

September 2017

## Graduate Training in the Social and Behavioral Sciences

Proceedings of a Workshop—in Brief

Graduate training in the social and behavioral sciences (SBS) has largely remained unchanged in the past 35 years despite trends toward multidisciplinary research and varying pathways given changing workforce needs. To help identify how SBS graduate education could be adapted given these trends, the Board on Science Education convened a 2-day workshop in June 2017 on graduate training in the social and behavioral sciences. Participants included current SBS graduate students, postdoctoral fellows, faculty and academic leaders, members of professional societies, funding agencies, and leaders in government and business.

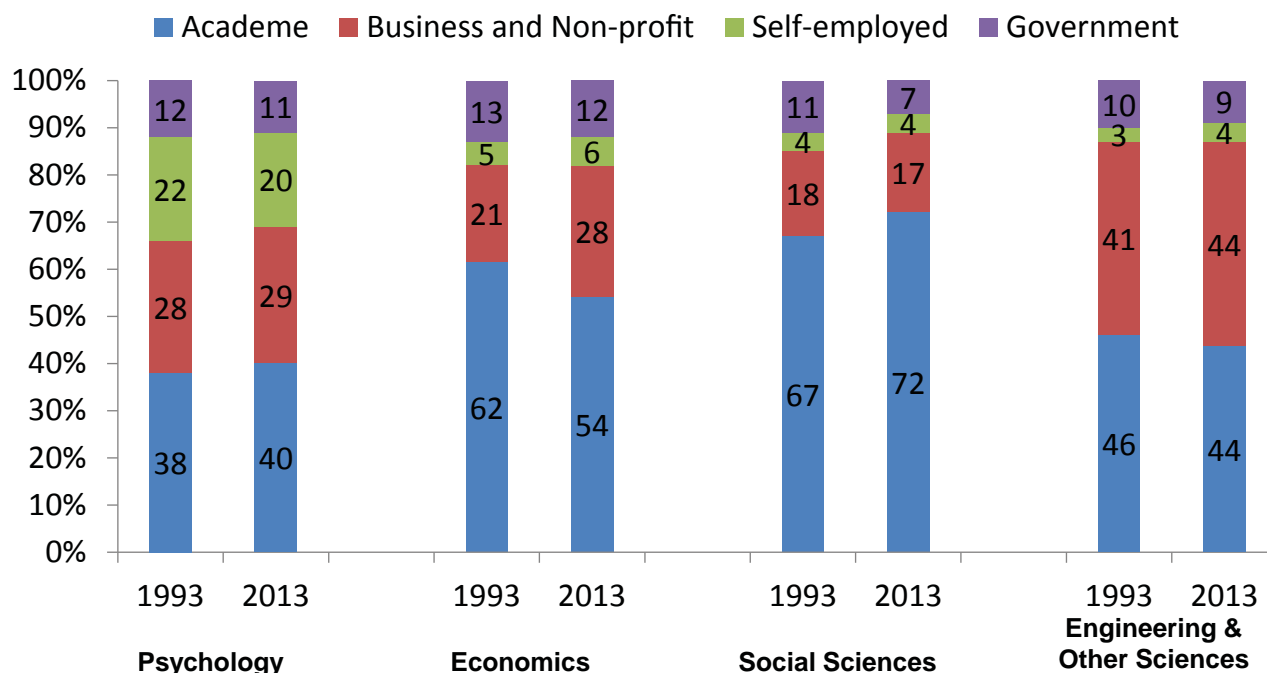
### CURRENT PHD PRODUCTION AND EMPLOYMENT PATTERNS

Alan Leshner (American Association for the Advancement of Science, emeritus) opened the workshop with an overview of issues in graduate education. He said an important overarching consideration is that approximately 60 percent of new PhDs in the sciences do not pursue academic research careers, yet graduate education primarily focuses on preparation for those positions. Shifts in science are also affecting graduate education, he noted: the scientific enterprise has grown tremendously, and research is increasingly occurring outside of academia, requiring teams of scientists to tackle complex and multidisciplinary problems.

Despite these changes in science and career paths, the system of graduate education has remained unchanged, Leshner said. Although the current approach may serve existing faculty, their institutions, and funding agencies because graduate students serve as a highly creative and productive yet inexpensive workforce, the current system may have fewer benefits for students and for other employers.

Fay Lomax Cook (Directorate for Social, Behavioral and Economic [SBE] Sciences, National Science Foundation [NSF]) and Robert Kaplan (Chair, Planning Committee), provided a current picture of SBE<sup>1</sup> doctoral graduate education and graduates' employment. In 2015, 5,313 social and economic science doctorates and 3,782 psychology doctorates were

<sup>1</sup>SBE (rather than SBS) is used when referring to data from the National Center for Scientific and Engineering Statistics (NCSES) or the SBE directorate in NSF.



**Figure 1** Employment of science and engineering doctorate holders, by sector: 1993 and 2013.  
Source: Presentation by Cook: data from NCSSES 2013 Survey of Doctorate Recipients. Presented at Graduate Training in the Social and Behavioral Sciences: A Public Workshop. Available <http://nas.edu/SBS-GraduateTraining>.

awarded; these graduates accounted for 30 percent of all doctorates.<sup>2</sup> Cook noted that the median years to an SBE degree is 7.7 years, about 1 year longer than the time for all other science doctorates.

Cook explained that many more SBE PhDs take jobs in academia immediately after degree completion than do other science and engineering graduates: see Figure 1. For those who do not, graduates with economics PhDs are more likely to work in business, nonprofit, and government sectors, while psychology PhDs are more likely to be self-employed (20%), primarily because many of them (about 40%) pursue clinical work. Economists tend to have the highest salaries of SBE PhDs, and those with academic positions tend to earn less than those with nonacademic positions: see Figure 2. In 2013, Cook said, the unemployment rate for SBS PhDs was less than 2 percent, a rate lower than that for PhDs in the other sciences.

Kaplan added that nearly 40 percent of SBE PhDs do postdoctoral training. However,

there is considerable variation among disciplines: approximately 60 percent of new psychology PhDs do postdoctoral work, which is almost 20 percent more than new PhDs in other SBE fields.

In some SBE disciplines, graduate students are more balanced by gender than other sciences: psychology is 56 percent female, and the other social sciences are 45 percent female. However, like other science fields, Kaplan said, there are relatively few graduate students from underrepresented ethnic and minority groups: 8 percent in economics, 10 percent in psychology, and 12 percent in the other social sciences.<sup>3</sup>

Kaplan summarized the data on SBE graduates. First, SBE scientists are a significant proportion of the scientific workforce, but they tend to have lower pay than graduates in the physical and engineering sciences. Second, there is a growing trend among new PhDs, including those with SBE degrees, to seek employment outside of academia, where they are better paid

<sup>3</sup>The “other” category includes anthropology, geography, linguistics, political science and government, public policy analysis, sociology, and others.

<sup>2</sup>The data are from the NCSSES.

than in academia. Third, SBE graduates tend to have more debt after graduation than PhDs in other science fields.

Alan Kraut (Psychological Clinical Science Accreditation System) explained that clinically oriented programs have unique features of training that should be examined separately from other programs. In particular, clinical psychologists need training to work in clinical settings, as well as research training. Other participants suggested a need to better understand what drives graduates to seek employment in or outside of academia, how best to train students to be parts of multidisciplinary research teams, and how to meet the needs of nontraditional students who pursue PhD degrees on a part-time basis.

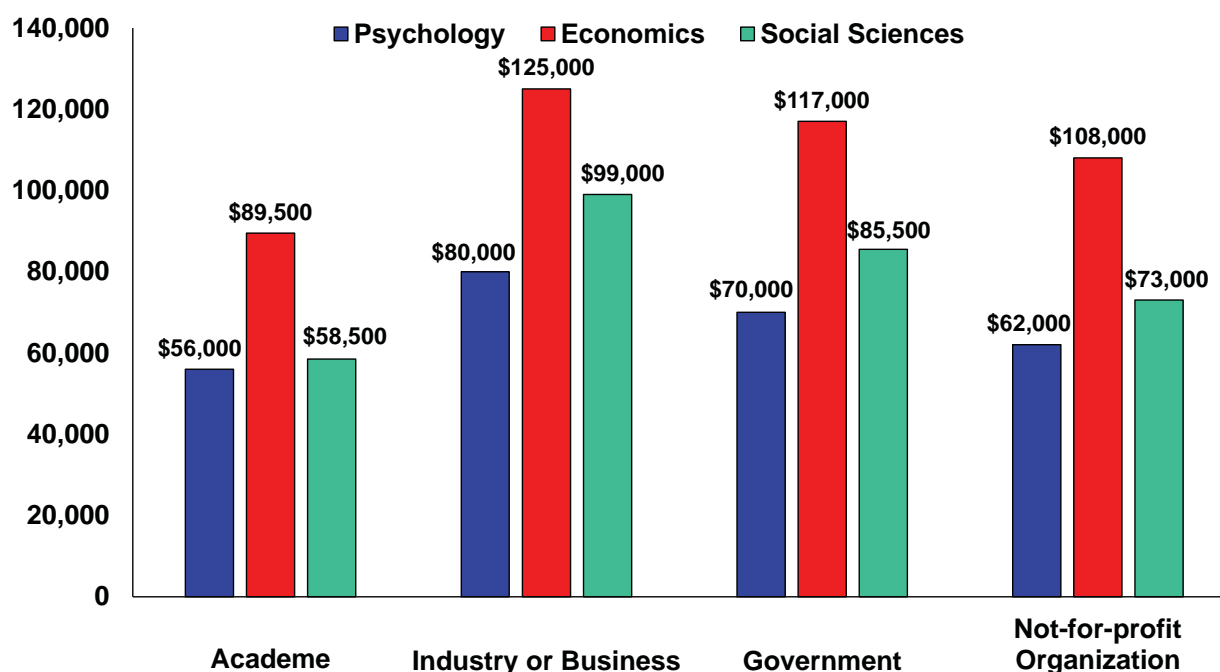
## EXPERIENCES IN WORKING OUTSIDE ACADEMIA

A panel of recent PhD students and another of leading researchers working in a variety of sectors discussed their experiences working outside academia and the role of SBS graduate training in preparing them. A third panel discussed the growing

need for SBS PhDs who are trained in data analytics.

The panel of recent graduates in PhD programs offered perspectives on how their training prepared them for their careers, focusing on their decisions to pursue careers outside academia, what jobs outside of academia are like, and their PhD training as preparation for their careers.

When deciding to pursue a career outside of academia, the desire to apply their research and see it have an immediate effect encouraged several panelists to pursue industry careers. Fred Leach (Facebook), a social psychologist working as director of marketing science, found appeal in the speed of application as part of “small, nimble teams.” Similarly, Justin Hepler (Facebook), a quantitative user experience researcher, appreciated the encouragement to take his research to direct application and change. Variety in the work was a draw for Chris Chapman (Google) and for Dmitry Tumin (Nationwide Children’s Hospital in Ohio), a sociologist working as director of research in the hospital’s department of anesthesiology.



**Figure 2** Median salary for SBE doctorate recipients with definite postgraduation plans, by sector: 2015.  
Source: Presentation by Cook: data from NCSES 2015 Survey of Doctorate Recipients from NCSES.

The culture of industry differs from the culture of academia in significant ways that required an adjustment, explained Megan Walsh (Nielsen), manager of data science. Focusing on research that is “good enough” to help the company make financially responsible decisions can differ from purely scientific approaches. Leach agreed and said that the research questions that drive industry focus on the needs of the business, which include the magnitude of effects and the predictability, replicability, and stability of those effects. Tumin noted that sharing useful findings as they are produced is emphasized in industry.

The panelists said that several factors influenced their job satisfaction, including believing in the company’s mission, engaging in a variety of challenging projects, being able to influence people as a mentor or manager, having a good work-life balance, and good pay. “I like solving challenging problems, and that’s what I get to do,” said Hepler.

All the panelists said they found their PhD training valuable, especially core training in science, critical thinking, and analytical skills. Learning how to be criticized, become expert in a subject matter, and to conduct independent research were other valuable experiences. In hiring, Walsh noted, she prefers industry experience over a recent PhD with no industry experience because often the PhDs need retraining. In contrast, however, Leach said that PhD training in complex quantitative analyses can be vital.

The five panelists all said that their PhD training provided little, if any, preparation for working in business settings. With few exceptions, they said, they learned much of what they know about business on the job, including how to manage, work collaboratively, and communicate with nonscientific audiences. Walsh described the high financial stakes attached to the decisions that she must make. Hepler said that graduate education could do more to provide training in communicating to broad audiences.

In response to the question of their experiences during graduate training when they decided to pursue an industry career, Walsh said she lost the support of people in her program, but Tumin and Leach reported more neutral responses to their choice, sometimes because advisors did not know how to support those career paths. Several of the panelists encouraged more exposure to industry during graduate training through internships and other avenues.

Reflecting on the lessons that academia could learn from industry, both Tumin and Hepler said that academia could learn more about nonacademic research priorities. As Hepler explained, “sometimes there’s a disconnect between the kind of research that’s being done in academia and the kind of problems that industry is trying to solve.” Leach said that academic research is often unable to keep up with the rapid pace of technological change and problems in industry.

The panel of researchers who work outside academia offered their views on those settings and discussed how graduate programs might better equip students for success outside academia.

Rachel Kleinfeld (Carnegie Endowment for International Peace) described preparation that is useful for positions in government and foreign policy and how academia could better prepare students for these settings. At think tanks, she said, researchers do not pick the relevant questions: if policy makers “are having a certain conversation, it’s incumbent upon us to comment on that discussion and have a useful point of view that helps improve their decision making within often radically reduced circumstances.”

Kleinfeld said that speed, thoroughness, and adeptness in communicating in political environments are essential skills in the people she hires. Building trusting relationships is also important in her field because needed information is often unwritten, classified, or just emerging, she

noted. Graduate school provided her with a necessary base knowledge and a rigorous way to pursue problems. In terms of preparation, she said that being able to apply interdisciplinary thinking to policy problems and quantitative data analysis are beneficial; theoretical discussions are less valuable.

Hal Varian (Google) said that his work involves identifying the right questions to ask and solving problems. Moreover, he often must anticipate questions that management is going to ask in the next month or quarter because of the tight timeframes that decisions demand. He also noted that most work is done on teams and requires project management skills.

When assessing new PhD hires, Varian considers their knowledge, their ability to clearly communicate, and their approach to solving ill-defined problems. Flexible thinking, the ability to formulate problems that can be answered quickly, and selecting the right tools to inform decision makers are essential skills. He suggested that having had an internship or preparing a brief paper demonstrating the ability to make contributions based on their expertise would be valuable to prospective employers. He noted that the ability to learn from and communicate to disparate fields is also valuable.

Katie Gan (The Lab @ DC) described how her organization's mission to use scientific insights and methods to test and improve policies and provide timely, relevant, and high-quality analysis to city leaders shapes her work. She designs, conducts, and communicates the results of program evaluations to help inform decision making. Her work is very deadline driven, she said, which constrains how the research is conducted.

Gan echoed others' comments that building relationships and focusing on the needs of policy makers is essential, and she added that humility and knowing how to go about finding an answer are key elements for her work. Graduate programs do little to

prepare students for project management, she said, so that new PhDs who have had experience running projects are attractive candidates. She suggested that graduate programs teach students to express their expertise in accessible ways and to provide opportunities to practice that skill.

In the panel on data use and analytics, Peter Zandan (Hill+Knowlton Strategies) observed: "If you look at some of the most successful enterprises out there today—Facebook, Google, Amazon, Uber—they are all social science enterprises . . . you're the ones training that talent." In Zandan's experience, social and behavioral scientists who can analyze and interpret data are in high demand.

Christopher Bail (Duke University), who directs a computational social science training program, said that PhDs have typically learned skills in less than ideal ways—in computer science departments, where coverage is overly broad and priorities differ from SBS, or on their own, using online tools. "In the long term, we want to build roads between computer science and social science . . . in the short term, we need a new generation of social scientists to learn computer science skills," he said. The skills needed include data cleaning, text analysis, data visualization, and machine learning. Ethics in data analytics is especially important, Bail added. Demand for training is high, but capacity is currently limited. Collaboration between academic and industry scientists is needed to address problems with sharing industry-owned data and proprietary technology; one potential solution is to create protected data warehouses.

Sehreen Noor Ali and Michelle Gill (Kaplan, Inc.) described an immersive, 12-15 week "boot camp" model for providing data analytics and web development training that is part of their work at Metis and Dev Bootcamp, respectively, which are part of the New Economy Skills Training Division at Kaplan. The curriculum is adaptable to fit industry needs, Ali explained, and train-



ing can provide a pathway to apprenticeship or employment. Employers value the mentoring that the boot camps provide in communication, collaboration, and team work. The camps specifically reach out to people from nontraditional and underrepresented backgrounds and adapt training to meet specific learning needs. Ali suggested that partnerships with universities could help fill a gap in providing “workforce-ready skills” to students.

William Riley (Office of Behavioral and Social Sciences Research, National Institutes of Health) noted that many SBS graduates, except for economists, currently have limited competency in data science, statistical analysis, and data management. He suggested that more and better use of computational social science would make SBS graduates better collaborative partners with people from other disciplines that rely on those methods. He also noted that technological advancement has made available large amounts of data on social and behavioral phenomena, but SBS may not be adequately leveraging those data. Keeping pace with the rate of change in data analytics is a challenge, Riley said.

Zandan noted that companies need social and behavioral scientists who know how to use data to make decisions. And they need senior leaders who understand enough to know what to ask for, added Ali. Bail explained that industry is more focused on prediction, but academia is often more focused on explanation. However, he said, businesses are increasingly valuing qualitative analyses to complement data analytics.

Gill said that preparation for analytic skills should begin early in education. Bail added that a strong theoretical or qualitative background is useful: “It’s not just that we have data about people, it’s that we have theories about social networks and organizations and social psychology that can all improve. So that part is vital.” Riley said that he thinks coursework, rather than apprenticeships, should address the learning of computational modeling approaches.

## ENVISIONING THE FUTURE OF SBS GRADUATE EDUCATION

A panel of academic leaders offered their visions for the future of SBS graduate education and their ideas for moving forward.

Nicholas Dirks (University of California, Berkeley) said that given student interests and world needs, interdisciplinary knowledge and experiences are as important as the ability to think critically, communicate clearly, and take criticism. Multidisciplinary programs continue to be a challenge to sustain, Dirks said, because they often do not provide students with the “disciplinary imprimatur” necessary to get traditional academic jobs and publications. One barrier to a different approach is changing a faculty culture that emphasizes replicating professors’ own training and career paths; changing faculty reviews, creating internships, and having more conversations about the changing pathways could help bring about culture change, he suggested.

Daniel Denecke (Council of Graduate Schools) said that graduate schools should collect data on and be transparent with students about time to degree and career placement. He also encouraged broader acceptance of multiple career paths for SBS PhDs and incentive structures that support those paths. Denecke said he believes that students should have multiple mentors, opportunities to teach and learn pedagogy, and individual development plans that help them be intentional about their careers. In order to be more inclusive of people with diverse backgrounds, he suggested careful broadening of admissions criteria to include training and life experiences. Developing online modules is another way to expand professional skills development for nontraditional students, he added.

Chase Robinson (Graduate Center of the City University of New York [CUNY]) said his vision for graduate education comes from imagining the career of a student who begins graduate school now and

ends her tenured position in 2062, when she will be teaching students whose own working lives extend beyond 2100. Because it is impossible to know what disciplines will exist, what work will look like, and what problems will need to be solved, he said. The most important type of knowledge that graduate schools can help provide is knowledge that is collaborative, interdisciplinary, and that sets humans apart from nonhuman thinkers. As robotic labor increases, knowledge that empowers people to create, experiment, and innovate will be most important, he said. He envisions a 4- to 5-year PhD program, comprised of 1 year of disciplinary focus and 2-3 years of interdisciplinary, team-based work. Students would acquire multiple competencies, not only at their universities, but through partnerships with other institutions and organizations.

Robinson said he sees faculty desire to recreate their own training and faculty governance as key barriers to innovation. He has implemented several strategies at CUNY to work around these barriers. For example, students work with visiting faculty in interdisciplinary teams. In addition, all PhD programs must generate their own plans for change and innovation. CUNY also offers certificates, partnerships with non-academic institutions, and seminars on writing that conveys expert knowledge in understandable language.

Mark Wallace (Vanderbilt University) described three initiatives at Vanderbilt that capture his vision of future graduate education. One initiative emphasizes interdisciplinarity, team work, and leadership skills needed for working in a variety of positions where students engage with community leaders to focus on local problems. Another initiative provides students with opportunities to work internationally in science. A third initiative provides annual seminars and internship opportunities for graduate students to learn and work with business partners and others outside of academia. Wallace indicated that for interdisciplinary programs to take hold in uni-

versities, mechanisms for dialogue across disciplines need to be created.

Resources devoted to graduate education are often secondary to those for undergraduate education, said Wallace. Resources and buy-in from the highest levels of administration are needed to reshape graduate education in innovative ways. At Vanderbilt, for example, funding has helped seed and formalize relationships among different schools that conduct collaborative research.

Several participants suggested that more change was needed in how graduate programs educate students rather than in what. Many emphasized fostering the ability to work in a team. Barbara Entwisle (University of North Carolina, Chapel Hill) said that informal aspects of training can be one way to provide valuable team experiences in highly individualized PhD programs. Planned, open work spaces can be used to put students from different disciplines and at different stages in their programs in proximity. "Who is talking to whom on a daily basis may be as important as what specific formal opportunity you give somebody," Entwisle said. Through informal interactions, students can learn to explain their work to people outside their disciplines and conversations can inform their research activities, noted Shevaun Lewis (University of Maryland). Group projects in seminars can also promote teamwork, suggested Bail.

In order to train students for the diverse careers they may pursue, Daniel Ginsberg (American Anthropological Association) suggested tailored experiences and mentoring; partnerships outside of universities may be important to these efforts. Future curricula should aim to shorten the time to degree, especially for those who plan to work outside academia: several participants echoed this point throughout the workshop.

Several participants noted the value of learning to teach in graduate school, which can help students to master con-

tent knowledge and to improve communication. Experiences that instill self-confidence—meeting with visiting scientists and delivering presentations—are also valuable, added Deborah Olster (National Science Foundation). Other participants noted that comprehensive exams and the composition of dissertation committees are points of influence to advance interdisciplinarity and make requirements more career-goal specific. Participants also discussed measuring success during and after graduate programs and the importance of collecting data on graduates' jobs.

Participants were asked to offer additional ideas in writing about the broad goals and outcomes for SBS PhD programs and ways to achieve them. A range of ideas were put forward by individual participants: (1) Rethink how to equip students to construct knowledge for the public interest directly and indirectly. (2) Educate students for a variety of employment settings. (3) Prepare students to navigate multiple careers in their lifetimes. (4) Teach, model, value, and provide students with opportunities to engage in crossdisciplinary work. (5) Value and reward a broad array of publications, across disciplines, and for a variety of audiences. (6) Avoid rigid curricula and overestimating the value of traditional disciplinary education. (7) Offer training in cybernetics and systems science. (8) Teach students to work and manage teams and interpersonal relationships. (9) Offer exposure to international research. (10) Provide better mentorship for students. (11) Provide coursework in interdisciplinary methods. (12) Consider how undergraduate education and postdoctoral work can complement graduate training.

## **POSSIBLE PATHWAYS AND TRAJECTORIES**

In a panel on pathways for graduate training, speakers emphasized focusing on problem solving, whether in health, engineering, or local community issues. Working with researchers from other disciplines

is essential to solving many of today's problems, said Nancy Cooke (Arizona State University). Moreover, this orientation is attractive to students. Graduate students in her program often work in teams with engineers, computer scientists, or medical professionals in various settings, and they ultimately go on to work in industry rather than academia.

Keith Whitfield (Wayne State University) said his work has focused on interdisciplinary initiatives around "big data," innovative entrepreneurship, and health disparities. These efforts are designed to solve issues of social import, many focused on local needs in Detroit. Arthur Lupia (University of Michigan) said that programs need to help students develop a service orientation and convey the value of their work to solving problems and improving quality of life.

Several of the panelists said that leadership and structural changes at universities—such as creating multidisciplinary centers or changing promotion and tenure criteria, as well as faculty buy-ins—are all important for building interdisciplinary graduate programs that endure. Lupia added that it helps to show administrators, legislators, and funders how such approaches solve problems that matter to people.

In interdisciplinary teams, graduate students "really have to know their stuff, because they have to be able to communicate it to somebody coming from a very different place," said Cooke. Lupia added that graduate schools have an "obligation to help their students survive in this highly competitive world." To do so requires skills in science communication, such as communicating clearly and accurately what scientific claims mean and engaging with stakeholders to better understand what societal problems science can address.

Carol Fierke (University of Michigan) explained that students must consider their career trajectories much earlier in training than ever before. Her institution of-



fers support to students—including workshops, talks by alumni, and immersive experiences at companies—to help them better understand options in and outside academia and the nonlinear pathways that careers can follow. Using data showing the career outcomes for graduates of their programs is part of increasing faculty awareness of these multiple pathways, she said. Fierke added that faculty members receive mentoring, workshops, and other professional development as they adapt to supporting a widening array of students and pathways.

A focus for John L. Jackson, Jr. (University of Pennsylvania) has been changing the academic culture to allow for broader ideas about scholarship and careers. Programs at Penn have focused on helping students find “individualized ways to make a compelling case for how and why they’re bringing something unconventional to the table as scholars,” he said. Whitfield added that electronic portfolios can be useful ways for students to demonstrate their diverse experiences in creative ways. Another useful strategy, Jackson said, is hiring faculty across disciplines and holding them responsible for supporting interdisciplinary research and multiple pathways.

Several panelists described how credentials outside of the PhD can prepare students for careers. Although Whitfield has seen a “huge explosion of master’s degree programs,” he said he has also experienced pushback from faculty focused on producing future researchers. He suggested considering “microcredentials” or certifications (e.g., for coding or teaching) that may be useful and help compress time to degree.

Postdoctoral training can be especially useful to PhDs who plan to pursue academic careers, both Jackson and Cooke acknowledged. A 3-year postdoctoral position can be preferable to a tenure-track position in some cases, said Jackson, because it delays the pressures of pursuing tenure, providing flexibility and time to build skills while

clarifying research goals. Fierke noted that some postdoctoral training is more specialized, focusing on teaching, for example. Although some of these programs are designed with a job waiting, others have no promise of employment.

To consider some aspects of training in more detail, participants met in small breakout groups to discuss five topics: (1) interdisciplinary training, (2) statistical literacy, (3) methodological literacy, (4) team science, and (5) preparation for non-academic employment.

### **INTERDISCIPLINARY TRAINING**

Individual participants generated a range of ideas: (1) Define what is meant by interdisciplinary (e.g., interdisciplinary centers, dual degrees, hiring specialists). (2) Identify who needs interdisciplinary training (all students or only some students, as well as training the faculty mentors). (3) Identify when this type of training should occur—before, during, or after disciplinary training. (4) Clarify why it is important to individual students.

### **STATISTICAL LITERACY**

Alex Eisenbarth (graduate student, The New School) and Lupia stressed the importance of helping students shed a negative stance toward mathematics. Other group participants suggested that SBS graduates need exposure to an array of analytical tools and ethical training to develop an awareness of what they do and do not know, to appropriately select statistical tools, to know how to seek information they may lack, and to properly communicate results.

### **METHODOLOGICAL LITERACY**

Emily Barman (Boston University) acknowledged the utility in providing training in both quantitative and qualitative methods, as both are important and trends in big data, such as textual analysis, involve both. Other group participants said that a variety of experiences could be built into the curriculum to teach students about is-

sues in reproducibility that are supported by good modeling and about practices that encourage transparency.

### **TEAM SCIENCE**

Margaret Vitullo (American Sociological Association) said that team science can refer to a single discipline involving multiple people or people from different disciplines working together on a common problem. Other group participants offered two additional ideas: (1) SBS graduate education needs to follow a “T” pattern—deep disciplinary knowledge and broad knowledge of related subjects. (2) Students need to be able to articulate the contribution of their own discipline while cultivating an orientation to and appreciation for learning from other disciplines.

### **PREPARATION FOR NONACADEMIC EMPLOYMENT**

Participants in the group offered several ideas: (1) Decoupling master’s and PhD programs. (2) Increasing diversity in programs to diversify ideas to include bringing outside groups and entities together. (3) Adopting a problem-solving focus. Although acknowledging that change will be difficult, individuals in the group said that it is important to support diverse pathways and consider whose job it is to know about and carry out this preparation.

### **TACKLING INEQUALITY IN SBS GRADUATE EDUCATION**

Several panel discussions addressed ways to increase diversity of graduate students in SBS graduate programs and individual participants generated suggestions for tackling this issue.

Robinson said he believes graduate schools cannot simply fight over small numbers of qualified students from underrepresented backgrounds. Rather, he suggested that graduate schools partner with undergraduate pipeline programs and offer mentorships to students of color, as well as hiring diverse faculty. Partnerships with community colleges also offer teaching opportu-

nities for graduate students and expose community college students to faculty of color, fostering contacts and professional relationships, he said.

A recurring point raised by several participants was that diversity cannot only be about a person’s ethnicity or gender but also be about diversity of thought. In addition, efforts to encourage greater diversity need to go beyond recruitment. “You actually have to have people that are going to embrace that population and understand that population,” said Whitfield. Varian added that role models are important, and a sense of inclusion and belongingness supports retention. Both Whitfield and Lupia said that creating a supportive culture within programs is a faculty responsibility, but university leaders need to exert leverage, bring resources and incentives, and encourage cultural change to increase diversity. Jackson noted that there is a tension in many institutions with “one side saying we get to excellence in and through diversity, and another cadre of academics, equally sincere, who think diversity means compromising rigor.”

Some specific practices can increase diversity, participants noted. Kleinfeld argued that efforts to increase diversity should start well before graduate school. Summer bridge programs and using “holistic reviews” of new applicants have been effective in increasing numbers of successful graduate students, she said. Whitfield noted that such initiatives as the Minority Biomedical Research Student Program, of which he was a beneficiary, have been effective.

Individual participants offered a range of ideas for tackling the lack of diversity in SBS graduate education: (1) Make use of the research on effective practices in reducing inequality. (2) Increase outreach and recruitment. (3) Read applications from underrepresented groups multiple times. (4) Consider structural changes to programs to accommodate nontraditional students. (5) Be self-reflective. (6) Broaden the diversity of reading materials and curriculum mate-

rials. (7) Be willing to take risks on people who bring a different way of thinking. (8) Pursue authentic, rather than surface, approaches to increasing diversity

## FUNDING

Individual participants identified several ideas for potential funding priorities for SBS graduate education, including interdisciplinary training programs, internships, and international experiences. Several participants noted that funding for research, other experiences, and credentials that clarify career goals, even prior to graduate study, may shorten time to degree. Zandan and Ellen Konar (Mindset Works) suggested seeking broader collaboration with industry, both to fund graduate training and to identify industry needs. Other participants suggested avoiding uniformity, supporting a range of training models, and supporting pipelines for students from underrepresented minorities. Lewis noted that funding for training programs provides credibility that strengthens administrative support from the university. Several participants noted that some existing funding efforts by NSF have been effective and could be continued or increased.

## FINAL REMARKS

Cook identified the five issues that she said she took away from the workshop: (1) legitimizing multiple pathways for SBS graduate students, (2) communication, (3) diversity, (4) expanding interdisciplinary training while maintaining disciplinary training, and (5) recognition that it is no longer necessary to debate the superiority of qualitative or quantitative methods.

Kaplan followed with his takeaway of six major workshop issues: (1) Achieving interdisciplinary science, which remains a significant challenge—for students, faculty, and institutions. (2) Developing the next generation of PhD programs, which is likely to require a significant academic culture change and which may be difficult. (3) The need for programs to prepare students for a wider range of careers. (4) The need for students in the next generation of programs to have better preparation to communicate across disciplines and with a wider range of sciences and nonscientists. (5) The need for greater effort to increase diversity in SBS graduate programs. (6) The role of SBS graduate programs in training responsible scientists.

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**WORKSHOP PLANNING COMMITTEE:** ROBERT KAPLAN (*Chair*), Clinical Excellence Research Center, Stanford University; AMANDA BAYER, Economics, Swarthmore University; JEAN COMAROFF, Department of African and African American Studies, Harvard University; RACHEL DWYER, Department of Sociology, Ohio State University; JAMES S. JACKSON, Department of Psychology, University of Michigan; ELLEN KONAR, Mindset Works; BRENT ROBERTS, Department of Psychology, University of Illinois; PETER ZANDAN, Hill+Knowlton Strategies.

**DISCLAIMER:** This Proceedings of a Workshop—in Brief was prepared by Holly Rhodes as a factual summary of what occurred at the meeting. The statements made are those of the rapporteur or individual meeting participants and do not necessarily represent the views of all meeting participants; the planning committee; the Boards on Science Education and Higher Education and the Workforce; or the National Academies of Sciences, Engineering, and Medicine.

**REVIEWERS:** To ensure that it meets institutional standards for quality and objectivity, this Proceedings of a Workshop—in Brief was reviewed by Kenneth A. Bollen, Departments of Psychology and Neuroscience and Sociology, University of North Carolina; and K. Andrew DeSoto, Policy Division, Association for Psychological Science. Kirsten Sampson Snyder, National Academies of Sciences, Engineering, and Medicine, served as review coordinator. The planning committee was responsible only for organizing the workshop, identifying topics, and choosing speakers.

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