Response to Recommendations from the Committee of Visitors (CoV) for the Division of Biological Infrastructure (DBI), September 13-15, 2016

Introduction: The Division of Biological Infrastructure and the Directorate for Biological Sciences are extremely grateful to the members of the Committee of Visitors (CoV) for their diligence, time and hard work in evaluating the review processes of DBI and for articulating a set of recommendations for the Division. The collective expertise of the CoV members was invaluable and through their report the committee conveyed a deep sense of commitment to the mission and practices of DBI.

The CoV report consists of an executive summary followed by a completed CoV template for the Human Resources (HR), Research Resources (RR), and Centers clusters. The CoV report covers DBI activities during the period of October 1, 2013 – September 30, 2015. Overall, the report is impressively thorough and indicates that the CoV was, "impressed with the accomplishments of DBI during the assessment period." In particular, the CoV indicated that DBI maintains a high-quality merit review process that supports all facets of the biological sciences and has improved its oversight of Center management across BIO, In addition, the CoV mentioned that leadership and management of DBI improved significantly.

While the overall assessment of DBI operations were viewed positively and also that DBI operations were viewed to be on an upwardly improving trajectory, the CoV noted several themes of concern across the clusters that if addressed could improve DBIs effectiveness across BIO. DBI appreciates these thoughtful observations, and will respond in the following section, referencing both ongoing activities within DBI and BIO, as well as proposals for future activities to address them. In the subsequent section, program-specific concerns noted by the CoV are addressed directly. All responses are depicted with blue text to distinguish them from the comments from the CoV report itself shown in italics.

Overarching Comments from the CoV:

- *Although the structure and organization of DBI appears to be effective, communication should be improved within DBI, between DBI and the other Divisions of BIO, and between DBI and the BIO Front Office:*

Communication continues to be a high priority for DBI, and DBI agrees that communication between DBI programs, between DBI and the other divisions, and with BIO OAD should be improved.

a) With respect to communication between DBI and other divisions the following has been implemented: i) in 2014, DBI began. a series of brown bag discussions between program officers in DBI and those in MCB, IOS and DEB to increase awareness of opportunities in portfolio development for infrastructure investments that support research across MCB, IOS and DEB. Programs in the Human Resources cluster played less of a role in these discussions, but DBI will encourage involvement of the Human Resource programs moving into the future; and ii) in order to increase communication between DBI and other divisions we organized a monthly series of

meetings for program officers across BIO that are involved in the oversight and management of Centers and/or Cooperative Agreements. The agenda for these meetings is provided by the DBI Science Advisor for Centers and Cooperative agreements. Topics have ranged from general management issues to sustainability. DBI will continue to run these meetings to address many of the issues highlighted elsewhere in the CoV report. Further, since 2014, DBI leadership has held internal funding specifically for DBI program officers to increase cross-divisional communication, co-review and co-funding across BIO and other directorates. Although this strategy has not been as effective as hoped we are discussing with program officers ways to make this opportunity to increase their success rate of greater interest. Lastly, DBI participates in the Science Communication Working Group (SCWG) established by the office of this Assistant Director in BIO. The express purpose of the SCWG is to enhance communication across BIO. Currently, two program officers and the Deputy Division Director serve as members of this working group. In addition, SCWG meetings are open to anyone in BIO that wants to attend, and there is an internal website that was set-up to post all meeting notes that are shared across the Directorate. The Chair of this group is currently visiting divisional staff meetings to make everyone across BIO aware of its purpose.

a) Within DBI beginning in June 2015, weekly meetings referred to as "Human Resource Cluster Meetings" and "Research Resource Cluster Meetings" were established to enhance communication between Program Officers and Administrative Support Staff and also to streamline and optimize workflows whenever possible. Because individual members of the Administrative Support Staff provide support to multiple programs, the timing of work requests from the various programs in a given cluster were sometimes not well coordinated. These meetings have succeeded in avoiding a number of barriers to proposal processing and review across programs in DBI and consequently have improved workflows and morale across the division. DBI will continue to use these meetings to optimize work efficiencies and increase morale across DBI. In the past DBI has conducted one retreat per year for team-building and discussion-based activities focused on identifying issues and practices that will promote DBI's effectiveness within the division and across BIO. DBI is now considering an additional retreat per year to help position itself strategically across high-priority areas of the life sciences to be pursued by BIO in the coming years.
b) With respect to the broader scientific community, in 2016, DBI launched a blog called, "DBInfo" to enhance communication with the scientific community. One of the features DBI is most excited about is called "Share": https://dbiblog.nsfbio.com/share-your-infrastructure/. This part of the blog was designed to allow scientists to highlight infrastructure resources developed by researchers supported through DBI infrastructure programs. DBI is currently working to advertise this blog broadly in the scientific community to help the community adopt it as a useful resource for promoting DBI-enabled research across the life sciences.

DBI will continue to utilize this broad set of approaches to increase communication within DBI, across BIO, and with the broader biological research community. In addition, DBI will continue to seek and develop additional opportunities for increasing communication wherever possible.

- *In partnership with the BIO Front Office, DBI should institutionalize mechanisms to enhance "transparency of decision-making" and establish data-driven processes to guide administrative decisions:*

DBI supports utilizing data-driven processes to guide administrative decisions whenever possible and has taken several steps to establish such processes. For example, DBI expanded a process developed in IOS in order to present this current CoV with the "Golden Data Set" of proposals for review, and this was commended in the CoV report. In addition, DBI has assigned a number of summer Interns and a Presidential Management Fellow to conduct portfolio analyses with newly developed text mining tools available to NSF to assess the overall impacts of Centers and training programs. Some of these have been shared with senior managers across BIO, with the BIO Advisory Committee and were also shared in a presentation to the CoV.

As a result of the decision to place two DBI programs on "hiatus", DBI has partnered with the BIO Office of the Assistant Director (OAD) in the evaluation of these programs (IDBR and CSBR) in the Research Resources cluster. DBI has had several discussions with NSF's new Evaluations and Assessment Capability Section of the Office of Integrative Activities to help establish sets of questions amenable to a data-driven portfolio analysis. DBI and BIO will use the outcomes of these types of analyses to make adjustments to programs as deemed appropriate in order to align their investments with goals of DBI and BIO. This evaluation process should increase transparency in the decision-making with respect to the status of these programs. DBI will continue to utilize and advocate for evaluation and assessment processes whenever possible to help guide administrative decisions.

- *Strategic portfolio planning should be undertaken regularly for all programs to determine the allocation of resources to innovation vs. development vs. sustainability projects, as well as to assess the success of these investments in attaining Division and Directorate goals:*

Strategic portfolio planning has been a practice that DBI has embraced in the past. DBI has shared whitepapers produced through such activities to articulate ways DBI thinks about cyberinfrastructure to support Data-Intensive Research in the Biological Sciences. While these efforts have focused more on cyber-related programs, DBI agrees with the CoV that using this type of systematic planning will be useful across all programs supported by DBI, such as the biological sampling activities being initiated by the NEON project. Through our twice monthly meetings with program officers we hope to facilitate such strategic planning activities and engage additional colleagues and stakeholders in these conversations as appropriate.

- *Strategic planning is encapsulated in the budget. Nonetheless, it is unclear how budgetary allocation and strategic planning interface in DBI, or in BIO with regard to DBI. We strongly recommend much more transparency in and engagement during processes in which strategic planning is implemented via budget planning activities:*

The budget process at NSF and across the US government is complex and involves many stakeholders, both internal and external to NSF. DBI appreciates this perspective, but cannot provide a response to this particular concern without input from the Office of the Assistant Director for BIO (OAD).

- *To reduce risk and enhance efficiency, DBI should continue to emphasize program and project management training, especially for POs associated with large investments. Project management training should ideally be conducted in the context of scientific projects rather than the context of commercial projects*:

DBI has recently established a list of training courses in project management, and based on feedback from Program Officers involved in various aspects of center management, prioritizes the courses based on the needs of the division and directorate. Program officers have found this professional development quite helpful and DBI will continue to explore new courses to ensure they are aligned with the growing needs of DBI's and BIO's larger projects.

- *DBI in particular, but all Divisions in BIO in general, should devise mechanisms and processes to leverage the expertise and experience in the HR Cluster to better catalyze efforts to broaden participation in Centers and other large investment projects. Importantly, broader impacts in general and broadening participation in particular should be as much a criterion for the decision to fund and renew large projects and Centers as it is for decision-making for more modest investments:*

This is an excellent idea and will be considered in the context of our Directorate wide communication, strategic planning, and program management training and oversight activities. The brown bag meetings, and the meetings for program officers that oversee centers and cooperative agreements mentioned above will provide ideal ways to implement leveraging this knowledge in the HR Cluster.

- *DBI in particular, and BIO in general, should explore innovative and entrepreneurial approaches to incentivize participation in panels by individuals associated with minority and minority-serving institutions, 4-year colleges, and community colleges. In addition to broadening perspectives on integrated research and education, this could serve as a mechanism to increase submission of proposals from these types of institutions or to increase collaboration between investigators from different categories of institutions:*

DBI appreciates the CoV's perspective on this issue and continues to work to improve its efforts in this area. While financially incentivizing reviewers from one type of institution is not possible, there are a number of other ways to increase participation of faculty from four-year institutions, MSIs and community colleges. Virtual panel participation has been shown to increase the participation of women as well as individuals from community

colleges and PUIs. In addition, through panel review by DBI senior leadership we will also encourage programs to increase the institutional diversity of reviewers.

- *Although improving, panel summaries still focus much more broadly and deeply on issues related to scientific merit than on those related to broader impacts. DBI's use of webinars to enhance panelist awareness of the need to substantively address both criteria represents a viable mechanism for doing so. Instructions to reviewers about what to look for in the broader impacts section of proposals (e.g. pro-active as opposed to passive statements) may also be conveyed via webinars preceding review panels. Nonetheless, this must be coupled with vigilant oversight by POs during panels so that summaries substantively reflect both criteria and that investigators receive accurate feedback about the decisions to fund or decline a proposal:*

DBI values this feedback from the CoV and will increase its efforts to seek more substantive feedback on the Broader Impacts by reviewers for all programs in DBI. In addition, increasing utilization of training webinars for panelists, as is currently undertaken by the REU program, across all of DBI programs will be undertaken. DBI will review, optimize and standardize the types of instructions and templates provided to reviewers by program officers when they are first assigned to a panel. Another simple, but effective way to help in this area is for the Division Director and/or Deputy Division Director to specifically emphasize the importance of substantively addressing both review criteria categories in the panel summary at the beginning of every panel meeting. Currently, the importance of the panel summary is emphasized, but particularly emphasizing the Broader Impacts criterion has not been practice. We expect that these activities will improve the quality of Broader Impacts review significantly.

- *"Panel-recommended but program-declined" proposals represent a point of tension between NSF and the community it serves. This is particularly true when the rationale for the decision, or the adjudication of positive and negative factors involved in the process of decision making, are not communicated or communicated effectively to the investigators. DBI should be commended for addressing such issues effectively in the official Program Review and associated documents in e-jacket. Nonetheless, the rationale contained in the Program Review is not always communicated effectively to investigators:*

Depending on success rates, there are often a number of proposals that are reviewed positively by the panel, but simply cannot be funded with the amount of money available to a given program. During the period reviewed by this CoV, DBI made a strong effort to ensure that the reasons for awarding funds to one proposal over another in such cases were well justified and articulated in the documentation associated with the decision. DBI appreciates that the CoV commended DBI for addressing such issues effectively. However, the CoV is absolutely correct in noting that DBI has not been as diligent as it should be with transmitting the actual rationale for such decisions to investigators. DBI will increase its efforts in this area by working to ensure that the investigator of every proposal that received a positive review also receives a program officer comment explaining the salient reasons for declining the proposal. This is a relatively simple thing to do and will be monitored closely in the next and subsequent rounds of peer review conducted by DBI.

Program-Specific Concerns Noted by the CoV:

Human Resources Cluster

Research Experiences for Undergraduates (REU Sites)

REU Sites QI.2: *While the CoV emphasized that the Division should enhance the quality of the Broader Impacts review criterion across most program in DBI, for REU sites the CoV noted potentially an opposite problem in that, "for some proposals, reviewers in particular struggled to meaningfully address the intellectual merit components when the theme of the site was broad."*

This is a well-recognized issue in the REU Sites program, and many REU proposals are declined due to the low quality or lack of focus of the potential research projects propose for REU participants. DBI will continue to monitor this issue and develop effective ways to ensure that REU reviews provide sufficient feedback to P.I.s with respect to the intellectual merit criterion.

REU Sites QII.1 and II.3: *The CoV states that, however, if there is interest in reaching larger populations of students, such as for REU recruitment, there should be an effort to reach possible reviewers from community colleges, other PUIs, and MSIs….and continues, "CoV encourages the program to reach out to this under-utilized reviewer pool." Furthermore, "The CoV noted little to no involvement from TCUs or CCs."*

This is a good idea. DBI has already begun to enhance its efforts in recruiting panelists from community colleges, MSIs, and TCUs and will continue to do so.

REU Sites III.1: *The REU POs expect all sites to participate in the URSSA survey so there is a measure of student outcomes embedded in all programs. POs are encouraging use of the URSSA-instrument among the REU supplements and other settings as a best practice for evaluation. This evaluation instrument should be promoted as a best practice across the other programs within HRC, and across the division and directorate*.

We appreciate the CoV's perspective on DBI's utilization of the URSSA-instrument to date and will discuss broader utilization of the instrument in the division and the directorate. .

REU Sites III.2: *One potential opportunity to investigate is the leveraging of technology to connect REU participants in small programs or isolated geographic regions to expand REU cohorts in an online learning community*.

This is an interesting idea that the REU Sites program officers, in particular, and DBI will take under consideration.

REU Sites III.3: *It is unclear how multiple applications from the same site are viewed by the REU POs especially when, aside from the science focus being different, the REU programs may be very similar and draw on the same institutional recruitment infrastructure and local target audiences. Given that there remains some geographic regions and disciplinary areas underrepresented in the REU portfolio, the CoV would like to see a better rationale for the*

decision to make awards to the same institution that result in temporally overlapping REU programs.

This is an important observation and DBI appreciates it. We looked at the current REU Sites portfolio to determine how prevalent this problem might be. Of 146 currently active awards, 26 of the 117 unique institutions in this set had two or more awards. The majority (18) of these were renewal awards in which the previous and new award overlapped in time, but not in the yearly cohort of student participants each award supported. In the other 8 cases, each award offered diverse sets of research topics in support of students with. For example, the University of Washington had one award (1358883) focused on Neuroengineering projects, whereas, the other (1358883) focused on the Integrative Biology and Ecology of Marine Organisms. Moreover, these two awards are at two highly distinct physical locations offering a diverse array of research possibilities to students with distinct sets of research interests. DBI appreciates the CoV highlighting this potential concern, and will continue to pay attention to this issue, however, we believe that the current status is acceptable given the other factors used to balance the portfolio.

REU Sites IV.C: For the REU sites, there are very few new investigators (9%) awarded. The reason for this outcome may be related to the number of proposal submitted, or explicitly due to the quality of proposals from new investigators, but the program should consider strategies to increase participation for this community demographic.

DBI typically does not encourage beginning or new investigators to submit proposals to the REU Sites program since there is a perception that this is not the type of award that will necessarily help them establish their research program as new investigators rising in the academic ranks. However, DBI will take the COV recommendation under consideration as we do outreach to potential new investigators. .

REU Sites QIV.D: ~26% of the REU awards, ~21% of PRFB awards and ~32% of the RCN awards went to investigators in EPSCoR states. Considering that that these states now make up over half of the potential applicant pool, DBI needs to continue efforts to increase representation from these regions within the portfolio of HRC programs.

This is an interesting observation and DBI appreciate the CoV for noting it. We will investigate this and also how many of the student participants are from EPSCoR states, which may be even more important. Depending on the outcomes of this analysis we will determine the most sensible way forward with our outreach efforts.

REU Sites QIV.E: Based on the pivot tables, 80 of the 215 awarded REU sites are at doctoral degree granting institutions or medical schools. Another 117 of the 215 awarded REU sites in the CoV period do not have a Carnegie Classification identified in the golden data set. It is unclear why data are missing for so many programs, and this hampered the CoV from addressing this question with much accuracy.

The Carnegie Classification data included with the dataset were generated by an exact text comparison of institutional names in the 2015 Carnegie data versus the NSF institutional names. No further reconciliation effort was made to manually curate the entries because the Carnegie data are not used in internal NSF processes. However, the CoV dataset did include the official values for "Educational Level Classification" and

"Business Institution Classification," as defined in the NSF system of record. These values very closely approximate the Carnegie classifications. There were 151 REU site awards (out of 215, 70%) to Doctoral institutions, 1 to a community college, 7 to Bachelor's institutions, 26 to Master's institutions. In the total set of REU awards, there were 19 awards to minority serving institutions (9%), including one award to a Tribal college (a community college, "United Tribes Technical College"). These awards closely reflect the participation of institutions in the REU program."

REU Sites QIV.F: The sample jackets included several proposals that included institutions from these communities (small non-research intensive colleges, MSIs and CCs) and the reviews occasionally labeled these as potentially transformative, however, there were generally hesitations on the part of the review panels to recommend these awards due to concerns with infrastructure and/or facilities or because there were questions about the scope of scientific research being proposed. Though the resulting funding decisions were understandable due to these concerns, the CoV recommends that the program explore potential ways to leverage the enthusiasm of these schools and investigators to engage them in the program while ensuring the high standards for this program that ensure a productive experience for the participants. One strategy might be to encourage program partnerships between multiple hosting institutions to share research infrastructure. This approach was noted in one of the two awards to a partnership of TCUs; the committee commends the program for supporting this type of programming innovation, and encourages investment in these types of awards in the future..

DBI appreciates the CoV's views on this complicated issue and the encouragement to pursue this area of broadening participation. We will continue our efforts in this area.

Postdoctoral Research Fellowships in Biology (PRFB)

PRFB QI.5: *The CoV observed a small set of awards where substantial criticisms on the part of reviewers were treated with only brief or cursory mention by the PO in the review analysis. This was the case in the few instances where proposals with medium to low meritorious rankings were awarded. Better documentation of the basis for these decisions is recommended.*

As mentioned above, care is taken to fully justify award/decline decisions in the Review Analyses but may not be communicated as effectively to the P.I. through the reviews and panel summary. We will institute regular use of program officer comments as appropriate to provide additional information and guidance to the P.I.

PRFB QI.6: In the case of PRFP, there was a small number of proposals where the panel summaries were brief and relied primarily on the individual reviews themselves. As mentioned above, this applicant demographic is most likely to lack experience in decoding the rationale of the panel's decision and may not wholly understand the process or the role of each of the documents. The PO should ensure that the documents provided to the applicant are easily interpretable with respect to the program awarding decision.

The PRFB program often utilized telephone discussions to convey the rationale for decisions made by the program. In future, Diary Notes will be kept to make note of these

discussions. In addition, DBI will increase the use of program officer comments to provide additional feedback to the investigator when appropriate.

PRFB QII.1 and II.3: *The COV mentioned the need to include more panelists from community colleges, TCUs, PUIs and MSIs.*

In the FY16 Broadening Participation panel, DBI had 2 panelists (of 17) from MSIs and DBI will continue to increase its efforts in this area.

PRFB QII.2: *The CoV mentioned an issue brought up on the 2013 CoV with respect to explicitly identifying the proposed PRFB mentor along with the institution in the proposal review materials provided to the panelists, and in the jackets provided to the CoV. This information was not readily available to the 2016 CoV without reading the full PRFB proposal.*

DBI has internal working spreadsheets with this information that we use to manage the PRFB review process. We regret that these were not available to the CoV and will make these spreadsheets available to the next CoV so they do not have to read the proposals to identify PRFB sponsors and host institutions.

PRFB QIII.1: *Overall, the PRFB is also well-managed although there are some programmatic decisions that seem unclear. The 2016 self-study mentions eliminating the year that could be requested by fellows for teaching training. The rationale or decision making process that led to the elimination of this training opportunity is unclear.*

The teaching option was implemented in PRFB for only a couple of funding cycles. Going forward, fellows have the option of teaching while holding their fellowship, in which case the fellow 'pauses' the fellowship. During the 'pause' the fellow is not paid their NSF stipend but rather is paid by the host institution to teach. In some ways this could be seen as a more effective use of funds because the host institution, rather than NSF, is paying the fellow to teach. However, DBI will revisit this topic to determine if there are cases where supplying a teaching supplement for such opportunities may make sense, especially in cases where the fellow is teaching at a CC, TCU, MSI or PUI that may not be able to support the teaching activities. In addition, we concur with the CoV that providing the rationale for such changes within a program would increase transparency and program accountability.

PRFB QIII.2: *As was noted in the 2013 CoV, the PRFB program is responsive to identifying new areas for program strands but the process for selecting new focus areas was not transparent and the timeliness of communicating could be improved.*

DBI agrees with this recommendation and plans to review the duration of prior programmatic foci, the timeline, and rationale for instituting such changes before undertaking the next transition. By sharing this information, and seeking input from relevant stakeholders, we will be able to provide the requested transparency and accountability to the biological research community.

PRFB QIII.4: *It was noted in the previous CoV report that mentors were not identified in the PRFB. This problem persists. This is exact language from the 2013 CoV report, as the access to mentor information in the PRFB jackets was still not readily available to the 2016 CoV, and would have aided in the thorough evaluation of the program.*

As mentioned earlier in our response to QII.2, DBI has internal working spreadsheets with this information that we use to manage the PRFB review process. We will make these spreadsheets available to the next CoV so they do not have to read the proposals to identify PRFB mentors and host institutions.

PRFB QIV.A: *For the postdoctoral fellowship tracks that spanned sub-disciplines within biology, such as the minority track and the intersection of math and biology track, there appeared to be an overall balance of awards, though these are more challenging to track because their titles are uniform and thus difficult to accurately classify.*

DBI is currently working to change our systems so that the research title will be included in the overall title for proposals submitted in FY18. For FY 17, this may have to be done manually, but DBI is considering how best to do this.

PRFB QIV.E: *PRFB applicants and awardees overwhelmingly identified research-intensive institutions for training platforms. While this is to be expected, to address issues of human resource capital disparity at MSIs, and potentially build infrastructure to increase participation in other DBI and BIO programs at these institutions in the future, the program should investigate strategies to incentivize PRFB awardee affiliation with these under-served academic communities. Offering a third year of funding to PRFB fellows that spend a year teaching or conducting research at an MSI could be one such approach. HRC leadership and POs could consult with their counterparts that manage the TCU and HBCU program to synergize outcomes.*

This is an intriguing idea and DBI will consider it when we discuss future changes in the PRFB program.

Research Coordination Networks in Undergraduate Biology Education (RCN-UBE)

RCN-UBE IV.C: *RCN awarded ~10% of the small number of awards (2 of 19) to beginning investigators. Reaching out to this demographic to increase the number of proposals should be a priority of the program.*

As with REU Sites DBI typically does not encourage beginning or new investigators to submit proposals to the RCN-UBE program since there is a perception that this is not the type of award that will necessarily help them establish their research program as new investigators rising in the academic ranks. However, DBI will take the CoV recommendation under consideration as we do outreach to potential new investigators.

RCN-UBE IV.I: *The award record for URM PIs in the RCN-UBE program was poor, with only 5% of the awards made to PIs from under-represented groups. HRC should seek ways to engage with potential URM faculty PIs, and increase representation across the award portfolio.*

This is an important observation made by the CoV. DBI coordinates this program in collaboration with EHR and will enhance its outreach to this constituency and pay attention to this matter in future rounds of competition for the RCN-UBE program.

Research Resources Cluster

Advances in Biological Informatics (ABI)

ABI QI.2a: The CoV noted that both merit review were addressed in all program officer review analyses and panel summaries. However, they noted that in ~5% of the individual reviews, both review criteria were not addressed.

DBI appreciates this observation and will take the advice of the CoV mentioned in Q1.3 to enhance its training of prospective panelists and provide better instructions to reviewers about what to look for in the broader impacts sections of proposals (e.g. pro-active as opposed to passive statements) which were indicated to be the weaker sections of review in DBI overall.

ABI QI.3: The written comments span the gamut from lengthy and substantive comments on the strengths and weaknesses of what is being proposed, to very short (or missing), non-substantive remarks. The former comments are helpful to PIs for understanding the panel recommendation; the latter aren't. Typically, the problem lies with 1 out of 3 reviews. We found particular lapses in ABI (nearly 1/3 of proposals examined).

In the short term, we will request four written reviews for each proposal in ABI and provide reviewer training to enhance the substantive nature of reviews. DBI leadership will request additional reviews before concurring any award/decline decisions for proposals for which substantive reviews do not exist.

ABI QI.4: We found that panel summaries were poorly written, sketchy or inconsistent in 3/19 of IDBR proposals and ca. 20% of ABI proposals. Quality of panel summaries is critical because it is the primary means of communicating NSF's decision to the PI. The program officer has control of the quality of the summaries and should enforce inclusion of meaningful detail.

DBI will discuss this with the program personnel and establish an action plan to address it. As noted earlier, increasing utilization of panelist training webinars, as is currently undertaken by the REU program, will be considered. DBI will review and standardize the types of instructions and templates provided to reviewers by program officers. Also, ABI is planning to provide to panelists an info sheet on how to structure panel summaries. Further, DBI leadership will also emphasize the importance of substantive panel summaries in their welcoming remarks that they give at every panel meeting.

Instrument Development for Biological Research (IDBR)

IDBR QI.2a: The CoV noted that both merit review were addressed in all program officer review analyses and panel summaries. However, they noted that in ~5% of the individual reviews, both review criteria were not addressed.

DBI appreciates this observation and will take the advice of the CoV mentioned in Q1.3 to enhance its training of prospective panelists and provide better instructions to reviewers about what to look for in the broader impacts sections of proposals (e.g. pro-active as opposed to passive statements) which were indicated to be the weaker sections of review in DBI overall.

IDBR QI.4: We found that panel summaries were poorly written, sketchy or inconsistent in 3/19 of IDBR proposals and ca. 20% of ABI proposals. Quality of panel summaries is critical because it is the primary means of communicating NSF's decision to the PI. The program officer has control of the quality of the summaries and should enforce inclusion of meaningful detail.

DBI will discuss this with the program personnel and establish an action plan to address it. As noted earlier, increasing utilization of panelist training webinars, as is currently undertaken by the REU program, will be considered. DBI will review and standardize the types of instructions and templates provided to reviewers by program officers. Further, DBI leadership will also emphasize the importance of substantive panel summaries in their welcoming remarks that they give at every panel meeting.

Major Research Instrumentation (MRI)

MRI QI.3: The CoV mentioned that ~10% of more than 66 individual reviews were not sufficiently substantive to explain the ultimate rating given to a proposal.

As mentioned earlier, reviewer training will be enhanced in an effort to ensure that virtually all reviews are substantive. DBI leadership will also pay extra attention to this and request additional reviews before concurring any award/decline decisions for proposals for which substantive reviews do not exist.

MRI QI.5: Occasionally there was a disconnect between the summaries and the Review Analysis. In particular, 2/22 of the MRI proposals we read were ranked highly meritorious and this was reflected in the comments within the panel summary. However, these proposals were declined, and the reason for declination was only clear from the Review Analysis which appears not to have been communicated to the PIs.

The PI often does receive the feedback noted in the Review Analysis when they call to discuss their declined proposal since that is one of the key documents program officers always review before any discussion about a declined proposal. However, DBI will seek to ensure the use of program officer comments to make this information more readily available to investigators.

MRI QII.2: The CoV noted some concern with documentation describing potential conflicts of interest in the MRI proposals.

As reviews and review panels are obtained for specific programs, DBI employs a number of strategies to ensure that all COIs are identified. Occasionally, one will slip through and will not be noticed until the panel meets. This is unfortunate, but NSF has transparent ways of dealing with these rare events; as soon as the COI is revealed NSF implements the appropriate action to ensure program does not use any information provided by the reviewer with the conflict. The CoV went on to state that, "the review was not released to the PI and was not considered in the funding decision" which is consistent with NSF policy.

Collections in Support of Biological Research (CSBR)

CSBR: No program-specific issues of concern were noted, but see "Other Concerns Noted by CoV" below).

Improvements at Biological Field Stations and Marine Laboratories (FSML)

FSML: No program-specific issues of concern were noted, but see "Other Concerns Noted by CoV" below).

Centers Cluster

Centers QI.1 and I.7: Decisions to release incremental one-year funds were based on annual reports. We recommend that these incremental increases be carefully monitored, tied to demonstrated performance on items in the cooperative agreements (as reflected in the annual reports) and tied to an analysis of currently remaining funds on the award. The CoV went on further to emphasize that for one of the supplement requests failed to contain sufficient documentation to justify the decision to provide the supplement funding request.

Under the Centers Cluster leadership of the Science Advisor, decisions to release yearly incremental funds for centers are now a multi-step process in DBI. First, the cognizant lead program officer conducts a review of center progress and often conducts a site visit or reverse site visit. Then a recommendation and rationale for continuing support or not is made by the lead program officer. The entire package is then reviewed by the Bio Office of the Assistant Director (OAD) who either approves or sometimes requires additional review steps to justify any funding decision. The PO recommendation and the OAD response are both upload to the Center jacket. Finally, DBI division leadership reviews and concurs the action. There should be few concerns at this final stage because DBI leadership works with the Program Officer through the Science Advisor for Centers and Cooperative Agreements to stay aware of management issues that may exist and how they are addressed. The supplemental request identified in the example above occurred prior to the implementation of this new system for processing increments. DBI will continue to work with this new system to ensure all such decisions are transparent and have sufficient documentation to make the rationale for such decisions apparent.

Centers QI.4: In general, the CoV indicated that panel summaries provided sufficient rationale for the panel consensus. However, for one of the centers, both strengths and weaknesses were noted, but the panel summary did not clearly provide insight into the way in which these opposing positions were adjudicated to result in a recommendation to fund.

As noted above in the Q1.1 and Q1.7 response, this particular panel summary summarized a review that was conducted before the new multi-step process now in place in DBI/BIO was implemented. Through this new management system DBI anticipates avoiding any such issues in the future.

Centers QI.5: The CoV believed that overall, documents in the jacket provided the rationale for the award/decline decision. However, they also noted that it was somewhat frustrating to locate such information due to the fact that multiple jackets are associated with each center and there was not a standard way of uploading various documents, such as annual reports.

Only recently has DBI begun to discuss how best to standardize document history and locale in the center proposals in ejacket. Since most of the center awards reviewed by the CoV were originally made years before the review period and before DBI took an oversight role for Centers, it will be important for DBI to establish best practices for document management prior to making any new types of center awards. DBI appreciates the CoV encouragement in this area.

Centers QIII.1: The CoV noted a number of issues and recommendations associated with the management of Centers. Each will be addressed individually with the following points noted by the following lower case roman numerals.

i. *For centers whose execution is less certain, the division should consider quarterly reports and quarterly conversations with POs.*

This is an excellent idea. The next set of cooperative agreements are in association with ADBC program and the NeuroNex solicitation. DBI program officers have continued to enhance their project management training. In particular, the NeuroNex program officers are working out strategies to ensure that these projects actually do change the way neuroscience research and infrastructure are developed together on a national scale. Any reviews that highlight potential risks for projects utilizing cooperative agreements will be used to determine the frequency of oversight interactions.

ii. *Some materials were more cursory, for example notes on one reverse site visit listed only who presented and what their topic was.*

See answers to Centers QI.1 and I.7 and Centers QI.4 for our increased oversight of decision documents for centers.

iii. *There are some fundamental challenges with the Centers Cluster. Because these activities are not planned from the outset with staff from DBI, they are disruptive to manage, do not integrate well with activities in the HR and RR Clusters and perhaps do not serve the BIO community as well as they might.*

This indeed can be a challenge, but DBI appreciates the observation of the CoV with respect to the work of the division. . If BIO were to establish a standard process for creating and implementing Center solicitation, it would help DBI interface with the process. DBI will continue to work with the other divisions and the BIO OAD to establish such a process.

iv. *Some centers seem to undergo significant challenges in the first year(s) of operation and sometimes require extraordinary efforts to get back on track. This pattern seems to repeat itself and it's possible that the distractions involved in rescuing one project have a detrimental impact on others that the Centers Cluster is managing. Planning grants to understand better what types of groups are capable of managing such activities before making large multi-year awards would be helpful, as well as more frequent reporting early in the process. Incorporation of risk management considerations in high investment projects from managerial, research, and educational perspectives should be emphasized at all times.*

Centers often have a difficult time in their first year for a number of fairly common reasons. DBI is in the process of developing a strategy document for launching centers. One idea we believe may be important, and is aligned with the CoV suggestion to implement planning grants, is to have a ramp-up phase in years one and two where certain deliverables are identified and assessed frequently. Then, subsequent year funding would be contingent on the assessments made at a relatively high level of oversight during this ramp-up phase.

v. *Centers also face significant challenges in the final years of operation as they transition to independence……. More effective planning for the transition phase appears to be incorporated in to the early stages even at the beginning of the five-year renewal for some of the more recent Center awards.*

Sustaining large resources developed for particular scientific communities is a continuous challenge across NSF because of the tension between supporting new innovative research projects and sustaining previously established resources. Within the ABI program, DBI has launched a sustaining track that will provide 'life-support' funding upon panel review to resources that are utilized extensively to promote cutting-edge research in the biological sciences. Experience with the Science and Technology Centers program suggests that sustainability planning should begin early, even during the first five years of an award expected to run for ten years. DBI is learning from its experience with the ABI sustaining track and, through discussions with other elements of NSF that have expertise in this area, to develop best practices and metrics to help deal with the issue of sustainability effectively.

Centers QIII.2: In many cases, centers seem to be planned from a level above that of the DBI leadership or scientific staff, and it is therefore difficult to comment on their selection and responsiveness to emerging opportunities. A strategic process should be developed that includes bottom-up initiation from the community and from POs. It is also unclear how the budget, as a strategic tool, can be used to ensure the "right mix" and number of centers for catalyzing research, education, and their integration.

DBI has produced documents and initiated conversations to establish a strategic process for planning centers. One such documents entitled, Data-Intensive Research and the Biological Sciences, was shared with the CoV, but may have not been reviewed given time limitations of the review process. This documents depicts how BIO has addressed data-intensive challenges in the past, the science drivers that could or should drive such investments and the parameters that need to be considered when making such investments. It then articulates several center-like mechanisms that could be used by BIO moving into the future. This documents has been shared with all senior managers across BIO and the BIO Advisory Committee in September of 2015. The ideas in this document received strong support and we believe BIO will consider some of them when developing future solicitations especially with regard to the Rules of Life. This document was the result of bottom-up discussions that POs have had with their communities at workshops in addition to working with experts brought into DBI specifically for this type of activity. There is always a top-down component to such considerations that has to interface with the bottom-up viewpoints. DBI believes the CoV is correct in encouraging DBI to work with to ensure the "right mix" and number of centers for catalyzing research, education, and their integration is attained and will continue with its efforts in this area.

Centers QIII.4: This question dealt with DBI's response to Center oversight from the last CoV. Specifically, this CoV believes we did not develop a robust process to assess the effectiveness of a synthesis center, did not develop a protocol by which each center is created and subsequently managed, or establish management teams to manage them.

While DBI has not yet established a robust standardized process for assessing center-scale investments, it has taken significance steps in this effort, a small fraction of which was presented during the introductory remarks to the CoV. Specifically, DBI has utilized interns to assess and compare the outcomes of three distinct types of postdoctoral training programs including postdoctoral fellows trained at Centers, through the PRFB program or on research awards managed across BIO. Those data suggest that postdoctoral fellows trained at Centers are twice as likely to obtain tenure track faculty position as compared to those trained on conventional research awards. Another pilot assessment using text mining tools sought to determine how Centers are utilized by the broad research communities they are designed to serve. Granted, these are only initial steps towards the establishment of a robust process for fully evaluating the impacts of Centers, but now that DBI has increased the scientific personnel associated with the oversight of Centers and Cooperative Agreements (Science Advisor and Science Assistant), DBI will be in a position to establish a more robust process than we have currently. In addition, DBI and BIO have begun to implement project management teams for the larger projects (CYVERSE and NEON) coordinated through DBI and we agree with the CoV that this will provide an opportunity to implement a more substantive process for assessment.

<u>Other Concerns Noted by the CoV that pertain to more than one program, but were not considered to be a general theme of concern:</u>

Human Resources QIII.4: A recommendation from the 2013 CoV indicated that DBI lead the development of a Directorate-wide process to assess the effectiveness and impact of the "broader impacts" criterion, with attention to how the community has responded to changes in the guideline language for this criterion. It is not clear how/if the program has been responsive to this charge, nor what the results of this assessment was if it has been addressed. As such, the same recommendation is made in this 2016 report

DBI is willing to participate in any BIO Directorate-wide process designed to assess the effectiveness and impacts of the "broader impacts" criterion.

Human Resources QIV.J: The programs in HRC are generally well-aligned with national priorities. The charge from the 2013 CoV report on this topic however, remains a salient point in 2016: All programs are encouraged to develop appropriate mechanisms to maintain relevance to the community, the agency, and constituent needs.

While HRC programs do consider relevance of the scientific scope in the awards they make, DBI is currently having conversations to determine how to better align HRC and RRC scientifically. In particular, BIO is leading the Rules of Life NSF Big Idea initiative across the foundation and this will provide an opportunity for the HRC programs to consider how best to align with this effort.

Human Resources Other Topics Q5: NSF would appreciate your comments on how to improve the CoV review process, format and report template. Sample data set was terrific, however, some actions were not as helpful to the CoV deliberations. Among the awarded actions, there were awarded proposals as well as supplements and notes on forward funding of specific proposals. Inclusion of these other actions diluted the number of awarded full proposals that were in the sample data set for review.

DBI appreciates this feedback and will remove supplements and forward fund actions from the HRC dataset for the next CoV. As part of our effort to provide full transparency for the COV review, we made data used for our analyses available to the maximum extent possible. We recognize that within the context of a CoV, it may have been daunting to parse that volume of information. DBI staff have already met with personnel from NSF Division of Information Systems (DIS) to demonstrate how the new MyNSF tools were used and have conveyed the CoV comments that both commend the provision of data and articulate the challenge of interpreting it. We expect that the 2016 DBI CoV feedback will contribute to a larger Foundation-wide approach to efficiently provide baseline data for review in an effective format.

Research Resources QI.6: In just about every case, the Review Analysis in the RRC provided by the program officers provides clear rationale for the funding decision, but the Review Analysis is not sent to the PI.

DBI will increase the use of program officer comments in order to communicate the basis of the rationale to award or decline in the Review Analysis to the PI.

Research Resources QII.3: In general, the reviewer selection process in Research Resources programs is quite good, except for a disproportionately low racial diversity of reviewers.

This has been an ongoing struggle for the programs in the RRC, but DBI will continue to seek new ways to enhance participation, possibly through ad hoc reviews, increased use of virtual panel participation, and outreach to PUI, MSI, TCU, etc.

Research Resources QIII.1: The CoV was concerned with the way in which the CSBR and IDBR programs were placed on hiatus for evaluations.

In fact, this was not a transparent process, but DBI program staff are now working extensively with the BIO OAD in the program evaluation process to ensure that any future decisions about these programs, or any programs in DBI, will be data-driven and made as transparent as possible. Any current communication to the community through the DBI blog and the program websites has been reviewed and approved by BIO OAD.

Research Resources QIII.3: DBI should better justify the balance of its portfolio along the spectrum from innovation to sustainability. In addition, the CoV mentioned that metrics should be better utilized for program planning and prioritization.

This is a very good idea and DBI will consider the innovation to sustainability as well as the scope and scale dimensions across programs within the entire division. In addition, DBI is also beginning to characterize and utilize more metrics in its planning efforts.

Research Resources - Other areas not addressed elsewhere Q1: From 2013 CoV: Self-reflection and measurement of progress. We recommend that DBI and the Directorate develop effective mechanisms through which they will track their progress on the recommendations that emerge from processes such as the CoV. This CoV endorsed this and encourages DBI to pursue it directly.

Tracking action plans from evaluations such as the CoV report is now expected as a responsibility of the senior management of all BIO divisions. This accountability should aid in producing the requisite documents supporting progress for the proposed recommendations and areas of concern.

Research Resources - Other areas not addressed elsewhere Q3: In the spirit of prompting DBI to expand demographically its pool of reviewers and PIs the CoV suggested a research initiation-type of funding mechanism focused towards MSIs and PUIs that provide support to alleviate teaching responsibilities.

This is an interesting idea and DBI will explore how such an activity might be used to expand participation from these institutions. .

Research Resources QIV:E and I: The CoV noted that while the balance of institution types across the division is quite reasonable, the RRC has a lower ratio of awards to MSIs, PUIs, etc. than the HRC and thought these data should have been organized by cluster. In addition, the CoV requested that demographic data be presented for participants of RRC awards.

DBI will consider this approach to organizing these sorts of data for the next CoV. DBI will also track these data to try and improve the institutional balance across the clusters.