

Preparing Future Faculty in the Sciences and Mathematics

A Guide for Change

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Council of Graduate Schools and the
Association of American Colleges and Universities

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Washington, DC 2002

This material is based upon work supported by the National Science Foundation under Grant No. DUE- 9813876.

Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

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Council of Graduate Schools
One Dupont Circle, NW, Suite 430
Washington, DC 20036
ISBN 0-9702680-1-7

Publisher: Association of American Colleges and Universities



Table of Contents

Preface	v
1. A New Vision of Graduate Preparation for Science and Mathematics Faculty	1
2. Strategies for Establishing a PFF Program	15
3. Content of PFF Programs in the Sciences and Mathematics	31
4. Outcomes of PFF Programs	49
5. Prospects for the Future	63
Appendix I Graduate Students and Postdoctorates from Phase 3 PFF Disciplines	81
Appendix II PFF3 Faculty Leaders and Partner Institutions	87
References	95

Preface

At a time when academic careers seem to be ever more demanding and uncertain, this publication offers a new vision for the preparation of college and university faculty in the sciences and mathematics. This new vision, Preparing Future Faculty (PFF), identifies teaching, research, and service as the three expectations for faculty at most institutions of higher learning and asserts that graduate students planning to join the faculty should begin learning about each of these elements of the academic profession.

This vision is a response to recent reports calling for significant change in doctoral education. *Reshaping the Education of Scientists and Engineers*, a 1995 report issued collectively by the National Academy of Science, the National Academy of Engineering, and the National Institute of Medicine, called for a “new Ph.D. degree.” The degree they envisioned would cultivate a broader range of academic and career skills, offer more program options, provide students with more knowledge about a variety of careers, and foster a greater sense of entrepreneurship than is customary. That recommendation was echoed in another report by the Association of American Universities, comprised of leading research universities (Committee on Graduate Education 1998). It declares: “Student interests should be paramount in designing a graduate curriculum that prepares students for a broad array of careers,” implying that current programs are sometimes too narrow and that student interests often are not paramount. The report went on to discuss a set of best practices, citing the PFF initiative as “one of the most systematic efforts to increase graduate student preparation for teaching.”

Several research studies on graduate students have recently been completed, and they add a sense of urgency to the calls for change. For instance, Golde and Dore (2001, 5) drew the following conclusion.

...in today's doctoral programs there is a three-way mismatch between student goals, training, and actual careers. ... Doctoral students persist in pursuing careers as faculty members, and graduate programs persist in preparing them for careers at research universities, despite the well-publicized paucity of academic jobs and efforts to diversify the options available to doctorate-holders. The result: Students are not well prepared to assume the faculty positions that are available, nor do they have a clear concept of their suitability for work outside of research.

The classic problem with reports like these from both blue-ribbon commissions and research studies is the huge gulf between their recommendations and the actions of leaders of campus programs. The history of such reports is that they seldom lead to significant change.

Unlike those reports, this volume focuses on operational programs that have been designed and implemented by faculty and administrative leaders of doctoral programs and that have enrolled hundreds of graduate students who have gained valuable experience within the programs. It contains both conceptual and practical information about how to carry out some of the growing number of recommendations for the improvement of doctoral preparation for the professoriate. It also addresses the struggles to forge new programs in departments burdened with tradition and identifies the actual benefits to students, faculty members, departments, and institutions of persevering with this task.



The basis for this report is a project titled “Shaping the Preparation of Future Science and Mathematics Faculty,” a four-year effort supported by the National Science Foundation. It is one of four coordinated initiatives in the PFF program co-sponsored by the Council of Graduate Schools and the Association of American Colleges and Universities. This project included work in five academic disciplines: biological and life sciences, chemistry, computer science, mathematics, and physics. In four of these areas the work was led by professional societies. The societies held national competitions to award grants to departments for developing model PFF programs in their fields. The societies highlighted these new approaches in their publications and meetings, encouraging their adoption by other institutions. This report contains the lessons learned by faculty members, graduate students, and academic administrators in establishing these innovative programs.

This volume is organized into five sections: the vision and its rationale, analyses of strategies for introducing PFF programs, illustrative content of the programs, information about the results and outcomes, and challenges for the future. These discussions point to actions that faculty members and administrators can take to improve faculty preparation. We hope that information about this new approach to doctoral preparation will encourage additional science and mathematics departments to pursue their own innovations.

The primary audience for this publication includes faculty members, academic administrators, graduate students, and others interested in the quality and preparation of college and university faculty. Others who might be interested include boards of trustees, state and national policy makers, leaders of educational associations, those who provide graduate fellowships, and anyone interested in improving the quality of graduate and undergraduate education.

Acknowledgments

We want to express our gratitude to many individuals who contributed to this project and to the preparation of this volume. Foremost are the PFF leaders who managed the work within the disciplinary societies that partnered with PFF:

- ▲ Robert Beck, professor and chair, department of computing sciences, Villanova University; chair, PFF leadership team, Special Interest Group on Computer Science Education of the Association for Computing Machinery;
- ▲ Jerry Bell, senior scientist, and Marta Gmurczyk, senior staff associate, American Chemical Society;
- ▲ Warren Hein, associate executive officer, American Association of Physics Teachers;
- ▲ Samuel M. Rankin, III, associate executive director, American Mathematical Society, Washington Office; and
- ▲ Thomas Rishel, associate executive director, Mathematical Association of America.

Faculty members who provided leadership for the PFF programs in nineteen departments of universities selected to participate in this program are listed in Appendix II. These faculty leaders helped their colleagues design new PFF programs, recruit faculty members and students in their disciplines, and implement the programs; they also shared ideas and information about their efforts to establish PFF programs that constitute the heart of this volume.

Faculty members and academic administrators at partner campuses with primary missions of undergraduate education were crucial to the operation



of these PFF programs. The partner institutions provided PFF graduate students with insights about faculty and student life on their campuses. They also are listed in Appendix II. Graduate students who decided to take a chance by enrolling in an innovative program, sometimes against the advice of their research advisors, were courageous and willing to share their experiences and judgments about the value of their PFF programs.

Several colleagues at the Council of Graduate Schools (CGS) and the Association of American Colleges and Universities (AAC&U) deserve special mention. At CGS, Debra Stewart, president; Leslie Sims, dean in residence and director of external grants programs; and Tracie Fellers, PFF program manager, offered valuable assistance throughout this project. Valuable assistance at AAC&U was provided by Carol Geary Schneider, president; Alma Clayton-Pedersen, vice president for education and institutional renewal; and Charles Bashara, associate director of PFF. Veronica Thomas, professor of human development and psychoeducational studies at Howard University, was the external evaluator. Two consultants advised us as we coordinated the life sciences initiative: Karen Oates, professor of integrated studies at George Mason University, and Kathleen Parson, professor of biology and chemistry at Macalester College. Richard Weibl served as PFF program manager at AAC&U for the first two and one-half years of the project and was instrumental in its success.

For its generous support of this project, we are grateful to the National Science Foundation. We especially appreciate the support of the NSF staff, including Norman Fortenberry, director, division of undergraduate education, Directorate for Education and Human Resources, and Myles Boylan, our program officer; they were extremely helpful as we proceeded with this large, complex, and previously untried initiative.

This project was built on two earlier university-wide PFF programs funded by The Pew Charitable Trusts, with excellent leadership from Ellen Wert, program officer. During most of the life of this project, we benefited from the leadership and consultation with participants in those two previous initiatives. A subsequent project focused on developing PFF programs in the social sciences and humanities is being funded by The Atlantic Philanthropies, with strong leadership from Theodore Hullar. This latter initiative also enriched the current project.

Preparation of the Report

This report is the result of a large collaborative writing effort. Campus leaders at the doctoral-granting institutions involved in the project (famously known as “cluster leaders”) provided responses to a number of questions posed by the national staff about their PFF programs. Executives of the disciplinary societies prepared syntheses of these reports for their individual disciplines. In October 2001, thirty-four individuals gathered in Washington, D.C. to discuss these disciplinary and cluster reports and the substance of this publication, and to add more details. Disciplinary discussion groups led by society executives included faculty leaders from nearly all nineteen graduate programs, several graduate student participants, a PFF alumnus in a faculty position, and the national PFF staff. Subsequent disciplinary draft reports were submitted to the national staff, which served as the primary writing/editorial group. We prepared an integrated draft and sent it to the executives for review and critique. When we arrived at a final draft, Bridget Puzon, editor at AAC&U, edited the manuscript, and Julie Warren, AAC&U production coordinator, transformed it into this printed volume.



To all who contributed, we are grateful.

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Washington, DC, February, 2002