the customary practice of NAS presidents and virtually every other scientist who has ever had to deal with setting priorities about what, when and why certain fields or facilities should get the most of the government's largesse.

This has been the scientific dilemma for decades. But it has become more difficult and divisive in recent years as new fields have flourished, older fields have withered and government funds for discretionary use on huge new projects have been scarce. To such a somber situation, Press offered a sobering solution: With an abundance (some would say overabundance) of insistent, innovative and ineluctable things to do, tough choices need to be made within and across fields of science—and if scientists fail to make the choices, then they cannot argue with the choices made for them by politicians, who after all control the public purse.

Press knows the problem firsthand. He served as President Carter's science adviser and as director of the Office of Science and Technology Policy for four years before his election to head NAS. One of his first actions as NAS president was to hold a convocation of some 100 academic and industrial scientists, national laboratory directors and government policymakers to discuss actual and proposed cuts in R&D budgets by the newly elected Reagan Administration. George A. Keyworth II, Reagan's science adviser, said he found the meeting "confrontational and self-centered." In his Academy address, entitled "The Dilemma of the Golden Age," Press cannot be accused of either malediction.

The dilemma, said Press, really lies in the exuberance of science—"in that golden age of discovery and advance." As Press put it: "It is not the lack of political support for science. Political decision makers in the executive branch and Congress no longer need convincing that leadership of American science and technology is vital to our nation's future. The real political issue is what does science most urgently need to retain its strength and its excellence."

In recent weeks, other voices have also spoken up for establishing criteria for ranking scientific projects in some order of merit and necessity. Robert M. Rosenzweig, president of the Association of American Universities, whose members include 54 leading research universities, and Roland W. Schmitt, president of Rensselaer Polytechnic Institute and chairman of the National Science Board, argued before different audiences in Washington that neither scientists nor politicians are prepared to participate constructively in setting budget priorities in science. At its meeting in Baltimore on 17 April, The American Physical Society's Council agreed to support a summer study of the way physics research priorities should be identified and allocated in the next decade.

When the Academies undertook the last comprehensive survey of physics, led by William Brinkman of Bell Labs, one objective was to sort out the community's priorities. To avoid fratricidal internecine warfare among physicists, the survey group refused in the end to do this (PHYSICS TODAY, April 1986, page 22). Press noted in his speech to NAS members that many scientists "urge us not to enter what they feel can only be a quagmire" serving to divide various communities and ensure political disaster.

While recognizing that listing priorities is fraught with dangers, Press nevertheless makes a persuasive, pragmatic case for doing so. In this he has the backing of NAS members who have been telling him at regional meetings in the past six months that it's high time to take the high road for the sake of both science and society.

A grand design

As improbable as it is for an NAS president to do so, Press provides, in a surprisingly assertive way, a grand design for setting priorities in research. Press's "absolute" highest priority is academic training and research grants for the largest number of scientists, engineers and clinical investigators. In an interview, he said he would include some mission-agency labs, such as the Naval Research Laboratory and Lawrence Berkeley, in his top category because they epitomize the best in basic research and graduate studies. In a subgroup of the category, Press would list reacting to national crises, such as AIDS and the problems of the space program, and responding to major scientific breakthroughs, such as high-temperature superconductivity. Press believes the Administration and Congress should be able to know what to fund first, even in a budget crunch.

Category 2 consists of projects with important scientific and political goals. Examples from science are the SSC and the sequencing of the human genome. From politics would come the space station, manned spaceflight, the Pentagon's R&D budget and projects that contribute to regional economic development, and hence jobs, or that enhance the nation's competitiveness in world markets. Accordingly, Press said, "It may be wise for huge multibillion-dollar projects like the space station to be left for major funding decisions by the next President, who . . . will have the responsibility for seeing them done."

Press told PHYSICS TODAY that he believes he has the duty to speak out about the problem, knowing that his message would be controversial. Part of the problem is that the government planning system for dealing with R&D appropriations is in disarray, Press admits. "It is astounding but true that nowhere in the Federal budget-making process is there an evaluation of the complete Federal budget for science and technology and its overall rationale in terms of national goals." Some 15 departments and agencies request funds in 14 separate budget categories, which are reviewed in at least six divisions of the White House Office of Management and Budget and require approval by nine different appropriations committees in Congress.

—IRWIN GOODWIN

FIVE YEARS AFTER 'A NATION AT RISK' US SCHOOLS STILL SEEK BETTER GRADES

In April 1983 the American public was numbed to read that ours is "A Nation at Risk." The scary phrase was the title of a searing report on US schools by the National Commission on Excellence in Education, a prestigious 18-member panel appointed by, of all people, Terrel H. Bell, a mild-mannered University of Utah professor who had been appointed Secretary of Education with the charge of dismantling the agency (PHYSICS TODAY, June 1983, page 44). Not since the Sputnik era of the late 1950s had the school alarms clanged so loud: A "rising tide of mediocrity" was engulfing the US education system, the report warned, "threatening our

very future as a nation and a people."

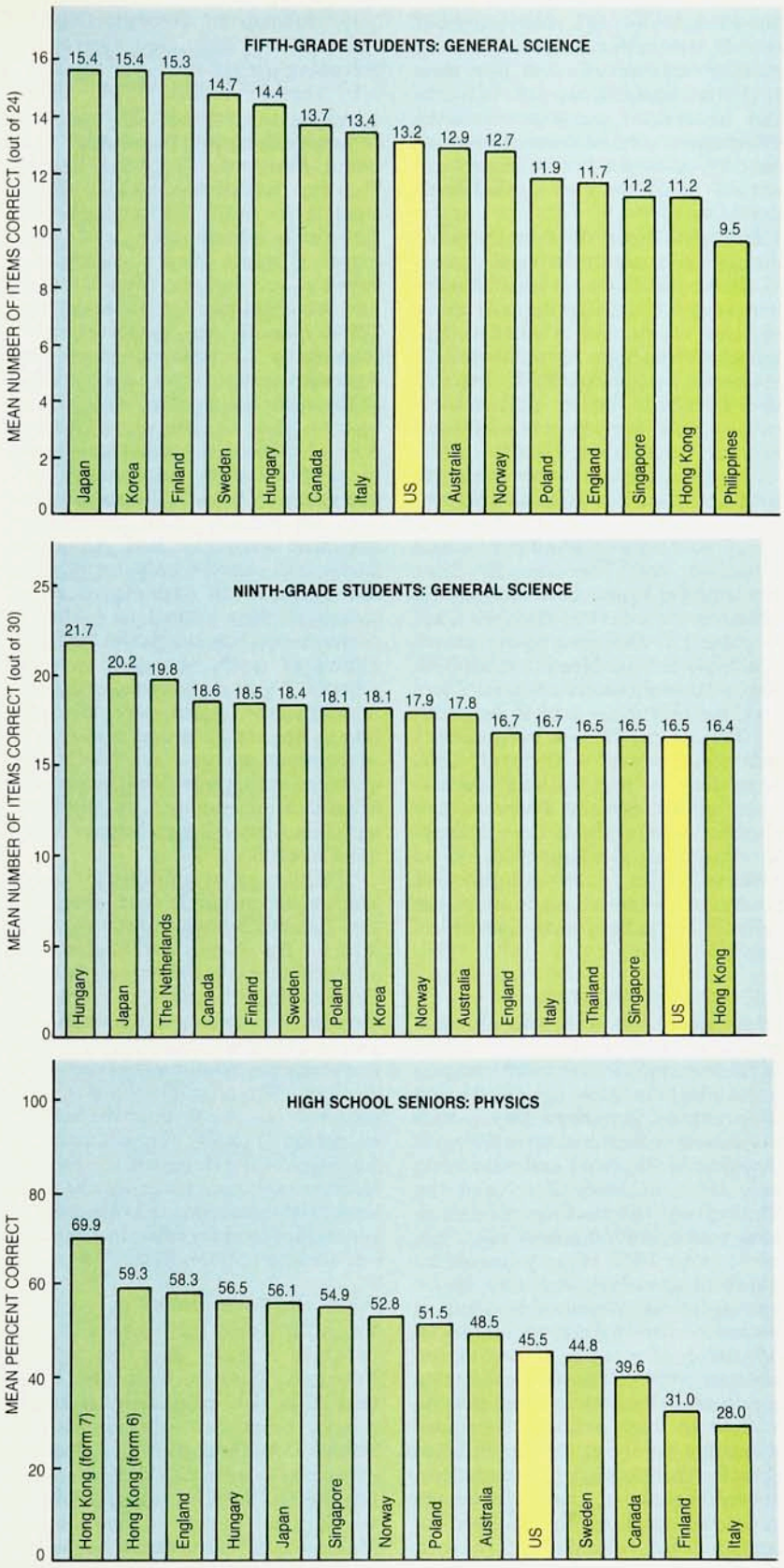
Five years later, despite a sustained wave of reforms involving parents, teachers, state governors, local school boards and business leaders, a chorus of condemnation continues to be heard about the status of the nation's schools. One of the most strident critics is, surprisingly, the current Education Secretary, William J. Bennett. On the anniversary of his predecessor's report, Bennett issued his own, bearing the seemingly innocuous title "American Education—Making It Work."

In it he claims that public education has made "some undeniable progress in the last few years." Some 35 of the 50 states have toughened graduation requirements; in 19 states students must now pass a test to receive diplomas. At least a dozen states have overhauled their school systems. Many states have raised salaries for teachers far above the inflation rate of the past decade and introduced competency tests for new teachers. Education is now the single largest budget item in all but 2 of the 50 states. Though nobody is sure of a cause-and-effect relation, scores on Scholastic Aptitude Tests and American College Tests have risen slightly in the past five years.

To be sure, standards are increasing measurably. While only 13% of 1982's high school graduates had completed what Bennett considers a minimum academic program, consisting of four years of English, three years of math, three of science and another three of social studies, by 1987 some 30% of the seniors had taken this program. What's more, the best and brightest seem to be working harder: Since 1983, the percentage of high school seniors taking Advanced Placement courses has doubled, from 4.7% to 9.7%.

Even so, Bennett is not congratulating the US schools. "We are doing better than we were in 1983. But we are certainly not doing well enough, and we are not doing well enough fast enough. We are still at risk," he writes in the foreword to the report. "The absolute level at which our improvements are taking place is unacceptably low. Too many students do not graduate from our high schools and too many of those who do have been poorly educated." Only hours before handing a copy of his report to President Reagan amid the panoply of a White House event on 28 April, Bennett gave news reporters his grade for the nation's schools: C to C-plus.

The report card has many depress-



ELLIOT PLOTKIN/PHYSICS TODAY

Falling science scores show up for US students as they advance in grade, compared with their counterparts in other countries. Scores on international science achievement tests indicate that the "best and brightest" US seniors place last in biology, 11th in chemistry and ninth in physics among 12th graders in 13 nations.

ing scores. The high school dropout rate is now around 30%. National reading tests reveal that less than 40% of all students are able to follow and understand current events in newspapers. Other tests show that only 2% of high school students can write a "clear, detailed and coherent narrative."

Bennett's report delivers the same message as a currently popular movie, *Stand and Deliver*, which tells the true story of Jaime Escalante, a mathematics teacher in a ghetto high school who badgers his students into mastering calculus. Both Bennett and Escalante argue that schools succeed when competent teachers and engaged students work hard.

The chief problem, say some, including Allan Bloom (University of Chicago) in his best-selling *The Closing of the American Mind* (Simon and Schuster) and Theodore R. Sizer (chairman of Brown University's education department) in *Horace's Compromise: The Dilemma of the American High School* (Houghton Mifflin), lies in the classroom, where many teachers now make a tacit deal with their students: "If you keep quiet, I won't make you work too hard." According to the National Assessment of Educational Progress, the cumulative effects have been dramatic. One-third of 17-year-olds do no homework; 10% to 15% of high school graduates are functionally illiterate; fully 25% of college math courses are remedial.

International rankings

In a recent survey by the International Association for the Evaluation of Educational Achievement comparing students in three age groups and 17 countries, American 14-year-olds in grades 8 or 9 ranked 14th, tied with students in Thailand and outscoring only those in Hong Kong and the Philippines. (At that age all Americans youths attend school full time, while only 32% of 14-year-olds in Thailand attend school at all.) Worse yet, American 17-year-olds taking a second year of biology, usually in an Advanced Placement class, placed last compared with students the same age in the 13 countries that provide science in high school. Advanced chemistry pupils in the US finished 11th in the ranking of students in those 13 countries, ahead of students in English-speaking Canada and Finland, but far behind those in such countries as England, Singapore, Japan, Hungary, Australia and Poland. In physics, American seniors in their second year of studies wound up ninth in the list of 13 countries, outdoing only students in Sweden, Canada, Finland and Italy (see figures on preceding page).

In another report, "The Underachieving Curriculum: Assessing US School Mathematics from an International Perspective," issued by the National Research Council's Mathematical Sciences Education Board, American elementary and high school students placed among the lowest of any industrialized country. The data indicate, for instance, that US 13-year-olds are competitive with students in the same age group elsewhere in computation and other basic skills such as algebra, but in the bottom 25% in geometry. Among high school seniors headed for college, the study found not only that American students were "substantially below" the international average but also that even the best American students performed only "at or near the average" of students in other countries. The culprit of such low performance, it seems, is the "diffuse" nature of math education in most schools. Topics are covered with little intensity, the report concludes. As late as the eighth grade, classes still concentrate on basic arithmetic. By contrast, at this level "France places a great deal of emphasis on geometry and Japan provides an intense treatment of algebra."

"The data paint a ghastly picture of science education in our country," says Bassam Z. Shakhashiri, assistant director for science and engineering education at the National Science Foundation. "American children have just as much innate curiosity and intellectual capacity for learning about science as students in any other country. We must develop quickly a national resolve to improve science education." NSF, for its part, is funding the development of new curriculum materials for grades K–12 as well as the training of both elementary and secondary school teachers in science and mathematics.

Public 'science deficit'

The need for better teachers is inescapable. A study done for NSF by Research Triangle Institute found that while 85% of elementary school science teachers studied biology in college, only about 35% took a college chemistry course and 20% a college physics course. The study, the 1985–86 National Survey of Science and Mathematics Education, also revealed that about half of the secondary school science teachers never had a college computer science course or learned calculus.

The results implicate America's educational system for contributing to the public's scientific illiteracy. What might be called the public "science deficit" is certain to have dreadful consequences for shaping US society in the 21st century. "In blunt terms, our educational system has produced generation after generation of young people who are ignorant in science and incompetent in mathematics," Paul E. Gray, MIT's president, has recently observed. "Many American adults are unable to distinguish between astronomy and astrology, for example, and a distressing number believe that their well-being can be influenced by crystals."

Without even a rudimentary understanding of science, asks Gray, "how can we as a people make well-informed decisions on the technical issues that affect our society? How can we weigh the risks and benefits of future energy sources, for example, or of gene-splicing in animals and plants? I seriously doubt that a democratically based society such as ours can prosper in a world that is increasingly technological and competitive when a significant proportion of its citizens don't have even a vague glimmering of the basic scientific and technological principles that affect our economy and culture."

Such ignorance, Gray declares, also threatens the scientific enterprise. To back his point he cites public and government opposition to the use of radioisotopes and radiation in medicine and medical research and to DNA research performed according to careful, prudent guidelines. "At the same time, however, the popular and government expectation is that scientists can, if they would only try, overcome almost any problem, literally on demand," says Gray. Here he refers to the beliefs that the Strategic Defense Inititive could be put in place soon and that a "magic bullet" will be found for AIDS if scientists just zero in on the agent that transmits the disease and kill it.

"Americans must come to understand that science and engineering are not esoteric quests by an elite few, but are, instead, humanistic adventures inspired by native human curiosity about the world and the desire to make it better," says Gray. "To achieve that understanding, schools and colleges need new programs and gifted teachers to provide students with a broad and comprehensive knowledge of science and technology." Few would argue with Gray's plea for a sustained national commitment to upgrading science and math education.

—Irwin Goodwin