SCIENCE

Science Careers: Playing to Win

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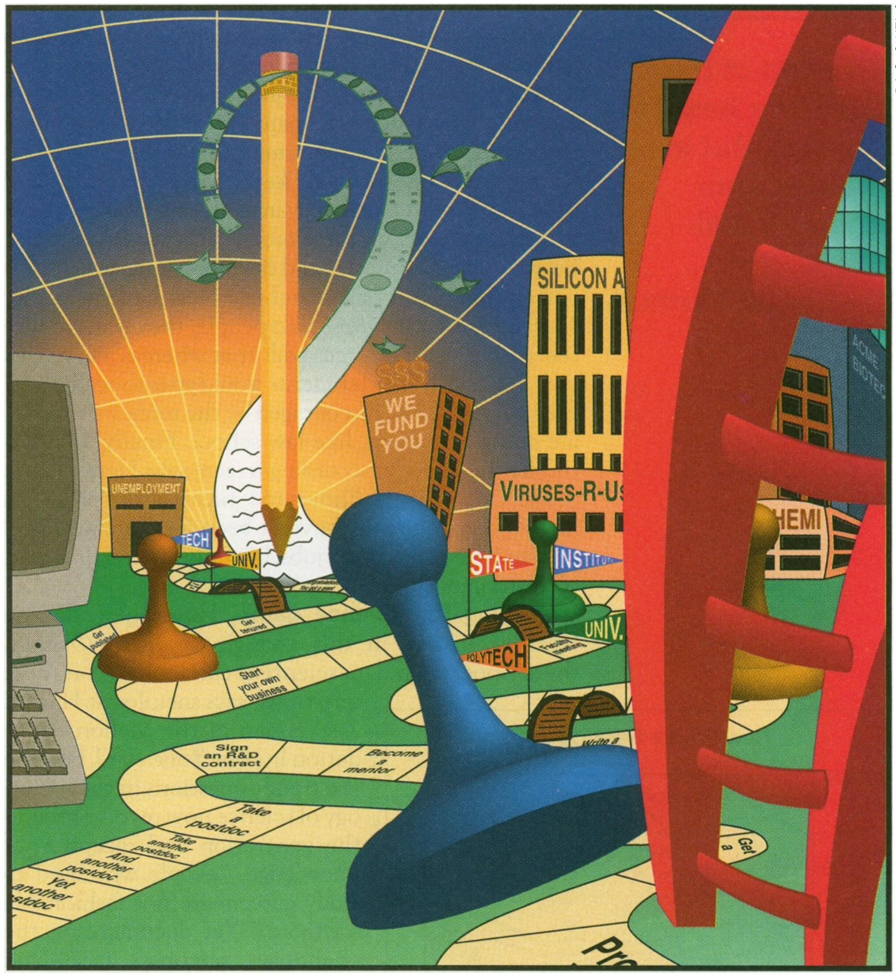


LINDA C. OWENS

"The expansionary era of American science has come to an end," says physicist David Goodstein of the California Institute of Technology. That's not news to Goodstein's fellow physicists, who have been buffeted by recession-induced corporate and government funding collapses, the end of the Cold War, and the paling of Big Physics signaled by the death of the Superconducting Super Collider. And it won't be news to beleaguered mathematicians: While unemployment figures for scientists as a class remain surprisingly low—1.4% as of 1991, according to the National Academy of Sciences—recipients of new mathematics Ph.D.s are suffering an unprecedented unemployment rate of 8.9%.

But most statistics fail to reflect the dislocations taking place: the numbers of young scientists in holding patterns of repeated postdocs, the shrinking numbers of those same scientists getting National Institutes of Health (NIH) grants (*Science*, 15 July, p. 314), the rise in the number of researchers holding temporary posts, and the expanding cohort taking longer to find jobs (see chart on next page).

To hear about these travails you need only tune in to the Young Scientists Network, set up by physicists who have been publicly fretting over what they see as bleak career prospects. "The reality of discovering the negative economic value of a Ph.D. is absolutely startling," says one networker, biophysicist Gene Nelson, who calls himself a "severely underemployed" computer programmer in Texas. Or you can listen to American Chemical Society (ACS) president Ned Heindel, age 57, of Lehigh University in Bethlehem, Pennsylvania, who says industry layoffs have hit his

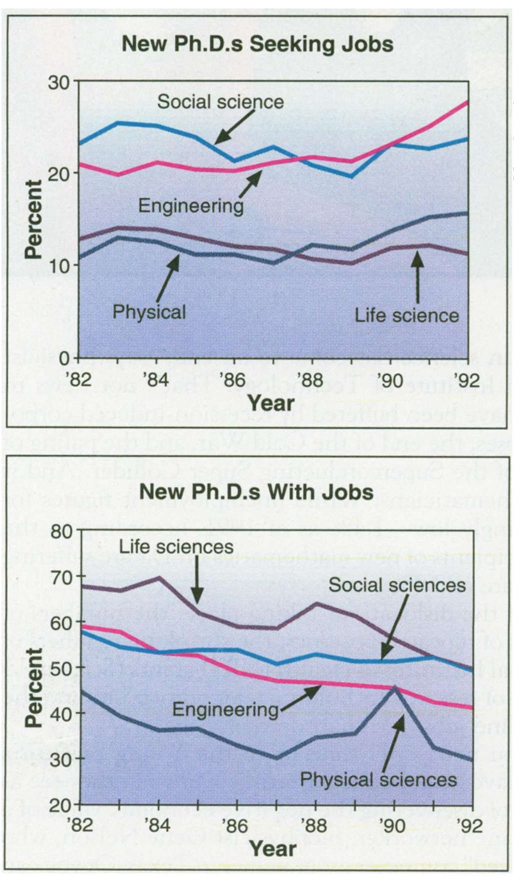
Graphics: Diana DeFrancesco
Photo Research: Anne Alvarez

field so hard that "my classmates of Ph.D. days live in dread of a call from the human-resources person." Chemists are experiencing an unemployment rate of 2.7%, the highest in 20 years, according to the ACS.

In biology, though, "the situation is very different," says NIH director Harold Varmus. "Our enemy's still there." At some elite research universities it even seems to be business as usual. Neuroscientist Corey Goodman at the University of California, Berkeley, says, for example: "The people I tend to know, the students, the postdocs—they've got jobs and they're continuing to get jobs. As far as I know, people who don't get tenure are the ones who haven't done that well." Yet even in biology, "there are so many good people coming through the ranks," says Varmus, that "jobs are tough at the moment." Prospects are keyed to the ebb and flow of opportunities in particular areas. Johns Hopkins University biologist Victor Corces, who works in a hot field, *drosophila* genetics and development, says it's suffering from a glut of researchers. Now biology faculty "don't want to hire *drosophila* people; they want to hire zebrafish people." Corces adds that whereas a few years ago "100% of [Ph.D.] students would go into academia," now perhaps 20%, discouraged by the money situation, are going elsewhere, like law school. Finally, in environmental biology, according to ecologist Henry Howe of the University of Illinois in Chicago, "the prospects aren't good and really haven't been for quite a while." His students have found jobs, but only after "4 or 5 years of postdocing."

The end of the Cold War has hit physics. But in biology, "our enemy's still there."
—Harold Varmus

Playing the science game. How, then, do you make your way in this changing world? "Overall, there's not much data scientists can look to" on these questions, says sociologist Harriet Zuckerman of the Mellon Foundation in New York. And, because the trendy questions in the sociology of science now revolve around the generation and reception of knowledge, "people who used to study careers are not fashionable anymore." Yet documenting the challenges scientists face—and outlining strategies to meet them successfully—becomes ever more important as the rules change.



Limbo. At graduation time, fewer scientists have definite jobs these days.

Our reporters have therefore interviewed dozens of scientists at various career stages to find out about these challenges and how successful scientists handle them. We start by exploring how you get a postdoc that optimizes your chances of landing a permanent position. Then we look at the criteria for promotion in industry, and at alternative career paths, such as teaching high school science. Then we turn to midcareer challenges: How do you put your best foot forward in a grant proposal? What is the future of tenure, and can you job-hop your way from institution to institution for a better future? How do you handle unemployment? Finally, we highlight issues that affect senior scientists, such as successful strategies for lab and research-team management and making the decision on when—and how—to retire.

Sea change. The challenges facing individual researchers are mirrored in—and often rooted in—challenges facing scientific institutions. Kumar Patel, vice chancellor of research at the University of California, Los Angeles, last June hosted a meeting on "reinventing the research university" where he observed, "One could say that research universities have become accustomed to high-octane fuel for too long, and that time is here to retune the engines for a lower octane fuel." Goodstein of Caltech says that in order to stay viable, research universities "have to forge a future based on a mixed economy"—that is, much closer involvements with for-profit concerns to make up for the shrinkage of federal support. At Caltech, he says, they've been laying the groundwork with a new set of conflict-of-interest guidelines and an intellectual property office. For the individual scientist in the new entrepreneurial environment, "life is going to be difficult because it will be harder and harder to find ways to finance research," says Goodstein.

Former presidential science adviser Edward E. David Jr. believes that the government will have to undergo a major shift in the way it supports research, moving to a system dominated by contracts for targeted research rather than grants for investigator-initiated proposals. But there's no unanimity on such future visions—people like Goodman of Berkeley say that in biology, basic, investigator-initiated research is likely to remain a top priority.

The new-paradigm grad student. Nonetheless, many observers feel that the impetus in the air for targeted research may have an effect on graduate education. ACS president Heindel notes that in academic science, "professors used to think they'd failed" if their students didn't replicate their own careers. "You were out there to clone yourself and produce one more supplicant at the federal funding trough." Now, though, "the litter's gotten [too] big."

It also may have become too specialized. At a California workshop hosted by Stanford University and the National Research Council last June, scientists and university administrators discussed the "new-paradigm grad student," a biology-physics hybrid. This new creature may have a dash of business experience as well: Suggestions for broadening graduate training included industrial internships for doctoral students. Redefining the Ph.D. "is pretty radical stuff," admits Stanford chemist Richard Zare, but even if only 10% of graduate students followed this pattern, "it would be a revolution in the way efforts at universities are coupled to the nation's needs."

Value in a changing world. Leaders such as National Science Foundation director Neal Lane still maintain that the Ph.D. is a great thing to have—a versatile instrument like a law degree. "Young people themselves don't realize how valuable they are with a Ph.D.," says Lane. "It means an ability to think deeply, solve problems, analyze data, criticize and be criticized." But Ph.D.s "often don't realize the breadth of what they are capable of doing." Realizing those capabilities is what this special issue of *Science* is all about.

–Constance Holden

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