

**APPROVED MINUTES
PLENARY OPEN SESSION
471ST MEETING
NATIONAL SCIENCE BOARD**

National Science Foundation (NSF)
Via Videoconference
February 23-24, 2021

Members Present:

Ellen Ochoa, *NSB Chair*
Victor McCrary, *NSB Vice Chair*
Sudarsanam Babu
Roger Beachy
Arthur Bienenstock
Maureen Condic
Aaron Dominguez
W. Kent Fuchs
Suresh Garimella
Dario Gil
Melvyn Huff
Steven Leath
W. Carl Lineberger
Matthew Malkan
Emilio Moran
Julia Phillips
Dan Reed
Geraldine Richmond
Anneila Sargent
Scott Stanley
S. Alan Stern
Stephen Willard
Heather Wilson

Members Absent:

Sethuraman Panchanathan, *ex officio*

There being a quorum, the National Science Board (NSB, Board) convened in Open Plenary Session at 11:00 a.m. on Tuesday, February 23, 2021, via videoconference with NSB Chair, Ellen Ochoa, presiding.

NSB Chair's Opening Remarks

Ochoa welcomed everyone to the NSB's 471st meeting. She began the meeting by acknowledging Black History Month, observing that the challenge and opportunity before the Foundation is to ensure that untapped talent in the black community, other communities of color, and underrepresented groups has the opportunity to be included in STEM careers. She announced an upcoming NSF-sponsored panel entitled "Black Scientists and Engineers at the Our Nation's Historically Black Colleges and Universities: Making American History Now," that Victor McCrary, NSB Vice Chair, would be moderating and that would highlight the innovative contributions of the next generation of black scientists and engineers. Ochoa thanked black scientists and engineers and STEM workers for their contributions and for inspiring future generations.

Ochoa also publicly announced the resignation of Maria Zuber from the NSB and thanked her for her service to NSB as a former Board Chair and committee chair. Zuber resigned to become Co-Chair of the President's Council of Advisors in Science and Technology (PCAST).

Ochoa then reviewed the meeting's agenda.

New Member Swearing-in

Ochoa performed a ceremonial swearing-in for two new members of the NSB's Class of 2020-2026: Matthew Malkan from the University of California at Los Angeles and Scott Stanley from Techno Planet.

She then turned the floor to NSF Director Sethuraman Panchanathan.

NSF Director's Remarks

NSF Director Panchanathan began by adding his thanks for the extraordinary work of black scientists and engineers, and expressed the Foundation's desire, through its missing millions work, to have more of them. He also thanked Maria Zuber for her service on NSB and congratulated on her PCAST appointment.

Using a series of slides, Panchanathan illustrated the tight alignment of NSB's *Vision 2030* and the Biden Administration's priorities with the four pillars of the NSF Vision: advancing the frontiers of research, ensuring accessibility and inclusivity, securing global leadership, and fostering translation, innovation, and partnerships. He stated that curiosity-driven research and use-inspired, solutions-driven research have long composed the two strands of the DNA of NSF. Panchanathan demonstrated this point by citing examples – including NSFNET and its links to the commercialization of the Internet, the Laser Interferometer Gravitational Wave Observatory (LIGO) and its links to quantum sensors and enhancement of quantum computing technology, and the Digital Library Initiative, an early effort to navigate and index the Internet that became Google.

Panchanathan then reported on several highlights from NSF-funded research. These included biological and social science research germane to the COVID-19 pandemic, research in physics and material science with implications for nanotechnology and superconductivity, a new high

resolution sunspot image from the Daniel K. Inouye Solar Telescope, and NSF-support of an event that brought together state and school district leaders focused on advancing K-12 artificial intelligence education in the states.

In closing, Panchanathan provided an update on the S&E stakeholders and partners with whom he has engaged since the December 2020 Board meeting and noted a recent editorial he had published in *Science* on innovative partnerships.

Chair's Activity Summary

Ochoa continued the meeting by providing a summary of her activities since the December meeting. She noted that due to the holiday season and the Presidential Inauguration, her external meeting schedule was lighter than usual. She reported that she and Panchanathan participated in virtual Fireside Chat in January hosted by American Association for the Advancement of Science's Chief Executive Officer Sudip Parikh. This was an opportunity to highlight NSB's and Panchanathan's visions for NSF and the S&E enterprise. Ochoa also announced that she and McCrary sent letters to each Congressional state delegation familiarizing them with NSB's role and pointing them to *Vision 2030* and *Science and Engineering Indicators*. She noted that the pace of engagement will soon increase with outreach planned to the new Office of Science and Technology Policy Director and Deputy Director as well as to the new Congress.

Racial Equity Task Force and NSF Harassment Policy

Panchanathan introduced Rhonda Davis, Head of NSF's Office of Diversity and Inclusion (ODI). He stressed that broadening participation in STEM and building safe, inclusive, and supportive environments in NSF and the wider community are important priorities for the agency and that one of his first actions as Director was to establish a Racial Equity Task Force.

Davis explained that the objective of the Racial Equity Task Force is to examine barriers and make recommendations about how NSF can be a leader in fully developing all of the talent and potential within NSF and the community. The Task Force has two prongs. One group is looking at employment barriers, including organization reporting structures, hiring practices, position management (including procedures for promotion and selection of individuals for training and development opportunities), and employment policies and procedures. The other group is reviewing barriers in relation to grant proposal writing and development, the merit review process, Research 1 and Minority Serving Institution partnerships and collaborations, and program policies and procedures. Both groups, which are comprised of agency staff who represent various kinds of diversity within the agency, will make recommendations for fast-track sustainable initiatives and measurable outcomes to improve racial equity. Preliminary recommendations will be shared with the Director on March 31. Those recommendations that can be easily implemented will be implemented immediately. NSF will develop paths to address more complex matters.

Davis and Robert Cosgrove, Compliance Program Manager in ODI, also gave an update on the term and condition of NSF's Harassment Policy. Effective October 22, 2018, awardee

organizations must notify NSF if a NSF-funded principal investigator (PI) or co-PI has a finding or determination that he or she committed harassment or if they were placed on administrative leave or subject to some type of administrative action. Since this term and condition went into effect, NSF has received approximately 38 notifications. NSF has a staff team that meets weekly to look at the implementation of the term and condition. Since its issuance, NSF has broadened the range of NSF programs to which the harassment term and condition applies having added post-doctoral fellowship awards, conferences, and Small Business Innovation Research (SBIR) awards. Davis asked that NSB members help carry the message to the community that NSF's harassment policy covers both sexual and racial harassment.

Member questions focused on how NSF is doing on these matters relative to other federal agencies and about how NSF is influencing various constituencies and dealing with institutions that are reluctant. Davis observed that other agencies turn to NSF for guidance and that NSF plays a significant role in leading and collaborating with other federal agencies, particularly on tougher challenges that could benefit from stronger cross-government coordination. In addition, NSF is engaging with professional societies and awardee institutions, and looking inward to identify barriers within NSF. Davis stated that she is not aware of institutions resisting NSF, but that there are institutions from which NSF is not hearing anything. NSF does compliance reviews, but it cannot be everywhere simultaneously. She added that it is harder to reach institutions that do not have Title IX offices, but that NSF expects them to do the right thing. Members also asked about immediate shortcomings and how NSF could be more impactful.

Geri Richmond stressed that it was important for NSF to lead the way by making trend data on the demographics of the PIs that are funded by each NSF division publicly available. McCrary noted that NSB should look at and highlight its own demographics, past and present. Suresh Babu suggested that NSF log and publish best practices since this would be helpful to universities. Ochoa observed that some further updates to the NSF's public website could help clarify the broad applicability of NSF's harassment policy.

NSB *Vision 2030* Implementation Working Group Update

McCrary, who chairs the Vision Implementation Working Group (VIWG), began his update by summarizing the *Vision 2030*-related external engagement activities since the Board's last meeting. These included an American Chemical Society webinar, an American Association for the Advancement of Science Fireside Chat, talks at the University of Texas at El Paso's research award ceremony, and with the HIBAR Research Alliance, the Association of Public and Land-Grant Universities' Council on Research, and the Vice Presidents for Research at Historically Black Colleges and Universities. McCrary also previewed some upcoming outreach events. He reiterated his request from December 2020 that NSB members use the pre-prepared slide deck to give *Vision*-related talks to their own institutions, networks, and circles of influence.

McCrary then turned to discussing VIWG's current *Vision*-related priorities. In terms of "Delivering Benefits from Research," McCrary stressed that VIWG thinks that the Committee on Oversight's (CO) work on Broader Impacts (BI) is extremely important. Given that it had been a decade since NSB last re-examined the merit review criteria, he stated that it was time to

consider what BI means in 2021. McCrary suggested that BI expectations need to be clearer and that perhaps BI should be re-envisioned as deal-breaker rather than as tie-breaker in considering proposals. Geri Richmond echoed McCrary's focus on developing clearer expectations for BI and urged the Board be more explicit about what it wants to achieve with Broader Impacts, noting that clear goals are a step toward getting to better metrics. McCrary noted that NSB is also focusing on the roadmap item related to conducting an organizational review of NSF. Currently the focus of that work is around pending legislation related to NSF. McCrary stated that the Board has an opportunity as a policy advisor to the Administration and Congress to improve proposed bills. The Board also has a role in talking with NSF about its plans for implementing what may come from this new legislation.

McCrary then discussed the links between the *Vision* and the agenda items at this 471st Meeting of the NSB. He observed that CO will bring two BI-related resolutions to the Board for consideration. The Committee on Science and Engineering Policy will discuss policy products related to *Vision 2030* goals. The Committee on Strategy will have discussions around strengthening foundational research, Missing Millions, translation and innovation activities and partnerships. External Engagement will talk about upcoming outreach activities. The panel in the plenary session on February 24 will focus on roadblocks to STEM graduate education. McCrary encouraged members to engage in generative and strategic conversations on those topics.

McCrary continued with a generative discussion around expanding the geography of research, a *Vision 2030* roadmap area that is also a Biden Administration priority. Noting that the *Vision 2030* Roadmap calls for NSB to conduct a review of NSF's strategies to expand S&E capacity in all states, McCrary asked how NSB should approach that commitment. Roger Beachy urged NSB to approach this by first establishing what NSB means by "expanding" the geography of research and defining the associated goals. Thereafter, he suggested that NSB look at existing programs and ask what the Foundation wants to accomplish and whether existing programs and their associated criteria fit or should evolve.

Members also identified a variety of possible foci, including the possibility of developing new cross-cutting programs, providing challenge grants that would require cost sharing by local communities, and developing mechanisms for NSF to help higher education institutions that cannot alone support robust sponsored program offices or technology commercialization offices. Members acknowledged that this effort includes and goes beyond NSF's Established Program to Stimulate Competitive Research (EPSCoR). Roger Beachy stated that he hoped that a regional approach would be an important part of the path forward since there is a desire in the states to pull together resources regionally and not just statewide. Director Panchanathan observed there are opportunities for NSF to scale efforts to expand the geography of research at the institutional, state, and regional levels and that the focus must be on all of the above. He also noted that there non-EPSCoR states also have needs related to expanding the geography of research.

Julia Phillips and Maureen Condic spoke about the human capital dimension of expanding the geography of research. To grow states and regions, it will be critical to support students everywhere and make use of both local resources and telecollaborations.

Suzanne Iacono, Head of the Office of Integrated Activities, noted that EPSCoR has evolved since its inception and now has tracks to support regional collaborations and early career faculty and mentoring. She added that NSF is doing important work on re-envisioning EPSCoR this year and suggested that EPSCoR Section Head Loretta Moore talk with NSB at a future meeting.

McCrary concluded the VIWG update by stressing it will be up to NSB to make *Vision 2030* a reality and asking that everyone contribute.

Session 2 (February 24, 11:00 a.m.–11:45 a.m.)

Roadblocks to STEM Graduate Student Retention

Ochoa invited Committee on External Engagement Chair Geraldine Richmond to introduce the panel moderator, Alan Leshner, former NSB member (2004-2016) and CEO Emeritus for the American Association for the Advancement of Science (AAAS). Leshner introduced the panelists: Kenneth Gibbs, Chief, Undergraduate & Predoctoral Cross-Disciplinary Training Branch at the National Institute of General Medical Sciences (NIGMS), National Institutes of Health (NIH); Renetta Tull, Vice Chancellor for Diversity, Equity, & Inclusion at the University of California Davis; Suzanne Ortega, President at the Council of Graduate Schools; and Celina Gray, Blackfeet/Métis graduate student in the University of Montana's Wildlife Biology MS program. The purpose of the session was to highlight roadblocks to graduate student recruitment and retention in STEM education. Each speaker gave a five-minute presentation.

Gibbs provided context for the panel, sharing the distribution of Bachelor's and Doctoral STEM degrees, with a focus on women and minorities underrepresented in STEM. He underscored the drop-off rates that occur in these demographics between undergraduate and graduate degrees, as well as the field variance with life sciences and psychology awarding more doctorate degrees to Underrepresented Minority (URM) students than computer sciences and engineering. To improve degree award numbers, Gibbs highlighted efforts at NIH to span the training pathway with programs focused on undergraduate students, graduate students, and postbaccalaureate trainees. Such programming that provides a cluster of support – tuition remission, stipends, networking opportunities, intense mentoring and oversight, cohort-building, and research experiences – has the highest likelihood to remove roadblocks in graduate education.

Tull spoke about how different mentoring models can strengthen student retention in STEM graduate programs by expanding professional networks and validating students' personal experiences. Specifically, Tull emphasized mentoring models that are more successful than the traditional dyadic (mentor-mentee) model. These included the collective model which involves multiple mentors and mentees, as well as the network mentorship model which buoys mentees with multiple mentor nodes, mentoring programs, and mentoring resources such as professional organizations and affinity groups. She highlighted that graduate students who experience multiple mentoring models can carry this approach to their own academic positions, thereby creating institutional change. In addition to multiple mentoring models, Tull espoused that graduate student retention depends on a clear and institutional/departmental definition of mentoring, institutionally-sanctioned structured feedback system for mentors/mentees, and a mentoring approach that recognizes and responds to student identities and the biases some face based on those identities. Tull also stated that effective mentorship must be rewarded in the tenure process and encouraged by grant-making agencies.

Ortega concentrated on data on the preponderance of graduate students who end up in positions outside of academia. She spoke to the need to support transitions between STEM sectors and provide students with the skills necessary for non-academic jobs. This skill set is one that is already part of the academic training model and includes project management, networking, and analytical thinking. She also noted that 80% of undergraduates are uncertain or less likely to go to graduate school immediately after completion of their Bachelor's degree, pushing them to STEM jobs that do not require a doctorate. This uncertainty – highest among women – is exacerbated by concerns over family, financial burdens, caregiving burdens, and career uncertainty, all roadblocks that need to be systemically addressed by providing stronger financial support and revisiting leave policies. Finally, to keep students in graduate STEM programs so that they can be trained for a wide variety of careers, mental health which currently affects 1/3 of graduate students and which is exacerbated by anti-blackness and covid-related disruptions needs to be addressed.

Gray shared her perspective on roadblocks as a Native American student and mother of young children. She highlighted that mentorship at her tribal college was essential in ensuring that she could apply to graduate schools. Her success was contingent on having multiple mentors to help her navigate applications, find programs that had family friendly environments and resources, and transition from a reservation to an urban area. In addition, support from professional societies provided necessary networking and NSF-funded programs such as the Graduate Research Fellowship Program (GRFP) provided some financial security. To better serve tribal communities, Gray recommended increasing social networks and safety nets for tribal students, providing more financial support especially for those with families, and expanding capacity building at tribal colleges.

During the question-and-answer session, members asked the panelists how support can be expanded from the micro-level of students with families to the macro-level of institutions. Several themes emerged:

- (1) Improving inclusivity – particularly around accessibility to affordable childcare, development of family friendly policies, access to affordable housing, and access to WiFi, particularly for tribal communities. In addition, recommendations were made for how the science community writ large needs to reach out to marginalized communities to ensure that they have access to science education, including knowledge about different STEM careers.
- (2) Valuing mentoring – This included having academic institutions, granting agencies, and professional organizations offer awards for effective mentoring. In addition, these mentoring awards should be counted toward the tenure and promotion process. Mentoring was also encouraged through the development of permanent staff positions to mentor and educate diverse students on non-academic and academic support mechanisms.
- (3) Developing institutional capacity building – This included establishment of NSF programs similar to NIH's Building Infrastructure Leading to Diversity (BUILD) program that targets schools that have a diverse population and enhances training at the student, faculty, and institutional levels.

Stephen Willard recommended that the Board examine the successes of Minority Serving Institutions in addressing roadblocks to graduate STEM education. Richmond responded that this will be the focus of the May 2021 panel. Richmond also recommended that Board members who are interested in understanding how data on graduate student populations can be collected and used for policy development look at the Next Generation of Life Sciences Coalition, which currently covers 52 universities and includes such data as admission and matriculation data of Ph.D. students, average time-to-degree and completion, and demographics of Ph.D. students by gender, URM status, and citizenship status. Leshner concluded by urging the Board members as representatives of higher education and NSF as a funding agency, to initiate systemic change by altering the incentive system to prioritize mentoring and graduate education.

Session 3 (February 24, 6:15 p.m. –6:38 p.m.)

NSB Chair's Remarks

Ochoa welcomed the NSF staff, guests, and members of the public listening via webcast. She began the session by congratulating NSB member Dario Gil for his promotion to Senior Vice President at IBM. She also announced that Brad Gutierrez, Executive Secretary to the Board, would be retiring. She thanked Brad for his tireless work to make NSB meetings flawless and productive.

Approval of Prior Minutes

Ochoa presented the minutes of the December 2020 Open Plenary for approval. Those minutes were approved as presented.

NSF Director's Remarks

NSF Director Panchanathan began by calling the Board's attention to the written update of OLPA activities that was in the Board Book. He then announced some senior leadership moves across the Foundation. In January, Peggy Hoyle was appointed the agency's General Counsel and Tie Luo became Deputy Assistant Director in the Directorate of Mathematical and Physical Sciences. Kendra Sharp officially began her term in February as the new Head of the Office of International Science and Engineering.

Panchanathan also noted that Margaret Martonosi, Assistant Director for Computer and Information Science and Engineering, was elected to the National Academy of Engineering.

Open Committee Reports

NSB Chair Ochoa then turned to the open committee reports.

Suresh Garimella reported for the Committee on Strategy (CS). He stated that the committee covered a number of topics including strengthening core research at NSF, NSF's translation and

innovation activities, NSF's efforts to reach out to the "missing millions" and the agency's next strategic plan. He noted that the committee will meet in March to discuss the strategic plan and asked members to email any thoughts on how the strategic plan's vision and strategic goals could be modified in the next plan.

Julia Phillips reported for the Committee on National Science and Engineering Policy (SEP). She stated that the committee heard from the National Center for Science and Engineering Statistics (NCSES) about progress in the review of draft thematic reports for the 2022 edition of the *Science and Engineering Indicators*. The committee also heard a report on the impact of *Indicators 2020* that was based on web analytics prepared by an American Association for the Advancement of Science S&T Policy Fellow in NCSES. This analysis demonstrated the importance of the various rollout events and of having a short, high-impact print product. The committee introduced a new infographic to be released after the Board meeting that shows the value of STEM employment during the pandemic's economic downturn. Finally, Phillips reported on two policy papers that the committee is developing, one on reducing financial barriers to undergraduate and graduate STEM education and a second on the economic impact of international workers.

Anneila Sargent reported for the Committee on Oversight (CO). She stated that the committee discussed and recommended that the Board approve two policies to improve aspects of NSF's merit review process. The first requires reviewer training in the skills needed to provide high-quality peer reviews and the second places a broader impacts expert on each Committee of Visitors. The committee also heard updates from the Office of Inspector General (OIG) and the Chief Financial Officer.

Dan Reed reported for the Committee on Awards and Facilities (A&F). He stated that the committee had heard an update on U.S. Antarctic Program.

Geri Richmond reported for the Committee on External Engagement (EE). She stated that the committee heard updates on plans for *Vision 2030*-related events in Tennessee and Texas and shared plans for the May meeting external panel. She noted that the committee would have draft congressional and media plans to share in the coming weeks.

Votes

Ochoa stated that the last agenda item was to consider a pair of statements and resolutions recommended to the NSB by the Committee on Oversight. The first requires reviewer training in skills needed to provide high quality reviews. And the second enhances the ability of the Committee of Visitors (COV) to assess and help improve the merit review process by placing a broader impacts expert on each COV. Ochoa noted that the two proposed policies are likely to improve specific aspects of NSF's merit review process and that the resolutions were written to give the Director latitude in how to implement them. Should the policies not be yielding in a year what NSB is hoping, NSB can re-evaluate them.

Ochoa asked for a motion to approve the Board's statement on training to improve peer review and address unconscious bias in the merit review process. This statement was approved as presented. Ochoa then asked for a motion to approve the related resolution:

WHEREAS, the National Science Board has made a statement regarding the expected benefits to the National Science Foundation's merit review process by preparing reviewers to fulfill their critical role in meeting the high standards and expectations of that process (NSB-2021-8),

It is RESOLVED that the Director, at his discretion, shall implement policies to maximize reviewers' preparedness to fulfill their role in the merit review process, such as through a program of required training for reviewers, and report back to the Board with an evaluation of the policies within 12 months.

The resolution was approved with one member opposed.

Ochoa asked for a motion to approve the Board's statement in support of broader impacts experts serving on committees of visitors. The statement was approved with one member opposed.

Ochoa then asked for a motion to approve the related resolution:

WHEREAS, the National Science Board has issued a statement regarding the expected benefits to the merit review process from inclusion of one or more experts on broader impacts on the Committee of Visitor (COV) panels (NSB-2021-9), therefore, be it

RESOLVED that the Director shall, at his discretion, develop a plan to ensure that there is appropriate broader impacts expertise on the COV panels and report back to the Board evaluating the impacts of the policy within 12 months.

The resolution was approved with one member opposed. In closing, Ochoa observed that these documents represent a step forward and thanked Anneila Sargent, the CO, committee staff, and NSF staff led by Suzanne Iacono for working in partnership to develop these policies and for furthering their commitment to bettering peer review at NSF.

Chair's Closing Remarks

Ochoa concluded the meeting by thanking all the external speakers and panelists who contributed to a very productive meeting. She also thanked the Board Office team.

There being no further business, the meeting was adjourned at 6:38 p.m.

Elise Lipkowitz
Acting Executive Secretary to the National Science Board