TRAINING AND WORKFORCE

What If the Science Pipeline Isn't Really Leaking?

The metaphor of a leaky pipeline is a fixture in discussions of whether enough U.S. students are pursuing careers in science and engineering. And scholars have explored in great detail why so many who profess a passion for science lose that inclination as they move through the education system.

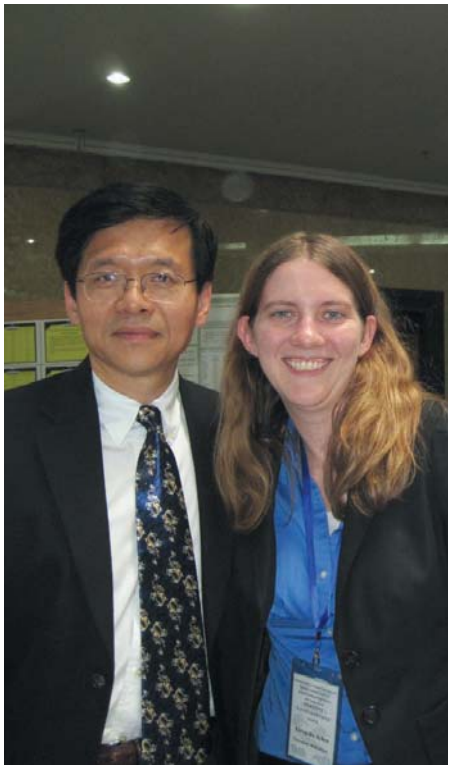
However, a new book on the overall health of the U.S. scientific enterprise argues not only that the pipeline isn't leaky, but that it's the wrong metaphor. "There is little evidence that science suffers a 'leaky pipeline' during the college years that disproportionately steers students away from scientific fields and toward non-scientific studies," write Yu Xie of the University of Michigan, Ann Arbor, a sociologist and longtime analyst of the scientific workforce, and Alexandra Killewald, his former doctoral student, who this month joined the faculty at Harvard University.

Xie and Killewald argue that the pipeline paradigm ignores two important variables: students who obtain an undergraduate science degree after switching from a nonscience field, and those who drop out of school before earning any degree. Those omissions, the authors assert, make the pipeline a fatally flawed description of a system that they believe is actually doing a pretty good job of meeting the country's need for scientific talent.

While that conclusion goes against the accepted wisdom, experts find the new book persuasive. "I think they have made a pretty good case [on both issues]," says sociologist Robert Hauser, head of the Division of Behavioral and Social Sciences and Education at the National Research Council of the U.S. National Academies. In particular, he adds, "the pipeline is clearly a much more complicated story [than most people realize]. It doesn't look like there is a wholesale slaughter of kids hoping to become scientists."

Xie and Killewald draw their conclusion from national longitudinal studies of high school seniors and their career aspirations. In particular, the pair found that the percentage of college graduates who earned a degree in natural sciences or engineering was higher than the percentage of high school students who said they hoped to earn such a degree. In the most recent cohort—students who graduated from high school in 1992 with plans to attend college—the comparable figures for men are 28.3% and 27.5%; for women, it's 13.2% and 10.5%. The numbers are comparable for the 1972 and 1982 cohorts. (A study following students who graduated from high school in 2004 is still under way.)

Those figures don't mean there is no attrition. Individual students do drop out of science, Killewald says, and moving into science at the graduate level is much more difficult, Xie adds. But at the undergraduate level, those turning away from science are outnumbered by "switchers," or those who enter from nonscience fields. The phenomenon is especially noticeable among women who decide to go into the life sciences. In fact, Killewald says, the pipeline paradigm "captures less than 40% of the women who end up with science degrees."



New message. Yu Xie and Alexandra Killewald reexamine accepted wisdom on scientific workforce trends.

The other big flaw in the pipeline paradigm, Xie and Killewald argue, is its failure to distinguish between students who abandon science for other fields and those who simply drop out of university. Among men in the 1992 cohort who fall short of their goal of earning a science degree, Killewald says, "70% receive no college degree at all, while only 30% receive a nonscience degree."

Aspiring science and engineering majors actually have a lower dropout rate than those planning to earn nonscience degrees—45% versus 51% for men, and 34% versus 40% for women. Those numbers, Killewald says, suggest that "the leaks in the science pipeline are really leaks in the education pipeline." What she calls an "unequal access to higher education," a combination of economic, educational, and cultural factors that make it harder for students to attend and complete college, also undermines attempts to attract more Latino and African-American students into science.

The authors give a flat no to the book's title question, *Is American Science in Decline?* Stagnant salaries, gloomy job prospects for academics, and growing international competition are indeed cause for concern, they write. But U.S. science is holding up surprisingly well, they say, and the country is more likely to benefit than be hurt by scientific advances elsewhere.

The book also takes issue with the widely cited figure that only one in three persons with science and engineering degrees is working in a science-related job. It's a statistic used by those who argue that the country already has too many scientists. "The real figure is between one-half and two-thirds," Xie says. The discrepancy comes chiefly from including those with social science degrees, a group that comprises half of all science degrees but for whom Xie says there exists "a weak linkage" between their degrees and their careers. The authors say it makes more sense to track only those with degrees in the natural sciences and engineering.

Hauser, who says "they are dead right on the definition of the workforce," also believes the authors' analysis has important implications for the broader, ongoing debate about training scientists (*Science*, 22 June, p. 1489). "It really comes down to how many folks you want to see in these fields," Hauser says. "If you think that the nation requires a lot more scientists, then you'll be troubled that the numbers aren't growing more rapidly."

Although Xie and Killewald believe there is compelling evidence for the need to rethink U.S. policies on training scientists, the authors do not plan to lead that debate. "We will not be making any clear-cut policy recommendations," they write. "On a subject as complicated and difficult as the scientific workforce, we feel that any attempt to do so would be presumptuous and foolhardy."

–JEFFREY MERVIS

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