

Advisory Committee for Geosciences (AC/GEO)

October 14-15, 2020

Meeting Held Online

Meeting Minutes

AC/GEO Attendees:

Dr. Kip Hodges (Chair)
Dr. Lihini Aluwihare
Dr. Carol Arnosti
Dr. J. Ramón Arrowsmith
Dr. Kerry Cook
Dr. Jose Fuentes
Dr. Luis Alberto González
Dr. Colette L. Heald
Dr. Kaatje Kraft
Dr. Amanda Lynch
Dr. Robyn M. Millan
Dr. Gary Mitchum
Dr. Shirley A. Pomponi
Dr. Stephen C. Riser
Dr. Alan Robock
Dr. Lisa D. White
Dr. Cathy Whitlock

NSF Senior Staff:

Melissa Lane

Other Meeting Participants:

Dr. Anjuli S. Bamzai, Division Director, Division of Atmospheric and Geospace Sciences (AGS)
Dr. Scott Borg, Deputy Assistant Director, GEO
Dr. F. Fleming Crim, Chief Operating Officer, Office of the Director (OD)
Dr. Ruth S. DeFries, Columbia University
Dr. William Easterling, Assistant Director, GEO
Ms. Lauren Everett, Senior Program Officer, The National Academies of Sciences
Dr. George Hornberger, Vanderbilt University
Dr. Candice Major, OCE Section Head
Dr. Stephen Meacham, Section Head, Office of Integrative Activities (OIA)
Dr. Sethuraman “Panch” Panchanathan, NSF Director
Dr. Lina Patino, Senior Program Director, GEO
Dr. Terrence Quinn, Division Director, Division of Ocean Sciences (GEO/OCE)
Dr. Smith-Nufio, Acting Division Director, Division of Earth Sciences (GEO/EAR)
Mr. Brian Stone, Chief of Staff, Office of the Director (OD)
Dr. Thomas Weingartner, Chair, AC/Office of Polar Programs (OPP)

Wednesday, October 14, 2020

Welcome

Dr. Hodges welcomed everyone and after preliminary administrative announcements and AC member introductions, turned to Dr. Easterling for his presentation.

Update on NSF GEO

Dr. Easterling thanked the AC members for their work. NSF continues to be fully operational during the COVID-19 pandemic, including the merit review system. To enable current and future awardees to operate in this environment, NSF is open to extensions and supplements on a case-by-case basis and relaxed deadlines for certain types of reporting requirements. He encouraged members and their communities to reach out to NSF staff and Program Officers with any questions.

Dr. Easterling told members about the new NSF Director, Dr. Panchanathan, and his concepts to advance the agency’s mission:

- Advancing the frontiers of research into the future
- Ensuring accessibility and inclusivity
- Securing global leadership in science and engineering

Dr. Easterling showed the overall NSF budget request for the current fiscal year, with different types of budgets for FY ‘19 and ‘20.

**NATIONAL SCIENCE FOUNDATION
SUMMARY TABLE
FY 2021 BUDGET REQUEST TO CONGRESS
(Dollars in Millions)**

NSF by Account	FY 2019 Actual	FY 2020 Enacted ¹	FY 2021 Request	FY 2021 Request change over:			
				FY 2019 Actual		FY 2020 Enacted	
				Amount	Percent	Amount	Percent
Research & Related Activities	\$6,578.14	\$6,737.20	\$6,213.02	-\$365.12	-5.6%	-\$524.18	-7.8%
Education & Human Resources	\$934.53	\$940.00	\$930.93	-\$3.60	-0.4%	-\$9.07	-1.0%
Major Research Equipment & Facilities Construction	\$285.27	\$243.23	\$229.75	-\$55.52	-19.5%	-\$13.48	-5.5%
Agency Operations & Award Management	\$332.69	\$336.90	\$345.64	\$12.95	3.9%	\$8.74	2.6%
Office of Inspector General	\$15.28	\$16.50	\$17.85	\$2.57	16.8%	\$1.35	8.2%
Office of the National Science Board	\$4.32	\$4.50	\$4.21	-\$0.11	-2.6%	-\$0.29	-6.4%
Total, NSF Discretionary Funding	\$8,150.23	\$8,278.33	\$7,741.40	-\$408.83	-5.0%	-\$536.93	-6.5%
Education and Human Resources - H-1B Visa	149.00	234.92	166.26	17.26	11.6%	-68.66	-29.2%
Donations	39.04	65.12	40.00	0.96	2.5%	-25.12	-38.6%
Total, NSF Mandatory Funding	\$188.04	\$300.03	\$206.26	\$18.22	9.7%	-\$93.77	-31.3%
Total, NSF Budgetary Resources	\$8,338.27	\$8,578.36	\$7,947.66	-\$390.61	-4.7%	-\$630.70	-7.4%

Totals exclude reimbursable amounts.

¹ Funding amounts below the account level for the FY 2020 Enacted were not available at the time of printing.

NSF is operating under a continuing resolution (CR) through December 11 and will continue to be funded at the prorated level of the previous fiscal year appropriation. He also presented the GEO budget.

GEO Funding
(Dollars in Millions)

	FY 2019 Actual	FY 2020 Approp.	FY 2021 Request	Change over	
				FY 2020 Approp. Amount	Percent
Atmospheric and Geospace Sciences (AGS)	\$303.41	\$279.68	\$234.45	-\$45.23	-16.2%
Earth Sciences (EAR)	181.96	199.36	168.24	-\$31.12	-15.6%
Integrative and Collaborative Education and Research (ICER)	113.79	113.78	94.71	-\$19.07	-16.8%
Ocean Sciences (OCE)	370.73	398.05	339.21	-\$58.84	-14.8%
Total	\$969.88	\$990.87	\$836.61	-\$154.26	-15.6%

Please see the directorate narrative in the FY 2021 Congressional Request for more information.

The FY '21 request is about 15 percent lower than the FY '20 appropriation due to a decision to hold certain administration priorities level, such as artificial intelligence, quantum information, science and industries of the future and he noted the funding levels are the starting point in a long process.

NSF and GEO are in tune with the administration's research and development priorities, which are:

- American Security
- American Leadership in Industries of the Future
- American Health and Economic Innovation
- American Space Exploration and Commercialization
- American Energy and Environmental Leadership
 - Energy
 - Oceans
 - Earth System Predictability

In the area of national security, for example, some seismic monitoring sites supported by GEO participate in the so-called neighborhood watch that enforces the Comprehensive Nuclear Test Ban Treaty. And GEO's responsibilities in the Arctic and Antarctic help maintain a constant vigilance in those key geopolitical areas. The most recognizable impact is on the American energy and environmental leadership priority, where GEO is providing leadership in Earth system predictability and in the science of Earth systems prediction.

He added that GEO is working with NSF partners across the directorates and with the National Academies of Sciences (NAS) to develop a vision for a systems approach to studying the Earth and to identify the facilities, infrastructure, computational resources, workforce development and external collaborations needed to support that vision. He said he hoped the community will be actively involved in providing input and direction.

Earth System Science study – Committee Charge

- Describe potential value and key characteristics of a robust, integrated approach for studying the Earth system.
- Discuss emerging opportunities and barriers to progress, including consideration of interdependencies and synergies among all components.
- Identify potential synergistic opportunities within current facilities, infrastructure, and coordinating mechanisms. Ideas for new facilities, infrastructure and coordinating mechanisms may be considered.
- Discuss computational, data and analytic support for Earth systems research, including guidance on harnessing existing, planned and future NSF cyberinfrastructure.
- Discuss workforce development to support personnel needed to advance Earth systems research. Draw upon relevant scholarship to consider new and existing approaches. This can include undergraduate and graduate education, technical training to support facilities and infrastructure and increasing diversity in the future workforce.

Responding to a question from Dr. Robock about how to provide input, Dr. Easterling said the co-chairs for the NAS study are on tomorrow's agenda and will listen to suggestions and concerns from the committee. He said AC/GEO will have ample opportunity to influence this study. NSF requested the NAS study based on input from the community and a sense within NSF that it needs to be more facile and agile in supporting Earth System Science.

Dr. Lynch said she is on The Scientific Advisory Panel (SAP) for the World Metrological Organization (WMO) and is developing a vision for the future focusing on the Earth system above the solid Earth, i.e., ocean and atmosphere. The charge looks similar and she asked if there is a mechanism for interaction between the American members of the SAP and the NAS committee. Dr. Easterling said that was a great suggestion.

NAS Committee Membership

- Committee co- chairs
 - Ruth S. DeFries, Columbia University (ecology and sustainable development)
 - George M. Hornberger, Vanderbilt University (environmental sciences and engineering)
- Committee Members
 - Claudia Benitez-Nelson, University of South Carolina (cross-disciplinary)
 - Asmeret Asefaw Berhe, University of California, Merced (earth science)
 - Melissa A. Burt, Colorado State University (diversity, equity and inclusion (DEI))
 - James J. Elser, University of Montana (ecology)
 - Courtney G. Flint, Utah State University (natural resource sociology)
 - Royce A. Francis, George Washington University (Earth systems engineering and management)
 - Inez Y. Fung, University of California, Berkeley (atmospheric science)
 - William "Bill" D. Gropp, UI-Urbana-Champaign computer science)
 - Melissa A. Kenney, University of Minnesota's Institute on the Environment (IonE) (cross-disciplinary)
 - Jerry X. Mitrovica, Harvard University (earth science)
 - Constantine (Costa) Samaras, Carnegie Mellon (civil and environmental engineering)
 - Kristen St. John, James Madison University (geology)

- Fiamma Straneo, Scripps Institution of Oceanography of the University of California San Diego (polar climate and oceans)
- Duane E. Waliser, Jet Propulsion Laboratory (JPL) (Earth system processes)

The study’s major objective is to advise NSF across all cognizant directorates on how best to promote a program in Earth systems research. In addition to GEO and the Directorate for Biological Sciences (BIO), the social and behavioral and economic sciences, engineering and the cyber sciences need to be fully integrated.

He also discussed:

- Major renovation of the National Center for Atmospheric Research (NCAR) aviation facility scheduled for completion by the end of 2020
- Construction activity on Regional Class Research Vessels (RCRVs) that has been re-planned and restarted following an 8-month pause to improve and complete 3-D structural modeling. Ship delivery dates have been delayed approximately nine months from the original schedule.
- GEO is exploring different models to manage geophysical capabilities to serve the Earth Sciences community and leading a working group to identify needs other agencies have for capabilities currently provided by Seismological Facilities for the Advancement of Geoscience and Earthscope (SAGE) and Geodesy Advancing Geosciences and Earthscope (GAGE).

Turning to diversity in the geosciences, Dr. Easterling, presented a table from *Nature Geoscience*.

**Nature Geoscience -
no progress on diversity in 40 years!**

R&E	Earth		Ocean		Atmospheric		All geosciences		2016 comparative percentages	
	Cumulative number	Per cent in 2016	Cumulative number	Per cent in 2016	Cumulative number	Per cent in 2016	Cumulative number	Per cent in 2016	All S&E PhDs ^c	US population ^d
White	12,279	86	4,435	87	2,856	75	19,570	85	73	61
Asian	622	5	237	6	324	11	1,183	6	10	6
Hispanic or Latino	335	4	198	4	95	9	628	5	7	18
Black	115	1	58	0	59	4	232	1	6	12
Native American	52	1	15	0	7	1	74	1	<1	1
Other or unknown	523	<1	145	<1	95	0	763	<1	1	<1
Two or more races ^a	92	3	50	3	22	1	164	3	3	2
Total	14,018	100	5,138	100	3,458	100	22,614	100	100	100
Per cent URM ^b		6		4		13		6	13	31

Total number of doctorates awarded 1973 - 2016, with calculated percentages of race, ethnicity for 2016.

Bernard & Cooperdock, 2018

He said the geosciences continue to lag other Science, Technology, Engineering, and Mathematics (STEM) disciplines in the engagement, recruitment and retention of traditionally underrepresented and underserved minorities, adding that it is not a resource problem but a strategic and tactical one. It takes a village to entice, engage and nurture women and people of color in the geosciences. GEO and NSF have reinforced their commitments to diversity, equity and inclusion as an ongoing concern and events of the past summer have made this more urgent.

Evidence-based strategies and meaningful experiences

- Improving Undergraduate STEM Education: Pathways into the Earth, Ocean, Polar and Atmospheric & Geospace Sciences (IUSE:GEOPATHs).
 - Evidence-based strategies for improving student engagement.
 - Meaningful experiences through creation of geoscience learning ecosystems (GLEs).
 - Leverage STEM stakeholder networks, academic and/or non-academic research activities and facilities.

Developing Leaders for Diversity

- Geoscience Opportunities for Leadership in Diversity (GOLD).
 - Unleash potential of geoscientists with interests in broadening participation to become impactful leaders.
 - Support leadership teams representing diverse social identities in both social and hard sciences.
 - GOLD-EN Dear Colleague Letter -- funding supplements, Early-concept Grants for Exploratory Research (EAGER), Research Coordination Networks (RCN) and conferences/workshops to expand the network.

NSF is looking for innovative ways of capitalizing on learning that is going on in the trenches to make a lasting impact on the composition of geosciences institutions, including students, faculty and throughout the workforce.

He turned next to the NSF-Wide Diversity and Inclusion Task Force:

- Internal NSF Racial Equity Task Force created in July 2020
- Charge: Identifying institutional and other barriers to full inclusion and to make recommendations to eliminate those barriers.

He said expanding participation in the sciences promotes innovation. It strengthens the community's ability to tackle complex research programs or problems and engenders widespread public science literacy.

Discussion

Dr. Whitlock asked if GEO runs any programs that connect to the international geosciences community. Dr. Easterling said there is a major international cooperative program between the

US and Great Britain focused on field work to help understand what's happening at the Thwaites glacier and Antarctica. He also cited the Belmont Forum to support interdisciplinary research focused on global change science. He added that NSF could do better at supporting international science but tries to make international research cooperative.

Impact of COVID-19 on Academia

Dr. Major began her presentation with a brief explanation of short-term challenges and the longer-term ripple effects and major, lasting challenges to the research community, in which the research enterprise as we know it may be at risk.

GEO decided to build off some successful models from the Office of Advanced Cyberinfrastructure (OAC) in using rotating Program Directors as direct links into research institutions. GEO (with OPP) has 24 rotating Program Directors who provide a direct link into research institutions. Their networks offer connections to their own institutional leadership and colleagues, but also colleagues from other institutions and they were encouraged to have discussions with them for a broader perspective. Two listening sessions were held in June of 2020. The 20 rotators who could participate in the sessions represented at least 19 institutions across 11 states and Puerto Rico.

Dr. Major reviewed the input that was sought:

- Please list up to five challenges facing the geosciences research community at your institution. This can include issues related to education, career preparation, and/or infrastructure. Challenges may be short term or long term. Challenges could also be at the individual PI, institutional, or community level.
- Are there any impacts that are being felt disproportionately by certain parts of the geosciences community?
- Are there any opportunities, innovations, or best practices created by the COVID-19 pandemic that could be built upon?
- Are there any current activities that you would like to bring to NSF's attention? Are there models for mitigating negative impacts?
- Is there anything else we might be missing (e.g., similar impacts from the current social upheaval)?

She also listed the general impacts to research and higher education:

- Responding to the day-to-day and ever-evolving challenges, no extra bandwidth, strains on mental health
- Transition to virtual teaching has been very difficult and in many cases resources are insufficient
- Re-initiation of research has been slow
- Insufficient/slow guidance on institutional safety protocols
- Support structures (human resources (HR), information technology (IT), facilities, Sponsored Research Office (SRO)) have been negatively impacted
- Increasing inequality between resource-rich and resource-limited universities, and questions about sustainability of the latter

- Decreased student enrollment, including international students
- Faculty furloughs

She also discussed the impacts specific to the geosciences:

- Difficult to train students etc., in the absence of field work and lab access
- Impacts on non-tenured geoscience workforce (students, postdocs, technicians)
- Isolation of researchers
- Geoscience research community may be less accustomed to using novel technologies than those in other disciplines, which has slowed adaptation

She said there was some pushback on the last point of disproportionate impacts. These people have limited timeframes and there is a risk of losing them to the field as they're unable to complete school. This applies to everything from undergraduate students up through graduate students, postdocs and beyond. They also are losing networking opportunities because of the reliance on exclusively virtual interactions. Minority serving institutions tend to be chronically underfunded and the situation has gotten even harder. There tends to be a higher proportion of first-generation university students and students who have to work to support their education, and a higher proportion of students who rely on their universities for access to computers and the Internet. If they're not able to get on campus and not able to get online, it's impossible for them to do the work. There is a disproportionate impact on caregivers and, in particular, women. This is especially so for those with young children. Finally, those with underlying health concerns face greater risks, though they might not have had any issues under normal circumstances.

But the findings also presented opportunities:

- Broader accessibility and increasing inclusiveness and equity, especially for students whose life circumstances make it difficult or impossible to be on campus
- Increase in overall attendance at several workshops and meetings demonstrates the reach of the virtual platform
- Increasing effectiveness of virtual learning tools (e.g., virtual field trips)
- Increased opportunities for citizen science
- Expanded and more effective telework

She said people are using virtual learning tools better and there have been some effective examples of virtual field trips. An example of increased opportunities for citizen science and engaging the local community in measurements and data occurred when scientists were not able to travel to some projects in the Arctic. The research continued even though the scientists were not physically there.

Suggestions For GEO

Report out to GEO/Office of the Assistant Director (OAD) in July 2020

- Additional GEO Town Halls (information sessions)
- Enhance student and postdoc funding opportunities

- OCE postdoc program Dear Colleague Letter (DCL) released October 2, 2020 (NSF 20-131)
- Virtual Research Experiences for Undergraduates (REU) programs
- Teaching buy outs for faculty
- Financial support for efforts that increase accessibility, data sharing, and on-line community building

Regarding the call to enhance student and postdoc funding opportunities, she pointed out the soon-to-be-launched or the relaunch of the GEO/OCE postdoc program. A DCL came out in early October and a solicitation is expected soon. There was another call for virtual REU programs earlier in the summer. Also, programs can consider teaching buyouts as supplements. There's flexibility at the Program Director level to work with individual Principal Investigators (PIs) on things like teaching buyouts. And there was a call for increased support for things that increase accessibility, data sharing and online community building.

In conclusion, Dr. Major discussed a Rapid Response Research (RAPID) award looking at the impacts of COVID-19 on the geoscience enterprise and a [webinar](#) series that covers some of these topics.

Discussion:

In response to a question about teaching buyouts Dr. Major said the purposed is for a university to fund someone else to teach a course for a semester so that that a faculty member can focus on research and mentoring.

Dr. Bamzai responded to a chat comment from Dr. Lynch regarding listening session participation, suggesting that those impacted the most could not participate because they were so badly impacted. Dr. Bamzai responded that the listening sessions were considered the quickest way to reach out to the academic community because the Intergovernmental Personnel Act (IPA) assignees are NSF staff, which expedited the process. It was an informal survey, not a scholarly survey, but allowed for a rapid response.

Dr. Lynch responded that she understood the necessity but cautioned there is a need to keep the study design in mind when interpreting the results.

Dr. Hodges asked about the best way for GEO to help. Despite what has been done at the Program Directors' level, there are not as many people calling in and asking questions as there should be, particularly from graduate students and postdocs, who are almost to the point of panic. They don't know what their careers are going to be like. They don't see an easy way to finish their project. They need help immediately, not a year or two after a study is done. Most of the postdocs and graduate students supported by NSF are supported through the individual research grants given to faculty at universities and not through postdoctoral programs or the graduate fellowship program. People who have proposals that are supporting those folks are rapidly running out of funds because there is a clock ticking on their grants. The students know this. NSF and GEO in particular need to put a major effort into this at Dr. Easterling's and Dr. Borg's level to solve this problem of bridging funds to get over for the next year or two for these

students to make sure they remain part of our workforce. A lot of this is being pushed down to Program Directors to figure out. This should be dealt with at a high level.

As an example, the Science Director at The National Aeronautics and Space Administration (NASA) has done a call for proposals. People with active proposals can apply for extensions of proposals and extra time for postdoctoral and graduate student support. It's done not at the level of individual programs but at a higher level. He strongly recommended that be considered. There may be a lot of early career researchers who have projects that don't have the same kind of relationship with the Program Directors that more senior faculty do. And they may not be calling to ask for help. There needs to be massive help fast, with a new pot of money made available for this kind of thing to solve these problems, rather than expecting Program Directors to carve it out of their budgets.

Dr. Meacham said there is a cross-NSF working group, which does something analogous to what Dr. Major did. One thing that was different was thinking about how to increase accessibility to data as a way of helping people continue their research, perhaps in a different direction.

One thing all communities identified was what Dr. Hodges noted. The impacts on graduate students and postdocs are severe and urgent. We're encouraged by the fact that Congress has drafted a bill specifically to help postdocs and graduate students. He said he was somewhat optimistic that if and when Congress considers the next round of stimulus funding, there may be some relief in terms of identifying funding. Now, the challenge is where to find such a pot of money. The budget request for 2021 is less than the funds that were available in 2020 and we haven't yet received an appropriation from Congress, he said, so we don't know how much we're going to get. If we were to identify a new pot of money, we would have to identify something else to give up. And there has been some internal discussion about whether that makes sense. So far, the thinking has been that it's going to vary significantly between different programs, different fields, and different projects. So, the best strategy for now, absent any new influx of resources, is to leave it in the hands of the Program Officers. They have a budget and they are in the best position to balance the competing needs in the program areas. We'll continue to monitor the situation and evaluate it. Hopefully, we'll receive some additional resources.

Dr. Hodges said that's likely to be too little too late. We're not approaching problems in the United States from the top down and the same problem at NSF is pushing it all down to the Program Directors. That means there's a non-uniform application of this in different kinds of science done within GEO. It's hard to believe there are not funds that could be reallocated to this. I would say, no more RAPID work until we get through this crisis. For example, how much money did we save on this meeting by having it virtual as opposed to in person in Washington, DC. Those are tiny amounts of money, but they add up and can make a huge difference in the lives of these graduate students and postdocs right now. I feel strongly about this because this is almost like a thoughts and prayers thing; we'd love to help you guys out and maybe we'll have the money to be able to do it. But that may be too late to save an entire generation of new geoscientists.

Dr. Mitchum said he agrees this has to be done at a higher level. Finding a pot of money is difficult, but that's easier done at the higher level than at the Program Manager level.

In addition to graduate students and postdocs, a lot of labs depend on long-term staff that are soft-money supported and with a six-month hiatus in funding and they go elsewhere. Now you have a lab that's going to be crippled for a decade. Dr. Hodges' phrasing was perfect when he said we're talking about bridge funding. We are talking about how to get past having extensions to our present grants. And there's not always supplemental funding available. Having extensions still leaves you with a hiatus in funding. For a lot of proposals, you can't write the next proposal until you finish the one you're working on. That's what I'm hearing from our faculty. We're looking at needing bridge funding for a large number of people.

Dr. Meacham said the estimate of what NSF would need to address the postdoc challenge is a quarter of a billion dollars. When you talk about finding a pot of money somewhere in NSF, that's why it's so difficult. That's why we're focused on helping the outside community and other stakeholders, including Congress, understand the magnitude and urgency of the challenges we face.

Dr. Hodges responded that he does not know how they arrived at that number. A lot of this is very short-term bridge funding. It's not like another three years of postdoc support. In a lot of cases, it's how do I get back the last six months? Also, not every postdoc needs that kind of money. I have postdocs, he said, that are supported by internal money that I support. I can assuage their fears about the future a little bit. But I worry about the ones that are fully supported on a standard NSF grant that's about to expire. And the last six months of their work has basically vanished into smoke. I understand there's no easy solution. But if we really want to help these kids, we're going to have to help them fast.

Dr. Borg said the committee made semi-independent estimates of the amount of monies that would be available that were not sent over to Congress to put in. And those were very large amounts. There was a wide discussion about how to do this, if we had a supplemental appropriation, including block grants to universities. Each the situation is dependent on a bunch of different individual circumstances. That's part of the reason NSF has arrived at a point where, especially in the absence of a supplemental appropriation, the people who are best positioned to understand the individual circumstances and what reasonable solutions would be are the Program Officers and that's why we really need PIs to raise these issues with their Program Officers and talk about bridge funding. The mechanism to do a supplement is absolutely in place. The Program Officers are the ones that can develop the specific rationale and have those discussions and initiate a recommendation to get some supplemental funding out the door. There have been a whole bunch of internal discussions about what latitude there is within policies and within appropriations to address some of these things. If we wanted to use the money saved for this meeting to make a postdoc award, we'd have to go to Congress and ask them because they're two different line items in our budget. That's what creates a firewall between what we spend on salaries ourselves and internal travel for advice and things like that and program funds. But we've had lots of discussions and in the absence of an appropriation the best solution NSF has — in light of the fact that we have over 40,000 active awards or so, whereas NASA has supposedly only about 7000 active awards — is to ask PIs to get in touch with their Program Officers and say, Look, this is what's happened, I need this amount of money to get me through. And those mechanisms are in place.

Dr. Hodges said he appreciated what Dr. Borg said but questioned whether those mechanisms have been communicated to the entire community. He suggested sending out 40,000 letters to those 40,000 PIs and say what you just said, because that's the easiest way to make sure every single one gets that message. I appreciate NSF is working on this problem, he said, but this is something that needs to be handled very, very quickly and very effectively at a very high level.

Dr. Meacham said the activities so far have mainly been collating information and coming up with possible good mitigations, estimating the resources required to implement those mitigations and then providing that information where it can be most helpful. In parallel with that there have been discussions about how best to deploy the limited resources that we have and the absence of supplemental funding. There's been a separate discussion about the cost of restarting facilities or continuing facilities or repairing damage some of them have incurred. And because of construction that's funded through yet another of the separate accounts, there is some potential to do things there that aren't available in the regular program accounts for non-research grants.

But when it comes to research grants, supporting technicians, supporting students and so forth, the main things NSF has been able to do has been to take advantage of the flexibilities provided by the Office of Management and Budget (OMB) so, for example, technicians who couldn't get into the lab could still be paid by grants. And although the special flexibility provided by OMB has expired, NSF still has the flexibility to provide case-by-case approvals for them. So, if people have an urgent need, then the thing to do is to contact your Program Officer and describe that urgent need. And they can provide feedback on how best to address that and mitigate it. And for most other types of issues, including expiring support for graduate students, contact the Program Officer. They're the ones who have the deepest insights into how to bounce priorities within a discipline and within a field. They can bounce requirements across their portfolio. They may decide if a number of grants really are confronted with an urgent need for supplemental resources for graduate students or postdocs, that it's better for the health of the field to meet that need and make fewer awards in that area over the coming year. That may be true in some fields, but not in some other programs. So that's why the expectation that those issues will be tackled is delegated to the Program Officers. They're the experts and the ones most in touch with the community and they have the overall perspective of their portfolio. If they need advice on difficult decisions, there's always the division management structure to assist them. It may sound like a cop-out, but it actually represents a lot of internal thought and it's a very powerful mechanism. I would not underestimate the power of the NSF program structure.

Dr. Bamzai added that money might not cut it; we've lost a field season. Let's say a graduate student was midway between working on field campaign data. Even if we provide some monies, the graduate student can't go on the field campaign because the field season has been cancelled and AGS cancelled several field campaigns this summer. It has just been so disruptive, which is why it needs to be dealt with at some local level. If the monies magically appeared, they would trickle down. But the decision-making has to be done with some thought and care because sometimes monies might not just cut it.

Dr. Borg added that program staff, GEO and all of NSF are very concerned about this but because of the way NSF operates on a project basis for two- to four-year projects, people are

depending on the pending proposals as much as the ongoing projects. So, this is where it gets into a real conundrum. In a fixed amount of money, do you put the money toward new projects, where some of the same technicians may be supported? Or do you put it to continuing an existing project? NSF has given a lot of thought to this. There have been many contentious, robust, impassioned discussions. And we've talked about various ways we can make the process work faster. And we've agreed on some of those and some of those haven't quite panned out. But it has all gone down to the notion that the Program Officers is really the best place. So, we have to be more effective about getting that message out. It is on our website, but maybe we have to be a little bit more proactive about getting that sort of thing out in the short term as a possible solution.

Dr. Major said the scale of the problem is not known because we're in a transient state. We don't know if this is a six-month problem, or an 18-month problem or a two-year problem. Part of the challenge for Program Directors is, are you doing one Band-Aid at a time to deal with individual problems when you don't know what's going to be needed to make these projects whole? Because we can't see the end of this. I think we know there's going to be a big demand in the coming months. And we're not at the end point.

Discussion of 21st Century GEO Draft Report

Dr. Hodges provided a brief history of *21st Century Geosciences*, which started with another AC/GEO report, *Dynamic Earth: GEO Imperatives & Frontiers 2015-2020*. Dr. Hodges reviewed the report's imperatives:

- Data and Cyberinfrastructure
 - Community-driven cyberinfrastructure to advance data/model-enabled science and education
 - Harness the power of computing and computational infrastructure
 - Infrastructure for observing sensors and sensor arrays
 - Distributed infrastructure and facilities in support of research and education
- Education and Diversity:
 - Increase undergraduate exposure to and enrollment in the geosciences.
 - Prepare a capable geosciences workforce.
 - Broaden participation.
 - Public and community-based science
 - Community resources for both research and educational resources.
- Earth System Processes That Cross the Land/Ocean Interface
 - Response of marine ecosystems to climate change and anthropogenic activity
 - Surface water-aquifer in interactions
 - Geodynamics at active plate boundaries
 - Differentiation between regional and global sea level activity
 - Atmospheric interactions at the interface
- High-Latitude, Ocean-Atmosphere-Ice-Ecosystem Interactions and Processes
 - Variations in freshwater delivery to ocean surface water
 - Feedback within the nonlinear climate system
 - Variations in ecosystem productivity and biodiversity
 - Exchange in carbon dioxide and heat; carbon cycle

- Climate change effects
- Better process models
- Urban Geosystem Science
 - Interactions and feedbacks between urban and climate systems
- Early Earth
 - When and why did the core and geodynamic originate?
 - Why does Earth exhibit plate tectonics?
 - How important is the magnetosphere preserved for preserving atmospheres and oceans?
 - What tectonics characterized Earth before plate tectonics?
 - How did the origin and evolution of the oceans and atmosphere influence the origin and early evolution of life?

In 2017, Dr. Easterling asked AC/GEO to reevaluate *Dynamic Earth*. The committee generally supported the content of the original report, especially the imperatives, but felt the research frontiers were not fully representative of the most exciting research directions in geosciences. Town Hall conversations showed the report had low impact and low community buy-in. But efforts to informally obtain a broader set of research priorities from the community yielded spotty results, often driven by self-interest.

The committee decided it was best not to rewrite *Dynamic Earth* but to produce a different document that would be valuable to both NSF and the broader community as they move forward. AC/GEO came up with three components to work on:

1. A concise argument for the importance of interdisciplinary geoscience research, including twin foci on basic science and applied science to address societal impacts. This section would be written assuming the leadership of NSF and policymakers are target audiences.
2. An argument that geoscience research in the United States is limited by an insufficiently diverse community and NSF must intensify its efforts to help the community diversify. This section, with GEO leadership as the primary intended audience, should include specific ideas for improvement, while recognizing the purely advisory role of the committee.
3. An argument that the current structures and procedures in GEO at the program level should be reviewed and modified as appropriate to encourage and better support interdisciplinary science to ensure the minimization of bias, to simplify and accelerate the proposal writing process and to ease burdens on mail reviewers, panels and Program Directors.

This spring, three writing groups were formed to take on these three sections. Last week, Dr. Hodges said, he put their work together into a single coherent document. The report also needed an introduction and a conclusion. Last week, he sent out a draft of that document.

Dr. Arrowsmith raised the issue of communicating that the committee is not avoiding the question of science priorities, but that it has been done elsewhere. In addition to high-level studies there are many specific studies that come from focused workshops.

Dr. Robock noted there are no decadal surveys in many areas. It seems like the report is saying it isn't important to define what's in the future or that we'll leave it to other random things that happen. He said that mission should not be abandoned.

Dr. Hodges responded that the strong sense from the community was that they did not trust us to do that. When there's a NAS report, there are many more people involved and they put more work into it than this committee has and more work than was put into *Dynamic Earth*. Dr. Hodges agreed that there's not uniform availability of those kind of documents across GEO. The committee could encourage GEO to get those things across all of the programs, at least at the divisional level. He said he wanted to be careful about calling for that because it's very expensive. Even if it's an NAS report, NSF has to bear the brunt of the costs.

Dr. Pomponi asked Dr. Robock if he thinks a recommendation should be made for one or more decadal surveys.

Dr. Robock said he was unfamiliar with the landscape of all decadal surveys, but the report should say more clearly that we don't have the facilities to do it and encourage it be done by others. Some communities, like astronomy, have very specific joint recommendations they all agree on. It has resulted in specific programs they all can get behind, while others are more diffuse. Some direction for the future would be useful. We should be more specific about what guidance GEO should follow in the future for deciding our priorities.

Dr. Hodges asked how the committee should do that and what more the report can say beyond the recommendation to turn to those community documents that are out there.

Dr. Robock said there aren't documents in all fields.

Dr. Hodges asked if the report should recommend that GEO sponsor more studies at a very high level that research priorities in certain fields.

Dr. Robock said he was not sure we have to do that because people submit proposals for what they're curious about. The community votes by submitting proposals. He said it was not clear we need a pathway for the next decade and he was not sure what to recommend. The question is whether there is something broken that needs to be fixed.

Dr. Easterling said Dr. Robock's last comments are spot on. Once you start setting specific research priorities, it becomes an almost never-ending process. You can make the argument that we're just putting a representative group up there for purposes of illustration. But that opens up the conversation we've been having. Where's geo-engineering? Why is solid Earth not represented better? What this committee has wisely done is turned away from the attempt to inclusively identify all the major grand challenge questions. Not that that's not important to do. But we've recognized that the Academy does this quite well. Rather to focus on some of the structural challenges to research we deal with at NSF. One of those is a concept threading its way through a structure at NSF that is still kind of mired in the Newtonian disciplinary structures that continued to funnel research down the pike of math, physical sciences, biological life sciences

and social and behavioral sciences. Having the power of this committee behind a call for structural improvements, calling to not just us but other parts of NSF that need to hear the importance of working together in an integrated fashion, the importance of actionable progress in diversifying the sciences. These are important priorities for us and you're giving us a pathway to make some steps forward, not just talk about it. So, that's why I endorse the way that that Dr. Hodges has led the committee with this report.

Dr. White raised the issue of where to put the responsibility for diversifying our science. Prior reports emphasized that students are not quite meeting the expectations we typically project. But over more recent years there's more attention to structural inequities that are part of the culture of geoscience that are real barriers. The most recent draft reflects that. Taking the time to cite recent articles on those inequities and putting more of the burden on responsibility to cultural change is an important way NSF can continue to recognize it's going to take some different kinds of leadership and recommendations to make the change.

Dr. Millan agreed, adding that the latest draft may not recognize there are fewer people that are minorities and putting the burden of work on those people to serve on all the panels is something we have to be careful about.

Dr. Hodges responded that it was a good point, but he thought it was in the draft.

Dr. Whitlock said the draft does not have an emphasis on sustaining the planet and using geosciences as a way of bringing in social justice and social equity. Unlike *Dynamic Earth*, this report doesn't have that interdisciplinary flavor to it. She suggested more of the human dimension as a way to be more interdisciplinary.

Also, she said she cringes seeing proposals for the development and exploitation of fossil fuels. That doesn't seem like what we should be promoting.

On diversity, she said there have been articles recently about keeping people from underrepresented groups in the system. NSF can do that in the review process, but also things like mentoring to keep junior faculty in the game despite what may seem to them like not a welcoming environment. She suggested adding mentoring structures to get people into professional areas of science and keep them in those fields.

Dr. Cook said she didn't realize there was anything about oil exploration.

Dr. Hodges said it is stated such that there's great problems and great benefits because of oil development and exploration.

Dr. Cook agreed with de-emphasizing that and saying there have been benefits, but it is time to move away. The first part of the report is very silo based and we need to think more about suggesting integration across the silos. She said she thinks of it as a balance between the disciplinary approach and interdisciplinary approach, but not robbing the disciplinary programs to fund interdisciplinary projects. She asked how to move above that to a bigger umbrella. She said maybe there is some wording that can be used so those two things aren't in juxtaposition.

Dr. Hodges asked where she would put that that wording.

Dr. Cook said there is a section that talks about a balance between disciplinary and interdisciplinary research. She said rather than a balance, maybe an integration pathway from disciplinary into interdisciplinary research and a section on the need for systems approach on page six (document version numbering).

Dr. Robock said it states the US must transition away from its dependence on fossil fuels, no matter how disruptive that might be, to protect the health of the planet and its inhabitants. So, it does have a pretty strong statement already.

Dr. Heald said she helped write that section and asked if it's just a reordering because in the original draft the first sentence was about the need to transition away from fossil fuel. And then we mentioned conventional and unconventional exploration as part of the idea of transitioning energy structures. Because that sentence may have been moved further down, it brought up the concern that we're advocating for fossil fuel extraction.

Dr. Robock said the first paragraph states how great fossil fuels have been in the past, so maybe they should be reordered.

Dr. Hodges said he did the reordering of some things and it was not meant to send a message like that but to pull things together. Anytime a group writes anything there are redundancies. He tried to eliminate some redundancies and it's possible he moved things down or up. Instead of eliminating redundancies we should focus on making the strongest points we want to make first. There's no problem moving things around. We just need to move them around the right way.

Dr. Whitlock said Page 3 puts the emphasis on development and exploitation of both onshore and offshore fossil fuel reserves to sustain energy demands as we seek a more sustainable path forward. She suggested changing the emphasis.

Dr. Hodges agreed but said we have to be representative of the GEO community as a whole and there is a rift, with a significant part that believes a big part of what geologists do is find hydrocarbon resources and help exploit those for the good of society. The question is, how do you write something for general consumption? There are probably people in the halls of Congress who radically disagree with changing that emphasis. We should say what we think as a committee, but I understand why there was the balance in this original section. So, we should decide as a committee how to focus that emphasis. It is within our power to eliminate this stuff about oil and gas completely. I'm not saying we necessarily have to keep it in, but a significant number of people who are practicing geoscientists in this country would agree that's a necessary part of what geoscience is.

Dr. Robock asked how much NSF research goes toward finding more oil and coal and gas. I realize, he said, that we have to keep the people that give us money happy to make them understand that what we do is important. But if we don't actually work in that area that much if that's more engineering or something else, then is it a big part of EAR?

Dr. Pomponi said there's a fair amount of infrastructure support that goes into what may be perceived as involving this type of exploration.

Dr. Easterling noted that NSF's mission is to support new, fundamental research. And it can also be to support applied research. As long as it's developing new knowledge in the process. Some of the fundamental rock mechanics that had to be figured out were the basis for hydrofracturing. And so, did NSF fund the actual engineering of hydrofracturing? We might have in developing the technique itself, in the engineering directorate here, but the basic geophysics of it was actually done with grants that were provided from GEO a couple decades ago. So, yes, indirectly we do support the knowledge that makes exploration and extraction of fossil energy possible. But in all instances, the original driving research questions were really very fundamental.

Dr. Quinn said there is an International Ocean Discovery Program (IODP), which is a drilling program. So, if we're not drilling for oil, that's the exact opposite of the safety issues associated with that, but people can associate that outside our specific community. And the same thing, with seismic investigations of continental margins. There again, there can be some confusion. There are some first order studies that we need to do that can sometimes lend themselves to applications in fields outside of basic science. But obviously, it's not the first and foremost goal of the projects we fund, it's those basic science questions. So, there are some perception issues that we need to address. But overall, we fund the basic science that has a multitude of applications.

Dr. Cook said making that point is important, along with what Dr. Easterling said about new research. She asked if there is a way to add something saying its research that would not be possible in the private sector right now, but that we want to lay a foundation for the private sector, which plays into the economics of it, to help develop these new energy resources, in the same way NSF basic research in the past helped develop the oil and gas industry.

Dr. Easterling agreed. He added that one thing you're going to hear a lot in your role as an advisor to us is how much importance we attach to developing partnerships, particularly partnerships with private industry, in in the conduct of basic research. There's probably no realistic way to form partnerships with industry without some element of the research moving into the applied domain because the interest we have is how do you translate fundamental research discoveries into actionable knowledge to help solve a problem or create an opportunity, whether in the private sector or just pushing the fields forward more effectively and efficiently.

Dr. Cook added that it can be the renewable energy industry, so basic and applied connections that say, Hey, didn't we do great with the oil industry? Let's now help the renewables industry in the same way.

Dr. González said alienating people doesn't serve us well. There's a lot of renewable and alternative fuel research going on funded by the oil industry. We are transitioning from fossil fuels to alternative fuels. The oil industry served us well while we were totally disengaged from the environmental consequences of our actions and it's time to transition to something else, so let's be careful about not adding statements that will alienate. Moreover, there are still many

people who are very pro-oil-industry in Congress, and they are determining our funding. We still need hydrocarbons for some practical uses, but not for fossil fuels and not in the quantities we've been using. So, let's give some sense of where the money comes from, how can we partner with industry, as evil as we may consider them, and get resources to do more of our research. He said his research applies to hydrology and contaminant transport, but also to hydrocarbon migration. I get some money from agencies for the hydrocarbon, especially the oil industry, and some for the hydrology and the contaminants from other sources, so it's a balance of where we get the money and still in the Earth sciences the majority of employment seems to be oil industry.

Dr. Hodges pointed to some comments in the chat and said the goal of the report is not why NSF support of geoscience research is important. The goal of this part of the document is to talk about the importance of geoscience research in the US as it might apply to NSF but also from the perspective of Congress and the executive branch. We have to think not just about the question of whether NSF supports this, but also about why the geosciences are important to America. And the geosciences are important from the perspective of producing the hydrocarbons that fuel the engine of this economy. And it's fundamentally important to remind us that we're screwing up the Earth as we do it. And both of those things are done by the Geoscience Directorate. We don't want to go off in the direction of saying, oil is fantastic. But at the same time, we don't want to be dismissive of what the petroleum industry has brought to the geosciences— a lot of the funding of our new products that are coming along in the pipeline trace directly to the hydrocarbon mining industries. It's not good for the science to alienate any particular component of the geoscience enterprise. I'm on the side of taking every comment in here about oil and gas out, but I don't think that's the right thing to do.

Dr. Cook and Dr. González said the document was good as it is, with Dr. Cook asking if there have been suggestions to make a stronger statement about how NSF can help us move forward.

Dr. Hodges said they should try to do so. The document is not sacrosanct as written. We should try to modify it and get as many of us on board as we can. He said he tried to strike a balance in the draft, but any attempt can be improved.

Dr. Riser said the report denigrates the idea of good old basic research. There are plenty of other agencies that fund interdisciplinary and transdisciplinary stuff. But NSF has a more basic mission than that. I don't think we should not do transdisciplinary research, but maybe the report over emphasizes the need for that.

Dr. Lynch said that as somebody who does a lot of interdisciplinary work, one of the issues that's often lost on people is that it has to be built on the foundation of really excellent disciplinary research. There are two parts to this; one is deep excellence in disciplinary research. And the other is that actually crafting good, rigorous interdisciplinary problems and methodologies is a research problem as well that has not entirely been solved. We need to attend to both of those things, rather than saying interdisciplinarity is good. Well, some of it's good and some is really awful. We need to emphasize excellence.

Dr. Hodges agreed. There are components in this document that speak to that particular issue, but obviously they're not strong enough, if members can read them and not see those. Quoting from

the document: “It’ll be especially challenging to continue to support both disciplinary and transdisciplinary research, but we regard that duality as essential.” So, there are very strong comments in that regard. But it could be stronger. He asked Dr. Riser to find statements or comments that dis disciplinary research.

Dr. Easterling said Dr. Riser’s and Dr. Lynch’s comments are deeply held beliefs by the science staff at NSF. NSF is the last stronghold of pure curiosity-driven research. We are the gold standard for that and having an inextricable relationship between translational transdisciplinary research and the fundamental research we do is absolutely essential to making progress and solving some of these really difficult grand challenge problems we confront in the geosciences.

Dr. Hodges said he thought everyone agrees and the AC just needs to make sure it’s sitting right in the document.

Dr. Hodges moved next to the diversity component and asked for comments.

Dr. Pomponi said the document does a good job of consolidating the issue of diversity from different sections.

Dr. Whitlock said it was great. She add the keeping people in the field piece, perhaps through a mentoring expectation.

Dr. Fuentes said some ideas are omitted. If you look at the composition right now of AC/GEO and the geosciences, we don’t really have much diversity. We need to highlight that element. It’s difficult to work on issues of diversity when it comes to staffing, especially for the permanent colleagues. But something can be done. He recalled what Dr. Easterling said earlier that this is a very complicated issue. But GEO has a really unique opportunity to reach out to the underrepresented community to come and serve NSF as rotators. We need more diverse panels. And we need to more consistently educate panelists and reviewers. The GEO community as a whole still has some reservations as to what broader impacts (BI) really mean. This is the time to sound the trumpet so we can provide some exemplars of the work already done within GEO. And Dr. Brandon Jones has been doing some important work that needs to be at least identified. Also, we need to cite some of the sentiments the African American community in particular have been articulating in recent months and we need to harvest those ideas and put them in this report. This is probably the most critical time for us as a geosciences community to come together and say we will really address this issue in a very meaningful way.

Dr. Hodges said he did not want to put the burden on the groups that wrote the sections in the first place. We should target specific parts of the draft and try to improve those specific points. It would help to have volunteers who will work on this. He said he would like to put Dr. Fuentes down for 500 words.

Dr. Fuentes said it could be a team effort. He asked for help from Dr. White and said Dr. Jones can probably help. The document does not include much context and there are some vignettes that can be used that may motivate some members of our community.

Dr. Millan asked if there's a plan to use graphics or highlight boxes, which could capture vignettes or profiles to call attention to those important points.

Dr. Hodges agreed.

Dr. Millan suggested Dr. Fuentes gather material appropriate for a sidebar, adding that some of the language is in a latter section.

Dr. Robock said the list of the benefits of geoscience research is in the text and suggested including it in a sidebar.

Dr. White said she could include highlights from the No Time for Silence group that Dr. Fuentes and she are part of with some recommendations that are being suggested to NSF, using call out boxes or inserts that also have quotes from these calls to action.

Dr. Kraft apologize to Dr. Fuentes who had earlier offered to provide input. She agreed about including No Time for Silence recommendations.

Dr. Arrowsmith said the action items could be sharpened.

Dr. Hodges said that one goal of the section is not to just elucidate all the issues and what the community can do about diversity but what specifically GEO can help us with. The term of art is recommendations. We don't say we'll do this now. Let's tease out very specific recommendations at the end of each section.

Dr. Arnosti addressed the section about field experience. What isn't addressed is that lots of us and our students and our postdocs participate in international expert expeditions. And this can be problematic because you're in situations with peoples from different cultures and there can be issues folks aren't prepared for. One of the vessels used as part of the Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOSAiC) expedition was a Russian icebreaker. There were problems aboard that icebreaker. Talking with some of the folks who might happen to know and reading the report, it's clear there's also a cultural issue in addition to everything else and folks in the field are facing those problems and are acting as a deterrent to keeping people in geosciences.

Dr. Hodges said he has heard plenty of scary stories about people who are working with American crews. They have cultural differences with the crew themselves. There are programs and policies in place, but it's not always obvious who to call out; it's hard for people who have experienced that to figure out where to go and who to talk to, especially if you're not in direct line with a PI on particular project.

Dr. Easterling said that is a persistent issue and it has kept Dr. Faulkner awake at night. She has been highly engaged in these issues of safety.

Dr. Falkner said she is familiar with the article Dr. Arnosti referred to. It was a classic clash of culture. Having experienced those cultural clashes for a good deal of her career, she said, shee

sees progress. And the fact that this was raised and dealt with right away in the field quite the way it was, was substantial progress. And the fact was that the institution is led by a woman in Germany who tackled that. You get into some legal constraints as to what kind of information gets put out there. There are always many dimensions to these stories. You raise a very important point when you try and think about how do you keep people in the pipeline?

Dr. Falkner added that tomorrow the AC/OPP chair will be providing AC/GEO a summary of the recent AC/OPP meeting on the same subject. It is very important and on the front burner for us, she said. An AC/OPP subcommittee is working hard on understanding what we've done in this space, with help from others within the foundation and elsewhere to come up with recommendations for what we should do that could make a real practical difference and, in the process, looking forward to the learning opportunities about the barriers that have just been blown open with some national events.

Dr. Hodges said there will be a couple other opportunities to talk about the report, but this has been a good start.

AGS Committee of Visitors (COV) Report

Dr. Kraft said the COV she chaired was the first to have been done online and commended all involved. After reviewing the committee's process, she moved to the programmatic highlights:

- Merit Review Process
 - Overall, working well- identifying high-quality research
 - Ad hoc vs. panel not always well explained and not clear if one advantages proposals over another, recommend consistent transparency in decisions
 - Rationale and transparency of PO's decisions and seeking out information was laudable
- Finding qualified and quality reviewers
 - Quality (particularly with ad hoc) of reviews ranged considerably.
 - Gender parity mostly achieved; race was too sparse to determine
 - Some panels/ad hoc reviews were from one institution- should be avoided if possible
- Program management
 - Migration to non-deadlines creates more even flow of workload (rather than sudden intense bursts) with higher overall quality of reviews
 - Recommend increasing permanent PO positions so that incoming rotation of POs has more consistent mentorship. Also help with managing workload overall. Larger programs may require two permanent members with one rotator
 - Impressive sharing of priorities across several AGS programs, and sharing funds between partner programs- particularly in education and training
 - A dearth of information regarding the career paths of students and post-docs who are supported directly by AGS funding. Recommend identifying useful approaches to where junior scholars funded by AGS programs are transitioning into. It may be helpful to look how other Federal and foreign science agencies are measuring this.

- Some programs are making strides in increasing diversity, sharing successful strategies across the program is recommended
- For example, collaboration of AGS with other NSF programs such as historically black colleges and universities (HBCUs), Minority Serving Institution (MSI), and Significant Opportunities in Atmospheric Research and Science (SOARS) that target diversity. Tracking this information from year to year will also help future COV reviews to assess growth over time
- Portfolio assessment
 - For those programs that had enough proposals, it was clear that there was a solid balance of types of proposals funded. No changes were recommended
- Multi-agency solicitations
 - In the spirit of promoting inter- and multi-disciplinarity and addressing the needs of the AGS community (e.g., for data collection, monitoring, modeling, applied research, and theory development) is recommended
 - For example, NASA and NSF jointly funded project calls for every funding cycle. This reduces the barriers significantly because, while NASA provides funding for scientists from government labs, NSF will fund researchers from academic or private research institutions

Dr. Kraft turned next to a discussion of BI and presented the following conclusions:

- Some cases where intellectual merit (IM) was strong, but BI was limited or poorly articulated —appears that BI plays a secondary role to IM
 - Exception: Education (EDU) programs in which there were some proposals with very high BI potential with weaker IM, PI's were provided a chance to address
 - Recommend better training and consistency in awarding

Dr. Kraft turned next to the COV's larger, NSF-wide recommendations:

- NSF-Wide Recommendations
 - Automatic letters of acknowledgement for reviewers; particularly important for reviewers in non-academic positions
 - Create a central database of reviewers with ratings/notes as a resource for POs [also possibly help with determining diversity of reviewers]
 - Greater accountability for BI in future funding and evaluating what productivity means, e.g., mentoring students
 - Productivity from a publishing standpoint, does not mean this person is a supportive member of the community for preparing the next generation of scientists. Not just NSF's responsibility, COV recommended an investigation of how systemic this issue is, and obtaining the perceptions of relevant individuals in programs as well as those who finished/left programs
 - Recommends NSF ensure that reviewers and panelists are in good standing with the community, in line with NSF's policies regarding PIs and co-PIs, as described in Important Notice No. 144, and The Office of Diversity and Inclusion (ODI) bulletin No 18-01, NSF.gov/harassment

- Other Recommendations
 - While NSF PDs & POs were laudable in efforts to support us in our virtual environment, still recommend in person COVs in the future
 - Division level analysis helps with bigger picture analysis, but some of the finer points within smaller programs may get lost

Discussion

Dr. Pomponi tied Dr. Kraft's discussion of BI with the earlier discussion of BI in the context of the *21st Century Geosciences* report. She said we still all harken back to BI as meaning education. And it doesn't mean that. There are many exemplars that have been provided by NSF for what BI mean. Dr. Easterling talked earlier about the fact that NSF has not been doing a really good job about diversity over the last 40 years. She asked if it is time for that to come up to a higher level in terms of the proposal process. She said she was not suggesting mandates, but BI is already very confusing for the PIs and reviewers. It isn't consistent across the board. And if there's something the foundation wants PIs to address or that the foundation itself is addressing with regard to diversity, does that need to play a higher level in this whole process?

Dr. Hodges added that GEO does not define BI, NSF does, so we can't make a recommendation that's inconsistent with NSF's recommendation, which is effectively the National Science Board's (NSB) definition. He agreed there's much more to be done to clarify that issue and bring it forward. Education is a huge component of that for the reviewers, the panelists, the Program Directors and NSF about what the diversity of ideas that make a good BI could be.

Dr. Robock emphasized educating the people writing proposals about what BI are. He said he is always confused by it. It is important to make a huge educational campaign to tell people there's a lot of different ways you could do it.

Dr. Borg said BI has come up in every COV since the term was invented. NSF is hesitant to define it because we're fearful that those writing proposals will feel it's a prescription. BI is defined in the proposal guide as an NSB approved thing, but the AC is a two-way street with the community and with us and it could be fair for the AC to make a statement that recognizes that broadening participation is a big challenge within geosciences and that the community should think about this more as they develop proposals and their own ideas about how they want to address the broader impact. In terms of proposals, some ACs put on their Web page examples they thought were exemplary of BI to broaden the discussion. But clearly broadening participation in the geosciences is a major challenge. And maybe raising awareness and encouraging people to think about this as they develop the BI part of their proposals — maybe there's some traction that can be had there.

Dr. Hodges said that could be done. But NSF does a fantastic job trying to tell people, here are some examples. They're to be perceived only as examples, not a litmus test. But that does not stop reviewers from making them a litmus test. They'll say there's nothing about formal education in this, ergo this is not a good BI. That's inconsistent with the spirit of BI from the NSB and NSF. And that has to be stopped. Even if it's at the level of the individual POs, there's got to be a stepping in and saying this is not appropriate to maintain a specific answer to this question. But an updated set of possibilities are really important. We need to do that in concert

with saying there's some directives here about how you should interpret and weigh BI in the overall evaluation proposals. It bothers me that there are situations where the BI are not even taken into consideration as to whether something's going to get funded. That should not be allowed.

Dr. Borg said that's one of the things COV reports should do. It should draw to our attention where that is not being done by programs. That is a management issue for us to deal with. Because NSF policy says we're supposed to take that as advice. Now, if a Program Officer has a good reason, it should be articulated such that a reasonable person could understand it and understand why the judgment was made in a particular way.

Dr. González said the problem with BI is that the guidelines are too broad. It doesn't give people a direction as to where to go. So, maybe we need to streamline how we define BI and say these are the things recommended. Guidelines need to be provided for a better definition of what counts as BI. He also said there's no follow-up; people promise to do things on BI but it's not there. If they never follow up with the BI, they never accomplish what they said they were going to do, he said, raising the issue of accountability.

Dr. Riser said he was on the GEO/OCE COV, which made similar points. He asked about defining productivity other than by publishing. He agreed, but said there was no opportunity to mentor students at some institutions and, for those, how else can you define productivity other than publishing?

Dr. Kraft agreed with holding people accountable not just for the productivity of their science but of their BI. One example was mentoring students. But there are other examples. Very rarely are people held accountable for what they did with their BI as much as IM. She asked how to hold people equally accountable for the science in addition to the BI they're proposing because there isn't a way for NSF to say you're not doing your BI and we're going to take your money back. The only real mechanism is to say that the next time you apply are you actually doing what you said you would do.

Dr. Bamzai said the NSB, in its wisdom, left BI a bit broad because it's so context dependent. We can't just generalize. One size just doesn't fit all. A course curriculum at one institution could be a BI but not at another institution where there are already many such courses. Also, sometimes a technology, technique or methodology that's developed in one field finds application in another. And that's a big BI. For example, this year's Nobel laureate in economic sciences had done work out of the Directorate for Social, Behavioral, and Economic (SBE) Sciences funding, back through the Information Technology Research Program, which was almost 15 years back, and now it's being used for spectrum auctions. If something finds its way in another field, that's a BI that can push that field forward.

Dr. Hodges encouraged AC members to read the foundational documents from the NSB from 2011 about what they regarded as broader impacts. There's a reference in the draft report. It doesn't have to be cross disciplinary. It says that if the scientific aspect of your research has a societal implication, that is a BI. The IM component can include the BI and you can refer back to

that BI from the IM. We have to make sure our own definitions are as broad as the original definitions.

The AC accepted the COV report.

AC GEO Member Talk: A Call to Action

Dr. White provided some background to her presentation, No Time for Silence; A Call to Action; A Commitment to Change and discussed the others involved in the effort. She said there is a recognition that there is a problem within the geosciences, which is commonly compared to the other STEM disciplines that have made more progress. It's incredibly frustrating, she said. Many she said, have been working on these issues of diversity and inclusion for many years, yet often come up short when using the same measures of progress. Therefore, No Time for Silence is calling on the community to take action in a way that's more meaningful to ensure that some of the goals can be met:

[A Call to Action for an Anti-Racist Scientific Community from Geoscientists of Color: Listen, Act, Lead](#)

- Simply saying we believe in equality, equity, full inclusion, participation, and voices of all people in the scientific community is not enough
- We must take action in a meaningful way to ensure these goals are met, and demand our collaborators and stakeholders do so as well
- We call upon Black and non-Black colleagues and collaborators to listen and act to dismantle structures that perpetuate injustice and systemic racism
- Actionable strategies for professional societies, government agencies, community science organizations, and academic departments

Dr. White presented references to a number of related books and said for many scientists of color, these topics are not new. But it is important that they are moved to the front burner with the murder of George Floyd and other examples of excessive policing, along with many other things plaguing communities of color, including the health disparities so evident with the COVID-19 outbreak. It's time for a new look at why the persistence of these different issues continue to undermine what we try to do in geosciences, she said.

She included a citation for "The Psychology of Blacks; An African-American Perspective," written by her late father, Joseph L. White and Thomas A. Parham. Her father was a professor of psychology and Dean of Undergraduate Studies when she was growing up in San Francisco in the 1960s. At San Francisco State, students went on strike and demanded ethnic studies and cross cultural studies and her father, she said, helped establish the field of black psychology and cross cultural psychology. She said that as a second-generation academic who attended and taught at San Francisco State, she appreciated being able to draw from his work and briefly discussed the origins of the term microaggressions.

She turned next to a call for geoscientists to act. She said that along with universities that were issuing calls to action, our professional societies were too. She discussed her leadership role at American Geophysical Union (AGU), where she is chair of the Diversity and Inclusion Advisory Committee. She discussed writings on the subject by her and others to highlight things we can do

differently in our community, knowing our history is not great on this topic and taking advantage of the momentum now to do things differently.

She said people clearly want to help and try to follow some important steps and actions that can be taken. But we all need help in this effort. She said we want to continue to think about doing things differently. And she is inspired when Dr. Jones talks about Justice, Equity, Diversity and Inclusion ([JEDI](#)). Often missing in a discussion of diversity and broader impacts is the justice piece. We can't begin to completely dismantle the range of barriers persistently present in education and achieve success and equality where students are able to learn and the kinds of resources are so uneven between districts, especially in the pre-college level. She spoke of thinking differently about issues of equity, diversity and inclusion that involve opportunities to thinking about putting resources in different places, a strategy that gets us away from just doing the same thing all the time.

She next presented recommendations in the call to action that she said can be very useful to the specific aspects of our network that we want to better engage.

Calling on the Scientific Professional Societies

- Develop robust and meaningful diversity, equity, and inclusion strategic plans
- Fully implement strategic plans with necessary resources
- Track progress against traceable metrics, hold the society accountable
- Diversify leadership and staff with scientists drawn from underrepresented racial/ethnic, cultural, and ability groups

Dr. White turned next to steps AGU is taking:

Eight Deliberate Steps AGU is Taking to Address Racism in our Community

1. Expand funding for AGU's diversity and inclusion (D&I) efforts
2. Diversify AGU's Governance and Committees
3. Enable, recognize, and reward diversity in our Honors
4. Create truly diverse meetings
5. Review diversity, equity and inclusion across AGU's publications
6. Support the success of emerging underrepresented scientists
7. Advocate for policies that eliminate racial Injustice
8. Partner with leaders across STEM to remove systemic racism and foster culture change

She then turned to GSA:

GSA Actions to Support Diversity, Equity, and Inclusion

<https://www.geosociety.org/>

- Integrating DEI into all GSA strategic plan aspirations and goals
- Bolstering scientific offerings by working toward greater inclusivity.
- Leading the geosciences in building a culture of professional ethics, rigor, and integrity.
- Priorities identified for improvement during an August 2020 DEI retreat included four target areas:

- Communication and transparency
- Mentoring and support
- Revising the nominations and awards process
- Creating diversity in leadership and meetings participation

Dr. White also provided recommendations for universities.

Calling on Universities

1. Commit to hiring, promoting, supporting, and retaining faculty of color instead of offering continual excuses (“I can’t find...,” “Not a good fit...,” “Not as qualified...”)
2. Promote and reward ethical anti-racist policies, penalize systemic racism in hiring, admissions, and promotion
3. Provide equitable access to mentoring and inclusive administrative practices
4. Require inclusive and equitable classroom practices
5. Draw from (and credit) the best practices of successful programs at HBCUs, MSIs, Tribal Colleges and Community Colleges.

In discussing Federal agencies, Dr. White had separate recommendations for NSF and for other agencies:

Calling on Federal Agencies

- NASA: Continue to assess goals and outcomes of the NASA Earth and Space Science Fellowship (NESSF) and Future Investigators in NASA Earth and Space Science and Technology (FINESST) programs
- U.S. Geological Survey (USGS): Implement programs modeled after NOAA’s successful Educational Partnership Program (EPP) to ensure full participation of Black and communities of color in their education and science missions
- Environmental Protection Agency (EPA): Ensure that funding decisions for proposals involve racially diverse panels and other decision-making bodies.

Turning to recommendations specific to NSF:

Calling on the National Science Foundation

- Diversify science leadership (e.g., Assistant Directors, Division Directors) and workforce to realistically reflect the community it purports to serve
- Take concrete measures to ensure all NSF-funded research and learning environments are free from racism.
- Communicate and enforce NSF policies so that organizations understand the consequences of racism.
- Ensure that funding decisions done via panels involve racially diverse membership
- In broader impacts statements ask: “How will this project specifically support the inclusion and participation of people from communities commonly underrepresented?”

Dr. White next discussed an upcoming series of workshops and Webinars:

A Commitment to Change:

A Race and Racism Workshop Series

- Create cross-institution communities of inquiry and practice
- Structure the events with a purpose to motivate action and dismantle oppressive structures
- Communicate stories, examples of how people have individually and collectively engaged in equitable and inclusive behaviors
- Support and grow a network of potential change agents
- Utilize professional societies to play a role in strategizing and convening
- Highlight commitments and progress in different forums, Heads and Chairs meetings
- Shape perceptions of what leadership norms are and should be

No Time for Silence is also organizing conversations around aspects of the culture of the geosciences that prevent progress that will provide actionable strategies:

A Commitment to Change: Listen, Act, and Lead

- Join us in a series of webinars and virtual workshops (GSA and AGU)
- Partner with a range of experts and leaders in geosciences to discuss and provide common principles, best practices, and tools to address issues relating to racism and the impacts on:
 - geoscience higher education environments
 - the geoscience workforce
 - the broader geosciences community
- Assist us in reforming practices to actively improve the climate in departments and institutions
- Make it a personal matter to champion and advocate for the complete inclusion of students of color as important and necessary participants in the scientific community
- Amplify and include underrepresented voices in all decision-making matters that affect them rather than making decisions on their behalf
- Develop actionable strategies and provide accountabilities: measurable milestones, goals, and timelines for change.

She concluded by saying she was hoping that we're starting a movement and not just having a moment.

Discussion

Dr. Robock asked how much of the problem is in the source of people coming into the field at lower educational levels.

Dr. White responded that it needs to be at all levels. We don't want to assume that a student is deficient because they didn't go to a private school or because they went to school in Newark or didn't have the advantage of so many of the other well-resourced districts. We also want to be recommending students for programs looking at exemplary models like SOARS and there are all kinds of REUs that are helpful and getting students the kind of skills they need to increase the likelihood they can be successful members of our community. We certainly shouldn't write students off if they have deficits, and not all of them do. That's why bridge programs are so

important and recognizing that with key interventions here and there, things can be done. But part of what No Time for Silence calls for is for us as professionals representing our institutions to look at the culture of the place, because it can be a real turnoff for students.

Dr. Jones referred the AC to Dr. Easterling's earlier presentation and the paper from *Nature Geoscience* about no progress in diversity for 40 years. Most of those efforts were at the front end, to Dr. Robock's point. But we see there's a retention issue.

Report on the U.S. National Academy of Sciences, Engineering and Medicine (NASEM) Study on Biological Collections

Dr. Pomponi, who co-chaired the [study](#), began with the reasons for carrying it out:

Motivation for the Study

- Biological collections are an invaluable, and often irreplaceable, component of the nation's scientific enterprise.
- Their health depends on the underlying infrastructure that assembles, maintains, and provides access to the collections.
- Sustainability of the nation's biological collections is under threat:
 - Lack of understanding of their value and contributions to research and education
 - Lack of appreciation for what is required to maintain them effectively
 - Inadequate coordination and interconnection among and between collections
- Without changes in support and organization, prior and current investments for building the nation's biological collections will be diminished, and their immense potential will be severely limited.

Dr. Pomponi next explained the guidance the foundation sought:

Statement of Task (abbreviated)

- NSF recognizes the breadth of needs for maintaining biological collections exceeds the capabilities of any one Federal agency.
- NSF asked NASEM for guidance on questions regarding long-term sustainability, including operational structures, policies, and social cultures that could provide momentum to maintain and grow biological collections.
 - Explore the contributions of biological collections of all sizes and institutional types to research and education.
 - Envision future innovative ways in which biological collections can be used to advance science.
 - Outline the critical challenges to and needs for use and maintenance of biological collections.
 - Suggest a range of long-term strategies that could be used for their sustained support.

Turning next to infrastructure, she said at the base are the biological collections themselves and then there's the physical infrastructure associated with storing and maintaining those collections and the digital infrastructure. Another aspect is the human infrastructure, the collections

managers, directors and curators. The committee recognized there was a need for the creation of a collections network so best practices can be shared.

She turned next to defining biological collections:

- Biological collections typically consist of organisms (specimens) and their associated biological material, such as preserved tissue and DNA, along with data—digital and analog—that are linked to each specimen.
- Non-living specimens include organisms preserved by scientists and naturally preserved remains, such as fossils, commonly referred to as natural history collections, some 800 to a billion specimens in 1,800 collections.
- Living specimens include research and model organisms that are grown and maintained in genetic stock centers, germplasm repositories, or living biodiversity collections. There are at least 2,855 living stock collections in the US.
- Focused on collections that receive, or are eligible to receive, support for infrastructure or digitization from NSF, excluding zoos, aquaria, or botanical gardens; biobanks or repositories of human tissues.

She gave the following examples of contributions of biological collections:

- Monitoring Changes in Environmental Quality
 - Birds of prey - Assessing environmental quality based on presence of contaminants
- Understanding and Forecasting Effects of Climate Change
 - Vertebrates in Yosemite - Document changes in elevation, abundance, and body size of species
- Ensuring Food Security and Crop Management
 - Herbarium records - Sighting of wild relatives to collect new germplasm
- Improving National Safety and Public Health
 - All biological collections - Identify distribution, reservoirs, vectors, and surveillance over time of pathogens

She also discussed how the report was structured:

- In chapters 2 and 3, the committee highlights ways in which biological collections contribute to science, education, and society.
- The committee recognizes that future success of biological collections depends on addressing four interrelated issues:
 1. Upgrade and maintain physical infrastructure and growth of collections (Chapter 4);
 2. Develop and maintain tools and processes needed to transform digital data to an easily accessible and integrated cyberinfrastructure (Chapter 5);
 3. Recruit, train, and support the workforce of the future (Chapter 6); and
 4. Ensure long-term financial sustainability (Chapter 7).
- Realizing the committee's vision will require enhanced communication and collaboration within the biological collections community and beyond (Chapter 8).

- Each chapter lays out main challenges for all collections and path forward for the biological collections community.
- Recommendations are offered to:
 - The leadership (directors, managers and curators) of biological collections
 - The biological collection community (professional societies, associations, coordination network etc.)
 - The NSF Directorate for Biological Sciences

Dr. Pomponi turned next to selected recommendations for the NSF Directorate for Biological Sciences:

- Continue to provide stable, long-term funding to support investigators who rely on biological collections for research and education (7.3).
- Continue to provide funding support for:
 - biological collections infrastructure and expand endeavors to coordinate support within and beyond the Directorate (4.4).
 - digitization of biological collections and cyberinfrastructure to support both living and natural history collections (5.3).
- Support initiatives that focus explicitly on systemic, systematic, and thoughtful development of the biological collections workforce pipeline (6.2).

There were certain areas where the committee felt that collections contribute to at least six of NSF's Big Ideas:

- Growing Convergence Research: Chapter 2 of this report presents a range of opportunities that garner the power of convergence through transdisciplinary research using specimens and their extended data.
- Understanding the Rules of Life - Predicting Phenotypes: Chapter 2 of this report provides the past, present, and future contributions of living and non-living collections to fulfill this goal.
- Harnessing the Data Revolution: Chapter 5 of this report describes the important ways digital data are used to benefit research in yet unimaginable ways.
- Navigating the New Arctic: Chapters 2 and 8 lay the foundation for understanding the critical role that collections play in understanding and documenting changing conditions in the Arctic.
- NSF Includes: Chapter 6 of this report focuses on workforce and includes diversity and inclusion.
- Mid-Scale Research Infrastructure: This report as a whole describes how biological collections are an essential element of the life science research infrastructure (see Chapter 4).

She noted that each chapter highlights challenges and paths forward and moved on to discuss the study's conclusions and recommendations:

Conclusions

- Harnessing the opportunity for data-driven discoveries and transdisciplinary collaboration will depend on a continuing effort to digitize new and existing biological collections.
- National and global portals and catalogues have made important contributions to the biological collections community by providing a platform to access, exchange and share data and promote standardization and consistency.
- Integration of specimen data with non-biological data sources will require implementation of a network of cyberinfrastructure resources not yet realized.
- Without a permanent national cyberinfrastructure that supports expanded digitization of dark data, improvement in data quality, collections—both physical and digital—will continue to be underused.

Recommendations for the NSF

- Recommendation 5-3: The NSF Directorate for Biological Sciences should continue to provide funding for digitization of biological collections and cyberinfrastructure to support both living and natural history collections. Specifically, NSF should:
 - partner with other directorates within NSF (e.g., physicists, chemists, computer sciences, and education) and beyond (Department of Health and Human Services (HHS), United States Department of Agriculture (USDA), Food and Drug Administration (FDA), The U.S. Department of the Interior, the National Oceanic and Atmospheric Administration (NOAA), NASA, The Department of Energy (DOE), etc.);
 - establish ongoing mechanisms for the biological collections community to meet, develop best practices, and work towards goals such as establishing and implementing unique identifiers, clear workflows, and standardized data pipelines; and
 - promote and fund the development of cyberinfrastructure, tools, and technology to effect the efficient multi-layer integration of data and collections attribution.

Recommendations for Collaborative Action

- NSF should help establish a permanent national Action Center for Biological Collections to coordinate action and knowledge, resources, and data-sharing among the nation's biological collections as they strive to meet the complex and often unpredictable needs of science and society.
- NSF should lead efforts to develop a vision and strategy, such as a decadal survey, for targeted growth of the nation's biological collections, their infrastructure, and their ability to serve a broader range of users and scientific and educational needs.
- NSF should expand partnership capabilities more broadly across NSF, other Federal agencies, international programs, and other sectors to maximize investments.

Dr. Pomponi concluded by noting that a Webinar recording with more information is available, as well as a slideshow.

Discussion

Dr. Hodges said the bigger problem is what to do about geological collections. Most universities do not want to provide long-term storage for rock samples in an archival way.

Dr. Pomponi agreed and said the Division of Biological Infrastructure will be addressing this. If there is going to be a National Cyber Infrastructure that NSF might facilitate, we ought to be looking across the board at collections in general. You're ready to retire, you have this collection that you've amassed and what happens to it?

Dr. Smith-Nufio said EAR does quite a bit of collaboration with the Division of Biological Infrastructure (DBI), adding that she is one of the Program Officers who works on the digitization program. We already have paleontological collections and some modern collections that are coming out of some of the more modern data sets that are highly integrated and collaborative with what BIO is doing. There is also quite a bit of co-funding. A good amount of the portfolio goes to supporting this. So, there is a good model in what we're doing here that could easily be grown. And conversations about how to integrate rock samples have been a big part of the conversation for well over a decade in the community. We've been engaging in those conversations on the cyber infrastructure side and the museum collection side. All the elements are there and it's just connecting those pieces and this report gives that opportunity.

Dr. González said one of the problems with rock samples is that they do not have location and other information. Once the researcher dies, that information is gone, so they are worth nothing. We need to do curation of collections if we are going to convince anyone to keep them for the long term.

Dr. Hodges said this is changing. The bigger problem is tons of rocks over the course of a career and universities won't provide the infrastructure to save that, no matter how important they are and how impossible they are to get. Permanent storage infrastructure is needed.

Dr. Smith-Nufio said there isn't a mechanism in GEO that does this, except for some repositories that can handle some pieces of the record. Even some rack sample people want facilities for the rock samples and throw in paleo to make it a little biological to fit in to BIO's program. BIO has been subsidizing our sample curation for some of the record.

Dr. Borg said in 1993 the bricks and mortar part of an infrastructure program went away. The Major Research Instrumentation (MRI) Program used to be part of a larger program that included the ability to get a few million dollars for bricks and mortar kinds of things. And that went away. Since then there has been sporadic investment in infrastructure around samples. He asked Dr. Bamzai if Program Officers have been approached about a research coordination network.

Dr. Bamzai responded that for atmospheric and related sciences, quite a few of our data repositories are at NCAR and she mentioned the Earth Observing Laboratory repository where any researcher can go. The Paleo Perspectives on Climate Change (P2C2) cross divisional program has an arrangement with the NOAA National Geophysical Data Center (NGDC). Most of her division's researchers also rely on NASA and NOAA data sets.

There used to be a lot of proposals in which the data management plan said PIs would archive their datasets in what was then The National Climatic Data Center (NCDC). And then when I contacted my colleague in NOAA and said, what's your criteria, they said, No, we are not there. We have limited resources. So, we don't archive data sets at NCDC (now The National Centers

for Environmental Information (NCEI)). We have certain criteria, and we make some hard choices.

Report on Upcoming AC ERE Meeting

Dr. White said the Environmental Research and Education Advisory Committee (AC-ERE) meets next week. It provides advice and recommendations concerning NSF support for interdisciplinary Environmental Research and Education portfolios, which include engineering, geoscience, social, behavioral and human health sciences.

There are three subcommittees within ERE. An education subcommittee is working on a document examining the integration of education and environmental research into the changing pedagogy of system science. There's also a subcommittee on environmental science and human security. They will also be sharing a draft document. The third subcommittee is public health and environmental research and education, which is working on a document that explores research at the nexus of public health in the environment.

The meeting will have a number of panels, including one on public health and one on broadening participation. For the broadening participation panel, the AC will hear from NSF reps with the GOLD program. We'll also hear from staff with the partnership and research and education for materials program; also broadening participation in computer and information science and engineering. There will also be an update on the Inclusion across the Nation of Communities of Learners that have been Underrepresented for Diversity in Engineering and Science (INCLUDES) program. The AC hopes to learn and promote that community engaged research can be as much a part of the IM of grants as it can with broader impacts.

NSF Strategic Plan

Dr. Borg said the Office of Integrative Activities at NSF leads the development of an NSF strategic plan, as required by OMB. The development of the next strategic plan is just beginning and there are avenues for public comments. He asked AC members to share this with their colleagues. There are two avenues for input. In June of next year, a draft of the plan is due to OMB, with a final draft due toward the end of next calendar year, with a goal of publishing it in February 2022.

Wrap Up

Dr. Hodges said that tomorrow the AC will continue the discussion on the draft report and the changes, with a focus on the third section. The AC will also discuss the system science study and will meet with the NSF Director. There will also be division subcommittee report outs. The meeting will conclude with action items.

Thursday, October 14, 2020

Discussion of 21st Century GEO Draft Report, cont.

Dr. Hodges incorporated members' comments and circulated a new draft of the report; the introduction, he said, is very different. Today will focus on the third section and the enumerated topics, starting with routinely collecting report information and funding trends.

Dr. Borg said in the past many POs provided information related to success rate often on a proposal cycle basis. NSF determined information like that was too difficult to verify and not meaningful and now treats that information as internal nonpublic information. Generally, success rates are only reported at the director or division level and only in annual cycles of reports of trends produced by an internal statistics and scientific analysis group. This is not something GEO controls directly. It isn't that the agency is trying to hide information. The agency feels it's important to have information that's released be well vetted and defensible.

Dr. Falkner said the analysis group is the National Center for Science and Engineering Statistics. She added that there was concern at the agency that when data gets disaggregated, you're going to be able to identify individuals and preserving anonymity is essential. So, they were releasing statistics that prevented that.

Dr. Bamzai said this came up at the AGS subcommittee. Subcommittee members were provided a baseline of where AGS is in terms of proposals. The Office of General Counsel said she could show bar plots produced using internal data to the subcommittee without approval from the Assistant Director for Geosciences (AD/GEO). The number of proposals, approximately 800, was large enough that she could give the subcommittee a baseline for what the workload is for the programs. Whatever is in the *Merit Review Digest* and the NCS [?] report can be shared publicly. She said she can go beyond that with a tag noting it as nonpublic information, which we can share in a closed session. And we don't typically talk about declines, which are kept anonymous; awards can be shared openly.

Dr. Hodges said he understands the concerns, but the community should be able to know the success rate.

Dr. Bamzai said the success rate was recently requested at a University Corporation for Atmospheric Research (UCAR) meeting for the AGS Postdoctoral Research Fellowship (PRF) program, which gets about 20 proposals. We could not share those numbers because of these new policies that are in place.

Dr. Lynch said this is a critical element of mentoring. As senior scientists we need to be able to talk to our students, postdocs and junior colleagues and tell them where a good place is to spend your time. We owe it to them to give them more than anecdotal information.

Dr. Robock agreed that the information should be made available so people can decide which program to spend time on submitting a proposal. The success rates are pretty high with AGS and it makes the program look good; maybe you'll get many more proposals if people find out. Also, when I mentor people, he said, I say to talk to the PM and explain what you want to do. Is this the kind of research you would consider? And if it's not, don't waste everybody's time. And if it is a large number, I can't see how privacy issues would come up. It would be nice to give the PMs more leeway in providing information for which privacy is not a problem.

Dr. Cook said she thought success rates should be provided. The privacy argument does not work for 800 proposals. She raised the issue of disaggregating success rates by gender and underrepresented minorities. Also important for decision making about where to apply for things

is the breakdown between the disciplinary and interdisciplinary success rates. She agreed that that will help in mentoring. The more you disaggregate it, the more the privacy argument holds water.

Dr. Heald said it would be great to have more public information but said it should be done with information about the mode of proposal review or evaluation. Last year there was a discussion about how, when certain programs go to no deadline, the number of proposals drops and the quality increases, so the success rates look higher. It's hard to look at comparing different programs. She said she did not know how one would appropriately discuss that.

Dr. Kraft said she supported what's being said. There's an argument of a perception issue that's important in terms of how people are responding and reacting to what they think is happening. When we can make data-informed decisions, we do better science. The fundamental mission of NSF is about making data-informed decisions. And that is an argument for why this is important. While recognizing the importance of anonymity, there's a threshold that can be set; anything below this bar, we put as an asterisk and say numbers are too low to report. We need to push it from the directorate level upward, so this is an issue we address.

Dr. Borg said a lot of POs were disappointed they were no longer allowed to share success rates at their program level. That said, sometimes the programs have small numbers. Also, when you disaggregate it, and you have different drivers; for instance, AGS has not had a tradition of mainly using ad hoc reviews and no deadlines for a long time. There were drops in numbers of proposals, when people moved from deadlines to no deadlines. When those show up, what does that mean? Unfortunately, some people will equate low success rates to excellent science that's been rejected. So, NSF does not want to encourage submission of throw away proposals to drive down success rate to make an argument for more funding to that area. It would be useful to frame the issue in a way that NSF is the audience.

Dr. Hodges said that was good advice and that is a question the AC can ask the Director. This is all about what does the community think and if you don't give them this kind of information, regardless of all the other good reasons to do it, they're going to speculate. And speculation being uninformed, it can do damage along the way. Dr. Hodges said he was thinking about things to do with tenure and promotion decisions. It's not uncommon to take into account someone's success rate determining whether they should be promoted or receive tenure. You need to need to put that in the context of what the real success rates are. And knowing directorate-level success rates does not necessarily provide the appropriate information for universities taking that into account. So, there needs to be greater transparency, understanding all the good reasons why it's as complicated as it is. But there's got to be some happy medium.

Dr. Arnosti said she is sympathetic to the point about anonymity. At her university, she can often find herself on anonymous graphs because of low numbers. But in mentoring new faculty, it is unsatisfying to only be able to relate anecdotal information. I wish I could provide actual information about success rates and my experience as a panelist where the Program Managers assure us junior faculty and new investigators gets specific consideration. I wish I could be more than anecdotal about that. It's super important to help people get launched, especially those uncertain about the trajectory of their careers.

Dr. Aluwihare offered a counter opinion. If I looked at those numbers, I probably would have never applied for NSF grants when I first started as a junior scientist because the numbers were so low, they didn't exist. It's not that I disagree with the idea of mentoring. But the numbers themselves aren't really grounds for making decisions about whether to apply for an NSF grant, or how I advise my students or junior faculty. I always say, talk to the Program Manager, because those numbers do impact how decisions are made upstream in terms of how funding might be distributed. And decreasing the proposal pressure on a program might make it look like a program is not valued by the community. Those are some of the arguments I've heard that I don't think are completely out of line. While I agree with the mentoring discussion about how you should spend your time, it's also true that for many underrepresented individuals, you can't use that information to make basic decisions about whether you're going to apply for a program.

Dr. Falkner posted two references ([1](#), [2](#)) re success rates in geosciences and Dr. Whitlock asked what further is wanted. She said it's not so much where students or young people should put their efforts. But it's very confusing as to whether to go for one of these more complicated interdisciplinary programs versus within your discipline. For those two options, it is really helpful.

Dr. Hodges referenced the EAR information included in what was posted and countered that the specific programs he submits proposals to in EAR do not have the reported 41 percent success rates. It's misleading because it implies it is uniform across EAR or AGS or Integrative and Collaborative Education and Research (ICER). It's variable on a program-by-program level. It may be if people write proposals to have symposia, and if the success rate is nearly 100 percent, it's useful to know that's a place they can reasonably get that kind of money for these kinds of symposia. It's better to bring this down to the level of individual programs and not the level of individual divisions.

Dr. Lynch said she posted the references so the AC would be aware of what is regularly provided. She said there is a comparable graphic for each directorate, adding that it is aggregated upward.

Dr. González said the information by program is important because when you get that first rejection it helps to know you've had a 70 percent chance of failing as opposed to a 70 percent chance of succeeding. Contacting Program Managers is extremely important. One student who we encouraged to talk to the Program Managers got funded on the first submission because of the conversation. Some of us have been accused, Well, we don't get funded because the minorities and the women are taking all the money. When you get an accusation like that, some of us would like to see the data. Dr. González said he supported a strong statement requesting that this data be provided as it used to be.

Dr. Bamzai said that when she had discussions with Evaluation and Assessment Capability (EAC) from SBE and the Office of General Counsel (OGC), they mentioned it is not a good idea to get fixated about the success rate, because the success a PI will face in a program will depend on what the goals of that particular interdisciplinary effort are. So early career PIs in particular should realize that if it's 30 percent, it doesn't mean that if you applied three times you will get

one. You would probably get 100 percent success, if you interacted with the Program Director and looked at the awards made through that program, which are at the bottom of each program page at NSF.

Dr. Borg said NSF wants to stick to the spirit of, Hey, we've got some interesting research opportunities here, please look at the intellectual issues first. And try to compete for another thing within geosciences because now that Dr. Falkner provided the URL you can look at things very easily. And all you have to do is change the last three to BIO or the Directorate for Engineering (ENG) or Computer and Information Science and Engineering (CISE) and you can see a similar graph for everybody else. You'll find GEO is pretty high. Within GEO there's high competition for facility support. For instance, there's a limited number of ships and they go out on cruises and only one complex project goes out. Competition for resources like that plays into these issues as well. And if you want to have things be meaningful, you have to consider those kinds of drivers for success rates.

Dr. Hodges said the second topic is striving for better procedural consistency across programs. As we become more interdisciplinary, there's going to be more and more opportunities for people who would write proposals that would not go into the same programs that they have always been writing proposals to. If you do that and you're an investigator and you encounter a very different way of proposal evaluation, it can get very confusing very fast. We all know successful proposals must be tuned to the individual program you're submitting a proposal to. If you're used to tuning your proposals to a particular program, suddenly you're going to send something to a new program and they're going to approach the proposal evaluation process in a different way, which could be problematic. It has been suggested, and we could recommend, that the way things are done procedurally within the individual programs be normalized across the directorates.

Dr. Heald said she appreciated the goal behind it and the motivation. But she suggested the different programs are entrenched in their current approaches, so it may not be practical. And from earlier discussions it appears the panels are highly valued in other programs.

Dr. Hodges said he didn't recognize entrenchment as a good argument.

Dr. Kraft said this came up in the COV. It was helpful to hear some of the rationale for why there was within AGS alone certain communities that were entirely ad hoc and some that were leaning more towards panels. There was good rationale for why that was the case in the sense of how easy it was to find reviewers and what the number of applications was in a given period of time. Rather than propose we normalize everything, maybe increase the transparency of why certain choices are made that helps people be better informed as they're applying for a particular program.

Dr. Hodges asked if she meant on the program level.

Dr. Kraft said there needs to be something like: for this program, we tend to use this as our dominant method.

Dr. Hodges said that's a good approach.

Dr. Riser said he agreed in spirit, but it seems difficult to implement. There are historical reasons for these differences. I like panels and like serving on them and when I think of the fact that there are ships you have to allocate, those may be issues that other groups don't have. The panel is involved in that and making those decisions. And the Program Managers are involved in making those decisions. So, I don't see exactly how it ends up getting implemented. And I don't know if this is a point that ought to be in here.

Dr. Robock said he did not agree that change is good. If it isn't broke, don't fix it. The way we do it at AGS without panels works great and I don't see why it has to be the same everywhere. Different communities do it different ways. If you have to spend a lot of time discussing where ships go, maybe a panel does work better.

Dr. Millan agreed. CubeSat typically had panels because there were engineers that needed to be involved. That's a very specific program that has specific review requirements very different from other types of programs. The outcome we want is fair review of proposals and to have the best proposals to be selected. And that may be achieved in different ways with different kinds of programs. But the point about transparency is important. In the solicitation itself, could there be something about how the review process is done? Then it isn't just a Program Director making the decision when they're trying to put the review together, but everybody knows the process ahead of time.

Dr. Mitchum said he was surprised that in some areas the panels are not preferred. My experience when I sat on the panels, he said, was that the mail reviews oftentimes were not helpful. Or there were at best one or two excellent reviews and the panel did an excellent job of getting into the proposals and evaluating the merit. I would be concerned about losing the panels in our case. Maybe a one size fits all the consistency is not such a good idea here. I'm not a big believer in consistency for its own sake. But maybe the issue we're really concerned about is transparency. Maybe this section should be written more towards the point of view of within each office there needs to be a greater transparency about how the process works.

Dr. Hodges said there was a consensus.

Dr. Riser noted that in the OCE COV report last year, significant room was allocated to this topic of fairness of panels and how people in OCE liked the idea. There was a lot of room for the ultimate report of the panel to have more clarity, that the panels didn't often provide a lot of useful feedback about why their proposal was not funded. Whoever wrote the report didn't always do a great job and it didn't communicate a lot of useful information. So maybe the idea is, we don't have to do it the same, but we all have to do whatever we do well and maybe better than we're doing it now.

Dr. Hodges asked for volunteers to rewrite the section. Given comments in the chat, he said it sounds like we're getting an advocacy to modify the section to focus on transparency as opposed to uniformity.

Dr. Cook asked if instead of striving for better procedural consistency across programs the committee will replace consistency with transparency.

Dr. Arnosti volunteered.

Dr. Borg said this conversation has been very interesting as context for what the report looks like at the end. One of the things NSF has been talking about related to this is streamlining processes. One of the things that plagued NSF internally is workload, because the number of proposals has gone way up. And the number of staff have not gone up commensurate with that. And things like changes to deadlines is seen as a workload issue. If we can encourage more proposals that come in to have gone through a more effective gestation period, then we'll see fewer proposals and there'll be better proposals and success rates go up. But some of the workload relates to the degree to which decisions are rationalized. And the tradition has been that there's a good explanation for all awards and declines. But there's some thought about, well, if something's going to be declined, how much time do you spend on it? This relates to the mentoring discussion. When you have especially young investigators who are not funded, who are near the waterline or even kind of far from the waterline, the feedback they get from the proposal process is helpful for their career. So, turning an obvious decline into a checklist exercise would do damage to the community we're trying to nurture. If you're talking about this kind of transparency, is it worth emphasizing what you see as the value of the feedback to proposers, particularly when there are declines, where the PI is going to be faced with the question of whether they revise and resubmit, or whether they turn their attention elsewhere? It wouldn't break my heart if you emphasized the value of solid feedback from the PO about the decision.

Dr. Hodges said the committee should take that into consideration in writing this section.

Dr. Millan said feedback is really important. I have always appreciated when I've written proposals that NSF provided the actual mail-in reviewer comments verbatim so I can see what people thought rather than consolidating those comments to support the given grade. It's important proposers get to see the feedback and not some kind of sanitized version of it.

Dr. Borg said that is an established requirement. If they're not doing that, it's a violation of policy and we need to know about it.

Dr. Millan said it was NASA that does not do that. I've always appreciated that NSF does that because I feel that feedback has always been much more valuable than what I get from a NASA review panel.

Dr. Hodges said every panel that I write proposals to and every panel I served on at NASA in planetary science requires a panel commentary to go back to the proposer. It's a persistent problem that things are done differently in different communities.

Dr. Hodges moved on to discuss the third section, focused on BI. It is a plea for a shared perspective across the spectrum of proposers and panelists, reviewers and Program Officers that there is no one size that fits all. One has to take into consideration there could be many different kinds of BI that are equally impactful for society that are completely different. When BI first

came in, it was an afterthought and over time it's gotten more and more important. It is worth having a statement of how important it is. Is it equal to IM? I think it's worth stating that because when I review proposals, it's kind of like an add-on the end. In other cases, it's a big deal. So, in addition to defining what we mean by it, it's useful to define how important we think it is.

Dr. Lynch said not everyone is evolving at the same rate in terms of how they're viewing, weighting and thinking about BI. I've sat on panels within the last 12 months where proposals, not in GEO, completely lacked a BI section. And the Program Managers said, that's okay. What that tells me is there's clearly not a shared vision for what BI really means. I was somewhat involved in developing language around BI back in the old days. So, this consistency issue is real. And it's internal to the culture of NSF and external in the scientific culture. And we need to make a concerted effort to say what this is. At the same time I am totally alive to the comment that consistency for its own sake is not a good idea. We need to have wiggle room with this. But at the moment, the wiggle room is way too broad.

Dr. Aluwihare said she was recently on a panel for the Graduate Research Fellowship Program (GRFP) and found reviewers aren't really qualified, in many cases, to evaluate BI because many of us are not trained that way. We run into this with our promotion issues; when you go up for tenure, the reviewers are primarily evaluating your research, not your contributions to diversity. If we decide this is important and it makes a difference in terms of ultimate funding decisions, we also have to do a better job training reviewers because I've seen terrible interpretations of what BI are when I'm sitting on a panel.

Dr. Hodges said that is specifically suggested in the document.

Dr. Robock agreed, adding we have to know how much BI counts. The draft says we have to educate both proposal writers and reviewers about BI. But we also have to know how much it counts. What are the instructions to Program Managers? Are they allowed to decide on their own?

Dr. Borg responded that NSF does not prescribe a weighting on BI, nor on cases where there are solicitation-specific review criteria in addition to the two NSB-approved criteria. If they were weighted, it would be NSB weighting that would be put on it. The official guidance for proposers is: Here are the two criteria, write a proposal and tell us how it meets these things. The instructions to reviewers are: Here's a proposal, tell us what you think about this idea in terms of these two things. A PO has discretion to fold into their rationale the importance they place on IM and BI. That should be explained in the rationale, but there's no prescription ahead of time.

Dr. Easterling said NSB has been a big supporter of thinking more broadly about BI. And because of the composition of the board and the pressures felt at NSF from our constituents, particularly Congress, we're being pushed toward putting a face on what is now popularly called translational science. This is a broad term that can account for everything from the so-called movement of fundamental science across the valley of death into the market, to science that is pushing certain areas of basic research forward. We're increasingly seeing a science board that is advising us to think hard about translational science as a kind of transition from the fundamental

curiosity-driven research that is our core strength into a recognizable product that stakeholders to NSF can recognize and value.

Dr. Mitchum agreed with the confusion about rank weightings, adding: Every time I write a review, I say explicitly how I weighed them before I come up with an overall score. But every reviewer has a different way of doing that. As a panelist, I ran into the same problem. It would be nice to have better transparency.

He added that the draft makes the point about doing a better job of letting reviewers know what is acceptable. He has seen as a panelist very poor scores or very high scores. Based on their own interpretation of the BI that was not consistent. So better education of the reviewers and the panelists might be the most important part of the section.

Dr. González said he favored guidance to reviewers and proposal writers about the intent of BI. BI are trying to get scientists and researchers to address some of the priorities of the agency. That may include issues of diversity, but also making our science public. We need to justify our science. The reason the American public is so uneducated about science, is not only a failure to provide that education, but we're failing to communicate to them why what we do is important. BI was trying to address that lack of reaching out to the public and telling them why the hell are you paying for our research? We are driven mostly by taxpayers entitled to know why we do the science we do. We need to provide guidance and enforce the fact that BI must be there.

Dr. Whitlock said that when evaluating the results of prior NSF funding, it's hard to understand whether the goals of the BI part has been met. Instead, you see in a proposal what was accomplished in terms of the science. People promise a lot, and it's not always clear whether there's follow through or any substantive impact of BI. Also, there's a broad institutional difference in what can be accomplished with BI. Some research institutions have programs set up for outreach and engagement. And the PI is plugging and playing into those. They have a real leg up. People from smaller or minority institutions are often just trying to bring an undergraduate into their lab. It's hard to evaluate the merits of those two. There needs to be a lot of discretion in evaluating that. Also, we're putting such emphasis on trying to strive for a more diverse community and that could be called out, maybe at the NSF level, as being something that should be addressed in BI, that PIs should be encouraged to come up with a plan for increasing diversity.

Dr. Hodges said there is wording to that effect elsewhere in the document.

Dr. Whitlock said this would be a good place for it.

Dr. Hodges said he would think about moving it around.

Dr. Aluwihare asked if the points is to make proposal writers think about how their research can be broadly applied. Or is it really making a difference? Do we see increased participation through these individual proposals that are putting in BI? In most cases, I don't see them actually doing what they said, other than maybe having an REU in their lab. There are so many mechanisms now to contribute to broadening participation or transdisciplinary research. Is this

just a way for us to get proposal writers to think about something beyond their research? Or are we expecting some outcome from this?

Dr. Arrowsmith said he worried about too much specification because creativity should be enabled in the sense that certain integrated BI with one project might look better than just gluing another REU onto a project. So, maintaining flexibility is key. I'm also feeling sympathy to POs; transparency is important, but so is allowing colleagues at NSF who are carrying these decisions forward to do their best with the conditions of that decision making. As long as it's documented appropriately, we should allow that. I'd hate to have our committee come in and require too much, not appreciating the subtlety of the challenges. Maybe there can be encouragement to the POs to speak to the importance of their BI. They give their opening speech and say this is important to us. But that should be done more and regularly. Not only are reviewers and many of us poorly trained on this topic, but there's variable interest; some people find it super important and a key motivator for all that we're doing, and others find it a distraction. How to find a common shared view on this topic is a challenge.

Dr. Kraft said our job as a scientific institution is to think about how we move forward and not stay stationary. The argument that BI isn't very important seems like it's sticking with the mentality that scientists should just do their science and not have to worry about the pesky little plebeians that don't understand science. That's put us in the situation we're currently in where people don't understand science and where people reject critical scientific concepts. We need to push BI further than what it's currently stating, so it's not just saying that you're advancing your science, but going to the point in the call for action, of how this project will specifically address pushing boundaries and helping support underrepresented communities. We need to think about how BI actually have a broader impact.

Dr. Hodges agreed, but said we've got to take into consideration something that came originally from the NSB. Why we have broader impacts is more about trying to demonstrate the societal value of what NSF funds, as opposed to actually improving some of the things we are excited about. We don't have the authority, nor does GEO, to redefine BI. That's all about the NSB and how the very top levels of NSF interpret what the NSB says. NSF just took what the NSB suggested, or demanded, and went from there. We have to be careful what we recommend and how we redefine things.

He added that he sees proposals and BI that have an educational component often with no attempt to evaluate the success of that education experiment. As scientists, we should not be accepting of that. Something that says, I'm going to do this and that educationally makes me feel all warm and fuzzy inside. But reading further, they're going to do it and assume it's going to have a positive impact. It should be very complicated to adequately evaluate these BI. I agree that informing and educating reviewers about how to approach that problem is a good idea.

Dr. Pomponi referred to a comment in the chat from Dr. White and the discussion yesterday regarding diversity and inclusion. Although it is not possible to make a recommendation about changing the instructions to the reviewers, it's something worth discussing. Acknowledging that NSF is serious about diversity and inclusion should not be a specific question to ask of the reviewers. I don't know how to put this in our report and recommendations since it needs to be

elevated at a higher level, but if we're serious about diversity and inclusion, we need to be specifically asking that question.

Dr. White said we keep having this same BI discussion. No matter what meeting I'm in, it's almost like we're willing to give people excuses for not getting BI, which is frustrating because there are so many guides and resources and examples of great BI. But it's almost as if we allow PIs to throw up their hands and say, we're not good at it and allow them to not emphasize it as well as they should.

But on a positive note and connected to the calls for action, and the recommendations around reengaging in diversity, perhaps we can make a strong statement that in light of the times, BI are a terrific way to reengage in issues of diversity and seek more creative approaches —maybe a statement that will motivate people to see a way to make a difference and think about your projects differently if you're really committed to issues of diversity and inclusion, maybe that is the first step.

Dr. Hodges asked if Dr. White would volunteer to craft an addendum to this section.

Dr. Millan agreed, adding that she didn't think there's necessarily a need to rewrite. There's a lot of that the way the BI are written. There are a lot of creative things people can do. Unless you convince the community that this is actually going to be weighted in the proposal review. People are trying to meet deadlines and they're going to put their effort where they think it's going to help them win. People don't think it's weighted heavily. Even if they care about it, it's not going to be the top priority when they're getting their proposal done.

Dr. Hodges agreed. He said, I think there's no problem with putting in that we think BI should be weighted significantly in funding decisions. That's the very least we could do without specifying the exact weighting. It may be that we can't specify the exact weighting and shouldn't. But we could say in this section that the Program Managers should be clear about how they weight these in the decision-making process in the mission statement.

Dr. Millan said that unless people know that's being done, they're not going to change their behaviors. So, it should be communicated to the community at large. And she supported Dr. White's idea. A lot of people care about these issues, so reinforce to them that it's worth putting your time into it and it will count for something. If you feel that's not being weighted equally, there's a tendency for people, even if they care about it, to not put the time in.

Dr. White said she would help get it started.

Dr. Hodges moved to the next section in the draft, ensuring the diversity of review panels, which he said was a way for GEO to create diversity in the review panels and lead by example.

Dr. Robock asked if there are enough people available to do all the work. If there aren't enough people, they can't be on the panels, he said.

Dr. Lynch said that is a point worth considering.

Dr. Kraft said it's worth stating that this is not to increase undue burden on our colleagues of color. But maybe there's a process of asking and then saying we recognize we might be asking too much, providing an opportunity to say no gracefully without necessarily feeling pressure to have to say yes. That provides avenues for people to also identify who they see as allies, if they're not comfortable or they don't have the time to put forward. She also raised the issue of pronoun preference.

Dr. Hodges said we can take that out. He added that you don't want review panels that are all old, white males. You want review panels that include young investigators but also older investigators, because that's the only way to get this balance of perception. If you want to eliminate bias against young investigators, then it's not a bad idea to have young investigators on the panel. At the same time, you don't want the argument that only young investigators should be funded because only young investigators are on the panels. Getting a representative group is not just a matter of the issues of diversity that we talked about in here in general. It depends on your seniority.

Dr. Riser said he agreed with the pronoun preference comment. He also suggested alternative wording for "white and non-white."

Dr. Hodges suggested using the words "racial diversity."

Dr. Millan said there was language in the original section about allies that can be used.

In response to a question about timing, Dr. Hodges said he wanted to get the report done before the end of the calendar year.

Report on NASEM Earth System Science Study

Dr. Easterling said the concept of Earth System Science has been around for decades. But over the past few years we've been seeing a reemergence of System Science in many forms. We felt having guidance from the community about how best to engage NSF in the promotion of our systems research would be extremely helpful, particularly in bringing in all the vested interests that should be in a holistic Earth system program here at NSF as part of the focus of the study. That is why we went to the Academy and asked for help from the community to make that statement.

Dr. DeFries said the study is focused on the strategy for NSF and presented a five-point statement of task:

1. Describe the potential value and key characteristics of a robust, integrated approach for studying the Earth system.
2. Discuss emerging opportunities and barriers to progress for achieving this vision, including consideration of the interdependencies and synergies among all components.
3. Identify potential synergistic opportunities within current facilities, infrastructure, and coordinating mechanisms to address the overarching capabilities, and recommend ways to leverage these efforts for Earth systems research.

4. Discuss computational, data and analytic support for Earth systems research, including guidance on harnessing existing, planned, and future NSF-supported cyberinfrastructure.
5. Discuss workforce development to support the personnel needed to advance Earth systems research. This could include undergraduate and graduate education, technical training to support facilities and infrastructure and increasing diversity and inclusion in the future workforce.

Dr. DeFries emphasized that the committee is focusing on Earth systems across the NSF directorates. GEO, BIO, ENG, CISE, EHR and SBE are participating in the study.

Dr. Easterling said the represented directorates went as a team to have an opening round of discussions with the Academy and spoke as one voice. It is important that the AC/GEO sees this as a cross-NSF initiative. GEO is the lead, but it is not geocentric.

Dr. DeFries discussed the committee composition:

Ruth DeFries, Columbia, Co-Chair
George Hornberger, Vanderbilt, Co-Chair
Asmeret Asefaw Berhe, UC Merced
Claudia Benitez-Nelson, South Carolina
Melissa Burt, Colorado State
James Elser, Montana
Courtney Flint, Utah State
Royce Francis, George Washington
Inez Fung, UC Berkeley
William Gropp, Illinois Urbana-Champaign
Melissa Kenney, Minnesota
Jerry Mitrovica, Harvard
Constantine Samaras, Carnegie Mellon
Kristen St. John, James Madison
Fiamma Straneo, Scripps
Duane Waliser, JPL/Caltech

She said her background is ecology and physical geography and she identifies as an Earth system scientist and has moved into linking up socio-ecological systems.

Dr. Hornberger said it is a diverse committee, with people who relate to all the included NSF directorates. Members are learning to communicate effectively with one another. We've made a lot of progress, however, and I think we'll get there. He said he is a hydrologist and now directs Vanderbilt's Institute for Energy and Environment. He thinks of himself a social scientist trainee. The committee has a lot of interdisciplinary and Earth system expertise.

Dr. Hornberger presented a timeline, which calls for external peer review in April to May of 2021, report release in June to July, with dissemination occurring from July 2021 to February 2022. The committee is currently designing workshops to solicit input from the community.

They are scheduled for November through January. He also discussed the study's use of a questionnaire.

Dr. Lynch noted that she is one of two U.S. members on the SAP for the World Meteorological Organization (WMO), which has a similar timeline. It is focused on the fluid envelope and has less to do with the solid Earth but includes the human component. She asked if there's a particular conduit whereby she could find out what the Academy study is prioritizing so we can make sure we're aligned.

Dr. DeFries said the study committee members are just starting to understand each other, but that it would be an excellent conversation to have with her.

Dr. Hornberger noted limits on what the committee can discuss.

Dr. Lynch said she understood, adding the process of peer review is robust and the WMO white paper process less so. She mentioned having a reality check and being aware of when you are ready to talk.

Dr. Hodges said he has been pushing his colleagues to go to the panel website and make suggestions to the committee. There's been enthusiasm for the members of the committee, but not for the breadth of the membership. Dr. Hodges read a comment he received from a colleague: "This is a very climate heavy committee. It is not a committee with integrated whole Earth system expertise." How do you understand a system without thinking about the evolution of that system to get it where it is now? And it's not clear the membership provides the expertise necessary. As soon as you start a study like this, the only way for people to get a sense of where it might go is to look at the committee membership. And when they see, other than Jerry Mitrovica, nobody who does solid Earth science, below the critical zone, then people get antsy about where the committee is going to go with its recommendation. The letter writer he quoted also wrote: "It's very odd and unsettling that the committee appears to have the notion that Earth System Science excludes the vast majority of the system and its history." Dr. Hodges said the Academy should be aware that sentiment is out there, adding, I don't know what can be done about it at this point.

Dr. DeFries said we are very aware of that and that Dr. Mitrovica is a big voice on the committee.

Dr. Hodges said the argument could be made that Dr. Mitrovica is not necessarily representative of most people who think about the history of Earth over billions of years.

Dr. Hornberger said it's not a surprising comment. With any such committee there will be a variety of people who want to see exactly who they think should be on. It's always a balancing act. Once you get a committee that's too large, it becomes difficult to work. We are working to both solicit information through our questionnaire and to have people at workshops. So, it's not only expertise on the committee, but expertise that we bring in by listening to people and having them participate in workshops and provide us information. The committee composition was thought about long and hard by the Academies. It wasn't without some give and take. Hopefully,

we will be able to reflect the true Earth history orientation. There are many of us who at least appreciate that orientation, even if we're not card-carrying members of the fraternity.

Dr. Hodges said he trusted they will do the best they can. He added it was important there be the expertise on the committee to write that section. He raised the question of whether there's an opportunity to expand the membership.

Dr. Pomponi said the committee has the ability to request an additional member be added, if you feel that there's a gap in the expertise. In the end, this will be a consensus report of the committee, not necessarily of all the people who submitted questionnaires or made presentations.

Ms. Everett confirmed that if the committee is lacking in an important member, we can add someone, but it's unusual to do so when the committee has met several times. But we want to ensure we appropriately reflect the community without having a committee that is overly large and unable to come to consensus. Also, we have a staff team involved that is much larger than any other project I've been involved in. And that includes access to the expertise of the various boards from across divisions. And the board members themselves have taken an interest in this study.

Dr. Pomponi asked if the Academies is considering bringing on additional member for the study.

Ms Everett said we can certainly raise it with the committee and with the leadership at the Academies. It's not off the table. She said she will take the concerns raised here to the full committee and to the leadership of the Academies.

Dr. Easterling said the Program Officer of record for this study here at NSF is Dr. Major, from Ocean Sciences and Dr. Bamzai has served as the approving division director of record for the charter of the study with the Academy. It might be appropriate to hear from both of them.

Dr. Bamzai said there have been monthly telecoms with Ms. Everett, providing information she might need to carry back to the committee.

Dr. Major added that she is very conscious of making sure the committee is able to act independently. Through the workshops, they will continue to invite input from the community and AC/GEO is an important part of the community. Also, there are a number of other directorates involved. So, there's an incredibly diverse group of people who need to be represented within just 16 people. So, it was a tough call creating the committee. However, if there are strong feelings about the composition, now is the time to do it.

Dr. Bamzai added that the study is being done in the hub and spokes model. For example, when the Academy asked for community input, we shared amongst our listservs all across GEO but that information was also shared by other parts of NSF in the science directorates.

Dr. Hodges said that was important and he was glad for the efforts that have been done already, adding that the study was off to a good start. He said AC/GEO looks forward to hearing more how things are going over the next few months.

Ms. Lane read a question from the audience: Will the study be soliciting community input, in addition to the questionnaire and workshops; for example, white papers, AGU and Town Halls?

Dr. Hornberger responded that the committee is still exploring options. It has not talked about commissioning white papers yet. But these are conversations that are ongoing. We want to figure out how we can best reach out to organizations like AGU—but not exclusively AGU, because this is a very broad study that goes well beyond the geosciences. They will be soliciting community input; they are just coming up with a plan now.

Ms. Everett added that many of the workshops in development are exploring opportunities to solicit written input from participants as well. And we're exploring the possibility of having prerecorded presentations and other ways to interact with people, understanding we're in a time when things are more difficult than normal. There may be multiple ways we can solicit input. She said she takes the suggestion seriously and everyone will be kept updated as these methods are explored.

Preparation for Meeting with NSF Director and Chief Operating Officer

The committee developed a list of questions it would pose to the NSF Director.

Meeting with NSF Director and Chief Operating Officer

After AC members introduced themselves, Dr. Panchanathan began his presentation by saying he had a familiarity with agency from two perspectives. He had been a member of the National Science Board for six years and as someone who received NSF funding. He had great admiration and gratitude for NSF, which built his research career. He said the recently announced Nobel Prize winners in Physics, Chemistry and economics were all supported by NSF several times. NSF empowers and manifests that talent in unimaginable creative ways. NSF is an exemplar of curiosity-driven, discovery-based research. That is who we will always be and the unique mission of this agency. He said he is going to try and reinforce that this is the foundational platform of NSF.

Since coming to NSF, he said he has done several layers of peeling the onion. I've done at least four levels of going deeper and deeper, understanding the programmatic levels, the division levels, the directorate levels, and at pan-agency levels of activity. He added that he is about to conclude his all-hands meeting. He is meeting with everyone as a team in each of the directorate offices and has had many meetings with the Assistant Director, deputy division directors and others. The agency runs in wonderful, efficient, creative and innovative ways and it is an exemplar for many agencies. He has also talked with agency heads at NASA, the Department of Defense (DOD), the Defense Advanced Research Projects Agency (DARPA) and The National Institute of Standards and Technology (NIST). He said partnership is a very important imperative to advance NSF's future.

Moving into the future, the terms that come to me are strengthening at speed and scale. That's what we need to do more of. The nation deserves and needs that scaling and speeding up of progress and strengthening of progress, which is required in this unique moment we are in.

He said promoting the progress of science is the hallmark of what we do. And this vision and mission is something that has stood the test of time and will stand the test of time as we move into the future because it is who we are.

When he testified to the Senate Commerce Committee last October, they asked me to speak about research and innovation and how to strengthen it to keep the United States in the vanguard of global competitiveness. He framed the answer, he said, through the three pillars.

The first pillar is advancing the frontiers of research into the future. Second, how do we ensure inclusivity and accessibility as we are embarking on these new futures. This pillar is exceedingly important to me personally, he said, adding that he has firsthand knowledge of bringing in talent from across the socioeconomic demographic; the geographical diversity of the nation can only augment, enrich, empower and therefore achieve unbelievable outcomes. As a nation we're already doing some of that and some at NSF through various programs. But we need to do a lot more at speed and scale.

As we look into the future, I see new conceptualizations. I have found that positioning the curiosity-driven research as a bedrock and then building initiatives around that also, like the current COVID-19 pandemic, has provided some opportunities to do something that addresses this challenge. Also bringing together the unbelievable work that has happened in the past decades towards solving the problem of today and launching things that can then solve the problems of tomorrow.

The AI institute that we launched should involve every state in terms of its potential to participate in this AI revolution. But AI is just one example. Another is Earth System Science. That should connect to every part of this great nation. Not that all of them will be symmetrical in the sense of how they participate. In some states, it could be empowering the K to 12 talent. In some states, it could be the community college talent. In some places it could be research university talent, in some places it will be how we work with the community. In some places, it will be how we partner with the State and industry and others. It could be a variety of modalities. But with a focus on ensuring that we bring the talent out across the nation. Likewise, the National Quantum Initiative. We need to have a national platform that is agnostic to where talent is and where ideas are coming from, that are able to connect and express that talent closer to home. In GEO, how might we take the unbelievable work of the GEO Directorate and bring it to life in new forms of conceptualization that further advance all aspects of GEO. One of those manifestations clearly is a system science and what is called resilience. We need to have this conceptualization of resilience. How might we build those resilient futures? And how might that challenge the curiosity-driven research to express itself in the highest intensity and the highest scale possible?

Likewise, learning everywhere. This is a moment that has shown that learning can happen anywhere. Yes, there are challenges. Yes, learning outcomes are still not necessarily homogenous. But that itself is an opportunity for us to do better, more at speed. And that also points out to us that no matter where you are in this great nation, that you will have the opportunity to have the learning possibilities. And that could therefore meet this objective that you're trying to set forth here. And you will see what I call it, that talent can be accessed and

nurtured, talent can be inspired, talent can be motivated, talent can be brought to life. And in doing all of this, that is the foundational element of partnership. In securing global leadership, clearly, GEO has a big role to play. The facilities that have been inspired by the work in GEO is causing us to be a partner, a leader and a significant force in terms of global scientific progress.

When I talk about securing global leadership as a third pillar, I'm not talking about one leader and other followers. America leads by its scientific values, its scientific rigor and scientific aspirations. And most importantly, we hold to our values of openness, transparency and reciprocity and value and model research integrity — all of that at the same time. And that set of values and aspirations and the process by which we pursue science and progress is something that we share with a number of nations across the globe. I've talked to a lot of international science leaders and one of the great things about working in this remote mode is I've probably done six to seven times the number of meetings I would have done if I was physically in my office. It gives me complete freedom to be able to build relationships and partnerships across the globe and across our nation.

These three pillars are the foundational aspect of this partnership. Partnership, partnership partnership. The GEO Directorate knows this very well. They already partner with the other directorates within the agency. And if you talk about the exemplar of interagency partnerships, GEO demonstrates that interagency partnerships can be at full scale and full force because of this welcoming nature and the connection to the scientific spirit with everything that happens in NASA or whatever the agency might be. Partnership with foundations, partnership with industry, partnership with states, partnership with cities, partnership with K-12, partnership with community colleges, partnership with international entities. When I talk about partnerships, its partnership in its full force, unleashing every possible avenue by which we can leverage partnerships for scientific progress, as well as be leveraged by scientific partnerships. And then when we do all of these things, we will always have the spirit of innovation that permeates everything we do inside the agency and challenge ourselves to be a lot more innovative. And through that, unleashed innovation across the nation.

That's in a succinct form my vision for NSF as we move into the future, strengthening at speed and scale. This is clearly a defining moment because we are at a point, not only because of COVID-19, we are at a point in terms of global competition which is as intense as it has ever been. But since when has global competition done anything other than bring out the best in us, made us perform even better than we would in the normal course of what we do. So global competition is now motivating us and driving us to higher levels of excellence. At the same time, we cannot and should not leave the missing millions of talent across this great nation.

So, if you are going to have to connect every bit of talent across this nation, the missing millions need to be brought to life. I've walked the halls of Congress to talk to many, many lawmakers as well as staffers. I found uniform excitement, enthusiasm and support for science and what science can do for prosperity, economically and societally. This is a unique moment and therefore we should take full advantage to see how we might capitalize it.

We need megatons of rocket propellant so that we can fly at speed and scale. Domestic talent needs to be unleashed in full force and global talent shall not be substituted to domestic talent but

has got to be augmented to domestic talent. We need both domestic talent at full force and global talent full force, all coming together to be able to make tremendous progress as we move into the future. It is not one versus the other. It is one and the other.

And last but not the least, translation. Translation is all that we do that creates impact that then comes and challenges back. It is not that basic science inspires translational science, translational science and activities influence and inspire basic research. I can tell you from my own personal research, many of my translational activities have made me ask very fundamental questions in computer science, which I would have never asked. But for the engagement in translational research. I'm not suggesting everyone and everything is that way. I'm saying there is light literally at the end of the tunnel, if you want to look at the end of the tunnel. It is not the end of the tunnel. But it really motivates you and challenges you to do better and even stronger curiosity-driven research sometimes.

As I'm thinking about all of this, I also ask the question, what are those threads that we need to have in this agency? We should think that innovative mindsets permeate everything. How do we process information? We bring data and analytics into everything that we do inside the agency and outside the agency. I heard that you were all interested to see how we might provide success rates at the program level. Why not? That's because we will have data and analytics at every level sliced and diced so that people might look at dashboards and be able to draw conclusions. It can be at so many levels of granularity. That's how we should keep ourselves accountable. How we process information is through data and analytics. How do we make decisions? Data analytics. How do we hold ourselves accountable? Data analytics. How do we engage? Through the global leadership mindset, openness, transparency, reciprocity, integrity. How do we equip? This is very, very close to GEO, that we are not just talking about the infrastructure of today, or even the next five years. We are planning for the infrastructure of the next decade and the decades to follow and challenging the agency and our leadership and the National Science Board in partnership to see how we might plan for the infrastructure of the future. So that future Nobel laureates are inspired by our thinking for the infrastructure of the future. And as we are thinking about this, strategic planning is not a once in two-year or once in three-year exercise, or a written piece of paper. Strategic planning is how we evolve every day. In this agency you're talking constantly in terms of how we evolve strategically and configure better. At the end of the day, it is by the people, of the people, for the people inside the agency and what the agency makes possible across the nation. And I'm so grateful to the agency, how they stood up and delivered and are delivering in this complex work environment; they are doing amazing work. I would argue that they are doing better than even before. That's because of the commitment. That's because of the excitement. That's because of the belief in advancing science and scientific progress.

Finally, how do we communicate? There is no substitute for communication and outreach that can communicate the excitement of science, the importance of science, the impact of science. I'm going to be out there talking to people about the excitement of what NSF is and what NSF makes happen, what NSF has done, what NSF is doing, what NSF is capable of doing, and how it is important to make sure that people understand at all levels. We need to communicate so that we might get the excitement of science and spread it across the populace of this great nation so

that we might have that excitement turn into opportunities for further discoveries and further advancement of the scientific spirit.

I cannot express my gratitude for your service more. I know how much your advice, your engagement, your criticisms, which I value enormously, your inputs, all of that is what has made NSF and GEO rich and performing better. And I expect that for the future. Also, Advisory Committees are vital to the success of NSF and the programs and you are a critical connection to the scientific community. I know that you had in your agenda a session on the impact of COVID-19 on academic research. It's very important for us to understand the concerns of the community under the challenging circumstances at hand. I encourage you to use this body as one way to relay concerns and also inform NSF actions. Your work on the 21st Century geosciences report to update your 2014 report is especially timely now. As you saw from my vision, revolving around the three pillars, engaging more Americans in science across the social, economic and geographic spectrum, maintaining global leadership in science, and advancing the frontiers of research in the future, your report will be an essential component in realizing this vision. The study of Earth System Science that NSF has commissioned will be another critical input in realizing the vision of NSF, the integration of research facilities, computation, and workforce development, and the emerging barriers and opportunities for progress are key factors in ensuring the health and growth of the research enterprise. I also see that you're reviewing a committee of visitor report for atmospheric and geospatial sciences. As you're very well know, COVs are critical for ensuring rigor in our merit review process. So again, I express my gratitude for carrying through that important responsibility. Please be aware that as a past member of NSB, and seeing what NSB is doing today, they are engaged in reviewing the broader impacts criteria next implementation. So, the results of their work will be a factor in future COV reviews also. Thank you. Thank you. Thank you for your time, your attention and effort this week. The NSF mission remains vital to our nation and I ask your help in achieving that vision.

Discussion

Dr. Arnosti asked about work across borders in light of COVID-19. He said there are numerous problems getting research expeditions launched and getting some students from other countries into the U.S. and sending students abroad to work with collaborators. He asked if NSF doing anything at a higher level to help overcome these problems.

Dr. Panchanathan discussed working with the Office of Science and Technology Policy (OSTP) and the State Department and others to see what can be done to make as much of the accommodations possible. We will not leave anything unturned to ensure the flexibilities are given to be able to pursue the progress of science, he said. In spite of these difficulties, we have people finally being able to go to Antarctica.

Dr. Borg said that in both polar regions there has been a lot of active work to ensure that our operational support for research can go on in a reasonable way. But these are unprecedented challenges and we have not overcome everything. I'm delighted to hear there's active discussions with the Department of State about looking for solutions that can ease this down the line.

Dr. Robock said there's been a proposal for a National Science and Technology Foundation and to expand the budget. And as I understand it, you're going to maintain all the science, but it will be on top of that. And our report talks about how important what we do in GEO is to the nation. How can we low level people help to get support for NSF and for the science that we do?

Dr. Panchanathan said we're all peers and colleagues in the same fight. We get the best science and the best scientific ideas realized as fast as possible. I cannot comment on the pending legislation you're referring to. But the concept of that legislation points to another similar registration point exciting from the point of view of our own future vision. How might we take the curiosity-driven bedrock of NSF, scale it and strengthen it, and speed up progress. So that is a fundamental notion embedded in that thinking and, in my conversations, I'm communicating that NSF is ready. NSF is already doing great things. And NSF will be able to achieve even greater things. NSF is in a great shape. And I'm showing that you can do great things and achieve the outcomes. We can do bigger and better things. But the point that you raised about curiosity-driven research, clearly you cannot get translational science outcomes unless there is significant investment in the fundamental curiosity-driven research. And it cannot be time bound. It cannot be do things today, for tomorrow. It's got to be very thoughtful investments. I keep reminding people, the AI of today is possible, because of four decades of investment in the whole discipline of computer science and engineering. If you're looking for the industries of the future, that's what NSF is engaged in today. And that's what curiosity-driven research is all about. These are augmentative and additive, not subtractive.

Dr. White said the AC hopes NSF awardees will be more intentional in their BI plans, particularly as it relates to the inclusion and participation of communities underrepresented in GEO. She asked if there are strategies he would recommend to better communicate and assess the commitment to BI?

Dr. Panchanathan said he dreams of a time this will be something we can get done to catalyze the process where universities have a BI mission. And that BI mission is what people are contributing to through the BI activities of the individual projects. The intensity, magnitude and scale of what we do is much larger than what a single project can do in their BI conceptualizations. We need the scale and the framework. And the framework is not with one person being as entrepreneurial as they are doing their part, as important as it is. But imagine that there is a BI framework built in universities. How do we partner with HBCUs and lift the HBCU talent? How do we partner with Hispanic Serving Institutions (HSI) and lift the talent? How do we partner with tribal colleges, universities and lift that talent? How do we partner with K-12? How do we partner with community colleges? Let us say these BI and more are platforms that if I am writing a proposal to NSF, I am plugging into this in my university and therefore I'm going to contribute to the BI mission and then be held accountable for it. Okay, so this is the partnership mindset. I've just given you one idea by which I think we can have at speed at scale and impact. So, we are thinking through ideas. We are doing a lot of listening sessions. We had two excellent panels and said: What can we do better? One of the first things I did when I came into the agency is launch the Racial Equity Task Force. The question I asked is: What are the barriers? Let's see how we can address them in a precise way. I hope that through listening from the community, we will do even better. And that's why groups like yours are exceedingly vital.

Your ideas, your understanding of the ground level issues is exceedingly important as you're thinking about framing solutions or catalyzing the framing of solutions through our investments.

Dr. Cook asked about continuity of funding through the pandemic for graduate students, postdocs, and research staff. He asked if there is any specific effort to provide bridge funding at the foundation level.

Dr. Panchanathan said we are thinking about this every day to see what we might do to help support them more in order that they will have the transition pathway to academic jobs of the future and the ability to finish their programs. We will try to see what we can do better.

Dr. Borg added that there's been a lot of discussion about this, including a cross agency committee looking at recovery possibilities. There's a lot of ideas, in case we have a supplemental appropriation. The best idea we have now is that Program Officers are best positioned to consider the needs of each individual project and PI. We want to get the word out and have to do a little bit better job of this. Students and postdocs who depend on continuing support for technicians need to talk to Program Officers, because we have the mechanisms in place to do supplemental funding. We can best deal with those on a case-by-case basis.

By policy, we limit programs to only committing up to about 60 percent. This means there's about a third of typical program funding available for new commitments. And in terms of making tradeoffs between needs, in terms of supplementing for existing grants versus investments in new awards, we believe the person best positioned to make those judgments in dialogues with PIs is the Program Officer corps, supported by their section heads and division directors.

Dr. Panchanathan added that solutions are at the ground level, that we are trying to not have macro solutions, one size fits all. But instead, let's engage with each project and keep each problem as that problem and how we might solve it. And so, Program Officers are doing their best across the agency engaging with every situation on a case-by-case basis. As you can appreciate, this is a systemic problem. It just is not limited to NSF, it's across all the agencies. In fact, OSTP got the extension from July to September and they will be working with OMB. That's what they did to help us in terms of providing flexibility until the end of September. So, these kinds of systemic things are being handled across multiple agencies. Also, entities like the Association of Public and Land-Grant Universities (APLU) are now making the case. Some of those support activities are indicating that resources need to be provided for addressing this unfortunate situation and what additional costs that incurs. And this is a multi-pronged solution approach. It's so complex, that it's happening at all these levels. So, you can rest assured we are cognizant and empathize; we are all researchers. We're working to the best of our ability under the under the guidance that we have.

Dr. Easterling stressed the importance of the creativity of the Program Officers. They know how best to preserve resources and allocate them to ensure their programs continue to thrive even under these circumstances.

Dr. Panchanathan said funding is always a challenge. We recognize that and that's why I was talking about it outside of the agency efforts to see how that might also come to assist us. And we are doing everything to communicate the importance by drawing attention to the problem. And the importance of this, for national progress, for American competitiveness. And these terms are exceedingly important because they resonate much more than just the science. I'm trying to contextualize it as about American competitiveness. This is about American resilience. This is about American opportunity.

Dr. Aluwihare asked about restructuring up funding among directorates. For example, keeping one area constant versus decreasing another to honor, for example, OMB priorities. So, you mentioned AI and quantum computing as examples, relative to priorities communicated to you by the scientific community supported by NSF.

Dr. Panchanathan said he is not a believer in a fixed pie, or a zero-sum game. I don't operate that way, as a leader. I believe that leading with ideas and impact, we can expand the pie. And that should be the job of the Director and the other leadership of the agency, with the scientific community all working together. We are not marginalizing any priority for the other. What we are trying to do is to see how we can communicate that NSF has impact that people can see that the investments can start to then grow. How do we build advocates saying, we need to support more. Expansion of the budget makes everything possible at a much higher level. And framing it in ways that can excite people. American resilience, Earth System Science and what it means for humanity and society, using the terms that excite people. GEO can participate in the missing millions being unleashed because of the inspiration that GEO programs can provide for a fifth grader getting excited about Antarctica and what our data can do. What might we do to excite people through the unbelievable ideas and progress and the excitement of GEO? That is the strategy that we are going to be pursuing. We need to move forward because I want to bring the full power of Earth System Science, the GEO community's full potential and power at scale and speed.

Dr. Kraft expressed concern about the recent directive from the White House that's banning discussion of white privilege and critical race theory, or any other training. She asked how NSF is responding to the White House directive in terms of, particularly, implicit bias training, but other policies that work to support efforts to diversify STEM.

Dr. Panchanathan said that if you read the OMB memo carefully, it does not call for stopping training. It talks about training, in terms of the inclusivity that we need in the scientific enterprise or any enterprise for that matter. So, we are not stopping training. NSF is leading by example. You've got an unbelievable Office of Diversity and Inclusion led by an amazing person. Our training is in keeping with making sure that you're following the guidelines of the OMB memo clearly and carefully and ensuring our training continues. We are all committed to ensuring inclusivity and the broad talent that exists across the nation being empowered, enriched and unleashed.

Dr. Stone added that NSF is reviewing the executive order on race and sex stereotyping. And we're going to comply with it. We are working on a report to OMB. Part of it was a reporting requirement. And that's due the end of November. So, we're still in the process of working

through everything and, if necessary, will provide updated guidance. But we're still in the reviewing phase right now

Dr. Panchanathan said, in closing, to keep the ideas coming. This will be an ongoing conversation and please tell me if I'm not doing something that you think is contributing in a positive way. Write me an email; I read all emails and respond to them.

Division Subcommittee Report Outs; AGS, OCE, EAR

Dr. Heald, representing AGS, highlighted two subcommittee conversations. One was around access to more funding statistics at the program level. There was interest to have more information at a higher level. Also, the subcommittee was briefed on the impact of COVID-19 on field campaigns in AGS. All the campaigns and most deployments have been deferred out by a year. Some of the campaigns that have been pushed out have start dates in the spring, next year. So, there's some other issues on the horizon for that.

Dr. Bamzai said staff expressed their opinion on the fact that the staff meeting was only 60 minutes and she asked if there can be periodic calls to share more about challenges and opportunities. She also noted the recent announcement that two women received the Nobel Prize in Chemistry and the news of the death of Nobel laureate Mario Molina, the first Mexican-born scientist to receive the Nobel Prize in Chemistry. He was pivotal in the discovery of the Antarctic ozone hole.

She also discussed three new hires, new assignments, virtual onboarding for new hires and thanked the AGS team for their work facing COVID-related challenges. The budget closeout was done in a smooth and timely manner. Also, there was a Webinar with the AGS community to inform them we were 100 percent teleworking and had Grants and Agreements attend to field questions from PIs. We continue to grapple with issues related to the loss of the field season and staff have been doing outreach at large events. The REU sites are also facing unique challenges and are being sorted out on a case-by-case basis.

Dr. Quinn presented the OCE subcommittee report. The subcommittee discussed biological oceanography going to no deadlines and it received presentations about the rationale and justification. He discussed a number of Town Halls, the OCE COV report, the NSF OCE post-doctoral fellowship program and COVID-19 impacts on OCE programs, including on the academic research enterprise, graduate student interruptions, furloughs and hiring freezes.

For the OCE COV response he listed:

- Prioritize for the first year; assemble working group; section retreats
- Diversity, equity and inclusion
- Eliminate deadlines
- Strategic planning
- Portfolio balance
- Reviewer training (already done for panelists; include reviewers)

Under the heading of the Postdoctoral Fellowship Program, he listed:

- New solicitation will be out this fall

- Goal is to get broad participation within OCE
- About 15 awards planned

And under COVID-19 impacts, he listed:

- University-National Oceanographic Laboratory System (UNOLS) ships into port; safety steps taken; began sailing in July
- Graduate students, early career scientists impacted
- Some kind of bridge funding is needed. Where will it come from? [This is a big problem, larger than PO alone can remedy]
- How much funding is required? Response must be fair and just.

He also discussed the question of OCE participation in the UN Ocean Decade. A meeting is scheduled in October.

Dr. González made the EAR presentation. He said there will be a new director and not an acting director. The subcommittee talked about the impact of COVID-19 and the need for additional funding to keep students, researchers and staff afloat. The subcommittee also talked about the possibility of engaging with universities to come up with innovative solutions, though universities are being hit hard with the lack of student revenues, so it's going to be difficult for them to assist their scientists.

He added that work is beginning on the recommendations for the Earth in Time report. Also, the subcommittee received a report about resources, implementation and other facilities. We're making sure that the program engages with other divisions to get a fair share of contributions across the board, he said.

Dr. Smith-Nufio continued the EAR presentation, speaking about the new division director and noting that a series of people have rotated out of the program and a new group has rotated in. Some of the team scheduled to rotate out has stayed on to help with the transition during COVID-19. Several rotators stayed on in a more limited capacity to help. There will also be a new permanent geo-informatics PO coming in near the end of the year. And the COV will be in the spring.

Dr. González added that a meeting with the staff and Program Managers will hopefully be held before the end of the year to get acquainted.

Discussion

Dr. Fuentes said the AGS Subcommittee discussed the idea of reporting the success rates of proposals and hopes to learn more about that idea. He asked whether GEO is monitoring the success of the proposals submitted and if GEO is monitoring the number of proposals submitted by colleagues from minority serving institutions. Also, are those proposals to be in tabulated as to what their success rate is? In the past, we discussed this idea with the previous leaders of GEO, and they promised to follow up on this.

Dr. Borg said he didn't know about the prior promises. He said he would look into it and follow up. He added that COVs are entitled to see all of this material. Because it's a subcommittee, it is

a closed meeting. But we can share a lot of these things in closed ways. And it should be accurate for minority serving institutions. That doesn't get into individual privacy. We've gotten into a practice of doing self-assessments prior to COVs and we can make this a regular part of the self-assessment.

He also raised concerns that members may hear from the community about instances where our merit review process may not work well, or when there are questions regarding minority serving institution success rates. These can be discussed as questions that should be analyzed as part of a COV. NSF has a COV process that includes a standard set of questions to be examined. But because the COVs are subcommittees of this committee, this committee can tell the subcommittee: We see what NSF is looking at and we want you to look at these questions and we want you to seek data for this and examine it on our behalf. That option is not exercised as much across the foundation as it might be. We can begin thinking about questions and asking that they be specifically folded into the COV.

Dr. Kraft said that would be helpful. The questions that are given are template questions. If there were specific directives that came from the Advisory Committee, that would help explain why you have a representative from the Advisory Committee on the COV. The turnover within the Advisory Committee is such that those who are Program Directors have a better sense of the conversations that happen over time. So, it's a great idea. It should be something that starts within one Advisory Committee and moves on and becomes part of the ongoing discussion.

Dr. Hodges said the AC should definitely give some thought to being more proactive on how these COV visits are conducted and what sort of things they try to get information about.

Dr. Kraft discussed other ACs following suit, so if there's common questions, it is raised to a level of something many ACs are talking about.

Dr. Borg said the COV reports are sent forward and the Office of Integrative Activities has lead responsibility for shepherding the COV process across the foundation and they look for commonalities. In an ideal setting, we should make available to the next COV the report from your COV and the report from the prior COV, particularly where there are threads that need someone to look at it for continuity.

Dr. Fuentes said he liked the last suggestion. When he helped write the report four years ago, we analyzed the data. But we couldn't analyze the data at the division level. Without data we cannot report how GEO is doing in terms of supports in PIs from MSIs. If there is any recommendation this committee can make, we base those recommendations on actual data.

Dr. Bamzai said there is no issue about sharing when it's again aggregated to an institutional level. There's more apprehension about sharing actions done to a particular project, with a PI's name tagged to it. So, with the MSI, your data is fine to share.

Dr. Hodges said the NSF Director referred back to our questions about getting a lot of statistical data at the program level and his response was: Why not? So, we need to explore more as to what's possible.

Dr. Borg said there's an activity that's been ramping up that has to do with requirements to better organize and understand the validity of internal data and success rates and the degree to which MSI success rates may be out of line or indicate a disadvantage. There are efforts underway to organize our data and figure out what needs to be done to understand how the data can be used in a way where we can have confidence in the conclusions.

Dr. Patino said NSF is standing up a rigorous evaluation unit within the Office of Integrated Activities. She said she is working with a group within GEO to represent the directorate. This is in response to different mandates from OMB and Congress. The Director wants to use data and data analytics to make informed decisions. We are taking advantage of tools that are being developed to answer all of these questions.

Dr. Borg added that the activity involves getting a better understanding of the questions people think are important. He said he hopes this unit will look at the veracity of data and will get to a point where we can have more data releasable without concerns that it's going to get to personally identifiable project-level issues.

Dr. Millan said the particular questions might depend on the context. During the midterm assessment for the decadal survey there was a frustration with not being able to get data and one of the questions was that transition between postdoc and the next step, whether we were losing a lot of people in that trying to get funding. Having the data available allows people to slice and dice it depending on their questions.

Dr. Hodges added that you don't need to validate data. What you need to figure out is what you can reasonably say with the data. And those are largely two different things. How many proposals that you get do you fund — that level of success rate is fundamental information. It's not something that needs to be validated.

Dr. Patino said she agreed, adding, we need an understanding on the methodology of how we will answer a question like success rate. Because people will have different ways of calculating success rates. And then we all say, this is the definition for success rate. And this is how it's calculated, so everybody knows what you're talking about. Otherwise, the number you get for success rate could be interpreted in different ways.

Dr. Hodges said he understands, adding he is an advocate of free data.

Dr. Bamzai said different software systems have slightly differing results. If Program Directors were calculating the success rate from one and somebody else from another, that's what Dr. Borg meant by validating. Some Program Directors show their program success rates by subtracting out the careers, because career is a separate type of award; it's not the regular proposal, per se.

Report Out on AC/OPP

Dr. Weingartner provided a synopsis of the fall AC/OPP meeting. A main topic was COVID-19. Dr. Weingartner made the following points about the COVID-19 discussion:

- Polar Community feels that NSF POs have been very helpful in assisting PIs develop workarounds and protection
- NSF POs have and continue to encourage PIs to contact them with problems
- Concerns about grad students, post-docs, playing catch-up on projects: TBD!

The AC/OPP also took up the issue of diversity, equity and inclusion in polar research. About a year ago, it started to form a subcommittee to address the issue:

- Established a 15-member sub-committee to:
 - Characterize current state of DEI in NSF-supported polar science
 - Examine existing efforts of NSF & others to enhance DEI
 - Recommend strategies for OPP to pursue to enhance DEI.
- Initial meeting to be held late Oct/Nov 2020
- Expect a 12-18 month effort

Dr. Weingartner also reviewed the reports by the Antarctic and Arctic COVs:

- COVs thoroughly evaluated the review process and were well-satisfied with the procedure.
- Felt POs adequately communicated reviews
- Recommendations:
 - Prune “dwell times”
 - Articulate a clearer statement on Broader Impact expectations.
 - Implement panels when possible as these provide a useful synthetic discussion of proposals.
 - Encourage NSF to continue improving participation of underrepresented minorities (URM) as reviewers
- NSF-OPP formal response to COV reports expected in Spring 2021

Dr. Weingartner said AC/OPP also heard from Dr. Easterling on NSF-GEO activities emphasizing developments in Earth System Science. In addition, Dr. Weingartner made the following points:

- To enhance integration across NSF divisions, the AC/OPP liaises with Office of Advanced Cyberinfrastructure, Committee on Equal Opportunities in Science and Engineering (CEOSE) and GEO. Received reports from Cyber and GEO
- NSF responded to the Antarctic Research Vessel Sub-committee report submitted 8/19. NSF briefed the AC on plans for entering into the Major Research Equipment and Facilities Construction (MREFC) process. NSF adopted the recommendations regarding a new and more capable Antarctic Research Vessel (R/V) while concurrently addressing the important logistics support activities served by Gould and Palmer.
- AC/OPP discussed concerns of some Native Alaskan communities regarding research in their backyard.
 - These concerns pertain to:
 - the sense of being excluded in the development of research initiatives,

- desire for community inclusion in the research activities and proposal evaluation.
 - OPP has recognized some of these issues & has had communications with these communities. OPP is working to enhance inclusion and to educate better researchers wishing to work in and with these communities.
- Met with Director Panchanathan who discussed his three guiding principles:
 1. advance the frontiers of research
 2. ensure accessibility and inclusivity in NSF-funded research, and
 3. securing and/or maintaining global research leadership.
- The Director also stressed that NSF must seed bold fundamental research having meaningful societal impact, make significant progress to ensure a healthy STEM workforce, and safeguard the future of the scientific enterprise.

Discussion

Dr. Hodges said he would like to coordinate at least the component of the report AC/GEO is writing that has to do with the AC/OPP DEI study. He said he wanted AC/GEO to know the individuals involved in that in OPP.

Dr. Weingartner agreed.

Wrap-Up and Action Items

Dr. Hodges asked those working on the AC/GEO report to send their comments or suggested changes to him by email within a couple weeks and he will incorporate them into a new draft and distribute it.

Regarding the last four components in the report not discussed, Dr. Hodges asked members to read those sections and send comments to all committee members. Dr. Hodges will send everybody another version and try to get consensus.

Dr. Pomponi asked the committee to pay particular attention to such issues as the submission timeline, when you can resubmit a proposal after it's been declined and rebuttals.

Dr. Hodges said to also pay attention to procedural differences from program to program. He also drew attention to the problem of not being able to resubmit a proposal for a year after it was originally submitted. He added that it is not perceived as a problem by some investigators because their programs don't have that rule.

Dr. Pomponi said it is a year from when you submitted your original proposal, so it would be more like six months. Her subgroup was looking at two months instead.

Dr. Hodges said some programs have a limit on the number of proposals for a given year. He was not sure if that is reasonable or not and greater clarity is needed. It would be better if it were broadcast to the community, so they know the procedures in the individual programs.

Dr. Aluwihare returned to the discussions about how much money it's going to cost to support postdocs or graduate students or staff. What are the numbers for six months for a graduate student or three months for a postdoc? Having the numbers gives perspective on the scale of the problem. The people who might be greatest in need may be least comfortable reaching out to their Program Managers, creating inequity. It would be interesting to see some accounting of the numbers, including how many postdocs and students are supported.

Dr. Mitchum supported Dr. Aluwihare. If the problem can be cut in half, that's very encouraging. But we don't have any idea what the magnitude of the problem is. We are encouraging people to reach out to their Program Officers and I'm going to share that with my faculty, he said. There was also discussion yesterday about the possible need for broader communication with the funded projects and then just see where we are. We can't promise to do anything, but at least find out the magnitude of the problem.

Dr. Easterling said we have done a very good job of trying to cover as many bases as we can. We really don't have the funding right now to step up to the plate and make everybody whole. But we don't want to do harm to the students and postdocs. The discussion thus far has been what can we do with the limited resources we have discretion over? And they are limited resources?

Dr. Borg said the AC's concerns will be a fair warning to the division directors. We can go back to the organizations within GEO and ask them to have a discussion about how best to go about this. It might be that we can use some of the business tools and generate a letter to active awardees and an invite and be sure they know the invitation is out there. I hope it's better than it might seem in terms of people knowing. We've tried to make things available on FAQs on our website, emphasizing they talk to Program Officers. But there are ways of communicating individually. Is that going to mean a Program Officer overseeing 100 to 150 active awards is going to have to send a letter to each person? But we can explore ways of trying to improve individual communication so that so that PIs know they should talk to their Program Officer.

Dr. Mitchum said that Dr. Major showed the AC a great report yesterday about impacts. But it does not include anything quantifiable. And the Director told us earlier today that in addition to pushing this to the Program Officers and saying, talk to your PIs, he said there are efforts at a higher level to do something about this. So, shouldn't we be providing him with a report with data that says this is the impact of the problem as opposed to just that there's a problem? Can we collect the data to have the next level up do something about it, not that you have to find a solution. I understand the money's not there.

Dr. Borg said part of the problem is that when you say you've got a student working on your project and you put a little bit of budget into a budget table, that doesn't translate into something that can be queried by us to get data. In annual reports, if people are reporting the number of people and they identify it, there's a little bit of information that comes out that way. But this committee made an attempt to take a sampling approach to developing a magnitude and it was a large amount of money. So, there is some information already there. And we can certainly have a discussion with the division directors, organization directors and section heads about how we can improve that estimate.

Bill Easterling said we're trying to feel our way through to just what data are needed. We've got a qualitative grasp of it. But partly due to insights from this committee, we can now see an impetus to become a lot more focused on quantifying where there are opportunities. The next supplemental is in turmoil right now. And it's not for us to advocate one way or the other for that money. But we've got to have a basis for how we would spend that money if we were to come into it in short order.

Dr. Quinn said he will try to figure out with his section heads the size of the elephant. In order to solve the problem, we have to identify what it is. The academic research enterprise is under extreme duress and we serve that community. We need to take this on. We'll work with my fellow division heads and office heads, with Dr. Borg and Dr. Easterling, and the front office and take this on. Part of the benefit of the AC/GEO is providing the catalyst to get us going.

Dr. Borg said we've been talking about existing awards. But the way NSF works with two-to-four-year projects, 20 or 30 percent who had probably come to the end of an award and we're hoping for another award, or we're getting ready to write and submit. We've got to figure out a way to quantify that aspect too. Just because they are caught in a particular time in a cycle, that doesn't mean they're not part of the community that we need to worry about.

Dr. Easterling added that we have to be cognizant of the junior scientists dependent on getting new grants. We can't focus all our resources on making sure there's a good ending to the funded research that happens to be underway at the time things began to start to shut down.

Dr. Mitchum said he was hoping that if we can gather the data to define the problem, we can give people at the Director's level new money.

Dr. Easterling agreed, saying we need to have good data to be able to tell this story in an unambiguous way.

Dr. Borg said Dr. Patino is instigating some investigations with one of the analysts to pull some information together and is hopeful we'll have some preliminary information next week.

Dr. Easterling, noting that Dr. Hodges had to leave the meeting, thanked everyone for an outstanding two days. Dr. Borg added his thanks to everyone who helped make the meeting possible.

The meeting was adjourned.