

Free Executive Summary



Enhancing the Postdoctoral Experience for Scientists and Engineers: A Guide for Postdoctoral Scholars, Advisers, Institutions, Funding Organizations, and Disciplinary Societies
National Academy of Sciences, National Academy of Engineering, Institute of Medicine

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The concept of postdoctoral training came to science and engineering about a century ago. Since the 1960s, the performance of research in the United States has increasingly relied on these recent PhDs who work on a full-time, but on a temporary basis, to gain additional research experience in preparation for a professional research career. Such experiences are increasingly seen as central to careers in research, but for many, the postdoctoral experience falls short of expectations. Some postdocs indicate that they have not received the recognition, standing or compensation that is commensurate with their experience and skills. Is this the case? If so, how can the postdoctoral experience be enhanced for the over 40,000 individuals who hold these positions at university, government, and industry laboratories? This new book offers its assessment of the postdoctoral experience and provides principles, action points, and recommendations for enhancing that experience.

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Executive Summary

The concept of a postdoctoral scholar in science and engineering arose about a century ago when a handful of PhD researchers were awarded small stipends for the purpose of augmenting their skills and experience. The postdoctoral population in the United States, after decades of gradual growth, leapt ahead quickly in the 1980s and now outnumbers the graduate student population at some US institutions. The total number of postdoctoral scholars, or postdocs, has grown to an estimated 52,000.

The primary purpose of the postdoctoral experience is to broaden and deepen the research and other skills that are required for a significant contribution to society and satisfying, professional employment. Ideally, this is accomplished through the guidance of an adviser in whose laboratory or department the postdoc works; the administrative and infrastructural support of the host institution; the financial support of a funding organization; and the professional development support of a disciplinary society.

The postdoctoral experience does not always succeed in its educational purpose. In some cases, the postdoc is poorly matched with the research setting; in others, there is little opportunity for growth toward independence, guidance is poor, or a mentoring relationship fails to develop. Sometimes mentors, institutions, and funding organizations have been slow to assign postdocs the status, recognition, and compensation that are commensurate with their skills and contributions to research.

For their part, many postdocs express frustration at their low professional status and inability to fulfill their own expectations to mature as professional researchers, collaborate productively with colleagues (and advisers), and advance

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in their careers toward rewarding professional positions. While some of this frustration results from a job market that, in some fields, has fewer positions than it does good candidates, it also reflects inadequate administrative attention to mechanisms of the experience that can and should be rectified. In considering needed improvements, it is essential to recognize that the situations of postdocs vary markedly from discipline to discipline and between academic and non-academic settings. Postdocs vary in proficiency; some are quite experienced with little need for guidance, while others are apprentices who require substantial coaching. They also vary in their rate of growth; some learn quickly while others require more time to develop sufficient knowledge and skills to move to the next stage of their career. Moreover, slightly more than half of US postdocs are non-US citizens, many of whom face additional challenges of acculturation and language.

GUIDING PRINCIPLES

After extensive interviews, workshops, and deliberations, COSEPUP drew up a series of recommendations for all participants in the postdoctoral experience—postdocs, their advisers, host institutions, funding organizations, and disciplinary societies. These recommendations are based on the following guiding principles:

1. The postdoctoral experience is first and foremost a period of apprenticeship for the purpose of gaining scientific, technical, and professional skills that advance the professional career.
2. Postdocs should receive appropriate recognition (including lead author credit) and compensation (including health insurance and other fringe benefits) for the contributions they make to the research enterprise.
3. To ensure that postdoctoral appointments are beneficial to all concerned, all parties to the appointments—the postdoc, the postdoc adviser, the host institution, and funding organizations—should have a clear and mutually-agreed-upon understanding with regard to the nature and purpose of the appointment.

TEN ACTION POINTS

In order to enhance the postdoctoral experience, advisers, institutions, funding organizations, and disciplinary societies should:

1. Award institutional recognition, status, and compensation commensurate with the contributions of postdocs to the research enterprise.
2. Develop distinct policies and standards for postdocs, modeled on those available for graduate students and faculty.
3. Develop mechanisms for frequent and regular communication between postdocs and their advisers, institutions, funding organizations, and disciplinary societies.
4. Monitor and provide formal evaluations (at least annually) of the performance of postdocs.
5. Ensure that all postdocs have access to health insurance, regardless of funding source, and to institutional services.
6. Set limits for total time of a postdoc appointment (of approximately five years, summing time at all institutions), with clearly described exceptions as appropriate.
7. Invite the participation of postdocs when creating standards, definitions, and conditions for appointments.
8. Provide substantive career guidance to improve postdocs' ability to prepare for regular employment.
9. Improve the quality of data both for postdoctoral working conditions and for the population of postdocs in relation to employment prospects in research.
10. Take steps to improve the transition of postdocs to regular career positions.

ENHANCING THE POSTDOCTORAL EXPERIENCE FOR SCIENTISTS AND ENGINEERS

A Guide for Postdoctoral Scholars,
Advisers, Institutions,
Funding Organizations, and Disciplinary
Societies

Committee on Science, Engineering, and Public Policy

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The **Committee on Science, Engineering, and Public Policy** (COSEPUP) is a joint committee of the NAS, the NAE, and the IOM. It includes members of the councils of all three bodies.

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Preface

The Committee on Science, Engineering, and Public Policy (COSEPUP) has, for some time, been concerned with the many issues that surround the education and training of scientists and engineers in the United States. Its 1993 report, *Science, Technology, and the Federal Government: National Goals for a New Era*, emphasized the importance of human resources to the research enterprise. A second report, *Reshaping the Graduate Education of Scientists and Engineers* (1995), urged institutions to offer graduate students expanded educational experiences so that they would be better equipped to choose from among the broad range of careers now open to scientists and engineers. This report led to the development of one guide for students, *Careers in Science and Engineering: A Student Planning Guide to Grad School and Beyond* (1996), and another for their mentors, *Adviser, Teacher, Role Model, Friend: On Being a Mentor to Students in Science and Engineering* (1997). In the course of its work on these reports and guides, COSEPUP became increasingly aware of the need to also address the experiences of those who undertake additional research training after completing their doctoral degrees—the postdoctoral scholars, or postdocs. The present report is the result of the committee’s intensive study of the postdoctoral experience. It is concerned largely with the personal and institutional settings of that experience. The core of a postdoc’s world, the research effort that is at the center of the hugely successful US scientific and engineering research enterprise, is of course of primary importance, but it is not the subject of this guide.

During the past year, COSEPUP gathered information in meetings with a total of 39 groups of postdocs and advisers at 11 universities, seven national laboratories, and five private research institutes or industrial firms. In addition,

the committee invited more than 100 postdocs, advisers, administrators, and others to a day-long workshop in Washington, DC (see Appendix D); conducted an electronic survey of research institutions (see Appendix C); met with the National Science Foundation (NSF) and the National Institutes of Health (NIH) staff; and consulted regularly with a 12-member External Advisory Group selected from institutions across the country. The informed and generous contributions of these groups are in large part responsible for COSEPUP's ability to document the characteristics of the postdoctoral experience. Besides reporting the committee's findings, this report suggests actions that can be taken to enhance the postdoctoral experience.

Although there is substantial variation in the experiences of postdocs from one field of science to another, certain elements are more-or-less common across the entire population. In the last 15 years, the number of postdocs has greatly increased and the nature of their experiences has changed in substantial ways. In some fields (e.g., life sciences), one or more postdoctoral experiences have become virtually mandatory for obtaining a regular position in academia or industry and the median time spent in postdoc positions has increased to 3.5 years. One reason for this is that graduate school programs cannot alone provide the broad range of knowledge and skills required for modern research. Another reason is that an extended postdoc period provides employment when regular positions are scarce compared to the number of students completing graduate degrees. A third reason is that postdocs want to accomplish work of substantial scope and significance in order to improve their chances of obtaining a desirable position.

Postdocs have become essential in many research settings. It is largely they who carry out the sometimes exhilarating, sometimes tedious day-to-day work. Their efforts account for a great deal of the extraordinary productivity of the United States' academic science and engineering enterprise. And yet the institutional status of postdocs, especially in academia, is often poorly defined. Consequently, although most postdocs value highly their experiences and the opportunity to engage in rewarding research without competing responsibilities, many of them are dissatisfied with their situations.

COSEPUP's analysis of the data gathered in this report indicates that the employment conditions for postdocs, especially in universities, need to be significantly improved if the United States is to develop the human capital needed to assure a healthy research enterprise and global leadership in science and technology. In many university settings, postdocs have uncertain status; they are neither faculty, staff, nor students. Consequently, there is often no clear administrative responsibility for assuring their fair compensation, benefits, or job security. Postdocs often receive no clear statement of the terms of their appointment and have no place to go to determine appropriate expectations or redress grievances. Often the sole person to whom they can turn for assistance is the Principal Investigator (PI) who hired them and upon whom they depend not only for support in their

current position but also for help in advancing their careers. Given this dependence, a reluctance to be perceived as a complainer is understandable. In contrast to the postdocs, university graduate students, faculty, and staff function under clearly stated assumptions, including: definition of expectations, rights, and responsibilities, defined pay scales, periodic evaluations, defined benefits, benchmarks for pay increases, and established procedures for consideration of grievances.

Although the stipends of most postdocs derive from grants to their faculty advisers, major granting agencies, such as the NSF or NIH, provide few guidelines on the obligations of advisers or their institutions toward postdocs. Indeed, these agencies were not able to provide COSEPUP with dependable data about the number of postdocs (in their nomenclature, Research Associates) supported by grants, or about their salaries, benefits, or length of service.

There are several unfortunate outcomes of the rapid growth of the US postdoctoral population under these irregular conditions. The range of annual compensation for first-year postdocs spans tens of thousands of dollars per year, depending on field and type of institution. At the lower end of the range—which is typical of the life sciences in academia—the pay is embarrassingly low, especially for postdocs with families, when compared to that received by professionals in other fields at analogous career stages. There is no standard health benefit package for postdocs; some receive no health benefits for themselves, and many have no health coverage for their families.

COSEPUP recognizes that part of the compensation for postdocs is the further education and experience they receive and their freedom from responsibilities other than research. The committee learned that many postdocs do indeed have stimulating and productive research experiences under the supervision of attentive, sympathetic, and thoughtful mentors. However, we also learned about postdocs who are neglected, even exploited inappropriately, while making creative and fundamental contributions to the research projects on which they worked. The need to improve the postdoctoral experience has led some institutions to formulate policies to govern their employment. In other instances, postdocs themselves have formed organizations to promote their common interests. Other indications of serious dissatisfaction are the occasional discussions of unionization and even litigation; though rare, these more confrontational calls for action are at least a sign that reform is needed.

Reform efforts will have to be collaborative. While the postdocs themselves must play a role, the major responsibility for change lies with those who have the most power: the advisers, the research institutions, and the funding organizations. Disciplinary societies can play an important role in catalyzing and supporting the reform efforts, especially because the needed changes vary by field. All these participants will need to confront difficult questions in addition to the challenges already mentioned. For example, if mentors have insufficient grant funds to improve salaries and benefits, should they consider accepting fewer postdocs to allow for larger stipends? Also, what is the optimal length of time to

be spent as a postdoc? Many are tempted to remain in their positions for five or more years because their experience and skill promise exciting breakthroughs and high productivity. Advisers may encourage long stays for the same reason, as well as because senior postdocs are particularly valuable in facilitating the education and training of graduate students and new postdocs. Junior researchers need to weigh the advantages and disadvantages of remaining overly long as postdocs against those associated with alternative opportunities. COSEPUP suggests that postdocs who remain in their positions for more than five years be reclassified as regularly employed researchers. Aside from personal considerations, there may be costs to the research enterprise itself if relatively junior researchers postpone their independence and are unable to apply their energies in the pursuits of their own original ideas.

Excellent postdoctoral experiences for new scientists and engineers are critical to the health and productivity of current and future research. High school, undergraduate, and graduate students need positive messages about scientific and engineering education and research careers if they are to continue pursuing their scientific and engineering interests. There are many marvelous aspects to the present system. It is essential that this highly productive relationship between research and education be continued under optimal conditions.

Maxine Singer

Chair
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Engineering, and Public Policy

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Academic Institutions

Arizona State University

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Harvard University

Indiana University

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The University of Michigan

The University of Texas at Austin

University of California, Berkeley

University of California, Los Angeles

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University of Minnesota

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University of Washington

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Virginia Polytechnic Institute and State University

Washington University

Yale University

Medical Schools

Johns Hopkins School of Medicine

New York University School of Medicine

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National Laboratories

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National Oceanic and Atmospheric Administration
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Research Institutes

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A Note on Using This Guide

This guide addresses five primary populations, all of whom participate in the postdoctoral experience: the postdocs themselves, their advisers, their host institutions, the agencies and organizations that support them, and professional disciplinary societies. It is also intended for senior-level graduate students who may be contemplating postdoctoral work.

At the risk of some repetition, the guide addresses the primary groups in separate sections because of differences in perspective, primary objectives, and responsibilities. For those readers who wish to skim material addressed to other groups, each section contains a summary of its main points.

The text is arranged in the following manner:

- Chapter 1 summarizes the trends that have brought growth and new stresses to the postdoctoral population and provides a description of **postdoctoral scholars in the United States**.
- Chapter 2 describes prominent **features of the postdoctoral experience**.
- Chapter 3 outlines the **rights, opportunities, and responsibilities of postdocs**.
- Chapter 4 addresses the relationship between the **postdoc and the adviser**.
- Chapter 5 describes the relationship between **postdocs and the institutions** where they work.
- Chapter 6 provides an overview of how **funding organizations** provide financial support to postdocs.
- Chapter 7 summarizes the role of professional **disciplinary societies** in supporting the postdoctoral experience.

- Chapter 8 provides a series of **principles, action points, and recommendations** for enhancing the postdoctoral experience for the benefit of all participants.

Throughout the guide appear boxes highlighting “Best Practices” we have seen among various institutions and organizations. This series of “Best Practices” boxes explores the postdoc-adviser research relationship; their fictional scenarios are based on discussions from our focus groups. In addition, the actual experiences of two recent postdocs are profiled.

Additional boxes summarize highlights of the institutional survey we conducted, as illustrated below (see Box). Note that some questions requested multiple responses. More information on the survey is provided in Appendix C. We encourage institutions to use the guide as a basis for dialog among all the populations it addresses. Discussion of the postdoctoral experience can occur in many settings, including:

- Orientation sessions
- Career counseling offices
- Departmental or school “practice of science” symposia
- Job fairs and conventions
- Student discussion or support groups
- Professional society meetings
- Meetings between advisers and graduate students or postdocs
- Information interviews
- Management meetings (e.g., faculty senate, department, school)

How Many Postdocs Are Currently Serving Appointments at This Organization?

Nearly 18 percent of respondents reported postdoctoral populations of more than 1000. Institutions reported smaller populations as follows:

Fewer than 50	15%
50-100	18%
101-250	21%
251-500	8%
501-750	5%
751-1000	15%

COSEPUP Survey Results

For those developing plans to enhance the postdoctoral experience, COSEPUP has developed a web site—www.nationalacademies.org/postdocs—which includes the full text of this guide, a one-page summary of the guide, and links to the web sites of institutions we suggest provide exemplary “Best Practices.” These best-practice models can be helpful to postdocs, postdoc advisers, institutions, funding organizations, and disciplinary societies as they explore ways to enhance the postdoctoral experience.

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