

Is Science Talent Squandered?

How future scientists can come undone

By CHRISTINE MLOT

In 1974, a 17-year-old from Stuyvesant High School in New York entered the annual Westinghouse Science Talent Search (STS). His mathematics paper, on quasiperfect numbers, won first place. One thing he gained from the project, he wrote on his application, was "a respect for the computer as a useful tool rather than just a 'toy.'"

Today, Eric Lander runs the computer-intensive genome sequencing project at the Whitehead Institute for Biomedical Research in Cambridge, Mass., and teaches at the Massachusetts Institute of Technology. Although he started out as a business school professor after earning degrees in mathematics, Lander found his way into a field of science where he has generated about 150 publications so far in biology and genetics. Last month, he was recognized with membership in the National Academy of Sciences.

It's the kind of creative life in research and teaching that most students in the high-level science competition set their exuberant sights on. "It'll definitely be science. It'll definitely be research," says one of this year's winners (SN: 3/15/97, p. 159). If the students express any hesitancy, it usually has to do with picking which inviting area to pursue. There is little doubt about their impassioned interest in science.

For a significant number of the finalists and winners, however, the STS will be the highlight of a very short scientific career. In a unique longitudinal study, education researcher Rena F. Subotnik of Hunter College in New York has been following the careers of about 100 of the semifinalists from the 1983 contest, including 9 of the 10 top winners. At the time, all but a few were intent on pursuing a career in science. Now in their early thirties, about half of them are still in science, many in applied fields like medicine or engineering. Only a few are established in academic research careers.

Their stories reveal a lot about the personal, educational, and social factors that must come together to turn an interested, talented teen into a productive sci-

entist. They are particularly telling about what happens—much of it discouraging—to science students in the first years of college.

The experiences of the STS students jibe with a national trend that other researchers have uncovered. The sciences do an especially poor job of retaining young talent. Half of the students who begin in the physical

or biological sciences and 60 percent of those in mathematics switch out of these fields, according to data from the Higher Education Research Institute at the University of California, Los Angeles. The humanities and social sciences lose only 30 percent of their students.

There is a certain amount of appropriate switching—students who discover more interesting or suitable fields or who lack some of the required preparation. However, a recent book documents that the students who leave science are among the most qualified, talented, and interested, at least initially.

Subotnik, whose interest is gifted children, turned to the Westinghouse competition because it is a clear and established indicator of talent—defined as the application of abstract potential in a specific area, in this case science, math, or engineering. In 1942, Westinghouse Electric Corp. began sponsoring the national scholarship competition, which is administered by Science Service, the publisher of *SCIENCE NEWS*.

Students are evaluated primarily on an original research paper, a truer gauge of talent than a test, according to Subotnik. Says Samuel P. Whalen of Northwestern University's Center for Talent Development in Evanston, Ill., "We aren't talking SAT scores. These are kids who have a knack for asking interesting questions."

That knack appears early. A retrospective study of eminent scientists in the 1950s (Anne Roe, *The Making of a Scientist*, 1953, New York: Dodd Mead) concluded that a bent for science emerges by age 7. This year's 40 STS finalists (SN: 2/1/97, p. 69) fit that pattern. They're hard put to explain the origins of their interest in biology ("I just always liked nature"), math ("I've always liked working with abstract objects"), or engineering ("I've been tinkering since I was a baby").

Having scientists in the family can be a positive influence, but it's not essential. One of this year's STS winners, the daughter of a poet and a power plant employee, is the first in her family to be interested in science. "When I was 4, I wanted to be a doctor," she says. Now, she's torn between medicine and anthropology because "they're both part of the human story." In Subotnik's group, about one-quarter had parents neither of whom had graduated from college.

Subotnik did an initial survey by mail of the STS students in 1984, their first year in college; she surveyed the respondents again in 1988, 1990, and 1994. This April, she gave an update on the project at the biennial meeting of the Society for Research in Child Development in Washington, D.C.

By 1988, when most had finished college, 22 of the 57 men and 37 women still in the study had left science and its applied fields. Fifteen of the 22 were women.

Typically, STS students are talented in a variety of areas, so some of the 1983 class simply chose to pursue another field or had shaken off their parents' influence. "I liked history as much as biology," reported one. Another student left to concentrate on training as a triathlete.

Historical and social forces no doubt shaped the fate of the group, as they have for each STS class, says Subotnik. The 1983 class came of working age when Wall Street, not Sputnik, dominated the zeitgeist and *Bonfire of the Vanities* was a best-seller. For some students, it no doubt seemed more prestigious to be





a Master of the Universe than a student of it, especially as funding and job opportunities in science tightened during the 1980s.

A frequently reported reason for leaving, however, had to do with the contrast between the students' high school and college experiences in science. As one student put it: "When I was doing the Westing-

house project, I really enjoyed the whole process of doing scientific research, so that was where I was focused. When I got to college and went to some of the required science classes, like intro bio and chem, I realized I was going to be in for 3 years of memorizing scientific facts. At that point I said to myself, 'I'm going to be miserable if this is what I do for the next 3 years.'"

Unlike talented young athletes or musicians, science students often have to give up the tinkering and inquiring—the science they've "always" been pursuing—once they get to college. If they are exposed to research science, the quality of that experience can be crucial.

One student who had won an STS scholarship for her high school project in neurophysiology was turned off by the routine work and unsupportive culture she found in her lab. "My job ended up being cutting out fish eyes." Although she earned a science degree, she says her "heart wasn't in it," and she now works as a business writer and editor.

Many of the students regretted their choice of school. "People picked schools for odd reasons," Subotnik says, usually unrelated to the quality of science training. She emphasizes the need for better advising and guidance of research-ready science students.

Indeed, the students who remained on a science track were more likely to have been singled out by supportive scientists along the way. Having mentors was the most important factor for one of the former STS students, now a physician and cancer researcher. "I was learning how to think like a scientist," he says of his generous interactions with mentors.

Another STS student, who attended the same university as the business writer, says she switched out of science because she felt more at home in her humanities classes. Coming from an immigrant family of nonscientists, she earned a degree in cultural studies and turned her thesis topic into a well-received book.

Eventually, the interest that had won her a scholarship for a project in protein chemistry resurfaced. She went to work for a biotechnology company and is now a medical student and researcher again, in microbiology.

"In science education, there's really not a focus on talent till graduate school. There's lots of talent lost at the undergraduate level that could have been nurtured," says Subotnik.

Most of the women who left science did so in college. For men, the defections and doubts about continuing in science came later, according to the 1990 and 1994 surveys. While in graduate school and postdoctoral training programs, concerns over jobs, salaries, funding, and lifestyle emerged as important factors in the students' decisions to leave.

Funding remains a worry, even for those who have it, like the cancer researcher-physician, who has published a dozen research reports. Since high school, he has had mentors, rich research opportunities, and funding. He considered leaving a few years ago, when it seemed to him that funding shortages were forcing doctors to work as full-time clinicians, but he is now settling into an academic job that combines both research and clinical practice.

About 10 years after the 1983 STS students had entered college, two sociologists from the University of Colorado at Boulder took a different look at the experiences of talented undergraduates in science, math, and engineering. Elaine Seymour and Nancy M. Hewitt describe their findings in *Talking About Leaving: Why Undergraduates Leave the Sciences* (1997, Boulder, Colo.: Westview Press).

The researchers selected 335 students at seven institutions who were asked to be "expert informants" about their science education. Another 125 students were interviewed in focus groups to check the reports. The 460 students were considered to be well qualified for science careers on the basis of their high math SAT scores (at least 650) and their high school preparation, but slightly more than half of them had switched out of science or related majors.

The seven schools ranged from a small, private, liberal arts college in the West to a large public university in the Northeast. All are considered to have strong science programs.

Although the design of this study was different from Subotnik's, the conclusions about college science were not. The most common of the 23 reasons offered for dropping out of science were a lack or loss of interest in science, belief that another major was more interesting or offered a better education, poor science teaching, and an overwhelming curriculum. The relatively few undergraduates who had opportunities to interact with faculty on a research project had a more positive view of science.

The Colorado researchers noticed something else: "Those who switch represent only the tip of a much larger problem." Most of the students continuing in science, math, and engineering shared with the "switchers" the same concerns about their education. Poor teaching was the most common complaint, cited by 83

percent of all the students.

Working scientists who have made it through the educational system often portray the undergraduate science experience as a proving ground—those who can't take it are better off in another field. Yet the process is turning off students with talent and interest and selecting for coping strategies and other traits, the researchers found.

Says one who stayed in engineering, "The people who leave aren't necessarily any less talented, but they just say, 'Why do this?'"

Efforts to recruit talented students, especially from underrepresented groups, will be doomed until the weeding-out system and the poverty of the educational experience are reformed, says Seymour. "So many of the really bright ones were bored out."

Reform has at least begun. In response to the widespread diagnoses of problems in science education (SN: 11/30/96, p. 341; 10/19/96, p. 244; 1/25/92, p. 61), a slew of institutions and individuals has set out to make the classroom experience of science truer to the inquiring experience of research science (SN: 2/3/96, p. 72).

In the last few months alone, the National Research Council in Washington, D.C., and the Howard Hughes Medical Institute in Chevy Chase, Md., have issued reports on improving science teaching in college. These follow other major initiatives—by funding agencies, national scientific societies, and many individual schools and professors—that are geared to improving science education from kindergarten through graduate school.

What are the chances that students entering college this fall will have their interest in science sustained instead of sapped? It's too early to see improvements, says Seymour, who also serves as an evaluator for one of the National Science Foundation's education change programs. "It's uphill stuff. It'll take a lot of time. . . . Faculty who are change makers are in the minority."

Most of the reform efforts focus on improving science education for students across the board. Programs that aim specifically to improve the lot of promising young science stars don't win the enthusiastic support reserved for young tigers in golf or gymnastics. STS students, for example, are often portrayed as members of an elite group who have enough advantages already.

Science is losing out "on the creative potential of men and women nationally recognized for their science talent," says Subotnik, who is next turning to a study of young musicians at the Julliard School in New York. "The arts are doing a better job of taking this level of talent and considering it a precious resource." □