

Chapter 5

Improving Postdoctoral and Early Career Education in the SBE Sciences

*Excellent postdoctoral experiences for new scientists and engineers are critical to the health and productivity of current and future research.*²⁹

Current Context

Key Needs

There is a high-priority need to address the continuing development and training of social, behavioral, and economic (SBE) scientists beyond their doctoral degrees. Despite the very real challenges for SBE science education considered in prior chapters of this report, most SBE disciplines invest primarily in the development and design of doctoral education and devote little attention to professional growth and education after doctoral training. The postdoctoral period of professional transition is critical to building and solidifying skills; charting robust research agendas; locating one's scientific interests in the context of larger disciplinary or interdisciplinary concerns; and building strong networks of guidance, collaboration, and enrichment. Whether new doctorates pursue formal postdoctoral programs or are otherwise employed, opportunities and support at this professional stage are critical to both the quality of their research and their career advancement.

Postdoctoral Positions and Programs. Since the mid-1980s, the number of postdoctoral appointments in science and engineering has increased rapidly, but relatively few such opportunities exist for SBE scientists.³⁰ Over the 30-year period from 1965 to 1995, for example, the number of doctorates receiving postdoctoral appointments in psychology increased from 22 to 32 percent, whereas the number in physics increased from 29 to 73 percent, in chemistry from 31 to 63 percent, and in the biological sciences from 40 to 71 percent.³¹ The most recent data

²⁹ National Research Council, *Enhancing the Postdoctoral Experience for Scientists and Engineers* (Washington, DC: National Academy Press, 2000), p. x.

³⁰ Postdoctoral appointments are defined as "a temporary position awarded in the academe, industry, or government for gaining additional education and training in research." See National Science Foundation/Division of Science Resources Statistics, 2001 Survey of Doctorate recipients. Footnote 1, Table 1

³¹ Although some of the dramatic rise in postdoctoral appointments in certain fields is attributable to changing employment opportunities and the limited academic market, in general those in postdoctoral positions report that they seek these experiences in order to obtain advanced training in their fields, training outside of their fields, or training with specific scientists. Mark C. Regets, "Has the Use of Postdocs Changed?," NSF 99-310, *Issue Brief* (NSF 99-310) (1998).

on such appointments vividly illustrate the lagging SBE situation: Of the 28,564 postdoctoral appointees in science and engineering in doctorate-granting institutions in 1999, 703 (2.5 percent) were in psychology and 451 (1.6 percent) were in all other social sciences combined.³² At the same time that SBE fields were taking up only 4.1 percent of all postdoctoral appointments, they constituted about 30 percent of all doctoral degrees in science and engineering.

Postdoctoral appointments—whether through fellowships, traineeships, or positions on research grants—provide an opportunity to enrich the doctoral research experience and establish a scholars' research program. Though postdoctoral appointments do not always realize their stated educational goals (the National Academy of Sciences report cited above outlines key areas for improvement in postdoctoral training),³³ such advanced apprenticeships are invaluable periods for honing scientific and professional skills and promoting career-long scientific productivity. Absent postdoctoral training immediately after graduate school or in early stages of a career, most newly minted doctorates in the SBE sciences move into tenure track or temporary academic positions where they face heavy teaching, course preparation, and service responsibilities before they have adequately sharpened their skills and established their research trajectories. Despite unevenness in the quality of postdoctoral training, it is far more intentional and institutionalized than the support and mentoring that junior faculty typically receive from senior faculty in most colleges and universities.

The SBE sciences would benefit greatly from a significant increase in the number of postdoctoral positions and programs that offer strong developmental components, closer alignment with the contexts in which SBE researchers work, and explicit attention to building skills across specialties and fields. As with doctoral training, current postdoctoral programs in science (including in the SBE sciences) largely focus on preparing graduates for academic careers in research universities despite employment opportunities in a range of academic markets and in non-academic settings. In all fields of science, most postdoctoral positions are located in academic institutions; this is especially true of postdoctoral programs in SBE sciences. In addition, too little attention is paid to developing interdisciplinary skills and ties. Also, postdoctoral programs need to examine their mentoring and training components, the adequacy of support packages for appointees, the duration of the postdoctoral traineeship, and even the prestige of the appointment. Thus, along with the need to increase the number of postdoctoral positions and programs in the SBE sciences is the need to do so in ways that improve upon what often constitutes the postdoctoral experience.

Career Development Beyond the Doctoral Degree. Capacity building and strengthening the human infrastructure for research are key to advancing productivity in the SBE sciences. The continuing education needs of junior and early career scientists vary by discipline, doctoral

³² National Science Foundation/Division of Science Resources Studies, Survey of Graduate Students and Postdoctorates in Science and Engineering, 1999, Table A-17.

³³ In 1998, the Association of American Universities issued a report prepared by its Committee on Graduate Education. This report includes some consideration of postdoctoral appointments and the analyses and recommendations therein are relevant for graduate as well as postdoctoral study. For the full report, see <http://www.aau.edu/reports/GradEdRpt.html>.

training programs, professional location (e.g., research institutes, teaching intensive institutions, government agencies), and individuals' experiences (e.g., extent of prior research support, publications). While strategies should be flexible, new PhDs in all employment sectors would benefit from explicit professional support especially during the first several years after their doctoral degrees. Academic and non-academic employers would be wise to consider professional development opportunities (e.g., seed money to nurture research ideas, reductions in teaching loads, travel support) as appropriate and sound investments. Also, national research societies can advance their disciplines and fields through intentional efforts directed to junior scholars. Professional development courses, workshops, and institutes on substantive, methodological, and professional issues or mentor-match programs can yield large dividends through enhancing the knowledge and networks of new SBE doctorates.

In essence, the skills and competencies requisite to scholarly productivity and to the advancement of scientific careers require continued development during early career stages. For women and underrepresented minorities (especially those who are first generation doctorates), there may be a special need for specific guidance in responding to the particular challenges they face in scientific and academic careers—ranging from stereotypes about their professional skills to being more in demand to advise students or serve on committees. Efforts on the part of senior colleagues, departments, disciplines, and institutions are important in alerting new scholars to obstacles and opportunities and in helping them overcome distinctive impediments. Strong signals about the legitimacy of seeking and receiving support are essential. So too are steps to ensure that such support is maximally available.

Impediments and Challenges

For far too long, SBE scientists have given insufficient attention to the role of postdoctoral training and early career development in enhancing research productivity. Although there is variation among the SBE sciences, overall they have moved toward collaboration at a slower rate than the natural and biological sciences, and thus the normative structures of these fields tend to support greater independence in scholarly research.³⁴ Since postdoctoral training almost by definition assumes explicit connection to a senior investigator, work group, or team, this mechanism of professional development might be expected to be less prevalent in SBE fields. Just as access to funding over time engenders research collaboration in science, so too the presence of financial support can be instrumental in encouraging postdoctoral training. At present, impediments and challenges include the following:

First, as already implied, postdoctoral training is most prevalent in large-scale centers or research contexts where the scope of work, including the scope of funding, can support both the research and training of postdoctoral appointees and professional research staffs. Perhaps as a function

³⁴ A number of studies make this point. See generally Felice J. Levine, "Professionalization of Social and Behavioral Scientists: United States," in *The International Encyclopedia of the Social & Behavioral Sciences* (London: The Elsevier Science Ltd, 2001), pp. 12146-12154. For a recent example, see Nicholas Babchuck, Bruce Keith, and George Peter, "Collaboration in Sociology and Other Scientific Disciplines: A Comparative Trend Analysis of Scholarship in the Social, Physical, and Mathematical Sciences," *The American Sociologist* Fall (1999), pp. 5-20.

Education and Training

of far more limited resources than in other fields of science, the culture of science in the SBE sciences is typically smaller in scale and premised on more individuated work. Thus, the paucity of large-scale laboratories and centers has limited the venues for employing postdoctoral trainees and developing effective models for doing so.

Second, for many new scholars, the pleasure taken at completing the doctorate is quickly overwhelmed by the strains resulting from the increasingly daunting task of building or linking to a research program and establishing an autonomous career. Absent appropriate advisement, new PhDs get caught up in meeting day-to-day responsibilities and too often are not well positioned to plan strategically for their research careers. At a broader level, the comparatively small size of many SBE disciplines, academic departments, and scholarly societies makes it difficult to mount programs that can enhance career development for new PhDs.

Third, experienced SBE scientists too frequently assume that new scholars are savvy about how to manage and pace their early career efforts. Overall there is limited systematic advice, an absence of assistance in applying for research funding or preparing articles for submission, only modest opportunities for leave during the early career period, and mixed support for special programs designed to assist women and minorities. Too often, the time at which the first sabbatical leave is earned comes too late or at a time when family obligations make it difficult for junior faculty members to go on leave.

Fourth, graduate department faculties tend to know best environments like their own. The dominant culture of graduate education manifests limited awareness of the nature and conditions of employment in other kinds of academic and non-academic institutions; insufficient appreciation of the range of career options available to students completing doctorates; and an absence of deliberate, self-conscious attention to mentoring beyond that required for the completion of the doctoral degree. Moreover, there are few incentives for reshaping the assumptions and expectations of those involved in preparing doctoral students, training postdoctoral fellows, or guiding new scholars. Under the proper conditions and with adequate support and resources, however, these patterns and practices should be amenable to change.

Best Practices

Government agencies, private foundations, academic institutions, and scholarly societies have invested in initiatives and activities—large and small—that address some of the professional development and early career challenges encountered by SBE scientists. Although extant programs are insufficient in number to meet SBE science needs, they offer examples of mechanisms that could be extended or transported to other institutions or disciplines to improve early career training. The variation in these initiatives speaks to the importance of flexible and adaptable approaches. All aim to provide positive developmental experiences for junior scholars and have their interests as the focal point.

Many of the best known and most successful postdoctoral programs have been funded by the National Institutes of Health (NIH) through the National Research Service Act (NRSA) Program. Established by legislation in 1974, the purpose of the NRSA Program is to help ensure

that a diverse and highly trained workforce is available to lead efforts to advance the country's biomedical and behavioral research agenda. NRSA is an excellent model of a flexible funding mechanism. It provides institutional training (T32) grants and individual (F32) fellowships to ensure a continuing supply of well-trained scientists prepared to conduct cutting-edge research. The NIH has used the NRSA Program as the primary means of supporting graduate and postdoctoral research training, including behavioral and social science training related to health and well-being. The first two examples below are supported by NRSA funding:

- Established in 1976, the Program for Research on Black Americans (PRBA), one of several programs in the Research Center for Group Dynamics at the University of Michigan, has been a long-term site for postdoctoral training under the leadership of James S. Jackson. In 1991, PRBA received support from the National Institute of Mental Health (NIMH) for a multi-year program to support more than 50 minority postdoctoral scholars for training in substantive and methodological issues related to HIV/AIDS in minority communities. Recently, NIMH allocated support for postdoctoral training related to mental health disparities among racial and ethnic groups. This award provides for ten trainees appointed for two years to participate in training seminars, take advanced statistics and methods coursework, have one-on-one mentoring, meet weekly on progress and experiences, participate in academic writing with appropriate guidance, and engage in professional development activities through conferences and workshops. In addition to these trainees, other postdoctoral fellows from a range of disciplines participate. PRBA postdoctoral training also includes year-long and summer fellows taking coursework and doing research.
- The Carolina Population Center (CPC) at the University of North Carolina, Chapel Hill operates a program of training for predoctoral and postdoctoral fellows. The postdoctoral trainees hold doctorates in such diverse fields as anthropology, sociology, demography, geography, and social statistics. With NRSA support, CPC offers one-year postdoctoral appointments that emphasize preceptorships between postdoctoral scholars and faculty sponsors; a weekly population seminar; research, writing, and proposal preparation; and sessions on research ethics. Scholars are early career fellows—ranging from those directly out of graduate school to those several years into their careers. With NRSA support from the National Institutes of Health, this funding permits intensive support and training to a cohort of scholars each year.
- The American Educational Research Association (AERA) operates a postdoctoral training program funded by the Institute of Education Sciences (IES) in the U.S. Department of Education. While this AERA-IES Grants Program includes mechanisms of support for doctoral dissertation research and small research grants, the cornerstone of the program is a series of three-year postdoctoral fellowships, wherein fellows and their designated mentors work jointly on research problems. Priority is given to research that enhances the educational opportunities of underrepresented minorities in education, focuses on literacy and mathematics, and involves cutting-edge research. The program aims to strengthen the research infrastructure through professional development opportunities that provide fellows with training and research outside of their own specialties or in new analytic or methodological techniques. In addition to fellows' undertaking research, the program

fosters strong mentoring relationships and interaction across cohorts of postdoctoral fellows. Fellows and their mentors come from diverse SBE disciplines, yet share a common interest in scientific research in education. As a by product of the program, cohorts of mentors also develop skills in working with postdoctoral fellows.

- Outside of formal postdoctoral support, there has been limited attention to initiatives directed to the development of junior scholars early in their careers. The American Council of Learned Societies (ACLS) has a fellowship program for newly tenured faculty members (about 20 each year) in the humanities and humanities-related social sciences that provides up to a one-year sabbatical in order to consolidate and extend research. For SBE scientists with specialties in mental health, there is the potential for early career support offered by the National Institute of Mental Health through the Behavioral Science Track Awards for Early Transitions (B/START). Similar programs in the SBE sciences might be desirable to provide research support for junior scholars or funding opportunities for mid-career scholars to change directions or master new technologies. While the SBE Directorate has some early- and mid-career offerings, they are currently limited to certain programs and modest in scope and level of support. These funding mechanisms deserve consideration.
- Almost all scholarly societies in the SBE sciences include professional development activities as part of their programs. Often associations hold courses or workshops aligned with their annual meetings; sometimes they operate additional institutes or workshops as freestanding initiatives. While scholars at all career stages take these courses, most attendees are advanced graduate students or scholars at early- to mid-career stages. For example, the American Statistical Association (ASA) and the American Psychological Association (APA) have formalized submission and review procedures to identify a roster of half- and full-day courses and also offer continuing education credits that can be especially useful for SBE scientists in non-academic appointments. In addition, the ASA and APA sponsor other developmental activities. For example, each summer, APA holds four-day Advanced Training Institutes to expose psychological scientists to important technologies and methodologies.

These illustrations point to postdoctoral and early-career training strategies that are feasible and desirable for the SBE sciences. As with best practices at every educational level, there is need for both sustained investment and also assessment and evaluation to determine what works well in engendering productive and successful research careers.

Components of an Action Plan

Enhanced Funding for and Wider Use of Critical SBE and NSF-wide Programs

There are opportunities within the structure of NSF for program enhancements directed to the SBE sciences. Some of the existing programs identified below are Directorate- or Foundation-wide; other initiatives are offered or included in only one or a few NSF programs. Postdoctoral and early career education in the SBE sciences would be materially improved if more funds were available for these initiatives and if they were more visible. In some instances, there is the need both to broaden awareness of programs and reduce the perception or reality that SBE scientists are not eligible for funding.

1. Postdoctoral Fellowships and Small Grants for Training and Research Fellowships (SGTRF) in the Science and Technology Studies (STS) Program are two modes of support directed to postdoctoral education and training. For both Fellowships and Small Grants, applicants must propose a training and a research component, and they must be within five years of receipt of their PhD. The primary difference between these two mechanisms is that SGTRF awards permit support of up to three graduate students. The postdoctoral fellow prepares the proposal in cooperation with the host faculty member at the host institution who also submits a plan to work with the fellow (and, where appropriate, graduate students). These well-specified mechanisms could be important to early career training in the SBE sciences well beyond the STS Program. Current award lists for the STS Program suggest that these Fellowships and Small Grants are few in number. Expanded use of these mechanisms across SBE sciences could contribute significantly to postdoctoral training in these fields.

2. The Minority Postdoctoral Research Fellowships and Supporting Activities Program in the SBE Directorate offers enhanced scientific training and career development for underrepresented minorities.³⁵ This initiative includes a number of components directed to Fellows' professional growth (e.g., two-years of support, a sponsoring mentor, an annual Sponsoring Scientist and Fellows Workshop, and the possibility of a one-year follow-up starter grant). Since 2001, the SBE Directorate has invested approximately \$3.5 million dollars supporting 32 minority postdoctoral fellowship awards and supporting activities. Proposal submissions have been steadily increasing, and more funds are needed to support this important program.

3. Mid-career mechanisms of support for professional development are also available through several programs in the SBE Directorate. The **Professional Development Fellowships** offered by the Science, Technology and Society Program (STS) are specifically directed to scholars seeking to expand their skills outside their areas of expertise (e.g., sociologists of science who wish to improve their knowledge of science or engineering, or conversely to physical scientists who seek training in STS disciplines). As with the STS postdoctoral initiatives, applications must include training and research components and a work plan prepared by a host faculty member. The Methodology, Measurement, and Statistics Program similarly offers **Mid-Career Methodological Opportunities Fellowships** that emphasize deepening skills as well as accomplishing research. These Fellowships are for nine- to twelve-month periods. The Cultural Anthropology Program also offers **Scholar Awards in Methodological Training for Cultural Anthropologists** to upgrade researchers' methodological skills by learning specific methods or techniques during a summer period or for as long as an academic year. And, finally, the Law and Social Science Program offers stipends of up to \$15,000 for **Mid-Career Training Fellowships** aimed at encouraging scholars (including tenured faculty) to pursue advanced methodological or theoretical training (e.g., institutes, workshops, seminars, courses). All of these mechanisms are rarely used. Examining the appropriateness of these initiatives directorate-wide, giving some a higher profile, and allocating adequate funds are essential steps to making meaningful investments in early or mid-career professional training for SBE scientists.

³⁵ Applicants from all disciplinary and interdisciplinary fields within the SBE sciences should be encouraged to apply irrespective of whether there is a dedicated funding program within the SBE Directorate.

4. The Faculty Early Career Development (CAREER) Program is an NSF-wide activity with considerable potential for social, behavioral, and economic scientists seeking support through the SBE or EHR Directorates. With a focus on the integration of research and education, this program seeks to invest in junior faculty with high potential for a lifetime of contributions to both domains. There are far fewer CAREER awards in SBE and EHR than in other NSF Directorates, suggesting that these two Directorates should seek applications and request the additional funds that would need to go with it. (In 2001, there were 397 CAREER awards NSF-wide, with 20 in SBE and 8 in EHR; in 2002, there were 392 CAREER awards with 10 in SBE and 11 in EHR; and in 2003, there were 406 CAREER awards with 18 in SBE and 9 in EHR.) These five-year awards are directed to junior faculty or their equivalents in tenure track positions who have the dual ambition of contributing to research and to education. In addition to enhancing the research and teaching capacities of CAREER recipients, an increased number of CAREER awards in the SBE sciences would improve undergraduate and graduate education in these fields.

5. The Research Opportunity Awards (ROAs) for faculty members at predominately undergraduate institutions is an extant mechanism of NSF support that could enhance the research skills and capacities of SBE scientists. Usually put in place as supplements to NSF research grants at host institutions, ROAs permit eligible applicants to pursue work as visiting scientists for periods ranging from a summer to a year in order to increase their research capabilities and effectiveness and to improve research and teaching at their home institutions. Expanded use of ROAs would ensure that early career SBE scientists at primarily teaching-intensive institutions continue to build their research skills, research networks, and programs of research. To widen the opportunities to do this in the SBE sciences, NSF might consider making *direct* awards to host institutions for applicants with strong rationales for being at a site and with strong developmental plans involving host scientists, without the requirement that these awards need to supplement extant NSF awards.

New Opportunities and Initiatives

Collaboration of SBE and EHR Directorates on an Integrative Postdoctoral Research Traineeship (IPRT) Program. The comparative absence of postdoctoral training in the SBE sciences and the need to foster advanced scientific skills to address issues that transcend any one discipline suggests the need for an Integrative Postdoctoral Research Traineeship Program in the SBE sciences. One of the goals of IGERT is to “catalyze a cultural change” in graduate education. In the SBE sciences, where postdoctoral training is rare and undervalued, there is a parallel need for a cultural change at this career stage. Following the IGERT model, IPRTs should also be five-year awards submitted by investigators who seek to engage in research and postdoctoral training on important scientific themes requiring interdisciplinary innovation. While IPRT funding would focus on postdoctoral fellows, resources from these awards or other funding could appropriately be used to support graduate fellows and undergraduate research interns as part of creating effective research teams and workgroups and providing postdoctoral fellows with direct experience in training other students at different points in their career preparation. IPRTs would have the dual goal of expanding the research skills and capabilities of new PhDs (within two years of degree completion) under the guidance of seasoned mentors and of enhancing fellows’

own experiences in training and supervising others. Proposals from research organizations as well as academic institutions and partnerships should be welcome. Problems within the Human and Social Dynamics (HSD) priority area would be especially ripe for IPRT focus.

An SBE Postdoctoral Research Fellowships Program. The National Science Foundation could have a major impact on the scientific workforce in the SBE sciences by investing in a program of postdoctoral research fellowships. The imbalance between the large number of scientists who receive PhDs in the SBE sciences and the small number of postdoctoral appointments in these sciences compared to the natural sciences, engineering, and medicine suggests that SBE fields would benefit greatly if new PhDs received advanced training, time for intensive research, and career development guidance in strengthening their skills and establishing research programs. Similar Fellowship Programs are present in other directorates and divisions outside of SBE in areas where capacity building is particularly important (e.g., microbial biology in the Directorate for Biological Sciences). Such a program would aim to identify fellows with strong training and career objectives as well as research plans. While applicants should be close to their PhDs (within two or three years), those in academic positions or with job offers should be encouraged to apply—with their home sites agreeing to stop the tenure clock. Academic and non-academic institutions should be eligible to be host sites. Also, any new initiative should be of sufficient duration (e.g., a five- to seven-year program) to permit meaningful assessment of the impact of such support on early cohorts of fellows and on the research environments in which they work. Institutions and individuals should be eligible to submit proposals.

SBE Vertical Integration of Research and Education (VIGRE) Awards. As noted earlier, the SBE sciences still tend to be conducted more by independent individuals than by researchers operating as members of large collaboratories or work groups. Disciplinary departments tend to train with an implicit model of the solo investigator rather than with a research and education framework that fosters teamwork. For a number of years, the NSF Division of Mathematical Sciences has been working to remedy a similar pattern and practice through VIGRE funding (recently integrated into a new initiative on Enhancing the Mathematical Sciences Workforce in the 21st Century). This mechanism holds promise for SBE as well. VIGRE awards aim to change the basis of education and training in departments by building team approaches to research and education where postdoctoral associates receive quality mentoring and training and serve in an educative role. VIGRE awards to departments (or to large groups within a department) seek to (1) strengthen the integration of research with educational activities; (2) enhance interaction among undergraduates, graduate students, postdoctoral associates, and faculty members; (3) broaden the educational experiences of students and postdoctoral associates to prepare them for a wide range of career opportunities; and (4) deepen department-wide appreciation of the value of collaborative work.

SBE Stimulus Package Partnerships for Professional Development. This initiative would partner the National Science Foundation with SBE scientific societies in order to accelerate attention to professional development in these fields. Scientific societies are well situated to partner with the NSF on a low-cost, low-overhead stimulus package of professional development activities. Support could include resources for such activities as conducting courses or institutes, providing small grants for research innovations, supporting research-related travel,

or coordinating mentor-match programs. Scientific societies have contacts with junior scholars (directly and through their work with department chairs), know the needs of their fields, are experienced in conducting peer review, and can capitalize on a tradition of volunteerism of accomplished researchers. These partnerships will allow NSF and professional associations to assess professional development needs using flexible strategies and evaluate the return on “venture” capital investments. Funding would be used primarily for external expenses (e.g., junior faculty support to cover travel to a workshop) although associations would need some support for the planning and execution of these activities.

Immediate Steps

- Enhance the prominence of existing postdoctoral training opportunities by preparing and disseminating an announcement that summarizes opportunities for postdoctoral training and early career development in the SBE sciences. Disseminate this announcement on the SBE and EHR pages of the NSF website, enlist the help of scientific societies and offices of sponsored research in its wide distribution, and encourage program officers to emphasize postdoctoral training and professional development opportunities in workshops and visits to academic institutions.
- Redirect on a pilot basis some resources dedicated to evaluation contracts within EHR to postdoctoral evaluation programs aimed at both evaluation studies and training SBE postdoctoral fellows (including education researchers) in evaluation research.
- Convene a meeting of key private foundations and federal agencies engaged in the support of SBE research and training initiatives to consider these recommendations and to identify funding partners that might participate in an effort to help make postdoctoral training a more integral part of SBE science education.
- Given the limited number of postdoctoral training programs in the SBE sciences (and given that they are largely health-related), convene a meeting of key program officers and principal investigators of postdoctoral programs to build on their operational experience and wisdom to help design an SBE postdoctoral initiative and program solicitation. A new program should pursue those strategies likely to have the broadest possible impact on the SBE sciences as well as on the postdoctoral fellows themselves. Depending on the level of resources that can be mustered, decide whether to solicit institutional proposals from departments, research centers or institutions, or scientific societies; whether to entertain individual fellowship applications; or whether to encourage both as done under the National Research Service Act.
- Extend the current statistical programs conducted by the SBE Directorate’s Division of Science Resource Studies to gather, summarize, and interpret detailed information on employment choices, research activities and productivity, and career trajectories across sectors of employment of new PhDs. Encourage research proposals addressed to scientific training and career development in the SBE sciences for submission under the Workforce

for the 21st Century priority area or the HSD priority area. NSF would be better situated to improve postdoctoral and early career education in the SBE sciences if there were more complete and reliable data on the production and career development of SBE scientists.

- Urge the American Association for the Advancement of Science (AAAS) and the Alfred P. Sloan Foundation to include the SBE sciences in Postdoc Network (part of *Science* magazine's Next Wave Website). Encourage the AAAS to include the SBE disciplines and SBE postdoctoral opportunities in its electronic career development database (i.e., the Career Development Center for Postdocs and Junior Faculty). Provide support to develop this website and promote its existence.

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