EDITORIAL FEATURE

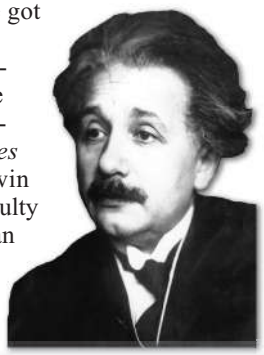
Not Your Father's Postdoc

In today's scientific labor market, just doing good science is no longer enough. Postdocs need realistic expectations, good information, and an entrepreneurial attitude toward their careers

On 18 March, 100 years and a day after 26-year-old Albert Einstein sent off the first of his 1905 papers that were destined to revolutionize physics, National Institutes of Health (NIH) Director Elias Zerhouni invoked the name of another Nobelist, biochemist Marshall Nirenberg, at a meeting held to unveil a new report on the plight of young researchers today. Nirenberg won his Nobel Prize at 41—even younger than Einstein. "In today's world," Zerhouni noted, "Marshall Nirenberg would get his Nobel Prize before he got his first NIH grant."

Today's young biomedical researchers, notes the National Research Council (NRC) report *Bridges to Independence*, don't win their first independent faculty appointment until a median age of 36, and they don't reach the milestone that marks their *real* debut as independent investigators—their first competitive NIH research grant—until a median age of 42. This late start doesn't just stunt individual careers, warns the report. It also threatens the vitality of the nation's scientific enterprise.

Moreover, for most aspiring biomedical scientists, there won't be an academic job at the end of that long apprenticeship: There are simply far more people in the pipeline than there are available academic positions. Given that inescapable arithmetic, experts advise today's budding biomedical Einsteins and Nirenbergs to think more broadly about their future scientific careers. "The number-one thing that every postdoc needs to think about is what they want to do when they grow up," says Ida Chow, executive officer of the Society of Developmental Biology.

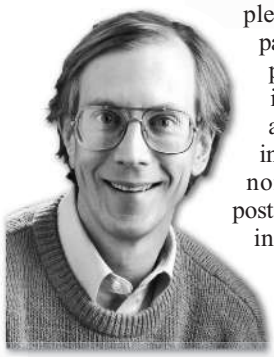


Albert Einstein
b.1879

Age	
23	Began work at Patent Office
26	*Annus mirabilus*
32	1st permanent post
42	Won Nobel Prize

Marshall Nirenberg
b. 1927

Age	
21	Received B.S. in zoology from University of Florida, Gainesville
25	M.Sc. in zoology from University of Florida
30	Ph.D. in biochemistry from University of Michigan, Ann Arbor
32	Postdoc at NIH
33	Appointed research biochemist at NIH
35	Made section head, Biomedical Genetics, NIH
38	Won National Medal of Science
41	Won Nobel Prize



Thomas Cech
b. 1947

Age	
19	Entered Grinnell College
23	Started grad school at UC Berkeley
28	Earned Ph.D. from UC Berkeley Started postdoc at MIT
31	1st faculty position (University of Colorado, Boulder)
41	Appointed Howard Hughes Medical Institute Investigator Albert Lasker Award in Basic Medical Research
42	1989 Nobel Prize in chemistry

Researchers today win their first competitive NIH grant at a median age of 42. These three scientists won Nobel Prizes at that age.

Funding patterns and holding patterns

NIH funding is itself largely responsible for the slowdown, explains the report. Over the past several decades, NIH has financed a swift rise in the number of life science Ph.D.s and then supported them—mostly by means of extramural research grants made to universities—in postdoctoral appointments that have become, in the report's words, "a 'holding pattern' for thousands of young scientists" who find themselves unable to move on to traditional faculty posts. The postdoc—a de facto requirement for an academic research career—now averages just under 5 years. For many life science postdocs, especially among the 80% paid out of NIH grants to principal investigators, " 'postdoctoral training' … has turned into 'postdoctoral employment'—with the postdoc remaining at the same professional position with little advancement of professional training," the report says.

"Simply put," notes the report in a model of understatement, "there are not enough tenure-track academic positions for the available pool of biomedical researchers." Between 1993 and 2000, the number of U.S. life science Ph.D.s under age 35 holding coveted tenure-track jobs in major research universities declined by 12.1%, to 543; meanwhile, the number of U.S. biomedical Ph.D.s in that age range increased by 59%, to nearly 20,000, and tens of thousands more scientists with foreign Ph.D.s came to fill postdoc positions in U.S. labs.

The traditional "linear progression" from "graduate school to postdoctoral positions to assistant professorships, then obtaining funding and tenure" now works for only a small minority of young scientists, the report explains. Instead of this simple progression, young scientists confront "a complex network of current career pathways" to a variety of occupations using scientific training, many of them outside academe. In addition, increasing numbers of scientists hold non–tenure-track university posts, a type of appointment that increased 55% between 1990 and 2001, a rate approximately seven times faster than that of tenure-track posts. The great majority of postdocs seeking stable career employment must therefore take what the academic world has long regarded as "alternative" jobs with unfamiliar professional cultures and skill requirements that scientists generally do not encounter in graduate school or a mentor's lab.

Building bridges to opportunity

In light of these changes, what can postdocs do to prepare themselves to move beyond the training phase, wherever that move might take them? A first step is to jettison the notion of jobs outside academe as "alternative" work, advises Chow. "The word 'alternative' gives a bad connotation of second class," she says. A far better term, she believes, is "career choices," specifically "the many career choices that science graduates—from the bachelors to the doctorate—have today compared to a generation ago."

Opportunities include industry—which in 2001 employed some 35% of life science

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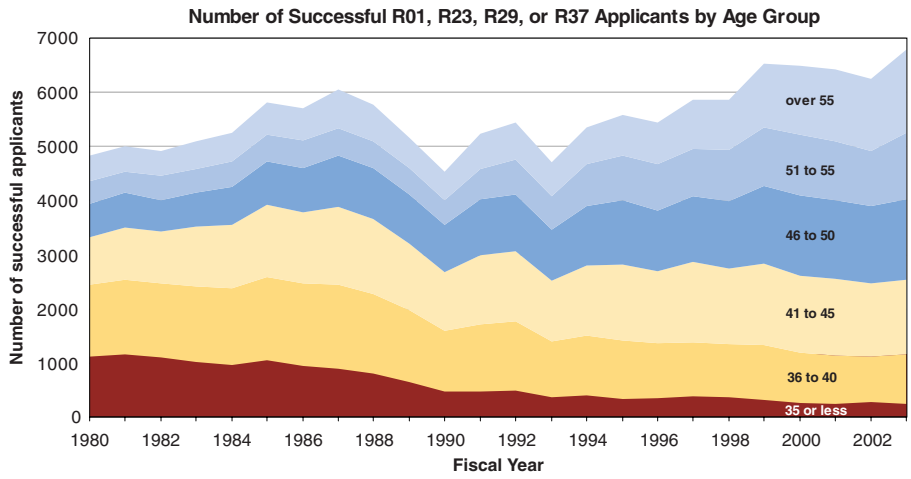
Ph.D.s, up from 15% in 1981—as well as government, science policy, writing, and nonuniversity teaching. "Even Wall Street needs people with science backgrounds to work as analysts," Chow says. "There are many more choices than just university jobs."

Setting a personal course for the future is particularly important at the postdoc stage, when young scientists no longer have the structure and goals automatically supplied by graduate school, says Andrea Stith, science policy analyst at the Federation of American Societies for Experimental Biology (FASEB): "There your goal is defined for you, and you have the evaluation of grades."

At one time, most postdocs' goals were also clear—a faculty job—and the guidance and help of the PI played a major role in getting there. But as the range of jobs scientists occupy has expanded, the help their advisers can provide has diminished. Faculty members who have spent their careers within academe often lack the knowledge and contacts needed to help their protégés find jobs in other sectors. So postdocs considering opportunities outside academic science need to assume far greater responsibility for their own futures. Key to taking charge, says Stith, is systematic planning. An effective approach to doing so, Stith continues, is to create an Individual Development Plan (IDP), a document that states specific goals and outlines specific means of achieving them.



Delayed independence. Researchers under 40 now account for less than 15% of NIH grant awards.

SOURCE: NIH

Doing science on yourself

Widely used in the business world, the IDP is unfamiliar to most academic scientists, although some universities and funders now use IDPs to help plan the postdoctoral period. FASEB has developed a 3-hour instructional IDP seminar, complete with interactive exercises, that it piloted at the Experimental Biology 2005 meeting in April in San Diego, California, and plans to present at other venues. "An IDP is appropriate for every stage of your life," says Stith, who served as one of the seminar presenters.

Like doing an experiment, the four-step process of creating an IDP involves thinking strategically, gathering data, and evaluating results. It begins with a self-assessment during which the individual determines his or her own values, interests, preferences, priorities, strengths, weaknesses, talents, and tolerances. "Is the amount of pay important to you?" Stith asks. "Is time with family? Is independence, as far as determining the project you're working on? How much and what are you going to compromise?"

Next comes the career-assessment stage, when the postdoc identifies and learns about occupations that appear to meet his or her needs. Information gathered should include the skills, knowledge, and characteristics needed to enter and succeed in the fields of interest and how to go about acquiring them. Sources of information can include university career centers and postdoc offices, professional associations, libraries, the Internet, and networking with people who have firsthand experience.

In the third stage, the postdoc composes the document. "Write down your goals and parse out your long-term and short-term goals," Stith says. Explicit timelines add specificity. Finally, in stage four, the individual puts the plan into effect, periodically measuring progress toward those goals and revising the plan as needed. "We expect people's interests to change," Stith says.

Weaning or weeding?

The entrepreneurial spirit symbolized by FASEB's IDP could be particularly handy for postdocs in the next few years if the recommendations in *Bridges to Independence* are adopted. The recommendations would create opportunities for some postdocs and insecurity for others, allowing—indeed, forcing—many postdocs to "grow up" to some form of independence more quickly.

On the opportunities side, one prominent proposal would reallocate NIH research funds to hundreds of new awards each year to postdocs doing their own research. Another would strengthen support for the growing cadre of investigators on soft money in non–tenure-track positions. Yet even the downside of these proposals is likely to have a secondary weaning effect: Given current budget constraints, these initiatives would most likely take funding away from some current investigators—and paychecks from their postdocs.

From a postdoc point of view, perhaps the most significant recommendation is one that would limit to a total of 5 years the postdoctoral support any individual could receive from all NIH sources combined, whether fellowships or employment on PI grants. This would eject the longest-serving postdocs from their current jobs and could endanger the immigration status of many noncitizens, who account for more than half of the postdocs working in U.S. labs. *Bridges* urges PIs to promote scientists remaining on after their NIH eligibility ends to staff positions with pay, benefits, and clearly defined institutional status commensurate with their experience and responsibilities. But doing so would be expensive, and the source of money to support it is unclear.

The weeding out that would occur is consistent with the goals of the NRC committee. "This is not a full employment system for postdocs," said National Academy of Sciences president Bruce Alberts at the 18 March briefing. "The system will select out those of real ability [so that] the very best have a chance to see what they can do." The changes "might be painful to some people," acknowledged the report committee's chair, Thomas Cech, president of the Howard Hughes Medical Institute in Chevy Chase, Maryland—who, incidentally, won the Nobel Prize in chemistry just as he turned 42—but they "should have a wonderful effect on encouraging early consideration of career opportunities."

Whether or not these recommendations are adopted—and the report itself points out that earlier recommendations were not—the career picture for most postdocs remains complex for the foreseeable future. "Each year, both new and experienced investigators compete in a Darwinian-like system," the *Bridges* report states. It should therefore come as no surprise to life scientists that those who adapt strategically to rapidly changing circumstances have the best chance of prospering in the years ahead.

–BERYL LIEFF BENDERLY

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