REAL LIFE II

Physics Famine: A Frenzied Search For Job Stability

In their thirties, young physicists are being forced into third postdocs.

U.S. physics faces a crisis. In the past 5 years top-ranking scientists, including Nobelist Leon Lederman and former National Science Foundation (NSF) director Erich Bloch, have warned that the nation is running out of the technically skilled people it needs to grapple with an increasingly technological society. But other members of the community have found that message hard to swallow as they witness hordes of young Ph.D.s showing up at scientific conferences desperately seeking jobs. Indeed, while their elders debate their future, young physicists are becoming increasingly angry: "I feel misled. I feel lied to," says Kevin Aylesworth, a job-seeking postdoc at the Naval Research Laboratory. "Honesty has been thrown to the wind."

Just how far physics has come from its glory days can be seen at any gathering of the profession. Take last month's 1400-attendee International High-Energy Physics meeting in Dallas. Nearly every young physicist approached by *Science* was job-hunting. Most said they were getting desperate. "Tell me about it," said Texas A&M postdoc Heath Pois, when asked whether a job shortage exists. A theorist who has already finished two postdocs, he's more than ready for a steady job. Instead, he's going into a third postdoc.

This sort of experience has so infuriated young physicists that some have organized to publicize their plight in *The New York Times*, *The Washington Post*, and *Science* (1 May 1992, p. 606). One of the most vocal of these is Aylesworth of the Naval Research Lab. He's 32, he told *Science* recently, and if he doesn't get a permanent position by 35 he's probably getting out of science. Meanwhile, he became so upset listening to NSF authorities publicly decry a "shortfall" of scientists that he started up an electronic support group called Young Scientists Network. Lo and behold, he found himself collector of an array of tales of woe from most of his nascent organization's 170 new members—most physicists, some unemployed, many frozen in postdoc hell.

The evidence of human misery isn't all anecdotal: Statistics collected by the American Institute of Physics show Aylesworth's hackers aren't just isolated whiners: The pool is growing, the demand shrinking, and the pipeline of physics clogging (see chart below). Department chairmen and placement officers at University of California (UC), Berkeley, Caltech, MIT, and Harvard all confirm that even the most talented people are having trouble getting jobs, and the crunch spans all branches of physics—especially solid state (or condensed matter) physics and high-energy particle physics.

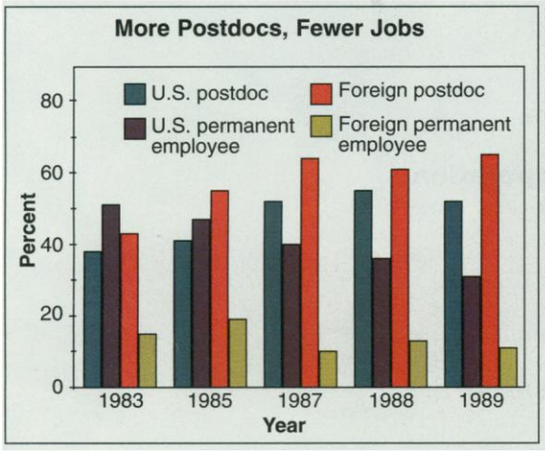
The inescapable conclusion to even many veteran researchers is that the golden age of opportunity for physicists is over. "In the '50s and '60s, anyone in particle or nuclear physics who had an idea got money," says Fermilab director John Peoples. Today, although some scientists still consider particle physics the most fundamental of all the sciences, Peoples lumps it among the "nonglamorous" fields, losing the limelight—and funding priority—to molecular biology and astronomy.

Suffering across the board. And these malevolent trends have damaged more than the high-energy physics elite. The traditionally profitable—and burgeoning—area of condensed matter physics is also suffering. Eric Grannon, a young condensed matter physicist at UC Irvine says: "When I was starting graduate school, everyone in the classes ahead of me got a job after doing one postdoc." Now, he says, he and most of the members of his class at Cornell are unable to advance to a permanent position and are going back for a second postdoc.

Robert Park of the American Physical Society (APS) worries that all these extra years of postdoc work could unfairly stigmatize a whole generation of physicists. "We all expect to do one postdoc. Many will do two. But when they do a third they are in trouble," he says, adding that this group might lose out to younger people coming up the pipeline later.

The situation is even worse for theorists. When occasional openings come up for experimentalists, they typically draw about 30 applicants; those for theorists will pull in 100, says Vigdor Teplitz, chairman of the physics department at Southern Methodist University. His is one of the few departments that may expand because of its proximity to the proposed Superconducting Super Collider (SSC).

Why is all this happening? Some blame the recession, others the end of the cold war, yet others the short-term orientation of U.S. industry, or the lack of



Status of First Year Ph.D.s by Specialty, 1990-91

Major subfields	% Postdoc	% Permanent employment	% Seeking employment
Astrophysics	66	25	-
Condensed matter	57	25	5
Electron, atomic, molecular	52	30	4
Elementary particles	67	11	5
Mathematical physics	46	21	8
Nuclear	61	27	4
Total	57	23	6

SOURCE: AMERICAN INSTITUTE OF PHYSICS

Depressing data. Through the 1980s, the number of permanent jobs fell while the pool of postdocs grew *(left)*. Job prospects differ from one specialty to another, with the highest percentage of permanent employment in electron, atomic, and molecular physics and the lowest percentage in elementary particles *(above)*.

public support. Lederman is his usual blunt self: "Industry is shucking research, universities are retrenching, and national labs are on a decayed mission and don't know what they are going to do."

Indeed, leading scientists cite the following factors as conspiring to dry up the job market: In particle physics, Fermilab director Peoples thinks the growth of big science is shrinking the job market. "We get fewer scientists per dollar," because more money is going into the construction of gargantuan experimental apparatuses—namely the SSC—and less into salaries. And he sees the range of projects narrowing. When Congress nearly killed the SSC last month, he and other physicists feared the death of their field.

Condensed matter physicists think the problem in their branch stems from another factor: the decline of basic research in industry. Young Ph.D.s say the once-fertile job-hunting grounds of industry offered slim pickings last year. Industry leaders confirm they don't need more specialized solid state Ph.D.s. "We've been shifting priorities," says Alan Chynoweth, head of research at Bellcore. "We're cutting back on physical science." That, in turn, is part of an industry trend toward more applied and less basic research. "The idea that companies could afford basic research is now disappearing," says physicist John Rowell, president of the California-based company Conductus Inc.

Unpredictabilities. There are other recent changes that make NSF's famous "shortfall" projection look off-base to physicists in all branches—condensed matter, nuclear, atomic, and particle. "Who would have predicted the problems we have with the economy?" says IBM recruiting manager John Oxton. Nor would anyone have predicted the abrupt end of the cold war, which has dramatically curtailed defense work and flooded the U.S. job market with scientists from the former Soviet Union. Says Park of the APS: "I know one whose salary is eating up four potential positions for young physicists."

Others blame the educational system for upsetting the supply side of the equation and clogging the pipeline. When asked about a shortage, Department of Energy physicist Jeffry Mandula says, "We're flooded." And by his estimate, things will stay that way. "We systematically produce enough people that the population of physicists would double in a 5-year period," he says. "The system produces more people than there are career paths for."

"We were putting more people through the pipeline—just spewing them out," agrees university of Pennsylvania materials science professor Rustum Roy. Roy, unlike Lederman, readily admits he's "as guilty as anyone else" for buying into and spreading the scientist shortage hype. NSF officials seem helpless in the face of the outcry: "I don't know how to fix this problem," laments Robert Eisenstein, physics director for NSF. "I don't even know how bad it is." He adds: "Five years ago, who could have predicted what we have today?"

But other senior physicists, such as Caltech's Barry Barish, say it's healthy to have more scientists than you need. It sets up a sort of natural selection, allowing only the best to survive. "All people who get Ph.D.s [in the field] should not necessarily get a job in high-energy physics," says Barish. Adds Fermilab cosmologist Edward Kolb: "If you are good and you work hard, you will get a job." Besides, adds Barish, there are still unfilled positions at the SSC now under construction. The young people argue that there's a big hitch to the SSC: You will have to wait at least 10 years before the machine will start doing science.

In the face of all this pain, it may seem incredible that some of the elders of physics are calling this generation "spoiled" and say no one should expect to be handed a job just because he or she has a Ph.D. Former NSF director Bloch, himself trained as an electrical engineer, told *Science*: "Nobody guaranteed a job for you. I don't know what people expect. There's no God-given right to a job. The country is in trouble today, but if you have a Ph.D. in physics you should be able to turn around" and apply your skills to something. "Go work in another field."

On the industry side, Bellcore's Chynoweth is more diplomatic: What's needed, he says, is flexibility. His company, for example, still badly needs physicists' expertise—but not in traditional specialties. "Some physicists have moved enthusiastically into new areas," he says—the big ones being software, systems, and services—or "the three S's." "There's no shortage of really interesting work to be done if people are willing to be flexible," he says. There is a need for people who can solve problems in data handling, video compressions, and speech technology—things of immediate use to the company. "Industry is changing rapidly and people have to be able to move with the priorities."

" I feel misled. I feel lied to.... Honesty has been thrown to the wind."

–Kevin Aylesworth

DARROW MONTGOMERY

Despite all these unpleasant new realities for the traditionally trained physicist, a few still succeed in their chosen areas. The University of Washington's John Sahr is one. He's an assistant professor of electrical engineering, but he says his area is on the border between electrical engineering and physics. He beat out 480 other applicants for the job. How did he do it? "My adviser is a big wheel," he says. "That helped. I was in the right place at the right time." He adds that he aggressively went after the job, flying out at his own expense for the interview.

Not all young physicists feel they were sold a bill of goods. Steve Jones, who is starting a second postdoc at UC Irvine, says he never expected things to be easy. As for NSF's predicted "shortfall," he says he hasn't spent much time thinking about it. "I didn't go into this to make money," he says. "I did it because I like physics. I was warned." In his experience, "most people eventually get a job" in the general area of physics, even if it may not be "the job of their choice."

Despite the painful lack of jobs now, Lederman insists that society really will be needing those Ph.D. physicists who can stick it out. He sympathizes with their plight—"It's scary to look forward and not see where jobs will come from," he says. And he says he worries about holding on to those who are hitting the job market at this unfortunate time.

Others agree. "Physicists are hard to make," says UC Berkeley physicist Harry Bingham. "Not that many people are capable of withstanding the grind." But APS's Park sees light at the end of the tunnel: "Logic would tell you you are going to need more technical people. In the long run, the demand has to go up."

–Faye Flam