Appendix I

Graduate Students and Postdoctorates from Phase 3 PFF Disciplines

This appendix places the Phase 3 PFF project in the sciences and mathematics within the larger context of graduate education. In 1998, graduate enrollment in science disciplines (NSF 2002a) was approximately 17 percent of total (NCES 2002). However, about half of all Ph.D. degrees conferred between July 1, 1999 and June 30, 2000 (FY2000) were in the sciences (NSF 2001).

Table I provides data on graduate enrollment and postdoctorates in fall 2000 (NSF 2002a) and Ph.D. degrees awarded in FY 2000 (NSF 2001) for all science disciplines and for each of the PFF phase 3 disciplines. Table I reveals that the PFF phase 3 disciplines enroll almost half of all science graduate students and award nearly two-thirds of science Ph.D. degrees. Biological sciences enroll more than 56,000 graduate students, computer science over 47,000, and the other fields combined over 45,000. Biological sciences support more postdoctorates and award more Ph.D. degrees than the other PFF phase 3 disciplines combined. According to Robert Beck, a member of the Special Interest Group on Computer Science Education (SIGCSE) of the Association of Computing Machinery (ACM), the small number of Ph.D. degrees awarded in computer science, compared to the sizable graduate enrollment, reflects the robust employment market for computer science master’s graduates.
The Biological Sciences encompass a broad range of distinct disciplines, from entomology to neuroscience, from structural biology to ecology. Doctoral programs may be located in colleges of arts and science, agriculture, or medicine/health. The career paths for biological science graduates vary by specialization: For example, biochemistry Ph.D. graduates may have more opportunities for non-academic positions than those from ecology, because of the large numbers of career opportunities in biotechnology and pharmaceutical industries.
The National Research Council has studied the career paths of biological sciences graduates since the 1970s (NRC 1998). They found that, on average, approximately 60 percent of doctoral graduates in the biological sciences have pursued postdoctoral appointments and that many employers expect this experience. Further, about 40 percent of biological science Ph.D.s in the NRC study ultimately obtained tenure-track academic positions; of these, more than 85 percent were in Ph.D. granting institutions, many in basic science departments in medical schools.

Although many biological science graduate students have opportunities to serve as teaching assistants, those in departments located in a college of medicine or agriculture often are supported solely by research grants and hence have no opportunity to teach or learn about the professoriate, except through PFF programs.

Almost three-quarters of Chemistry Ph.D. graduates (1,990 in 2000) take jobs—including postdoctoral positions—in business and industry, according to Jerry Bell of the American Chemical Society. Those who obtain academic positions are broadly distributed among the diverse institutions of higher education. Many chemistry graduate students serve as teaching assistants, often in laboratory courses. Few have the opportunity to gain experience in classroom teaching. Thus, PFF is an important complement to the normal graduate experience of chemistry graduate students.

A total of 861 Computer Science degrees were awarded in 2000, about 35 percent to international students. Because of the explosive growth of the discipline and the strong demand from business, most computer science graduates enter the workforce after either an undergraduate or a master’s degree. According to Robert Beck (SIGCSE/ACM), among Ph.D. graduates, only about one-third obtain an academic position; as a result, approximately
700 faculty openings annually either remain unfilled or are filled by computer science master’s graduates or by master’s or Ph.D. graduates from related fields.

Of the 1,048 Ph.D. degrees awarded in Mathematics in 2000, about half were earned by international students, 22 percent of whom indicated immediate plans to seek employment outside the U.S. (presumably, many of these planned to return to their home country), and 24 percent had immediate plans to join the U.S. work force—12 percent each in academic positions and in industry (NSF 2001). Among the 1999-2000 Ph.D. mathematics graduates with definite plans for U.S. employment following graduation (63 percent overall; 45 percent of international graduates), 40 percent had academic positions (25 percent of international graduates); 33 percent had post-doctoral positions (45 percent of international graduates); and roughly 20 percent planned to enter industry (26 percent of international graduates). The remainder reported other U.S. employment (NSF 2001).

According to Samuel M. Rankin, III, of the American Mathematical Society, most mathematicians seek employment immediately after the Ph.D., and taking a post-doctoral appointment is a much less common option. Eventually, about 75 percent of doctoral graduates who reside in the United States obtain faculty positions, primarily in four-year colleges.

Most mathematics graduate students serve as teaching assistants for some portion or most of their graduate program. Experienced teaching assistants commonly are given sole responsibility for an entire course. Consequently, many mathematics departments have a teaching assistant training program, and faculty and students tend to be particularly supportive of PFF programs.

Physics and Astronomy awarded 1,392 Ph.D. degrees in 2000, about half to international students, only 10 percent of whom indicated immediate
plans to seek employment outside the U.S.; presumably, for many of these, in their home country. Among 1999-2000 Ph.D. physics graduates with definite immediate post-graduation plans for U.S. employment (56 percent of the total), 48 percent had obtained academic positions (3 percent of international graduates); about 60 percent of both U.S. and of international graduates planned to take postdoctoral positions and postpone entry into the workforce; and approximately 33 percent of both groups planned to take employment in industry (NSF 2001).

As a result of a declining production of Ph.D. physicists and increasing retirements among Sputnik-generation faculty, the current academic job market is more favorable than at any time in the last ten years, reports Warren Hein of the American Association of Physics Teachers, making PFF programs in physics especially valuable and timely.
Appendix II

PFF3 Faculty Leaders and Partner Institutions

Biological and Life Sciences

Duke University
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Partner Institutions: North Carolina Central University, Guilford College, Durham Technical Community College, Elon University, Meredith College

University of Cincinnati
Carl A. Huether, Professor, University of Cincinnati, Department of Biological Sciences, P.O. Box 210006, Cincinnati, OH 45221-0006, Ph: (513) 556-9764, Fax: (513) 556-5299, E-mail: carl.heuther@uc.edu
Partner Institutions: Raymond Walters College, College of Mount Saint Joseph, Northern Kentucky University, Xavier University

University of Nebraska, Lincoln
Leon Higley, Professor, University of Nebraska, Department of Entomology, 303A Plant Industry Building, Lincoln, NE 68583-0816, Ph: (402)
Partner Institutions: Alcorn State University, Concordia College, Creighton University, Dana College, Doane College, Grambling State University, Metropolitan Community College, Nebraska Wesleyan University, New Mexico Highlands University, University of Nebraska at Omaha

University of South Carolina
Tom Reeves, Professor, Midlands Technical College, Department of Biology, Airport Campus, Robinson Building—Room 108, Columbia, SC 29202, Ph: (803) 822-3554, Fax: (803) 822-3422, E-mail: reevest@midlandstech.com
Partner Institutions: Benedict College, Midlands Technical College, South Carolina Commission on Higher Education, University of South Carolina-Salkehatchie

Chemistry
Duquesne University
David W. Seybert, Professor, Duquesne University, Department of Chemistry and Biochemistry, 308 Mellon Hall, Pittsburgh, PA 15282, Ph: (412) 396-6465, Fax: (412) 396-5683, E-mail: seybert@duq.edu
Partner Institutions: Chatham College, Seton Hill College, St. Vincent’s College, Thiel College, West Liberty State College

Queens College of the City University of New York
Thomas C. Strekas, Acting Dean, Queens College of the City University of New York, Division of Mathematics and Natural Sciences, 65-30 Kissena Boulevard, Flushing, NY 11367-1547, Ph: (718) 997-4105,
Fax: (718) 997-4103, E-mail: thomas_strekas@qc.edu or tcsqc@forbin.qc.edu

Partner Institutions: Baruch College, Manhattan College, Queensborough Community College

University of California-Los Angeles

Arlene A. Russell, Senior Lecturer, University of California-Los Angeles, Department of Chemistry and Biochemistry, 607 Charles E. Young Drive East, Box 951569, Los Angeles, CA 90095-1569, Ph: (310) 825-7570, Fax: (310) 825-4795, E-mail: russell@chem.ucla.edu

Partner Institutions: California State University-Fullerton, Mount San Antonio College, Mount St. Mary’s College, Pierce College, Pomona College

University of Massachusetts-Amherst

Julian F. Tyson, Professor, University of Massachusetts at Amherst, Department of Chemistry, 701 Lederle Graduate Research Tower, 710 North Pleasant St., Amherst, MA 01003-9336, Ph: (413) 545-0195, Fax: (413) 545-4846, E-mail: tyson@chem.umass.edu

Partner Institutions: Amherst College, Hampshire College, Greenfield Community College, Mt. Holyoke College, Smith College, Holyoke Community College

University of Michigan

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E-mail: bcoppola@umich.edu
Partner Institutions: Baldwin-Wallace College, Calvin College, Eastern Michigan University, Grand Valley State University, Hillsdale College, Hope College, Oakland University, Oberlin College

**Computer Science**

**University of Cincinnati**

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Partner Institutions: College of Mount Saint Joseph, Northern Kentucky University, Xavier University

**University of Iowa**

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Partner Institutions: Central College, Cornell College, Grinnell College, St. Ambrose University

**Mathematics**

**Arizona State University**

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Partner Institutions: Arizona State University-West, Northern Arizona University, Scottsdale Community College

Binghamton University

Luise-Charlotte Kappe, Binghamton University, Mathematics Department, Vestal Parkway East, P.O. Box 6000, Binghamton, NY 13902, Ph: (607) 777-2355, Fax: (607) 777-2450, E-mail: menger@math.binghamton.edu

Partner Institutions: Broome Community College, Ithaca College, King’s College, SUNY-Oneonta

University of Washington

Virginia M. Warfield, Senior Lecturer, University of Washington, Department of Mathematics, Mail Stop 354350, Seattle, WA 98195, Ph: (206) 543-7445, Fax: (206) 543-0397, E-mail: warfield@math.washington.edu

Partner Institutions: Seattle University, Seattle Central Community College

Virginia Polytechnic Institute and State University

Robert C. Rogers, Graduate Program Director, Virginia Polytechnic Institute and State University, Department of Mathematics, 530 McBryde Hall, Blacksburg, VA 24061-0123, Ph:(540) 231-4184, Fax:(540) 231-5960, E-mail: rogers@vt.edu

Partner Institutions: Bridgewater College, High Point University, Virginia State University, Washington and Lee University
**Physics**

**Howard University**

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Partner Institutions: Bowie State University, The Catholic University of America, Howard Community College, Marymount University, Virginia Tech-Northern Virginia Campus

**University of Arkansas**

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Partner Institutions: Crowder College, Drury University, Northwest Arkansas Community College, University of Arkansas-Ft. Smith, University of Kansas

**University of California, San Diego**

Rosalind Streichler, Director, Center for Teaching Development, University of California, San Diego, 307 Center Hall – Mail Code 0030, La Jolla, CA 92093-0030, Ph: (858) 534-3958, Fax: (858) 822-0318, E-mail: rstreichler@ucsd.edu

Partner Institutions: Grossmont College, San Diego City College, San Diego State University, University of San Diego
University of Colorado at Boulder

John Cumalat, Professor, University of Colorado at Boulder, Department of Physics, Campus Box 390, Boulder, CO 80309-0390, Ph: (303) 492-8604, Fax: (303) 492-3352, E-mail: jcumalat@pizero.colorado.edu

Partner Institutions: Adams State College, Colorado College, Colorado School of Mines, Colorado State University, Denver University, Metropolitan State College of Denver, United States Air Force Academy, University of Wyoming