the 1990s, reported in 1981 that "there should be many tenured positions in colleges and universities for students now at the point of starting graduate studies." The Board was not sanguine about prospects for the interim, however. It warned that "the continued availability of enough teaching assistants is in doubt, with many departments seeking TAs from other sources in addition to their own graduate students." The Board found that "in 1980, over 25% of all TAs employed by mathematical science departments were not mathematical science graduate students."

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## Education

# Foundations award new grants for video science productions

Donors of grant money continue to express confidence in the educational value of television programming about science, a well-established if somewhat under-nourished staple on public (but not commercial) networks. Recent awards will support training of television science writers, production of new shows for an exceptionally successful series, and repackaging of another series for use in high school instruction.

This summer, 12 high school physics teachers and administrators were invited to spend two months at Caltech adapting "The Mechanical Universe" for use in secondary schools. "The Mechanical Universe" is a college-level introductory physics course being prepared at Caltech for showing on public television stations around the country, starting in fall 1985. The course was conceived by Caltech physics professor David L. Goodstein, who is managing its production and will serve as host of the show.

Goodstein's objective is to create a course that can be viewed with profit both by the general public and by people with some grounding in science—secondary school teachers, for example, who are being required to teach physics for the first time. Viewers will be able to earn credit for

the course through correspondence with local colleges.

The adaptation of "The Mechanical Universe" for high school use is being funded by a grant of $650 000 from the National Science Foundation. The teachers and administrators selected to participate in the project at Caltech spent this summer selecting material from 26 half-hour videotapes on classical mechanics for three hours of video material consisting of 15-minute segments. The teachers also helped prepare instructional guides for the series. Upon returning to their schools this fall, each of the teachers is to start testing half the segments in cooperation with another teacher who did not take part in the production of the series. The results of this preliminary assessment will be evaluated by an educational consulting firm, and if the rating is high, the series will be revised next summer and distributed in fall 1985, just as Caltech's television series begins. According to Richard Olenick, a visiting associate at Caltech from the University of Dallas physics department, who serves as codirector of "The Mechanical Universe," the high school series will be made available to schools at the lowest possible cost.

Don Delson, a coordinator for the high-school project, reported that work was going "quite well" this summer and that "everything was on schedule." Olenick said that the teachers were particularly impressed by the video graphics, especially those illustrating mathematical concepts such as angular momentum and the universal law of gravitation.

If the high-school adaptation of the 30-program course on classical mechanics is well received, the participants hope to follow it with an adaptation of the course's second part, which covers electricity and magnetism, relativity, waves and optics, thermal physics and modern physics (PHYSICS TODAY, June 1984, page 67). The second part is to be shown on public television starting in Fall 1987.

**"3-2-1 Contact,"** the PBS television science series for children aged 8 to 12, has received renewed support from the National Science Foundation, with the blessing of NSF's policy-making group, the National Science Board. In June, NSF announced a grant of $8.5 million to support production of 20 more half-hour segments over a period of five years. Created by the Children's Television Workshop in New York, which also produces the popular "Sesame Street," "3-2-1 Contact" is the recipient of numerous prizes including four Emmy awards. A. C. Nielsen, the Chicago-based organization that surveys television viewership, reports that 23 million children have watched the series at home and another 3 million at school. Some 650 000 teachers have received guides to the series. Of this number, 70 000 have attended workshops on how to use the program to best effect.

The third season of the program was produced this summer with $1 million from the Corporation for Public Broadcasting. The additional 20 segments funded by the new NSF grant will bring the total number of episodes to more than 200.

**Television science** got another boost in August when the Josiah Macy Jr Foundation in New York announced a $1.5-million grant to establish a training school for science writers at station WGBH in Boston. Six fellowships, each worth $25 000, will be awarded each year for three years to bring writers to WGBH, the nation's largest producer of science programming for public television. According to John T. Bruer, a Macy Foundation official, each fellow will spend four months working on a radio news magazine show, one month learning television techniques, and seven months working independently on stories with a crew and television editor. Academic and research scientists are eligible for the fellowships and may apply to WGBH, which will make the selections each year. —ws

## Education

### Stanford team writes curricula on peace and violence

Arms control, once the exclusive preserve of foreign policy specialists and weapons scientists, continues to involve more people. In a program at Stanford launched last fall, study materials on conflict, violence, war and arms control have been compiled for use in classes from kindergarten through grade 12. Project participants are developing curricular materials for use in high schools, and they plan to organize training sessions for secondary school teachers.

The project is jointly administered by the Stanford Program on International and Cross-Cultural Education and the Stanford Center for International Security and Arms Control. Steven Zansberg, outgoing coordinator of the project (soon to be replaced by Rose McDermott), reports that the best known and probably the most widely used materials located by the project were prepared by several organizations in the Boston–Cambridge area—Educators for Social Responsibility and Union of Concerned Scientists, among others. Materials for young children usually focus on how conflicts break out and are resolved, Zansberg says, while the more sophisticated material on international relationships is reserved for older students. A bibliography of such materials has been prepared at Stanford, and next summer, the project coordinators hope to bring 30 to 50 Bay Area teachers to the University for an intensive residential institute on how to teach arms control at the primary and secondary level.

Last fall, the Union of Concerned Scientists and Physicians for Social Responsibility urged teachers around the country to devote up to a week of instruction to arms-control issues, but Zansberg notes that such efforts often provoke controversy locally and nationally. Zansberg says that classroom material prepared by groups that favor arms control has come under attack from organizations such as the American Security Council in Washington, D.C., and Phyllis Schlafly's Eagle Forum in Alton, Illinois. The National Education Association, on the other hand, has endorsed use of "Choices," a 10-lesson series on war and peace issues prepared by UCS.

Stanford's International Security and Arms Control Project does not specifically endorse use of the items it compiles, and because certain items are regarded as biased in some circles, participants in the project are developing new curricular materials which—they hope—will be seen as objective on all sides. They expect to have some of the material ready next summer for the pre-college teaching institute. —ws

# New center studies climate trends

A new Center for Climate Research, to study long-term climate changes, has been established under the auspices of Columbia University with a seed grant of $1 million from the G. Unger Vetlesen Foundation. The Center is to promote cooperative work between Columbia's Lamont–Doherty Geological Observatory in Palisades, New York, and NASA's Goddard Institute for Space Studies, located near the Columbia campus in New York City.

The Goddard Institute, a division of the Goddard Space Flight Center in Greenbelt, Maryland, is developing models to project climate trends into the next century. The Lamont–Doherty Observatory boasts the world's largest collection of deep-sea sediment cores, which are being studied to compile a history of the world's climate changes going back more than 100 000