

about \$1 billion that the U.S. Department of Energy (DOE) has spent since 1988 to build just two of the premier U.S. x-ray synchrotron facilities and upgrade two others. Crystallography is often faster and better able to decipher bigger molecules, but NMR works on molecules in solution, a more natural state for biological molecules such as proteins. NMR researchers already solve nearly one-quarter of the 900 or so new protein structures completed each year, and the resolution of the new NMRs is expected to be nearly on a par with that of crystallographers, says Wemmer.

Even if new NMR funds materialize, however, "these very high field magnets are getting beyond the ability of individual institutions to acquire [them]," says Wright. And if the PNNL facility and another planned in Florida wind up being the only facilities constructed, "there's no way we'll satisfy all the people who want to use these machines," warns Ellis.

To soften the blow, Jack Crow, director of the National High Magnetic Field Laboratory in Tallahassee, Florida, and others have proposed that funding agencies set up regional centers to house the new machines, an idea that got a thumbs-up from meeting attendees such as Griffin. Researchers could use their own NMR machines to do preliminary work on molecular structures, then travel to regional centers to collect a relatively small amount of data to sharpen the resolution—a practice already used by crystallographers.

Such cooperation has occurred temporarily whenever manufacturers introduce a new line of cutting-edge NMRs, until bulk manufacturing pushes the price lower, says Griffin. But thanks to the high materials cost of the superconductors, next-generation machines are likely to stay pricey—and few in number—for an indefinite period. That will require extended cooperation both among

researchers as well as the federal agencies that normally fund NMR research—DOE, NSF, and the National Institutes of Health.

"It's a cultural shift," says Griffin. He and others say that the new machines will transform the NMR community from a collection of independent researchers to a group that carefully reviews—and prioritizes—each other's research to vet access to the high-end machines. One option discussed at the meeting was to extend collaboration even further by wiring up next-generation NMR centers with high-speed data and Internet links. Researchers around the country would then send their samples to a regional lab, log onto the Net at a scheduled time, and run their experiments remotely. But before that shift takes place, say Eisenstein and other agency officials, it will be up to the NMR community to make the case that the change will be worth it.

—Robert F. Service

## CAREERS

### Young Physicists Despair of Tenured Jobs

Physics is the search for universal laws that stand the test of time. But for recent Ph.D.s in the United States, doing physics can be an endless search for a tenure-track faculty opening. Ever since a faltering economy and the end of the Cold War flooded the academic job market with physicists in the late 1980s and early '90s, the bad news about physics careers has kept coming. New studies suggest that in spite of jobs spawned by a resurgent economy, a minuscule percentage of young physicists can expect to move from a postdoc to a plum faculty job—and they are painfully aware of their poor prospects.

The American Institute of Physics (AIP) estimates that during the 1995–96 academic year, when 1438 new physics Ph.D.s were conferred in the United States, only about 50 postdocs—the next step up from a Ph.D.—moved on to tenure-track jobs in Ph.D.-granting physics departments. Although there's no comparable analysis of job movement for previous years, some observers are drawing an obvious conclusion. "The bottom line is that the job problem in physics is not over," says Sherrie Preische of the American Physical Society's (APS's) Executive Office. Because most of the new jobs have appeared in "nontraditional" areas such as engineering and finance, the APS is now boosting efforts to prepare new physicists for careers outside academia.

The AIP's jobs analysis\* did reveal some encouraging signs. In 1996, for the first time since the early 1980s, more new Ph.D.s were hired into "potentially permanent" jobs than

into postdocs. But most of those jobs were outside physics, in areas such as engineering and computer software. A young physicist seeking an academic post still faced crushing competition. About 400 temporary and permanent faculty jobs were filled in all degree-granting institutions over 1995–96—a figure that has remained "remarkably stable" for years, says Roman Czujko, manager of AIP's education and employment statistics division. But most of those jobs were filled not by postdocs or new Ph.D.s, but by more experienced physicists, often from industrial labs or other physics departments.

The toll on young physicists' morale has been heavy, as Preische found in a separate survey, published along with the AIP's job numbers in the February APS News. Fully 70% of the 592 junior members of APS whom she sampled said that their peer group is "pessimistic with regard to career prospects," and 40% "would not advise someone to pursue a career in physics." Glen Crawford, a postdoc at the Stanford Linear Accelerator Center, says he wasn't surprised by these findings. During his physics education, he says, "there was the implicit assumption that you would always be doing physics research. So the prospect of not doing physics can be depressing."

Young physicists need to realize that their

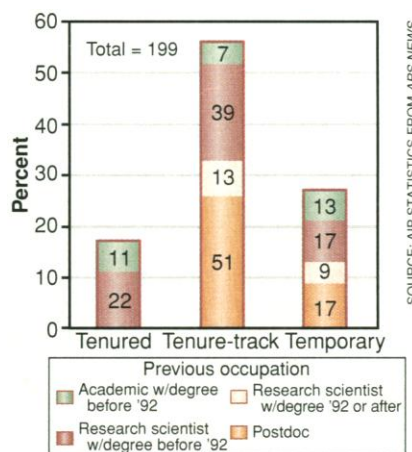
skills are much more likely to be exercised outside academia, says Roy Richter, a senior research scientist at General Motors Global R&D Operations and a member of the APS Committee on Careers and Professional Development. Indeed, the APS survey found that junior members who had already made the switch to industry were more content than postdocs were. "The Ph.D. is becoming more like a set of tools that you can then apply to

other areas," says James Kakalios, a professor at the University of Minnesota who says his students have been particularly successful in finding work at small companies, such as those that make computer components.

"Physics departments should take note of where their graduates are finding their career paths," says Barrett Ripin of the APS, who helped form the careers committee. To educate departments about career alternatives, the committee is devel-

oping resources such as speakers and industry internships, and it plans to hold an open discussion of these programs during the spring APS meeting in Los Angeles next month. As Crawford says, all this might help students realize "that, hey, maybe you're not going to be a professor at Rattlesnake University. Maybe you'll be at Applied Materials."

—James Glanz



**Experience counts.** Senior physicists got most of the jobs that opened at Ph.D. granting institutions in 1995 to 1996.

\* See AIP's 1996 *Initial Employment Report* at <http://www.aip.org/statistics/trends/trends.htm> for numbers and links to further details.