Response to Recommendations from the Committee of Visitors
Division of Integrative Organismal Systems
June 7 – June 9, 2018

INTRODUCTION
The Directorate for Biological Sciences (BIO) would like to thank the Committee of Visitors (CoV) for their efforts in evaluating the management and review processes of the Division of Integrative Organismal Systems (IOS) at NSF. BIO is aware of the extraordinary amount of work that the CoV members contributed before and during the meeting and is especially appreciative of their commitment to this important review. The thoughtful report that emerged from the CoV deliberations is highly appreciated by BIO and IOS. BIO appreciates the thoughtful responses to the division specific questions posed to the CoV in Section V of their report.

Section I. Questions about the quality and effectiveness of the program's use of merit review process.

Recommendation… It appears that about 10% of panel-reviewed proposals received only one ad hoc, which is a small proportion. Even so, the opinion of the COV is that all proposals should receive two or more ad hoc reviews to balance the panel reviews. We know that it can be challenging for Program Directors (PDs) to get ad hocs, and we encourage NSF to continue to improve its tools for managing the review process (similar to the excellent tools available for managing journal peer reviews).

> *Response: BIO agrees that a panel review supplemented by two or more ad hocs is a best practice, however there are often exceptions to this. When a proposal is co-reviewed by two programs, it may already have 4-6 reviews from panelists. There are also competitions where only panel review is conducted. As part of the Renewing NSF initiative, new Smart Tools for finding reviewers and other NSF activities were released NSF wide in August 2018. Mandatory, agency-wide training for incoming program directors (Merit Review Basics I-IV) includes sections on using multiple tools to find ad hoc reviewers. This training will be emphasized in onboarding of new program directors, and best practices for panel and ad hoc review of proposals will be incorporated as recurrent items in Division retreat and staff meetings.*

Recommendation…PIs may be surprised that their proposals receive as few as 3 or as many as 9 reviews. The context statements do not address this variation, and we were not given information on the distribution of this variation across different types of proposals, applicants, or funding success rates, consequently we could not assess the extent of the variation or its potential impact. Perhaps PIs could be informed in context statements that proposals receive at least 3 reviews, and proposals that are co-reviewed by more than one panel are expected to have a larger number of reviews.

> *Response: It has long been NSF policy that a proposal must have a minimum of 3 reviews for a program director to make a recommendation. The Division is now in the process of revising the template for context statements and panel summaries and will consider this recommendation in that process.*

Recommendation… The COV recommends that in-person panels should not be eliminated, but the addition of hybrid and small virtual panels is valuable.

> *Response: BIO has no intention of eliminating in-person panels and agrees that the addition of hybrid panels (in person panels where a few panelists attend virtually) and small virtual panels have provided needed flexibility and allowed for greater participation in panels by individuals for whom travel was a constraint.*

Recommendation… Including these internally-reviewed proposals inflates the apparent funding rate which is listed as 23% in the IOS Self Study, but the COV was informed that the funding rate for panel-reviewed proposals is under 10%. The 23% value is misleading and should not be emphasized in public statements about the IOS funding rate.

> *Response: Discrepancies between published funding rates and rates reported in IOS context statements were largely a result of not considering preliminary proposals. Since BIO is no longer using preliminary proposals for core funding programs, the published funding rate for IOS should be more consistent in the future. The publication of funding rates is not handled at the level of the Division, but rather by the Office of Budget, Finance and Award Management.*

Recommendation… We recommend that specific guidance as to the purpose of the reviewer summary statement, and what the summary statement should and should not contain, be provided explicitly to reviewers. This is particularly important in the cases of proposals that are not discussed, as no panel summary is generated for such proposals, reducing the feedback that PIs can receive on their proposals. … The COV's opinion is that the review form could provide even more guidance about criteria and parts of the proposal that need review. For example, these could include, but need not be limited to, the following: productivity from prior support, Data Management plan, significance of question(s) asked, potential for innovation, appropriateness and feasibility of proposed methodology, or potential for impact on the field. … The COV recommends that panel members drafting these sections should continue to be educated about how to write a good rationale, and the other assigned reviewers and panel members should be encouraged by the PD to look carefully and improve the Rationale sections.

> *Response: This has been an ongoing effort across BIO and NSF. NSF has now made available instructional videos on how to prepare reviews that help to educate reviewers and panelists. IOS programs will include links to these videos in pre-panel instructions and in invitations sent to reviewers.*

Recommendation… we recommend that more of the rationale that the PDs explain so well in their Review Analyses, be communicated to the PIs.

> *Response: Program Directors are encouraged to include any information about the decision that is not evident from the reviews, panel summary or context statement in a PO Comment that is available to the PI in FastLane/Research.gov. We will continue to encourage PDs to use this option when appropriate.*

Recommendation… At the review, Panel Summary and PD Analysis levels, IOS should strive for substantive evaluations of Data Management Plans. In the Results from Prior NSF Support and in Annual/Final Reports, the implementation of Data Management Plans and actual data sharing should be evaluated.

Response: BIO is already moving in these directions, having recently posted an update on our website (Feb. 2018) providing guidance to investigators and PDs about preparation and review of DMPs. IOS recognizes that different research communities may have their own data management practices and standards; that these norms will change over time; and, that life cycles of usefulness will vary for different data types. As such, it is essential for scientific communities to guide needed standards development and to shape expectations for sharing or archiving. Annual project reports required for all NSF multi-year awards must include information about progress made in data management and sharing of research products, and it is BIO policy that implementation of the DMP will be monitored through the annual and final report process by BIO Program Directors. Substantive evaluations of DMPs will be emphasized in panel orientation and reviewer requests. In Fall of 2018 a revised panel summary template was introduced in IOS that includes the DMP as a separate category for panel discussion and comment.

Recommendation… Some PIs include a narrative of prior review scores, reviewer and panel criticisms, and how they have been addressed in the current version. But this is not required, nor does it seem to be described in any proposal instructions. It is the opinion of the COV that there should be a uniform process in place to inform PIs that they may include information on prior reviews, if they chose to do so.

Response: As described in the Proposal and Award Policies and Procedures Guide (PAPPG NSF 18-1), a declined proposal may be resubmitted, but only after it has undergone substantial revision. The Foundation thus treats revised proposals as new proposals, subject to the standard review procedures, so there is no requirement to include previous review information. In general PIs may include any information in support of their proposal that they wish, but there is often not enough space within the page limitations to address previous reviews. There is also a risk that adding a uniform statement about the option for this information will be interpreted as a requirement. BIO believes that the best practice of individually advising PIs on this option when asked should be maintained.

Section II. Questions concerning the selection of reviewers.

Recommendation… The COV was not concerned about the number of reviewers per application but did express considerable concern about the variance in reviewer number across full proposals. The COV recognized that large, complex, and/or multidisciplinary proposals do require the expertise of multiple reviewers, but the high variance was not explained by this consideration. Consistency in the review process, and its impact on fairness, is important, and we urge the Division to consider mechanisms to limit the variability in the number of reviews per proposal**.**

Response: Fairness in review is an ongoing concern that is regularly discussed in all our programs and we constantly strive to balance our requests for review with the variance in responses. Given the variation in rates of return for requested ad hoc reviews, it is difficult to control the number of reviews precisely. However, best practices will be adopted for asking for an average of 2-3 ad hoc reviews only, in order to reduce the reviewing load on the community. This, combined with panel review, should result in a target of 4-6 reviews per proposal. We anticipate that even with this best practice, there may be some proposals with only 3 reviews due to failure to receive ad hoc reviews and some proposals with >6 reviews due to being co-reviewed with another panel.

Recommendation… A review of the sample of the Division jackets in addition to the data presented in the Self Study indicate that the Division has an effective process for identifying COIs in potential ad hoc reviewers and panel members, and for excluding them from participating in the review of

proposals. Based on the number of COIs it does not seem as though a meticulous adherence to COI policy has significantly limited the ability to conduct effective reviews. However, we do suggest that the Division consider how broadly some of the current COI categories are defined, and how they might limit the availability of otherwise appropriate reviewers in light of an increase in collaborative research, interactions among universities and researchers at different universities, and large multi-author publications, as well as emerging areas of science that involve a relatively small but highly interactive community of scientists. The 2014 COV report noted the issue of COI interpretations potentially affecting reviewer availability negatively, and the current COV did not have the impression that the issue has been addressed.

> *Response: The Division has taken steps to mitigate COI effects on the review process. The COI guidelines are established by the Office of General Counsel (OGC) to ensure that NSF processes meet all applicable federal laws and ethical standards. IOS consults closely with OGC in interpreting those guidelines for specific situations and communicating the outcomes of those guidelines to implement a robust and fair review process and will continue to do so. The OGC is working with BIO to prepare revised COI guidelines for programs. We will maintain regular consultation with OGC going forward.*

Recommendation… The new "no-deadline" system will come on line shortly. It is incumbent on the Division to consider how the new system may impact availability or nature of reviewers and monitor this carefully as this new system is implemented.

> *Response: The Division has developed a new tool to identify COIs for each panel, based on the Collaborators and Other Affiliations (COA) spreadsheets included with each submission. We anticipate refining this tool as we get more experience with the no-deadline system.*

Section III. Questions concerning the management of the program under review.

Recommendation… IOS is a scientifically high impact division that is centrally important to the overall mission of the BIO Directorate and the NSF overall. The COV believes that it needs strong stable leadership to continue to succeed in its mission. The COV was nonetheless impressed at how well the program directors and staff have functioned in promoting the mission of IOS despite the lack of stable leadership over the review period. …As in the prior 2014 Committee of Visitors report, the Division continues to have a notably high rate of turnover in senior leadership positions. Moreover, consistent with the prior report, it appears that there continues to be fewer permanent program officers who have been in their roles for longer periods of time… The COV recommends that the Division retain a permanent leader (Division Director or Deputy Division Director) and maintain a balance between rotating and permanent program staff that is consistent with the other Divisions within the BIO Directorate.

> *Response: As the COV has noted, this has been an ongoing issue. In 2018, IOS began the process of hiring 3 new permanent program directors and is looking forward to hiring additional permanent program directors in 2019. Shortly after the CoV met, the Directorate conducted a search for a permanent Deputy Division Director (DDD) for IOS – that search was successful and a permanent DDD is now in that position. A rotating DD joined the Division in July 2018.*

Recommendation… With the change to a no deadline submission policy, the COV believes that this could afford program officers time and opportunities to develop cross Division and cross-Directorate interactions. The COV noticed a lack of apparent cross-organizational discussions and opportunities. Given the nature of the NSF's laudable goal of discerning the *Rules of Life*, this

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question will require a scale of scientific inquiry that could be unprecedented, bringing together researchers from across the BIO Directorate and from different NSF Directorates. IOS could stand at the intersection of NSF to address this important goal and could play a pivotal role. The COV recommends that the IOS Division utilize the no deadline submission policy as a method to set processes in place that will enhance co-review and co-funding of proposals that address key priorities of NSF.

> *Response: Programs in organismal biology are central to the Rules of Life activities and IOS included processes in the new solicitations issued for FY 2019 that support enhanced collaboration, co-review and co-funding. The BIO Directorate has also recognized the value of co-review and co-funding and has instituted procedures overseeing the collaborative review of RoL submissions in FY 2019 and beyond. BIO is also currently developing tools that will greatly enhance the visibility between portfolios within BIO and across NSF – it is anticipated that this will facilitate co-review and co-funding and help BIO drive the scientific interest and questions in biology.*

Recommendation… With the addition of the Plant Genome Research Program, the IOS Division has broadened its scope and priorities. The COV notes that there could be unintended budgetary consequences and recommends that the Division continues to monitor and maintain a healthy balance of supporting larger team-based projects and independent investigator projects in all the clusters within this Division.

> *Response: The Division is responsible for maintaining a balanced portfolio in all its funding programs, including the Plant Genome Research Program, which has been managed by IOS since 2009. The balance of IOS awards portfolio is reviewed every four years by a CoV.*

Recommendation… The COV recommends that the Division develop strategic goals with metrics of success and a path for programmatic evaluation.

> *Response: Strategic goals are implicit in annual retreats that the Division holds, and in coordination of the Division with Directorate-wide initiatives, e.g., Rules of Life. Individual PI-based science, and the recommendations of panels during peer review are influential in guiding programmatic portfolios. This combined with the expert opinions of permanent and rotating program directors, assure a dynamic and agile funding strategy. Programmatic evaluation and metrics of success for basic science funding programs are topics of concern within NSF and the BIO Directorate but are beyond the charge of a COV.*

Recommendation… The COV encourages IOS to develop such [*strategic*] goals, both for the purpose of directing long term funding decisions and for articulating to the scientific community and to the broader public what IOS does. In particular, IOS needs to consider the appropriate balance between research on model/reference organisms and non-model systems and communicate this policy in program solicitations.

> *Response: Strategic goals are addressed in annual retreats for the Division and in coordination with Directorate-wide initiatives and NSF-wide programs (e.g., The Ten Big Ideas). The funding environment at NSF and in the Division is dynamic and BIO does not have static policies with respect to model and non-model systems. When initiatives such as EDGE are formed, the community is informed through a variety of outreach to professional societies, web-based platforms, and solicitation descriptions.*

Section IV. Questions about Portfolio.

Recommendation… The COV noted that IOS has been doing a meritorious job at balancing their awards portfolio, funding a range of exciting and important research. The COV encourages IOS to continue to be aware of the balance of their award portfolio. In addition, the COV noted that smaller awards (ranging from $50-150,000) could be important additions to the IOS portfolio. Here, members of the COV noted such smaller awards would be useful to a variety of investigators, ranging from Beginning Investigators to experienced PIs moving into new areas.

> *Response: BIO believes great science can occur at all funding levels and in all types of institution. Each of the previous IOS solicitations contained language reminding PIs that IOS is willing to consider funding all sizes of projects. IOS is currently willing and able to fund those smaller projects; however, they are seldom submitted. In outreach events, IOS program directors will continue to signal their interest to supporting smaller scope projects if meritorious.*

Recommendation… While the value of innovative or potentially transformative (IPT) research is recognized, it is unclear whether IOS has a goal for the percentage of funded proposals that are designated as IPT. IOS should determine whether a targeted percentage has value and whether there should be any linkage of this designation to the scale of the project. For example, should larger projects have higher expectation for innovation? ...IOS should be more transparent about how the IPT designation factors into decisions about funding. …Additional guidance/examples of what constitutes IPT proposals would be helpful to reviewers and to PIs. …The relationship between risk and innovation should be clarified. While risk tolerance is important, reviewers should be sure to focus on innovation and potential for transformation, rather than focusing primarily on high risk, per se.

> *Response: The definition of "potentially transformative" came out of a 2007 report from the NSB and is used NSF wide. It can be found here: https://www.nsf.gov/about/transformative_research/definition.jsp. This definition is presented to panelists during panel orientation. A proposal is labelled as PTR by the review panel during discussion. NSF includes a Special Program Data Element code (PTR) in the proposal jacket that IOS codes for each reviewed proposal. The BIO Directorate is addressing the issue of how to promote innovative science and encourage risk-taking among PDs. IOS is participating actively in these discussions and is discussing these issues with program staff.*

Recommendation… The COV noted that there was a reasonable degree of inter- and multidisciplinary projects, as self-reported by the PI. … The COV recommends that IOS also track the interactions <u>within</u> BIO, in that collaborations between, for example, geneticists and ecologists would reflect an equally strong and important interaction for the advancement of the field. The COV also noted that areas in the *10 Big Ideas*, such as the *Rules of Life*, will require focus on co-funding efforts in the future (e.g., crossing boundaries between molecular biology and IOS), beginning as soon as FY 2019 when the *Rules of Life* funding may become available. An example of this activity in the past is the collaborative effort with GEO to develop awards to study ocean acidification. The COV encourages IOS Program Directors to reach out to other programs in BIO to facilitate the process of IOS grantees having access to these future funds allocated to the *Rules of Life*.

> *Response: In October 2017, BIO released a Dear Colleague Letter (DCL) "Rules of Life-Forecasting and Emergence in Living Systems" that called for conferences, EAGERs and RAISEs as the first of Rules of Life activities within BIO. Those submissions were required to cross Divisional and Directorate boundaries and have been a chance for BIO/IOS program directors to collaborate with each other and with their counterparts in other Directorates. The*

FY19 solicitation for IOS, and the other BIO Divisions, all have descriptions of RoL submissions, along with explanations for the collaborative nature of these submissions. One requirement for the review of these proposals is that they are reviewed by at least two different Divisions.

Recommendation… In the self-study report, only percentages of final awarded projects were presented, whereas we felt strongly that the major parameter that should be evaluated is relative success rate of different subgroups. For future COV evaluations, we strongly recommend reporting success rates in addition to final portfolio distributions.

Response: BIO is discussing ways to improve how we track our portfolios and ensure fair and substantive review processes. With new tools being introduced agency wide, our ability to track such metrics will be greatly enhanced.

Recommendation… Overall, the COV thought that IOS is doing a good job of distributing research money throughout the country. However, IOS needs to provide more and clearer data on the geographic distribution of awards for future COV panels. The COV also discussed what the "appropriate" geographical distribution of PIs might be and suggest that NSF provide more guidance as to the goals they are trying to achieve.

Response: Program directors are expected to maintain a diverse portfolio of awards, which includes geographic and institutional diversity. However, there is no specific goal or expectation as to what is an appropriate geographic distribution. NSF tools available in the electronic systems available to program directors now have easily calculated geographic maps of awards. These can be generated for the Division as well as individual programs. These tools will help to understand and monitor funding portfolios. IOS also practices a panel debriefing procedure where PD recommendations are presented and discussed with the DD and DDD. This allows the Division to review and track all demographic data, including geographic distribution of award recommendations.

Recommendation… The COV recommends that the IOS division encourage more proposals from bachelors and masters-granting institutions. The number of preproposal and full proposals from these schools appeared to be small. We note that this was also recommended in the previous COV report.

Response: NSF, BIO and IOS engage in outreach and endeavor to encourage more proposals from these institutions and are always looking for more ways to connect to schools and investigators that are not well represented in proposal submissions or in the portfolio.

Recommendation… The Division has done an excellent job of tracking funding to BIs [*beginning investigators*], including using a data driven approach to analyze outcomes during the pre-proposal program. As a recommendation, the COV noted that as IOS transitions to the "no deadline" (no DL) data gathering should be continued as it was for the pre-proposal process (possibly including hiring a contractor to conduct a study). In particular, we encourage IOS to track the impact of no DL on the number of submissions and success in funding from PIs and co-PIs who would be impacted by caregiving and career/life balance.

Response: As noted, this is a concern both inside and outside NSF. We are already planning to continue to track beginning investigators and other groups of concern. Since the entire BIO Directorate has transitioned to no deadline submissions for its core programs, BIO is developing appropriate metrics for groups of concern that will be uniformly tracked in each of the BIO Divisions. In addition, BIO has convened a subcommittee of the BIO Advisory

Committee to advise on the development of metrics to track multiple portfolio statistics – including beginning investigators and other groups of concern.

Recommendation… We observed that some educational goals as described in proposals include a plan for assessment of educational objectives. We believe that having such assessment plans should be encouraged and that these plans should be reviewed, with comments provided in the reviewer summaries.

Response: It has been NSF policy for some time that the standards for broader impacts activities are set by the scientific community rather than NSF. We note that IOS reviewers regularly praise the inclusion of assessment and note its lack and this is leading to more and more proposals that include assessment. Hopefully, this recognition by reviewers is also encouraging an ongoing discussion in the scientific communities funded by IOS.

Recommendation… When results of previous NSF support are included in a proposal, IOS is encouraged to ensure that reviewers are assessing the success of both the intellectual merit and broader impacts of the previous work.

Response: As mentioned previously, all panels start with an orientation from the program directors where guidance on these issues for panelists are covered. All NSF reviewers are given the same instructions in Fastlane and across IOS, all panelists are given the same instructions and use the same panel summary template that requires them to address the outcomes of prior support. We strive diligently to ensure that discussions in panel are appropriate, fair and complete and will continue to do so.

Recommendation… IOS should evaluate the success of educational programs at the programmatic level.

Response: NSF has opted to make this the purview of the institutions themselves.

Recommendation… The COV notes that the integration of research and education is usually introduced in a proposal as part of the broader impacts. IOS should consider the full range of possible broader impacts when communicating with reviewers; PDs should clearly articulate this full range. For example, IOS has recognized the importance of promoting the participation of women and underrepresented minorities in science, and in increasing public outreach and engagement with science. We suggest that IOS might also encourage other areas of broader impact, such as increased partnerships between academia and industry, enhanced infrastructure for research and education, and projects with potential economic benefits.

Response: In our panel training we continue to note that broader impacts come in all varieties and PDs try to include a vast range of them in the set of awards. NSF does not want to provide undue influence on proposers regarding what their likely broader impacts activities might be or imply that the exemplary activities are in any way proscriptive. Therefore, they no longer provide a list of examples of broader impact activities to PIs. However, the Office of Integrative Activities provides guidance to supplement that given in the Proposal & Award Policies & Procedures Guide, https://www.nsf.gov/od/oia/special/broaderimpacts/*. The importance that NSF ascribes to these facets of broader impact are evident in the programs that have developed specifically to promote such activities. Examples include the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs in ENG. The Division of Biological Infrastructure is charged with enhancing infrastructure for research, and many IOS investigators participate in funding programs in that Division (e.g. CYVERSE).*

Recommendation… As mentioned for the issue of geographic distribution of awards (#5 above), the COV noted that the goals of IOS and of the NSF as to what the "appropriate" proportion of "underrepresented" PIs might be, and what the appropriate definition of "underrepresented" is in this context, is unclear. Merely "broadening participation" is an overly simplistic and insufficient goal. The COV recommends that the NSF develop more specific and explicit goals in this regard.

> *Response: This issue extends beyond IOS and BIO to the level of the agency as a whole. The importance NSF ascribes to this is evident in the "Broadening Participation page on the NSF website. The Committee on Equal Opportunities in Science and Engineering (CEOSE) has been working on a multi-year initiative that advises NSF on broadening participation programs to increase diversity and inclusion in America's STEM workforce.*

Recommendation… the COV notes that it is now clear that "race" is no longer an acceptable scientifically valid category, but rather is a social construct. Indeed, the NSF has supported much of the genomic, genetic and social science research that has demonstrated this. As the governmental scientific foundation tasked with advancing science research and education, it is inconsistent for the NSF, and the IOS within it, to continue to implicitly support these unscientific categories by tracking the "race" of PIs, staff, and other participants in the NSF's mission. Accordingly, the COV does not recommend that the category called "race," as it is currently presented to PIs, be included uncritically as a category for tracking PI participation in IOS or NSF programs. The "racial" categories offered as options are limited, inadequate for the current and projected future national demographic, historically biased, and most importantly, unscientific. However, we do recommend that the NSF track self-reported ethnicity, socioeconomic status, and other personal identity elements, which are elements that can contribute to the reality of racism, across the individuals that participate in and enact the mission of the NSF.

> *Response: This is an issue beyond the purview of IOS and BIO, as the PI/co-PI information sheet is an agency requirement for proposal submission. However, the COV concern will be communicated to agency levels above BIO.*

Recommendation… While China and other countries are greatly increasing funding in the biological sciences, the flat funding in the NSF Biological Sciences Directorate, coupled to increasing costs of performing cutting edge science, has resulted in a decrease in the amount of science that can be supported. This is doing damage to the US research and education enterprise…… We believe that the alignment of IOS activities with national priorities should be communicated more broadly and effectively. We recommend that IOS provide some indication of what level of support for national-priority-focused projects is expected or desired, in order to allow for an assessment of how well this goal is being met.

> *Response: BIO is always working on improving communication of the value of the research it supports. The NSF budget request submitted to Congress each year includes a description of each division and BIO divisions clearly state their contributions to national priorities. However, as a basic science agency, it can take years for NSF-supported basic discoveries to be applied in addressing national priorities. BIO and IOS will continue efforts to frame its funded portfolio in a way that makes this connection to national priorities clearer, so that it can be more readily assessed.*

Recommendation… IOS should also evaluate ways to encourage grant submissions that relate to current and emerging BIO priorities, as well as to other NSF-wide and national priorities.

Response: We were encouraged by the response to the BIO [Dear Colleague Letter (DCL) "Rules of Life-Forecasting and Emergence in Living Systems"](#) and to special calls for proposals such as the initial EDGE track in an earlier version of the IOS core programs solicitation that grew into the EDGE program with its own solicitation. We have continued to do outreach at professional society meetings, individual campuses, through webinars (available live and recorded for those that are not able to attend) and posts in our blog to provide information to investigators.

Recommendation… Fundamental research is the engine of applied science. Without sacrificing the important role of IOS in advancing fundamental research, IOS should look for opportunities whereby its research outcomes may be linked to economic development through mechanisms such as SBIRs, i-Corps grants, creation of startup companies etc.

Response: We regularly encourage investigators to take advantage of other funding options such as SBIR and iCorps. We expect that the creation of startup companies will be reported in annual and final reports.

Section V. Other Topics

Recommendation… IOS occupies a unique position within the directorate and across the foundation, operating across scales from molecular networks, through organisms to ecosystems. This moment in the evolution of NSF and biological sciences presents opportunities to promote the division within the foundation. For example, IOS is naturally positioned to play a leadership role in advancing the '*Understanding the Rules of Life*' and '*Growing Research Convergence at NSF*'. The move to 'no deadline' submissions provides the program staff the opportunity to reorganize their collaborative processes as they rethink panel focus and composition. We recommend using this organizational moment of change to create a unified mission statement to use in communication within Bio and across the foundation. It should resonate well with the appropriate elements of the *Ten Big Ideas* and emphasize desired outcomes that will resonate with stakeholders within the community, the public and Federal government. A consistent message coming from all IOS program staff and leadership is encouraged.

Response: IOS is continually working to communicate clearly, directly and consistently. In the months after the COV meeting, IOS instituted a bimonthly science discussion of 'science drivers' that will inform this missions statement. A Divisional retreat has already been held that included this topic, and others are planned in order to develop a unified mission statement.

Recommendation… we believe that access for the COV to outcomes data (or perhaps the results of the analysis of outcomes performed in the Director's office) would significantly improve the ability of the COV to make recommendations that would have the greatest impact on improving the work of IOS and its alignment with the broader mission of NSF.

Response: Measuring and interpreting impacts is regularly discussed across the foundation. NSF has established an Evaluation and Assessment Capability Section in the Office of Integrative Activities to provide centralized support for the design of program evaluation studies. However, evaluation of outcomes from awards and their impacts is beyond the charge of the CoV.

Recommendation… The COV strongly suggests increasing the media presence for IOS. **…** we recommend that IOS can mitigate some of the obstacles to implementation by leveraging materials and resources already created by IOS grantees in research projects. In addition, the enormous growth of mass media technologies and venues will facilitate the Division's communications efforts, and greatly increases the potential reach and influence of the work supported by IOS. A few suggestions to broadcast the importance of IOS's sponsored research are:

-An IOS YouTube channel that makes IOS news more accessible and that distributes them more widely (this channel could include short clips already produced by NSFs Public Communications and Media and those produced in Broader Impacts in IOS funded projects).
-A compilation of TED talks by IOS funded researchers on IOS funded research.
-A compilation of TED ED lessons developed by IOS-funded PIs.
-Partnerships with Google Earth.

> *Response: BIO appreciates these suggestions, and will share this with the Office of Legislative and Public Affairs (OLPA).*

Recommendation… The COV would appreciate being provided with data that is both more thorough and a better match to the questions being asked in the Template. It would be very helpful to generate a check list of data needed for each question asked to ensure that the relevant information is readily available to the COV.

> *Response: We endeavored to provide as much data as possible in the self-study and associated excel file, along with a list of data and documents available in the READ ME document. In the event that the CoV needed additional data we assigned our analyst to assist in real time. We regret that you did not have the types of data you expected for each question and will consider organizing documents and data by question for the next CoV.*

Recommendation… The COV had a particularly difficult time analyzing true success rates of proposals at multiple points in the submission process, not just at the award stage, as well as comparing them along multiple dimensions. … including more detailed success rate data in the COV materials and Self Study prior to the meeting to match the questions we are asked to address would have made the COV process more efficient. If there currently NSF wide standards for Self-Studies, we suggest that the Division argue for more flexibility in preparing these documents.

> *Response: The templates for the self-study change regularly and we will pass along your comments. We have had repeated discussions about the best way to analyze the data and at what points and expect that these will continue to inform our decisions.*

Recommendation… The COV suggests providing all eJackets rather than a sample, as this would have supported a more accurate analysis of multiple items contained in the template.

> *Response: IOS followed the agency-wide directions for providing representative jackets to the COV. We will pass on the recommendation to the cognizant agency officials, but the provision of all jackets was beyond our capabilities. We note that each proposal included in the set that the CoV has access to has to be uploaded to the CoV module. In the case of the 2018 CoV there were 13,145 actions during the period under review. We used a sample of 426 representative actions noting that statistically this is a reasonable sample to represent the larger population of proposals. Additionally, it would be difficult for the CoV members to inspect 13,145 individual jackets in 2.5 days. A compromise might be providing all jackets for specific subsets of the actions, such as those from beginning investigators or minority serving institutions.*

Recommendation… The COV would benefit by a more efficient method for accessing specific information from eJackets, such as whether or not they were flagged as "transformative" and any other information that is specifically queried in the Template. Additional columns in the downloadable eJacket excel file would help with this to ensure that there is an appropriate column for each question specifically asked of the COV.

> *Response: We will endeavor to make the file clearer and better labeled. We will also pass this concern on to agency officials involved in developing future COV templates.*

Recommendation… Use of information in individual jackets would be enhanced by being able to download, or at least view online, all documents included in the eJacket for a given application, as a single document, rather than having to select and open each component file separately. Related to this point, there seems to be a technical glitch in the system when more than one tab of a browser is opened, each containing a different eJacket file. When the user opens one eJacket in a new tab, and then a second eJacket in a second tab, clicking on any given document in the second eJacket yields the corresponding document for the first eJacket. This means that only one eJacket can be opened at a time, which is inefficient.

> *Response: Unfortunately, that functionality is not available; there are ways to view the entire proposal, and all the reviews as a group but not the entire jacket. The agency-wide eJacket team is always working on ways to improve the software and we will pass your suggestions along to them.*

Recommendation… Access to site visit documents should be provided, as this was an item the COV was specifically asked to comment on.

> *Response: Site visit reports are included in eJacket as documentation of the management of awards. The site visit documents were not specifically isolated into a separate category for the COV, an oversight that was one of the items that was lost in the regular turnover of leadership that the COV noted above.*

Recommendation… The COV felt that the overall organization of the Template was effective in guiding their deliberations. Having the Template in a free text Word format rather than table format would make the initial writing and merging of sections more efficient even if the final document is compiled into a table format.

> *Response: The template is in use NSF wide; we will pass along your comments.*

Recommendation… The COV knows that the evaluation of process and mechanism by our COV is distinct from the evaluation of outcomes and understands the rationale for dividing the IOS evaluations along these lines. However, it is difficult to evaluate the effectiveness of process without knowing the success of outcomes. The COV suggests that the outcome analysis be completed first, and the results communicated to the COV evaluating process and mechanism.

> *Response: NSF has established an Evaluation and Assessment Capability Section in the Office of Integrative Activities to provide centralized support for the design of program evaluation studies. However, evaluation of outcomes from awards and their impacts is beyond the charge of the CoV.*

Recommendation… How might we ensure that new investigators as well as mid-career scientists are equipped with appropriate skills to participate in multidisciplinary, collaborative, and integrative

research? …The COV suggests that one way to address this charge is to examine existing career enhancement programs and assess whether they have dimensions that could be enhanced and/or modified to address the goals of this charge. We also suggest some ideas that might require new programs that would be specifically designed to address the goals of this charge. Although we find most of the ideas proposed in this answer to be appealing, it is important that a cost/benefit analysis be applied before these are implemented so that core programs are not adversely affected.

> *Response: We continually endeavor to make data driven decisions and maintain the strength of the core. In a tight and relatively flat funding climate, it is difficult to start new programs without some cost to ongoing programs. This particular topic is an active area of discussion for the BIO Directorate as a whole.*

Recommendation… We recommend that attention and support be continued for the early-career stage of faculty through normal funding channels with a note that funding at this stage supports the advancements of IOS disciplines into the future. The NSF graduate NRT programs as well as Graduate Research Fellowships could also be reviewed for ways to promote a culture of collaboration.

> *Response: We agree and expect to continue to support early career faculty through both CAREER awards and regular research awards. NRT and GRFP programs are managed by the EHR Directorate, but BIO is heavily involved in both and provides program directors to assist with NRT and GRFP panels.*

Recommendation… We suggest that the post-doctoral stage be given more attention for the development of collaborative research experiences. Currently, PGRP has a post-doctoral program that includes a strong mentoring component and excellent networking opportunities for candidates receiving these awards. We suggest that funding be continued for this program and that successful models for training and supporting post-docs in PGRP be broadened to include all of IOS, with specific emphasis on multi-disciplinary training (e.g., support for post-docs to have inter-lab training opportunities).

> *Response: We agree that it would be a great opportunity to expand PGRP's postdoctoral program, it would be imperative to ensure that it was not at the cost of ongoing programs since inflation in the cost of doing science has typically consumed any budget increases received. The BIO Directorate recognizes the importance of such training and is engaged in planning ways forward.*

Recommendation… Second, we recommend a joint early- and middle-career faculty time release/sabbatical program for development of collaborative science projects and/or for gaining skills in a new research approach or method that will enable inter-disciplinary projects. These could be modest one-semester supplements for a faculty member to cover salary and travel in order to advance their research program in new and innovative ways through the process of inter-disciplinary collaboration and could have a focus on developing projects for the *Rules of Life* and other emerging programs. In addition (or instead), supplements to current grants could be made to support travel to other labs for faculty to develop research and educational collaborations and to learn new skills and this could be included as a new grant supplement mechanism along with other programs such as REU, RET, RAHSS, and ROA. Also, we think that the Research Coordination Network (RCNs) can provide a cost-effective way to promote the development of a collaborative culture. This point is discussed in detail in the answer to Charge question 2 concerning how to integrate modern genomics more widely into IOS programs.

Response: In 2012 IOS issued "[Dear Colleague Letter: Beyond the Genome: IOS Funding Opportunities FY 2012 – 2013](#)" IOS has offered a Mid-Career Investigator Award as a supplement to a grant held either by the person wanting to gain a new skill or the investigator hosting that person and has included travel funds and some limited salary. Since that time, each of the IOS core solicitations has contained the opportunity to add a mid-career supplement to an award and the Plant Genome Research Program had a MCA track for this purpose. Our intention is to continue that supplement option in our new no deadlines solicitation. Unfortunately, we have had fewer requests than expected. Individuals interested in adding a MCA supplement to their grant as either the recipient or host should contact their program officer.

Recommendation…. Thus, we suggest that the balance of support for traditional models vs. novel or emerging systems be determined by a combination of submissions from the community and evaluation of these submissions by panels within the context of the questions being addressed.

Response: This recommendation is the current practice in IOS and allows the Division to continue to focus on supporting the most impactful science rather than a quota of model or non-model organisms.

Recommendation…We encourage IOS and NSF to keep the bidirectional nature of the relationship between the phenotype and genotype in mind when considering developing new opportunities and support for submitted projects. We emphasize that IOS has an important role to play in funding projects aimed at understanding intermediate mechanisms that may allow phenomes to feedback and affect genomes. The genome to phenome initiative and the *Rules of Life* more broadly provide an extraordinary opportunity to raise awareness and appreciation for the critical role of integrative mechanistic insight in developing broadly applicable explanations for both unity and diversity across biological systems

Response: We are excited about the Rules of Life activities both within BIO and across NSF and hope to see many exciting projects that consider the reciprocal and dynamic nature of the interactions between genomes and phenomes.

Recommendation… Research Coordination Networks (RCNs) have been a cost-effective way to provide cross training in cutting edge technologies using symposia, short and focused courses, and travel grants to trainees and PIs to cross train in expert labs. Increased visibility and funding of Research Opportunity Awards (ROAs) can be especially effective in allowing Primarily Undergraduate Institution (PUI) investigators to involve themselves and their students in studies of new model taxa and technologies. We encourage support for flexible grant supplements to mid-career researchers to lower the barrier to functional genomics in the integrative biology community.

Response: We expect to continue funding for all these supplements including the Mid Career Awards (MCA) that have been offered through the IOS core programs solicitation since 2013.

Recommendation… We recommend that IOS collect and analyze data on the factors below as the division transitions to no-deadline submissions and compare them to data from the pre-proposal period.
- Number of submissions both per fiscal year and per quarter;
- Success rate both by fiscal year and as a function of quarter of submission;
- Time from submission to decision as compared to previous review paradigms, and as a function of submission quarter
- Collaborative nature of proposals i) within IOS, ii) across BIO, and ii) across Directorates;

- PI and CoPI characteristics: individual demographic characteristics, particularly those indicative of underrepresented status, years since degree, new investigator, prior support as well as prior submissions that were not funded.
- For the reasons explained at the end of question #IV.9, we do not recommend that a category called "race" be included uncritically in tracking PI success through the new no-deadline system. However, we do recommend that the NSF track ethnicity, socioeconomic status, and other identity elements that contribute to the reality of racism, across the individuals that participate in and enact the mission of the NSF. For more specific discussion of this issue and the rationale underlying this recommendation, please see the end of the answer to question #IV.9.
- Institution type, including EPSCoR institutions, as a function of both submissions and awards.

Response: BIO plans to track a wide variety of aspects of investigator characteristics, submission data and success data from each Division. This will enable us to evaluate the impacts of the new review process and ensure that all groups of investigators are treated fairly and ensure that the best science is supported.

Recommendation… We also recommend that IOS monitor and address any unintended impact on the following areas:
- Proposal quality (based on panelist and ad hoc ratings as well as Program Director (PD impressions);
- Participation by prospective PIs;
- Challenges to administrative efficiency;
- Appearance that reductions in proposal submissions could be seen as lack of activity in area;
- Timing of awards (under the scenario that NSF continues to operate under continuing resolutions);
- Size of awards
- Panel breadth. The no-deadline model is likely to result in smaller panels due to the possibility of fewer proposals per year coupled to more panels per year. It will be important to monitor panel expertise and to ensure sufficiently broad expertise.

Finally, the COV was enthusiastic that the no-deadline approach could facilitate sharing of portfolios among BIO and other directorate PDs. The data on jointly funded projects by year should be tracked and be provided to the next COV.

Response: We share your enthusiasm for the potential of no deadline review to increase collaboration across BIO. We will include these recommendations (and the items in the recommendation above) in ongoing discussions with the BIO AC subcommittee on proposal submissions metrics. We thank you for these suggestions.