

National Science Foundation
Directorate for Social, Behavioral, and Economic Sciences (SBE) Advisory Committee (AC)
October 27 – 28, 2016; NSF Headquarters, Stafford I, Room 1235
Meeting Summary

SBE Advisory Committee (AC) Members Present: Dr. Kenneth Bollen, AC Chair, Department of Psychology and Neuroscience and Department of Sociology, University of North Carolina, Chapel Hill; Dr. Joseph Altonji, Economics Department, Yale University (via WebEx); Dr. Karen Cook, Department of Sociology, Stanford University; Dr. Catherine Eckel, Department of Economics, Texas A&M University; Dr. John Gabrieli, McGovern Institute for Brain Research, Massachusetts Institute of Technology; Dr. J.W. Harrington, Vice Chancellor for Academic Affairs, University of Washington, Takoma; Dr. Jon Krosnick, Department of Communications, Stanford University; Dr. Arthur Lupia, Department of Political Science, Institute for Social Research, University of Michigan; Dr. Thomas McDade, Department of Anthropology, Northwestern University; Dr. Joanna Morris, School of Cognitive Science, Hampshire College; Dr. Jennifer Richeson, Department of Psychology, Yale University; Dr. William Riley, Office of Behavioral and Social Sciences Research, National Institutes of Health (*Ex officio*); Dr. Linda Smith, Department of Psychological and Brain Sciences, Indiana University; and Dr. Lydia Villa-Komaroff, Massachusetts Life Center (Committee on Equal Opportunities in Science and Engineering, CEOSE, liaison).

SBE Advisory Committee Members Absent: Dr. Nilanjana Dasgupta, Department of Psychological and Brain Sciences, University of Massachusetts at Amherst; Dr. Ruth DeFries, Department of Ecology, Evolution and Environmental Biology, Columbia University; and Dr. Martha Farah, Center for Neuroscience and Society and Department of Psychology, University of Pennsylvania.

NSF Staff in Attendance: Dr. France Córdova, Director; Dr. Richard Buckius, Chief Operating Officer; Dr. Fay Lomax Cook, Assistant Director (AD), SBE; Dr. Kellina Craig-Henderson, Deputy AD, SBE; Mr. John Gawalt, Division Director, SBE/National Center for Science and Engineering Statistics (SBE/NCSES); Ms. Emilda Rivers, Deputy Division Director, SBE/NCSES; Dr. Daniel Sui, Division Director, SBE/Division of Social and Economic Sciences (SBE/SES); Dr. Alan Tomkins, Deputy Division Director, SBE/SES; Dr. Howard Nusbaum, Division Director, SBE/Division of Behavioral and Cognitive Sciences (SBE/BCS); Dr. Sunil Narumalani, Acting Deputy Division Director, SBE/BCS; Mr. John Garneski, Budget Officer, SBE/Office of the Assistant Director (SBE/OAD); Ms. Madeline Beal, Communications Specialist, SBE/OAD; Mr. Anthony Teolis, SBE Administrative Coordinator, SBE/OAD; Ms. Clarissa Johnson, IT Specialist, SBE/OAD; Mr. Philip Johnson, IT Specialist, SBE/OAD; Dr. Roger Wakimoto, AD, Directorate for Geosciences; Dr. James Olds, AD, Directorate for Biological Sciences; Dr. Joan Ferrini-Mundy, AD, Directorate for Education & Human Resources (EHR); Dr. Stephen Meacham, Senior Staff Associate, Office of Integrative Activities; and other NSF staff.

Note: The meeting was open to the public and representatives of stakeholder groups also attended. Guest speakers included Dr. Robert Hauser, Executive Director, Division of Behavioral and Social Sciences and Education (DBASSE), the National Academies of Sciences, Engineering, and Medicine (NAS); Dr. Barbara Kline Pope, Executive Director for Communications and the National Academies Press, NAS; and Dr. Nathaniel Kendall-Taylor, Chief Executive Officer, FrameWorks Institute.

Summary: This was the second meeting of the SBE AC in 2016. The agenda included the following items: Updates on the activities of the SBE Directorate and its divisions; presentation and discussion of NSF's strategic planning process and the *Report to the National Science Board on the NSF's Merit Review Process Fiscal Year 2015*; an update from the National Institutes of Health Office of Behavioral and Social Sciences Research; a presentation and discussion of the 2016 SES Committee of Visitors (COV) Report and the SES Response to it; a presentation from the Executive Director of the NAS DBASSE; presentation and discussion of two NSF Big Ideas for future research investment: *Navigating the New Arctic*, and *Understanding the Rules of Life: Predicting Phenotype*; a conversation with NSF leadership; presentations and discussions about science communications; and planning for future SBE AC meetings. Additional information about the meeting is posted at https://www.nsf.gov/events/event_summ.jsp?cntn_id=189378.

Welcome, Introductions, Review of AC Meeting Summary from May, 2016, and Preview of Agenda (Dr. Kenneth Bollen, SBE AC Chair)

Following introductions, the SBE AC Chair Dr. Kenneth Bollen welcomed one new AC member, Dr. Jennifer Richeson, Yale University. The AC approved the May, 2016 AC meeting summary, and Dr. Bollen previewed the agenda for the current meeting.

SBE Directorate Update (Dr. Fay Lomax Cook, AD, SBE)

Dr. Cook welcomed the AC and provided a brief update on staff transitions within the Directorate leadership and OAD. She then discussed the NSF/SBE Fiscal Year (FY) 2016 budget and the President's FY 2017 Budget Request. The FY 2017 Budget Request called for a \$500 million increase in the NSF budget, \$400 million of which was in one-time "mandatory funding" (\$16.4 million for SBE), a category of funding outside of the regular appropriations, and one that Congress did not consider. As FY 2017 began in October, 2016 without final passage of the appropriations bills, NSF and other Federal agencies are operating under a Continuing Resolution through December 9, 2016.

Dr. Cook then summarized the Directorate's activities in Robust and Reliable Science that were informed by the AC's 2015 [Social, Behavioral, and Economic Sciences Perspectives on Robust and Reliable Science](#) report. The SBE Office of Multidisciplinary Activities (SMA) provided approximately \$1.9 million to co-fund, with various SBE core programs, 11 awards that foster robust and reliable science. In addition, the Directorate published a [Dear Colleague Letter: Robust and Reliable Research in Social, Behavioral, and Economic Sciences](#) that invites submission of proposals to enhance the robustness and reliability of the SBE sciences.

Dr. Cook then described the Directorate's plans to participate in the following cross-directorate initiatives in FY 2017:

- *Understanding the Brain (UtB)*;
- *Critical Resilient Interdependent Infrastructure Systems and Processes (CRISP)*;
- *Innovations at the Nexus of Food, Energy and Water Systems (INFEWS)*;
- *Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science (NSF INCLUDES)*;
- *Secure and Trustworthy Cyberspace (SaTC)*;
- *Smart and Connected Communities (S&CC)*; and
- *Cyberinfrastructure Framework for 21st Century Science, Engineering, and Education (CIF 21)*. SBE's primary activity in CIF 21 is *Resource Implementations for Data Intensive Research in the Social Behavioral and Economic Sciences (RIDIR)*.

She also noted two ongoing projects: First, the NAS Standing Committee on the Future of NSF-Supported Social Science Surveys is tasked with helping NSF monitor and develop the most promising trajectories for the “big three” surveys: the American National Election Studies (ANES), the General Social Survey (GSS), and the Panel Study of Income Dynamics (PSID). Second, SBE and the NIH Office of Behavioral and Social Sciences Research are providing support to the Academies’ Board on Science Education to organize a workshop on the future of graduate education in the social and behavioral sciences. The workshop will address themes related to needs of current and future employers; changing graduate training to meet future workforce needs, including variation across the SBE sciences; and the data and research needed to inform the reshaping of SBE graduate education.

Dr. Cook ended her presentation with a discussion of NSF’s [“Big Ideas”](#) for future investment. The four research ideas to which the social, behavioral, and economic sciences can make a major contribution are:

- *Harnessing Data for 21st Century Science and Engineering*
- *Work at the Human-Technology Frontier: Shaping the Future*
- *Understanding the Rules of Life: Predicting Phenotype*
- *Navigating the New Arctic*

Dr. Cook provided an overview of *Work at the Human-Technology Frontier: Shaping the Future*. Led by SBE, this initiative is based on the underlying premise that technologies and human-technology interactions are transforming the world of work and lives of workers. NSF proposes supporting research in three thematic areas: 1) identifying the benefits and risks of new technologies; 2) investments to create technologies that will promise to enrich lives in the workplaces of the future; and 3) research to inform education and lifelong learning for tomorrow’s workforce.

The next steps for SBE are to assemble a working group with representation from all participating NSF directorates to develop the idea more thoroughly. The Directorates for Engineering, for Education & Human Resources, and for Computer & Information Science & Engineering are playing major roles in this activity. SBE is also seeking input from relevant research communities through discussions with ACs and scientific disciplinary professional associations. NSF is also considering organizing workshops to convene researchers to discuss opportunities in this area.

The AC discussion that followed the presentation focused primarily on *Work at the Human-Technology Frontier: Shaping the Future*. Several AC members expressed enthusiasm for the idea, noting its obvious importance to the U.S. economy. Also mentioned as worthy of attention were the potential exacerbation of inequalities by the development of new workplace technologies, the need for better data and measures of what people do in occupations, basic science that will inform how we, as humans, prepare ourselves for new technologies in general, rather than for any particular technology, and the global nature of this Big Idea.

NSF Strategic Plan (Dr. Kellina Craig-Henderson, DAD, SBE)

Dr. Craig-Henderson presented the process for developing the 2018-2022 NSF Strategic Plan. She reviewed the key elements of the Plan, i.e., a vision, core values (scientific excellence, inclusiveness, learning, accountability for the public benefit, and organizational excellence), strategic goals, strategic objectives and management objectives. Dr. Craig-Henderson asked AC members to review the existing [NSF Strategic Plan](#) to get a sense of current guidance and provide feedback on the key elements and

strategic goals for the 2018-2022 Plan. She ended her talk with questions to consider: 1) What are the interests, values and emergent science and policy issues that the Strategic Plan should recognize? 2) How can NSF help maintain U.S. leadership in an evolving global research and education landscape? 3) How can the Plan best underscore the importance of fundamental research and its broader impacts? 4) What elements of the current Plan, if any, are no longer relevant?

The discussion following the presentation touched on several topics. The importance of educating the public about science and why it matters was noted, and a suggestion for additional staff to trace the impact of NSF awards was made.

Update from the National Institutes of Health (Dr. William Riley, Director, NIH Office of Behavioral and Social Sciences Research)

Dr. Riley began with a presentation of the new [OBSSR Strategic Plan](#), its guiding principles, the process and timeline for its development, and the expert panel that provided input to it. The Plan articulates three scientific priorities: 1) Improve the synergy of basic and applied behavioral and social sciences research; 2) Enhance the methods, measures, and data infrastructures to encourage a more cumulative and integrated approach to behavioral and social sciences research; and 3) Facilitate the adoption of behavioral and social sciences research findings in health research and in practice. Each priority has an accompanying set of specific objectives and expected primary outcomes. Dr. Riley also updated the AC on NIH's [Precision Medicine Initiative](#)[®] (PMI), which supports research at the intersection of lifestyle, environment, and genetics to produce new knowledge with the goal of developing more effective ways to prolong health and treat disease. PMI will engage over one million volunteers to be subjects and active participants in the design of the study. They will be able to donate biological samples, healthcare records, and provide longitudinal self-report and sensor data. Geospatial and environmental data will also be collected. The program is expected to launch by the end of 2016.

The AC discussion following the presentation centered on the difference between PMI and the National Children's Study (that was begun but then canceled) and the advantages and disadvantages of launching a new initiative versus extracting relevant data from existing, major, longitudinal studies and/or linking new and existing data. AC members also questioned whether the average outputs that will come from ordinary statistical data mining could provide individual level, actionable medical advice and decision-making.

Division of Social and Economic Sciences (SES) Committee of Visitors (COV) Report (Dr. Karen Cook, SES COV Chair)

Dr. Karen Cook began by thanking the members of the COV and describing the review process, the topics covered in the review, and the Committee's key findings. The COV reported that SES programs are well run, carefully managed and exemplify the "gold standard" of peer review worldwide. In addition, SES is well-positioned to contribute to major NSF-wide future research priorities and is engaged and taking a leadership role in efforts to advance robust and reliable science. She then articulated suggestions and formal recommendations made by the COV. The main recommendations addressed the review process, specifically calling on SES to: 1) triage proposals early in the review process to minimize program officer burden; 2) restrict the use of virtual meetings in favor of in-person meetings when possible; 3) broaden the reviewer pool by soliciting nominations from chairs of relevant departments in liberal arts colleges and by focusing on diversity; 4) manage transitions of rotating program officers effectively; 5) broaden the base of proposals from members of underrepresented minority groups; 6) continue investing in research to improve data availability, access, security, and privacy; 7) require Principal Investigators (PIs) to provide public access to research at the point of

publication and to comply with journal rules about data (and metadata) access in published material; 8) require complete reporting of publications and DOIs in annual and final reports for up to three years post award; 9) include data management plans as key elements of proposal review; 10) mandate discussion of data access and sharing at program review committee meetings, with a focus on best practices; 11) foster engagement with NSF-wide efforts to assure robust and reliable science; 12) add “Adequacy of Data Management and Sharing Plans” as a third, standard NSF merit review criterion; and 13) provide broad reporting of ways in which graduate education is being supported.

The COV also enumerated the following exciting research opportunities for SES: Interactions of Human and Natural Systems; Socio-Genomic and Biological/Social Interactions; Big Data and Related Developments; Human Security; Human Factors in Development, Adoption and Impact of New Technologies; Systems Science; Polarization, Incivility and Tensions in Society; Exploring Shifting Borders and Flows of People; Food, Water, Energy and the Environment and Security over the Life Course; “People of Difference” and the Consequences of Social, Economic and Political Disparities; Policing, Public Disorder and Social Conflict; and Data Quality, Availability and Cost Issues. Dr. Karen Cook concluded her presentation by thanking NSF for its continued efforts to support the best of science in a wide range of social and behavioral sciences and for its continued leadership in support of all science, especially best practices in merit review and scientific conduct.

SBE/SES Response (Dr. Daniel Sui, Division Director, SES, and Dr. Alan Tomkins, Deputy Division Director, SES)

After thanking the COV for its service, Dr. Tomkins described SES’s actions to address the COV’s recommendations. The Division will 1) continue to experiment with ways to reduce the time spent by panels on proposals receiving weak *ad hoc* reviews; 2) continue to have face-to-face panels, with periodic use of virtual participation for panelists who cannot travel due to personal need; 3) seek additional ways to increase the pool of reviewers from minority-serving institutions (MSIs) and predominantly undergraduate-serving institutions; and 4) strengthen outreach to MSIs. Dr. Tomkins also discussed support for public access by highlighting the big social science surveys and other data sharing projects, data repositories, and newer directorate and cross-directorate programs: *Resource Implementations for Data Intensive Research in the Social Behavioral and Economic Sciences (RIDIR)*; *Data Infrastructure Building Blocks (DIBBS)*; *Critical Techniques, Technologies and Methodologies for Advancing Foundations and Applications of Big Data Sciences and Engineering (BIGDATA)*; and *Smart and Connected Communities (S&CC)*. He discussed the new NSF requirement for public access to research products, effective January, 2016, and continuing exploration by the agency’s Public Access Working Group of data-sharing options and opportunities. SES is also considering how to improve the merit review process as it relates to data management plans.

The discussion with the AC following presentation of the COV report and SES response touched on several issues, including PIs’ need for more explicit guidelines about data management plans. Such guidance could be in the form of templates, checklists, questions to consider, and/or examples of strong plans. Other topics raised during the discussion were weaknesses in proposals’ attention to broader impacts; encouraging PIs to report progress after grants have expired; the utility of automatic reminders to reviewers to submit reviews; the availability of Research Opportunity Awards to support PIs from underrepresented groups; engaging diversity-inclined committees at national conferences to draw in members of underrepresented groups; encouraging more PIs to be reviewers; and improving the quality of reviews by training and mentoring new reviewers. There was also discussion of the science of broadening participation and how findings from research in this area should be used to improve the

Foundation's own activities to broaden participation in Science, Technology, Engineering and Mathematics (STEM).

The AC voted unanimously to accept the [SES COV report](#) and the [SES response](#) to the report.

SBE Division Updates

Dr. Howard Nusbaum, Division Director, BCS, began his update by introducing new staff and describing several programmatic changes. BCS has established a core program in the Science of Learning, a natural evolution of the Science of Learning Centers, and has refocused the Developmental Sciences program (formerly Developmental and Learning Sciences). He updated the AC on the Division's continuing efforts to respond to the 2015 BCS COV report, and described three emerging foci for BCS: neuroscience; data science and high-performance computing; and genetics and epigenetics.

The AC discussion following the BCS update touched on the Foundation's support of neuroscience research beyond the current BRAIN initiative (Brain Research to Advance Innovative Neurotechnologies), and the availability of different kinds of data relevant to human behavior, e.g., real-time sensor data, behavioral data, neuroimaging data, etc. The challenge is how to organize, aggregate and connect these myriad data to answer important scientific questions.

Dr. Daniel Sui, Division Director, SES, began his update by reviewing the Division's programs and staff transitions. He then described the SES retreat that focused on four topics: priorities, processes, portfolios and performances. Going forward, the Division plans to contribute to NSF's 10 Big Ideas for future investment, promote robust and reliable sciences in SES, further strengthen SES's research infrastructure and intensify outreach efforts to MSIs. Dr. Sui then highlighted recent SES-sponsored workshops, new awards made by the RIDIR program, and high profile awards bestowed on SES-funded investigators.

The AC discussion following the SES update focused on the effects of high staff turnover and the process for making funding decisions, allocating funding among programs, and providing support for cross-directorate initiatives and new SBE Directorate priorities.

Mr. John Gawalt, Division Director, NCSES, started his update by describing recent NCSES reports and publications (InfoBriefs, tables, data updates, working papers, and web applications). He then reviewed national patterns of research and development data and NCSES's preparation for the *2018 Science and Engineering Indicators*. He concluded the presentation with a description of survey and data improvement activities, including the launch of the Nonprofit Research Activities Survey pilot, the fourth revision of the OECD/Eurostat *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data*, the completion of the Early Career Doctorates Survey pilot, and several other activities.

The National Academies' Division of Behavioral and Social Sciences and Education: Reflections from the Executive Director (Dr. Robert Hauser, Executive Director, Division of Behavioral and Social Sciences and Education (DBASSE), The National Academies of Science, Engineering, and Medicine)

Dr. Hauser first introduced Ms. MaryEllen O'Connell, who will succeed him as Executive Director of DBASSE when he retires. He then reviewed the charter of the U.S. National Academy of Sciences, as it was called in 1863, the unique strengths of the organization, and its current organizational structure. The presentation then shifted focus to DBASSE, its Boards and Committees, activities, processes, and the principles that guide its work. Dr. Hauser then reviewed past and current DBASSE projects, many of which have been supported by SBE. Projects have taken many forms: evaluations of government

programs; proposing priorities for scientific research; providing advice on statistical methods, surveys, and research designs; informing policy; improving economic measurement and data sources; fostering exchange among scientific experts; and others. He concluded his presentation by describing a recently launched project: *Social and Behavioral Sciences for National Security: A Decadal Survey*. This activity will explore how research in the social and behavioral sciences has in the past and can continue, in the future, to inform efforts to improve national security.

During the discussion following the presentation AC members thanked Dr. Hauser for his leadership and service to DBASSE, and complimented him on the Division's work, noting that NSF hopes to continue collaborating with DBASSE in the future.

Navigating the New Arctic (Dr. Roger Wakimoto, AD, Directorate for Geosciences)

Dr. Wakimoto introduced *Navigating the New Arctic*, one of NSF's 10 Big Ideas for future investment. This idea rests on the premise that the rapid warming that is occurring in the Arctic is fundamentally altering climate, weather, and ecosystems in ways that we do not yet understand but which will have profound impacts on the world's economy and security. To address this issue, NSF proposes an observational science campaign to advance our understanding of the processes underlying Arctic system change and our ability to prepare for the environmental, economic, and societal impacts of this change at local and global scales. Many research questions are emerging, ranging from how changes in the Arctic land ice will impact global sea level, to how ecosystems will reorganize in response to changing habitats of animal and insect species. Questions that will engage SBE scientists include: 1) What are the psychological, social, and economic impacts of the forecasts of rapid warming in the Arctic on individuals, organizations, and communities that will likely be affected? 2) To what extent are these impacts mitigated or exacerbated by the types of planning in which the communities are engaged? 3) To what extent are communities exploring alternative scenarios for managing the social and environmental change that can be anticipated?

Dr. Wakimoto described potential partners that might work with NSF on this idea: 16 IARPC (Interagency Arctic Research Policy Committee, a subcommittee of the National Science and Technology Council) Federal agencies, Alaskan native tribes and organization, international partners, Alaska state agencies, non-governmental organizations, and shipping, oil and gas, timber, tourism, and fisheries industries. He also reviewed the potential of this idea to capture the interest of the public and Congress, the justification for NSF's leadership on this topic, and community engagement activities that have already started.

The discussion following the presentation focused on the network of observational platforms, international involvement and protocols, and the importance of involvement of indigenous people in this work. AC members were divided on how best to garner public support for this initiative. Some felt that the focus should be on the negative impact of environmental change on indigenous, island and coastal communities, while others favored targeting the positive opportunities for commerce and natural resources. There was consensus that there was an opportunity to shape a discussion on quality of life and use social media to engage the public.

Report to the National Science Board on the NSF's Merit Review Process Fiscal Year 2015 (Dr. Stephen Meacham, Senior Staff Associate, Office of Integrative Activities)

Dr. Meacham presented highlights from the [Report to the National Science Board on the NSF's Merit Review Process Fiscal Year 2015](#). These began with basic descriptive statistics on research proposal submission, awards, success rates, award budgets, and co-funding across NSF divisions. He then

provided information about the review process and described several merit review pilots conducted over the last three years. The Division of Earth Sciences (Directorate for Geosciences) experimented with eliminating program deadlines, which resulted in a marked reduction in the number of proposals received. Dr. Meacham also presented results of a pilot using virtual panels in place of face-to-face panels. Virtual panels were shown to have several advantages: increased participation by women; reduced reviewer time commitment; increased flexibility in panel implementation; and cost savings to the Foundation. The disadvantages included a reduction in the opportunity to network, panelists who are distracted by other work; and glitches in the technology (e.g., bandwidth problems, poor WiFi connectivity). Overall, 67% of reviewers surveyed preferred face-to-face over virtual panels. The pilot led to a recommendation that virtual panels be used for small panels (six or fewer panelists). The other pilots described by Dr. Meacham were the College of Reviewers used by SBE's program in Perception, Action, & Cognition, and the "One-Plus" pilot instituted by SBE's program in Geography and Spatial Sciences. Both have been well received by the reviewers and by the 2015 BCS COV.

Dr. Meacham moved on to a series of findings about PI demographics. These data revealed asymmetries in success rates by gender and underrepresented minority investigators. He also presented results from a 2015 survey of people who had submitted and/or reviewed NSF proposals. The survey data revealed that respondents perceive success rates to be lower than they actually are. The survey also collected data on reviewers' relative weighting of various factors when forming judgements about NSF's standard merit review criteria. For intellectual merit, the highest weighted factors were the originality of the research question and the project's potential to change our understanding of an important existing scientific or engineering concept, while the lowest weighted factors were the quality of the data management plan and the size of the budget. For broader impacts, the highest weighted factors were the significance of the potential broader impacts and the clarity and detail with which the proposal explains them. The lowest weighted factors were the quality of the data management plan and the size of the budget. Over half of the survey respondents felt that provision of improved feedback to PIs would have the most significant effect in fostering the progress of science.

The AC discussion following the presentation surfaced several issues, including implicit bias, which may contribute to the poor success rate for proposals from PIs in underrepresented groups, and the need to improve the feedback given to PIs.

Meeting with NSF Leadership (Dr. France Córdova, NSF Director, and Dr. Richard Buckius, NSF Chief Operating Officer)

This session began with discussion of NSF's Big Ideas and SBE's role in them. Dr. Cordova agreed that the SBE sciences are integral to these priorities, but also opined that various external communities still need to be educated about this. AC members articulated the deep interest and history of work by behavioral and social scientists on the science included in *Understanding the Rules of Life: Predicting Phenotype*. This led to discussion of "big data", new forms of data, and the need for data-sharing, something SBE scientists have been doing for decades. Also noted was the need for exploration of the ethical, legal and moral issues raised with the development and implementation of new biological technologies, e.g., gene-editing.

The discussion then shifted to the NSF INCLUDES program, which recently funded 40 awards (out of 600 proposals) for pilot programs to broaden participation in STEM in new ways, using collective action to connect with communities and to facilitate scaling. Dr. Joan Ferrini-Mundy, AD of EHR, gave a brief presentation that elaborated on the approach, accomplishments so far, and the next steps. The ensuing AC discussion touched on the mix of participating institutions (research institutions, non-profits, two-

year colleges, museums, etc.), the importance of evaluating the success of programs supported by INCLUDES, and the need for incorporating strong SBE science into INCLUDES and the other Big Ideas. Several AC members expressed the need to knit the Big Ideas together in a cohesive fashion and suggested as a theme “Opportunity, Prosperity, and Security”.

The final topic discussed was how NSF’s current *Understanding the Brain* and BRAIN initiatives fit into NSF’s future goals. Dr. Cordova described the strong commitment of organizations around the world to brain research, as evidenced at two events she attended in September, 2016. The first, [Coordinating Global Brain Projects](#), held at Rockefeller University and co-sponsored by NSF and several other organizations, aimed to promote collaboration and cooperation in emerging large-scale international brain projects, as part of NSF support for the U.S. BRAIN Initiative. The second event, *Dialogue on Brain Science and Launch of an International Brain Station*, held at the United Nations headquarters, was hosted by the U.S. Department of State in collaboration with The Global Partnerships Forum, The Kavli Foundation, and NSF.

Understanding the Rules of Life: Predicting Phenotype (Dr. James Olds, AD, Directorate for Biological Sciences)

Dr. Olds posited that the universally recognized biggest gap in our biological knowledge is our inability to predict the phenotype of a cell or organism from knowledge about its genome and environment. He then described how NSF investment in *Understanding the Rules of Life: Predicting Phenotype* would elucidate the rules governing the emergence of an organism’s traits from different types of information processed across multiple scales, e.g., biophysical, genomic, evolutionary, ecological, environmental, and temporal. Unpacking phenotypic complexity will require convergence of research across biology, computer science, mathematics, the physical sciences, behavioral sciences, and engineering. Key questions include: 1) How can computational modeling and informatics methods enable data integration for analysis and prediction of complex living systems? 2) Given that variation in traits expressed by organisms is a feature of all life, what are the genetic, epigenetic and environmental factors that explain its magnitude and occurrence? 3) How can we predict the behavior of living systems, from single molecules to whole cells, whole organisms, and whole ecosystems? To what degree do group interactions and behavior affect phenotypic expression? 4) To what degree is an organism’s phenotype a result of the microorganisms that live in symbiosis with it? To what degree is the production of a phenotype a ‘joint effort’ among genomes of different organisms? 5) Can we synthesize cells and organisms based on knowledge of genome sequence and physical features of other basic molecules?

During the discussion following Dr. Olds’s presentation, several AC members noted that SBE scientists have been exploring how phenotype emerges from interactions between genotype and environment for 100 years. More recent advances have been in the development of new technologies that enable the mapping of genetics in large numbers of people and the growing recognition of the role of epigenetics in phenotypic emergence. AC members also recommended caution in predicting or expecting simplistic “rules” of life that might handcuff researchers and impede the progress of science, as happened with theories of genetic determinism of most phenotypes. Other AC members questioned the breadth of the topic, as it appears to encapsulate all of biology and the SBE sciences. Dr. Olds explained that the Rules of Life idea started as a framing device for the research supported by the Directorate for Biological Sciences, and was then expanded to other scientific disciplines as it grew into an NSF-wide Big Idea.

Reframing the Social and Behavioral Sciences (Dr. Barbara Kline Pope, Executive Director for Communications and the National Academies Press, The National Academies of Sciences, Engineering, and Medicine, and Dr. Nathaniel Kendall-Taylor, Chief Executive Officer, FrameWorks Institute)

Dr. Barbara Kline Pope described the NAS [From Research to Reward](#) activity, a collection of narratives designed to demonstrate the value of investments in basic science. The first six narratives focus on SBE sciences, with subsequent ones planned for the geological and the natural sciences. She then showed a video on kidney transplants, which features the work of SBE-supported economist, Dr. Alvin Roth.

Dr. Kendall-Taylor described the FrameWorks Institute’s activities, beginning with a review of the concept and importance of message framing and how it influences how the intended message is received. He then zeroed in on reframing the social and behavioral sciences, which he postulated could help overcome some of the public’s inaccurate perceptions, such as the idea that social sciences are not “science” and that anyone can do SBE scientific research, and that research is fickle and involves hidden agendas. He described the tasks needed to reframe the SBE sciences to overcome skepticism and build the understanding that research is a process of knowledge generation, that SBE sciences can improve society, that the principles of “hard” sciences apply to the SBE sciences. Dr. Kendall-Taylor then described the FrameWorks Institute’s research exploring the use of various aspects of the narrative (e.g., word choice, topic, and metaphor) to improve people’s attitudes toward SBE sciences and their abilities to generalize specific SBE findings to other areas of science. The research showed that metaphors such as puzzle-making, map-making and powering society were most effective at facilitating people’s abilities to generalize from one area of science to others.

The discussion following the presentations was led by Dr. Arthur Lupia, who described the communications challenge of compressing the description of multi-dimensional phenomena into small bites for consumption by a public that has a very short attention span, in a very competitive information environment. This introduces subjectivity and raises the question of which parts of a story to tell. While there is no easy solution to these challenges, one overarching recommendation is that scientists not mislead in their communications and that they be ready to address how they might be wrong. This supports scientists’ ability to move forward credibly and reliably, and is the essence of robust and reliable science. Another topic raised during the discussion was the *Research to Reward* kidney transplant video, whether it adequately tied the life-saving kidney exchanges back to fundamental research in the SBE sciences, how it might be tested with various target audiences, and how to get the information in front of policymakers. Dr. Pope noted that audience-testing is not currently planned, but could be explored if additional resources were made available.

Future Meetings, Assignments, and Concluding Remarks (Dr. Kenneth Bollen, SBE AC Chair; Dr. Fay Lomax Cook, AD, SBE)

A small group of AC members volunteered to draft a brief document describing how the SBE sciences could contribute to NSF’s Big Ideas and how those ideas might be tied together in a theme of “Opportunity, Prosperity, and Security”. Regarding the next SBE AC meeting (May 18-19, 2017), one expected agenda topic to be the future of the “Big Three” surveys; other suggestions included inviting an SBE scientist member of the National Science Board (NSB) to discuss his/her research as well as experience on the NSB; and a discussion of evidence-based policy making.

Dr. Cook thanked and presented certificates and small tokens of appreciation to Drs. JW Harrington, Jon Krosnick, and Joanna Morris, who with this meeting were completing their terms on the SBE AC.

The meeting was adjourned at 1:00 p.m.

This summary was approved by the Advisory Committee at its spring, 2017 meeting on May 18, 2017.