Wanted: 675,000 Future Scientists and Engineers

A shortage of technically trained workers is looming, unless more women and minorities can be attracted to science

THE JOBS MARKET for researchers with freshly minted Ph.D.'s is tight right now, creating tough competition for those who want to advance in scientific and technical fields. But if the National Science Foundation's vision of the future is correct, the situation will soon reverse. A "sellers' market" will develop over the next decade, according to NSF, in which companies and universities will be falling all over each other to recruit young scientists and engineers to replace older employees who are coming up for retirement.

That will be good news for those now in the educational pipeline, but it could spell disaster for the U.S. economy. Even though better opportunities should lure able students into science, a shortfall of about half a million scientists and engineers is expected to develop by the end of the century. And this shortfall is looming at a time when overall educational standards in the United States are dismally low in comparison with those of America's major industrial competitors. Says William O. Baker of Bell Labs, the country can no longer operate on the old assumption that "the gifted and talented will see us through."

The crisis that is being widely predicted over the next decade is rooted in an incontrovertible demographic fact: because of low birthrates in the 1960s and 1970s, the college-age population—the raw material for tomorrow's educated workforce—is shrinking. According to the Census Bureau, numbers of 18- to 24-year-olds will bottom out at a little under 24 million in the mid-1990s—compared with a peak of over 30 million in 1980. Currently, a little over 5% of 22-year-old Americans earn B.S. degrees. Unless that fraction is increased, says NSF, there will be a shortage of 400,000 scientists and 275,000 engineers by 2006.

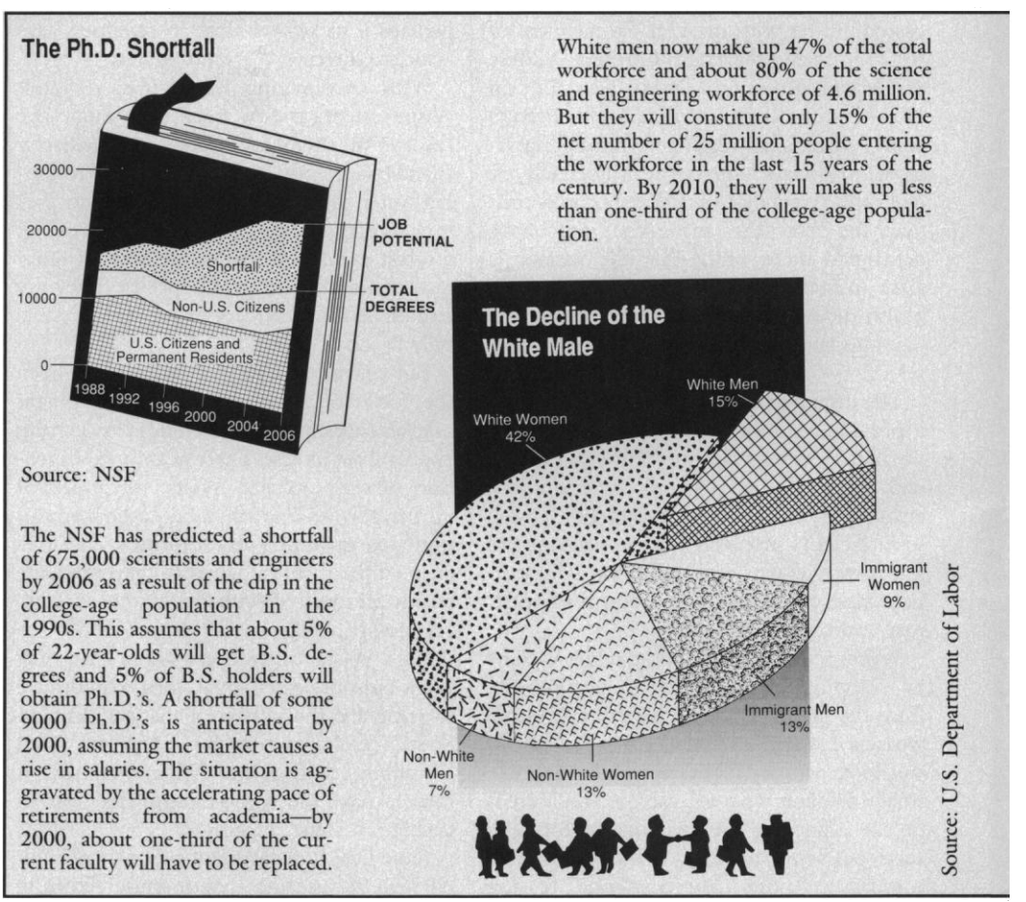
Although the dip in the college-age population will be temporary—the children of the baby boomers will be entering their early 20s in growing numbers in the late 1990s—the nation could still be faced with a shortage of scientific manpower over the long term because of growing proportions of nonwhites in the population. Current new additions to the workforce are mainly women, immigrants, blacks, and Hispanics, groups that have traditionally been grossly underrepresented in science and engineering.

In fact, Jaime Oaxaca of Northrup Industries, a member of a congressionally established task force on women and minorities in science, says recent trends make the NSF's shortfall projections "look super-optimistic." Says Oaxaca: "The dilemma we face is by and large America doesn't believe there's a problem because America's a short-term thinker."

Others are more sanguine. Hilliard Williams, research director at Monsanto Corp., admits that a look at the demographic picture could easily persuade one that "we are headed for a period of immense crisis." But he believes that the fears are exaggerated and that market demand will draw in more people, particularly foreigners, to fill the gap. Aggressive recruitment of women and minorities is essential, he says, but as far as such programs are concerned, "I don't see much of anything having a profound effect in less than 10 years."

Engineer Mildred Dresselhaus of the Massachusetts Institute of Technology, who headed a National Academy of Sciences workshop on women in science and engineering, says that despite spot shortages, the manpower crunch is yet to be felt at higher degree levels. At the moment, she says, students fresh out of graduate school are actually encountering a constricted job market. Industry demand is "soft" because of slow growth in R&D expenditures and academic research funding is tight. But although she believes "demand and supply are pretty well matched now," she predicts "the tide will turn very rapidly" as the rate of retirements accelerates in academia.

On one point, all are agreed: If a long-term shortage of scientists and engineers is to be averted, unprecedented numbers of women and minorities will have to be attracted to technical careers. There are a few bright spots. Asian Americans, for example, are heavily invested in natural sciences and engineering; although they constitute only 2% of the population, in 1986 they garnered 5% of the doctorates in these fields. But overall, recent trends provide scant hope



that women and minorities will plug the projected gap.

The number of women planning careers in science and engineering appears to have plateaued after peaking in the late 1970s. Female participation in the science and engineering workforce has grown to about 15% from 13% a few years ago. The slowdown is not surprising: Women scientists still suffer higher unemployment, lower pay, and fewer opportunities for promotion at every degree level than do males. According to the Office of Technology Assessment (OTA), "the gender gap in recruitment to and participation in science, reduced by two decades of gains, is in danger of widening again."

Although women account for about one-third of all doctorates in the sciences, they tend to be concentrated in the social sciences and psychology. In fact, the number of Ph.D.'s awarded to women in natural and computer sciences has stayed flat since 1983. A similar pattern prevails at the undergraduate level, with some exceptions—for example, 38% of the freshman class at MIT is now female. The Educational Testing Service reports that only 11% of female SAT-takers, compared with 34% of the males, plan to study the physical sciences in college.

The situation for blacks and Hispanics is, unfortunately, even worse, because both groups continue to lag far behind whites from early elementary school onward. "The participation of blacks and Hispanics in engineering, as well as the physical sciences, shows little sign of substantial increase," says the OTA.

In some respects, the lot of blacks, particularly males, has actually been deteriorating. Blacks, now more than 12% of the population, make up about 2% of the science and engineering workforce. Although various reports claim that they now graduate from high school in roughly the same proportion as whites, the percentage of black high school graduates going on to college dropped from 33% to 26% in the decade ending in 1986. This mainly reflects the dramatic drop in black males going to college: black females on campus generally outnumber black males by two to one.

At the Ph.D. level, the situation is even bleaker. According to the National Research Council, the numbers of blacks earning Ph.D.'s in all fields has dropped by 27% in the past decade. More than half of all black Ph.D.'s are in education. In 1988, according to the NSF, the combined total of Ph.D.'s in the natural sciences and engineering for blacks and Hispanics was a mere 287.

Hispanics, who now make up perhaps 9% of the population, have the worst high school dropout rate of any group and, as with blacks, college enrollment has declined in the past decade. Moreover, only 25% of Hispanics who attend 4-year colleges persist to get their bachelor's degrees. Despite their smaller numbers, Hispanics are getting roughly the same percentages of higher degrees in the sciences as blacks.

Can the pull of market forces lure more women and minorities into scientific careers, as Monsanto's Williams hopes? Even he is discouraged that "the minority community doesn't realize what a gold mine of opportunity sits there today." Industrial competition for minorities and women "is absolutely fierce" and big companies are sometimes offering them higher salaries than white male competitors. But despite that, he says, "the hardest thing in the world to find is a Ph.D. female [or black or Hispanic] chemist."

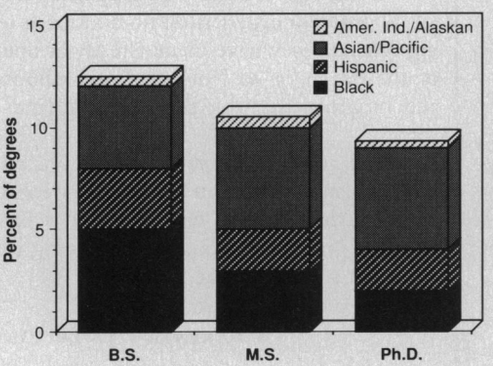
The NSF does not express all that much optimism that the market alone will be enough to fill the gap. Peter House of NSF says the greatest immediate payoff would be from efforts to improve the college retention rate of students who already have an expressed interest in science and engineering. In an April report on future scarcities of scientists and engineers, the NSF says the problem could also be remedied if the 8% of high school graduates who don't go on to higher education, but whose grades and course-taking qualify them as "apparently able," could be induced to go to college. Furthermore, the agency says increased scholarship support would provide quick results, especially at the Ph.D. level. Foreigners won't make up the shortfall, it says, unless there are "significant reductions in barriers to obtaining student visas."

There are enormous numbers of government-, university-, and industry-sponsored programs now operating at all levels of education that are designed to raise the participation of women and minorities in science. But the NSF report says that "it is too late for precollege programs to contribute" to alleviating looming Ph.D. shortages in science.

To NSF director Erich Bloch, it will take 20 years to bring about necessary improvements in precollege education. But even if schools eventually succeed in providing a solid early foundation for all students, there is no guarantee that blacks and Hispanics—or women—are going to gravitate in great numbers toward physics, math, computers, and engineering. Policy-makers seem to have adopted the implicit assumption that these groups should ultimately distribute themselves in the disciplinary patterns favored by white males. But it may be that as the demography of science shifts the landscape too will be altered.

■ CONSTANCE HOLDEN

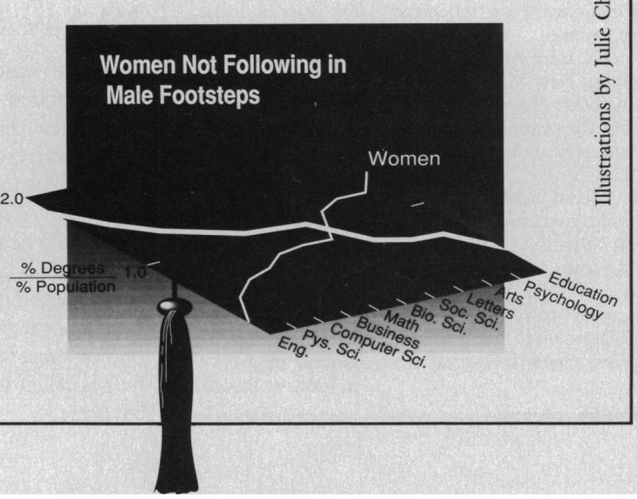
Minority Progress Stalled



Source: *Educating Scientists and Engineers, Grade School to Grad School*, OTA, 1988

Blacks, Hispanics, and American Indians continue to show high drop-out rates from high school and college, and college attendance has declined over the past decade. Blacks and hispanics make up more than 20% of the population but get only 7% of B.S. degrees and 4% of all science and engineering doctorates. In physical sciences, engineering, math, and computer sciences, proportions of black and Hispanic doctorates each hover in the neighborhood of 1%.

Women get almost 40% of B.S. degrees and have been making gains in graduate school. But female interest in engineering seems to have plateaued since 1983. Heavily represented in biology, health sciences, and psychology, they get only 16% of doctorates in the physical sciences, 10% in computer science, and 7% in engineering. Asian women are the only ones who violate the overall pattern: the highest number of B.S. degrees are in computer sciences, math, and biology.



Illustrations by Julie Cherry