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According to NSF statistics, doctoral scientists' median income rises with each year of experience until late middle age, peaking 25 to 29 years after the Ph.D. at just under \$100,000.

What's Ahead for Early-Career Scientists?

Beryl Lief Benderly
United States
1 February 2008

Every 2 years, the U.S. [National Science Board](#) (NSB), the 23-member body charged with overseeing the National Science Foundation (NSF) and advising Congress and the president, takes a detailed snapshot of the scientific enterprise. Unveiled on 15 January, NSB's main report, [Science and Engineering Indicators](#) (SEI), pronounced the U.S. research and development (R&D) effort "robust." But in a [companion document](#), *Research and Development: Essential Foundation for U.S. Competitiveness in a Global Economy*, the group warns of declining support for basic research that "could over time have severe implications for U.S. competitiveness in international markets and for highly skilled ... jobs at home."

For early-career scientists, this year's report paints a mixed picture. The report cautions against using "difficult-to-define words like 'surplus' or 'shortage' " to discuss the S&E labor market, because the great variety of fields and occupations in which scientifically trained people find work makes "any 'simple' comparison between projections of labor and market demand impossible." Overall, industry continues to "dominate" the nation's R&D, the report notes. Most young scientists, however, opt to start their careers in academe, where the proportion of traditional tenured faculty posts is shrinking.

A SURGE IN SCIENTISTS

One element of the robustness noted by the report is the continuing growth of the scientific labor force. Nearly 30,000 S&E Ph.D.s--a record number--were awarded in the United States in 2005, the latest year for which *SEI* presents graduation figures. About 12,000 Ph.D.s went to noncitizens, a category that has doubled since 1985. Meanwhile, the number of U.S. citizens earning Ph.D.s each year increased by about 2000, to 16,000. (The citizenship of about 1500 2005 Ph.D.s is "unknown.") Among U.S. citizens, female S&E Ph.D.s nearly doubled to 8000 and minority-group members more than doubled, to 3300, compared to 1985.

Paradoxically, the scientific profession, which is devoted to collecting and analyzing data, doesn't know how many postdocs work in the United States, and "some parts of [that] population are not systematically measured at all," says *SEI*, which estimates that there were 89,000 postdocs in the United States in 2005. This figure includes:

- 22,900 citizen and permanent-resident postdocs at degree-granting academic institutions, as reported by NSF's *Survey of Doctorate Recipients* (SDR), which quizzes Ph.D.s from American universities annually;

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- 22,600 academic postdocs on temporary visas, as estimated by NSF's *Survey of Graduate Students and Postdoctorates in Science and Engineering (GSS)* which queries institutions;
- 13,000 U.S. degree holders in postdoc positions at government, industry, and other nondegree-granting organizations not counted by *GSS*, as estimated by *SDR*; and
- 26,500 temporary visa holders in "positions not covered by *GSS*," a figure that assumes "a proportion ... in other sectors and other parts of academia ... the same as the portion covered by *GSS*." That's an assumption that cannot be proven, *SEI* concedes. "Other, comparably plausible assumptions lead to a substantially different total," it states.

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A POSTDOC ADVANTAGE?

Despite their low pay and long hours, former postdocs generally value the postdoc experience. For several decades, a consistent 53% to 56% have told *SDR* that the experience "greatly helped" their careers, and 33% to 38% rate it as "somewhat" helpful. Only 8% to 12% found it "no help" at all, *SEI* says.

Objective evidence, however, paints a more complex picture. Doing a postdoc is related to a higher probability of getting a tenure-track job, but the size of the advantage varies greatly from field to field. Among scientists who earned American Ph.D.s between 1997 and 2001, 31% of the ex-postdocs, and 25% of those without postdoc experience, held tenure-track jobs at institutions offering at least a 4-year degree in 2006. The postdoc advantage was largest--21 percentage points--for engineers and physical scientists. It was a substantial 14 percentage points for computer scientists and mathematicians.

But in the life sciences, "where," according to *SEI*, "it is often said that a postdoc position is a requirement for an academic career," doing a postdoc didn't seem to matter nearly as much. For Ph.D.s earned between 1987 and 2001, ex-postdocs were about 5 percentage points likelier to be on the tenure track than their nonpostdoc classmates; for the 1997-2001 group, the figures were 30% for the former postdocs and 25% for the nonpostdocs. Among the most recent crop of Ph.D.s, with degrees earned after 2001, the difference shrinks to about 2 percentage points and the success rate drops to about 25%.

Outside the academy, the postdoc advantage is even less straightforward and depends on whether the focus is on income or the nature of the work. Comparisons of the Ph.D.s who earned degrees between 1992 and 1996, a cohort that has had time to build their careers, found that in every scientific field, ex-postdocs in industry earned less in 2006 than colleagues of their cohort who had skipped that stage--8% less in computer and mathematical sciences and 10% less elsewhere. The education field showed mixed results, with former postdocs earning more in social and life sciences and less in engineering and in computer, mathematical, and physical sciences. Only in government did ex-postdocs consistently outearn nonpostdocs, by 3% in engineering and 9% in life sciences.

Ex-postdocs, however, are likelier than nonpostdocs to have jobs in research and development--73% versus 59%--and to do work "closely related to their degree"--73% to 65%.

THE LABOR MARKET

The newest holders of American Ph.D.s report little trouble finding jobs. Unemployment among those with degrees from the past 3 years was a mere 1.3% in 2006. That same percentage reported inability to get work "closely related" or "somewhat related" to their field--although that figure was larger for chemical engineers (10%), physicists and astronomers (6%), and sociologists and anthropologists (5%). Half of those who earned Ph.D.s in the United States--and 60% in physical and life sciences--became postdocs in 2006, most citing "training" as the reason.

But 9% of the postdocs (including 5% of the life sciences postdocs, 8% of those in computer science and mathematics, 10% of those in physical sciences, and 16% of those in engineering) reported doing so because "other employment was not available." The percentage citing a lack of other opportunities was down from a peak of 14% for 1992-1996 degree holders (including 35% of those engineers and just over 20% of those computer scientists and mathematicians). But it was several percentage points above the rate that had prevailed for those with degrees from the 1980s.

Despite plentiful jobs, S&E doctoral study often has a low initial financial payoff. Holders of S&E bachelor's degrees 5 years old or newer earned a median \$40,900 a year in 2003, ranging from \$34,300 for life scientists to \$53,500 for engineers. The median for graduates 5 years or less after master's degrees was \$55,200. Ph.D.s averaged only \$5000 more. The small differential is a result of both "relatively low postdoc salaries" and Ph.D.s' higher propensity to take academic jobs, *SEI* suggests.

That tendency notwithstanding, the proportion of Ph.D.s working in academe continues a "long-term decline" spurred by "continual movement away from the full-time faculty position as the academic norm,"

SEI found. The share of academic scientists with full-time faculty appointments has fallen nearly 20% over 3 decades, to 72% in 2006, even as real-dollar academic research funding rose 73% and the large cohort of tenured professors hired in the 1960s began to retire. Meanwhile, nonfaculty academic positions--"full- and part-time adjunct faculty, lecturers, research associates, administrators, and postdocs"--surged by 41% between 1993 and 2006, whereas full-time faculty positions grew by just 15%, the *SEI* says.

On the bright side, *SEI* reports a small uptick in the percentage of scientists with recent American Ph.D.s landing on the tenure track at institutions offering at least a 4-year degree in 2006, to 19.2% of those 1 to 3 years beyond their doctorates and 25.8% of those 4 to 6 years out. And holders of recent American doctorates working in industry also did well, with median earnings twice the \$40,000 median for postdoc pay. Postdocs' "foregone earnings add significantly to the costs of a doctoral education and may discourage doctoral-level careers in S&E," *SEI* states.

THE LONG VIEW

Viewed in a "lifetime perspective," S&E can provide "very lucrative" careers, said NSF director and ex officio NSB member Arden L. Bement Jr. at the January news conference that launched the new *SEI*. According to NSF statistics, doctoral scientists' median income rises with each year of experience until late middle age, peaking 25 to 29 years after the Ph.D. at just under \$100,000. Bachelor's- and master's-level S&E degree holders top out 10 to 15 years earlier and, respectively, at about \$40,000 and \$30,000 a year less than Ph.D.s. Young scientists need to look beyond academe--and the short term--to the many opportunities awaiting them, Bement advised.

But whether the next 30 years will prove as kind as the last 30, when the scientific labor force grew an average of four times faster than employment at large, is anyone's guess. "S&E occupations may be particularly difficult to forecast," *SEI* warns. "Many spending decisions on R&D by corporations and governments are difficult or impossible to anticipate. ... R&D increasingly crosses borders in search of the best place to have particular research performed. ... Finally, it may be difficult to anticipate new products and industries ... created via the innovation processes ... most closely associated with scientists and engineers."

Moreover, "indicators of stagnation, and even [of] decline in some subject areas" in the level of support "for U.S. R&D and especially basic research" are causing "concern," says NSB in *Research and Development*. "Especially alarming" are signs of a "de-emphasis" on basic research by American industry, such as drops in both the number of peer-reviewed journal articles by industrial scientists and "the industry share of support for basic research in universities and colleges." Support by both industry and government for basic research done in their own facilities also "has stagnated over the last several years."

In addition, federal government support for R&D at academic institutions "began falling in 2005 for the first time in a quarter century." Unless such ominous trends are reversed, NSB cautions, future snapshots of the American scientific enterprise--and, therefore, of the opportunities available to scientists seeking to build careers--may be considerably darker.

Beryl Lief Benderly writes from Washington, D.C.	Comments, suggestions? Please send your feedback to our editor .
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