PAST IMPERFECT II

What Went Wrong: Why Programs Failed

Ford Madox Ford began his famous novel *The Good Soldier* with the words: "This is the saddest story I have ever heard." Were he alive today, he might apply that line to the history of America's two-decade-long effort to bring color to the scientific and engineering work force. "The country cannot repeat the experiment of the last 20 years," says Luther Williams, assistant director for education and human resources at the National Science Foundation (NSF). "That was an incredible waste of financial and human resources." And yet, as every scientist knows, embedded within even the worst failures are lessons for the future. It is in this spirit that we look at the failings of the multitude of programs designed over these last 20 years to correct the underrepresentation of minorities in science and technology.

History. It was early in the 1970s when scientists, engineers, executives, educators, public policy whizzes, politicians, and the like decided that something must be done to reverse what they saw as a most disturbing trend in science: While blacks, Hispanics, and American Indians made up about 13% of the American work force, these three minority groups together accounted for less than 2% of the country's scientists and engineers.

Once the problem was recognized in the late '60s and early '70s, officials confidently set about to solve it, says engineer John Slaughter, former head of the NSF and now president of Occidental College in California. The mood was optimistic: Slaughter and others were certain that "opportunities were going to grow exponentially" and that a sizable number of minorities would jump at the new opportunities in science and engineering.

Universities, scientific societies, and industry rushed to join the effort. Across the country, Fortune 500 companies appointed minority affairs vice presidents to find minority workers and plan strategies for diversifying the work force. In an address to the Engineering Education Conference in July 1972, J. Stanford Smith of the General Electric Co. noted that of 43,000 engineers graduated in 1971, only 407 were black and a handful were other minorities and women. But he took a can-do approach to the problem: "The only acceptable solution is to take bold, innovative, all-out action to increase the supply of minority engineering graduates not by a few percentage points, but ten- or fifteenfold, and get it done within the decade," he said.

Meanwhile, a small but steady stream of minorities was moving through graduate programs; a few universities began looking for minority faculty. The professional societies formed committees, which eventually spawned major programs like the American Chemical Society's Project SEED (Summer Educational Experience for the Disadvantaged). Engineering supported some of the earliest, largest, and most sustained efforts, such as the University of California, Berkeley's, Mathematics, Engineering, Science Achievement (MESA) program, the National Action Council for Minorities in Engineering (NACME), and the Graduate Engineering for Minorities (GEM) program at Notre Dame University. The nation's major foundations began setting aside millions of dollars and advertising for proposals for minorities in science.

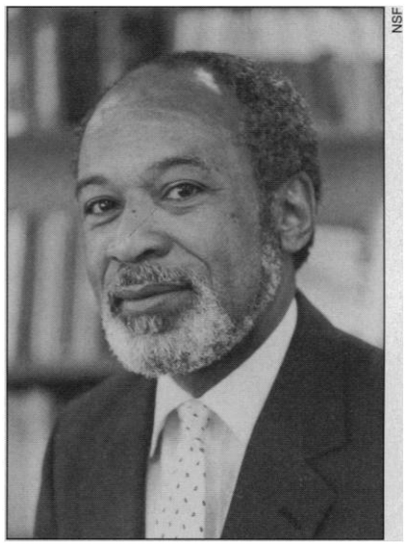
Government itself became proactive: In the late 1960s, the NSF inaugurated a slew of programs and now estimates that it averaged about $100 million a year, or about $1.5 billion in the past 20 years, to increase the number of minorities in science. Over at the National Institutes of Health (NIH), officials estimate that the two central minority programs have absorbed about $675 million over the last two decades.

But 20 years later, matters have barely improved. Although blacks are now 11% of the work force, they make up only 3% of employed scientists and engineers. Hispanics account for 5% of workers but 2% of scientists and engineers. And American Indians in science are so rare that the numbers are statistically suspect. Engineering is the exception: The number of minorities earning undergraduate degrees grew from 1255 in 1972 to 4575 in 1992. What went wrong?

Billions of dollars have flowed into programs with little to show for the money.

Failure. In recent interviews with *Science*, dozens of government officials, educators, and industry executives admitted that much of the money had been misspent. Although they were still reluctant to point fingers at failed programs, they explained why so many well-intentioned efforts made no dent in the problem. And their explanations most often included these seven culprits:

- Programs were run with little oversight or assessment; funding did not depend on results.
- There was little real commitment from the top or from most faculty.
- Programs had vague or unrealistic goals.
- Funding was inconsistent, magically appearing one year and vanishing the next.
- Programs ignored subtle psychological issues, such as low expectations on the part of teachers and counselors.
- Colleges recruited unprepared minority students and then left them to sink or swim.
- Programs targeted college-age students or higher, instead of also going to the root of the problem in elementary and high schools.



NSF

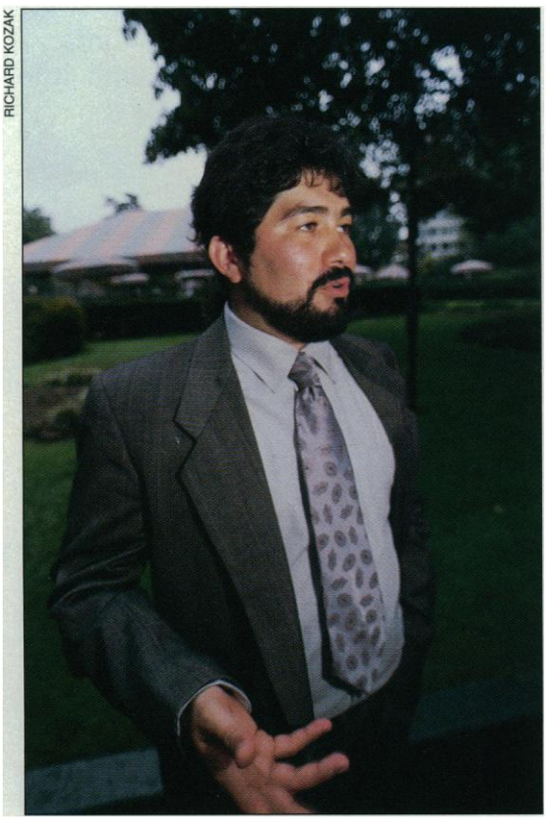
No nonsense. NSF's Luther Williams wants more accountability.

Some of these issues, such as the need to target young students, are discussed elsewhere in this special section (see story on page 1195). What follows is a dissection, with examples, of several of the reasons why well-intentioned programs failed.

No follow-up. Take the problem of assessment—or of its lack. "Most federal agencies awarded large grants to colleges and universities and unfortunately did so with zero accountability," Williams says. "As a result, there was no serious monitoring of the outcome, of how well students were progressing toward

their degrees. And when graduation time came around, they looked up and realized that they had accomplished very little."

Indeed perhaps no other type of grant required so little evidence of progress. Research awards require publications for renewal, but most minority grants didn't track students, so there was no way to judge success or failure. "There's no teeth in the programs, no sense of how you'd measure success," says Kenneth Olden, director of the National Institute of Environmental Health Sciences (NIEHS) and member of a committee charged with evaluating the NIH minority programs. "Nobody asks if these programs are working. There are no criteria for measuring success. They just keep throwing money at them."



RICHARD KOZAK

"It was clear he [the professor] didn't want me in class."
—Gustavo Muranda

Outfits like the American Association for the Advancement of Science made this point in reports published back in the 1970s—but somehow, few programs incorporated the recommendations.

Williams of NSF includes only a half-dozen ventures on his personal list of successes—and says that "by inference, everything else has not worked." And he provides an example at his own agency: the Minority Institutions Science Improvement Program (now at the Department of Energy), which received about $100 million in the last 20 years but which he says failed to show any tangible results. This program was to give minority students "hands-on" experience in research and gave grants to colleges with predominantly minority populations. But colleges put the money where they chose—on lab equipment or into their general fund for science and engineering. With few specific goals, there were few direct benefits for minority students, says Williams.

This year, both NSF and NIH are finally spearheading a massive drive to evaluate their programs. But NIH ran its programs for 20 years without tracking students. "The importance of tracking was always known, but we didn't have the funds," says Ruth Kirschstein, a physician who directs the National Institute of General Medical Sciences, which administers the NIH programs. "I'm sorry we didn't do it sooner."

Industry has made much the same mistake, it seems. Carver Gayton, director of college and university relations for the Boeing Corp., says industry threw money at colleges and universities without any oversight. "We gave them little direction, set few goals, and we failed to follow up on many of the programs to see if they were working. Many were not," he says. For example, many corporations started "adopt-a-school" programs, in which they gave colleges grants of $75,000 to $100,000 to address the issue. But again, schools used the money for whatever they thought they needed, and there were few tangible results.

Lack of commitment. NSF's Williams also provides an example of another cardinal sin: "Many of these university programs were run by marginal faculty members who had no real commitment to the task at hand. In large part they were given the assignment because they were low men on the totem pole and got stuck with it."

Departmental administrators were often not committed to spending resources—including professors' time—on minorities. Eloy Rodriguez, a professor of biology at the University of California, Irvine, recalls being warned by the department chair to "stick to your research. You won't get tenure if you keep worrying about these students"—meaning Hispanics and other minorities from the inner city who were working in Rodriguez's lab.

In a related problem, many programs were set up as additions, not integral to the mission of an institution. For example, in 1974, Olden, now director of NIEHS, went to the National Cancer Institute through NIH's regular postdoctoral program. "I learned when I got there that they had brought in other blacks, through minority channels. In 2 years they [minorities on special programs] were up and gone, and I stayed. I stayed because I went to someone who wanted me in the first place. And then later I got tenure at NIH. They didn't succeed in part because there was no commitment to them in the first place."

Unrealistic goals. Several programs sought to boost research facilities and train students at black colleges. Among the most visible—and politically sensitive—initiatives are the MARC (Minority Access to Research Careers) and MBRS (Minority Biomedical Research Support) programs launched 20 years ago by NIH. About 3000 minority scientists have benefited from the two programs, but critics charge that the programs do not meet their goals. Leo Davis, chemist and associate vice president for academic affairs at the University of Iowa, says MBRS wastes money on grandiose research projects and administration instead of helping students. "A lot of this is guilt money being thrown at the problem," he says.

For example, he cites an NIH-funded organic synthesis project at a poorly equipped black college. To do the work properly required a $500,000 nuclear magnetic resonance spectrometer. According to Davis, the researcher went ahead and did the project without the NMR, knowing the results would be inconclusive. "It was like trying to race a model T Ford against a 12-cylinder race car. That money could have been better spent on students."

One way to judge such programs is to see whether schools that have gotten MBRS funds—and some have gotten money every year for the past two decades—have gone on to win mainstream grants. But NIH officials say they can't count how many mainstream grants go to black colleges because they have just begun their review process. Still, Kirschstein admits that the record among black colleges for getting mainstream grants is "dismal." She insists, however, that the NIH programs have "greatly increased the skills of faculty at minority institutions and

doubled the number of graduates majoring in science at these schools."

The MARC program also comes under fire because it is supposed to cultivate Ph.D. researchers, but at least half of the recipients use it as a stepping stone to medical school instead, according to Kirschstein's data. Again, MARC has its defenders, including Daryl Chubin of the Office of Technology Assessment, who cites a survey showing that three out of four MARC recipients go to either graduate or professional programs.

Inadequate funding. Every year even programs that are recognized successes scramble for dollars. Since 1979, mathematician Manuel Berriozabal at the University of Texas has run a summer math-based enrichment program called TexPREP for middle and high school students. Virtually all participants graduate from high school, and 80%—more than half of whom major in science or engineering—graduate from college. Others are trying to imitate this highly regarded program nationwide—but back in Texas, the funding is shrinking. This year, the program requested $560,000 from NSF but got only $225,000.

In another example, after Sputnik, NSF launched a series of highly successful teacher training initiatives. But in the early '80s, the money and programs vanished. Older teachers no longer had a way to brush up their skills, and younger ones emerged from often-inadequate schools of education and went straight into classrooms, according to education experts like Doug Lapp of the National Science Resource Center.

As a result, today many science and math teachers are barely keeping ahead of their students. Richard Woodring, the former dean of engineering at Drexel University, began working in a regional engineering program in the 1970s and found that in Philadelphia's inner-city high schools, "teachers were totally unqualified." One math teacher kept canceling visits by other teachers to his class because, as they finally realized, "he was intimidated by the fact that adult teachers were going to sit in the class, and he didn't know his material."

Brown University associate provost James Wyche puts it this way: "The problem with American education is everything is a 2-year, 3-year, 5-year experiment. We have to stop that. We have to look at long-term projects that we know work, put resources in them, and give them time to develop the type of outcomes that are best."

Sink or swim. In their haste to qualify for industry money, colleges aggressively recruited minority students, accepting many who hadn't taken much high school science or math, and then left them to struggle through—or drop out—on their own, educators say. In the early days "colleges took any person of color who wanted to become an engineer, regardless of their background," says Mary Perry Smith, who founded MESA in California. "They tried to turn students who barely knew algebra into engineers and it was a total failure."

Even when colleges tried to help students make up for gaps in their preparation, they didn't always do a good job of it. One precalculus course offered at the University of California, Berkeley, during the early 1980s was intended to boost minorities' math skills. But the designers didn't coordinate with the math faculty, and the course didn't prepare students for the regular mathematics curriculum. Fewer than 20 of the 2800 students who passed the precalculus class went on to pass second-semester calculus. Now, however, a second-generation calculus program at Berkeley is highly regarded.

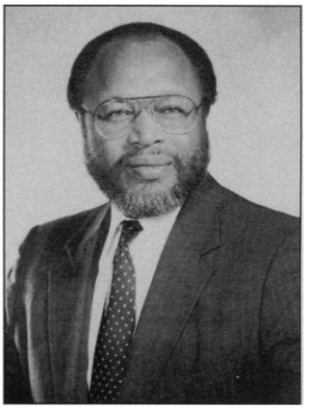
Lee Browne, retired director of secondary school relations for the California Institute of Technology, sums it up this way: "How can these youngsters be expected to learn and absorb the college engineering material while at the same time they are being given remedial instruction for what they were not taught in high school? It doesn't make a lot of sense."

Psyched out. One reason so many minorities are poorly prepared is that instructors and guidance counselors may discourage them from believing they can succeed in science or even from trying. In 1969, Wilbur Somerton, former head of the petroleum engineering program at Berkeley and a founder of MESA, was surprised to find that black and Hispanic freshmen admitted to Berkeley had been advised by their well-intentioned counselors not to take tough science and math courses in high school—because it would bring down their GPAs.

This is part of a larger problem of low expectations. University of California, Los Angeles, biology major Gustavo Muranda recalls one professor who would not admit him to class: "It was clear he didn't want me. When I asked him why, all he said was, 'This is my class and my choice.'" George Campbell Jr., an AT&T physicist who is now president of NACME, says: "There is a general assumption that minorities are not smart enough to handle the work." He offers workshops where faculty are videotaped talking with white students, then with minorities. "The difference is so obvious, we don't have to say anything to the teachers. Even the well-intentioned faculty talk down to minorities."

Like those well-intentioned faculty, many of these misguided programs were launched in good faith. Unfortunately, while they were missing the target, the country was changing. Perhaps the saddest part of this tale is the sense of opportunity lost. The '60s and '70s were the age of expansion, when the nation was ready to make war on poverty. Today's climate, with its stagnant economy and research retrenchment, is a poor time to begin such a massive effort—even though the need is even greater now, as the number of minorities in the U.S. population continues to rise. In the lean and mean 1990s, new and perhaps improved minority science programs will have to compete with remedies for other pressing social and scientific ills. And that means they'll have to demonstrate results. "The only way I know to ensure we make progress is to emphasize accountability," says Williams. "We have to go into a goals-oriented, no-nonsense mode."

—Calvin Sims



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With reporting by Elizabeth Culotta, Ann Gibbons, Constance Holden, and Dawn Levy. Calvin Sims is a business and technology reporter for The New York Times. *See also Sims' personal reflections on growing up black and going into engineering on page 1231.*