

CORE QUESTIONS and REPORT TEMPLATE for FY 2022 NSF COMMITTEE OF VISITOR (COV) REVIEWS

Guidance to NSF Staff: This document includes the FY 2022 set of Core Questions and the COV Report Template for use by NSF staff when preparing and conducting COVs during FY 2022. Specific guidance for NSF staff describing the COV review process is described in the “COV Reviews” section of NSF’s Administrative Policies and Procedures which can be obtained at <https://inside.nsf.gov/tools/toolsdocuments/Inside%20NSF%20Documents/Policy,%20Procedures,%20Roles%20and%20Responsibilities%20for%20COV%20Reviews%20and%20Program%20Portfolio%20Reviews.pdf>¹.

NSF relies on the judgment of external experts to maintain high standards of program management, to provide advice for continuous improvement of NSF performance, and to ensure openness to the research and education community served by the Foundation. COV reviews provide NSF with external expert judgments in two areas: (1) assessments of the quality and integrity of program operations; and (2) program-level technical and managerial matters pertaining to proposal decisions.

The program(s) under review may include several sub-activities as well as NSF-wide activities. The directorate or division may instruct the COV to provide answers addressing a cluster or group of programs – a portfolio of activities integrated as a whole – or to provide answers specific to the sub-activities of the program, with the latter requiring more time but providing more detailed information.

The Division or Directorate may add questions relevant to the activities under review. Copies of the report template and the charge to the COV should be provided to OIA prior to forwarding to the COV. In order to provide COV members adequate time to read and consider the COV materials, including proposal jackets, COV members should be given access to the materials in the eJacket COV module approximately four weeks before the scheduled face-to-face meeting of the COV members. Before providing access to jackets, the Conflict of Interest and Confidentiality briefing for COV members should be conducted by webinar, during which, NSF staff should also summarize the scope of the program(s) under review and answer COV questions about the template.

Suggested sources of information for COVs to consider are provided for each item. As indicated, resources for NSF staff preparing data for COVs include the COV Dashboard in Enterprise Reporting ([https://bi.nsf.gov/analytics/saw.dll?Dashboard&PortalPath=/shared/Enterprise%20Reporting/Pre-Built%20\(Canned\)%20Reports/COV%20Dashboard/COV%20Dashboard&Page=COV%20Landing%20Page](https://bi.nsf.gov/analytics/saw.dll?Dashboard&PortalPath=/shared/Enterprise%20Reporting/Pre-Built%20(Canned)%20Reports/COV%20Dashboard/COV%20Dashboard&Page=COV%20Landing%20Page)) and Enterprise Information System (EIS) –Web COV module (accessed by NSF staff only at <http://budg-eis-01/eisportal/default.aspx>). In addition, NSF staff preparing for the COV should consider other sources of information, as appropriate for the programs under review.

For programs using section IV (addressing portfolio balance), the program should provide the COV with a statement of the program’s portfolio goals and ask specific questions about the program under review. Some suggestions regarding portfolio dimensions are given on the template. These suggestions will not be appropriate for all programs.

Guidance to the COV: The COV report should provide a balanced assessment of NSF’s performance in the integrity and efficiency of the **processes** related to proposal review. Discussions leading to answers of the Core Questions will require study of confidential material such as declined proposals and reviewer comments. **COV reports should not contain confidential material or specific information about declined proposals.** The reports generated by COVs are made available to the public. *We encourage COV members to provide comments to NSF on how to improve in all areas, as well as suggestions for the COV process, format, and questions. For past COV reports, please see <http://www.nsf.gov/od/oia/activities/cov/>.*

¹ This document has three parts: (1) Policy, (2) Procedures, and (3) Roles & Responsibilities.

FY 2022 REPORT TEMPLATE FOR NSF COMMITTEES OF VISITORS (COVs)

The information below should be completed by program staff.

Table 1 - Summary Information

Summary Information
Date of COV: June 28 – July 1, 2022
Program/Cluster/Section:
Division: IOS
Directorate: BIO
Number of actions reviewed: 276
Awards: 90
Declinations: 186
Other: 0
Total number of actions within Program/Cluster/Division during period under review: 3879
Awards: 1211
Declinations: 2668
Other: 0
<p>Manner in which reviewed actions were selected:</p> <p>The NSF-wide COV Dashboard and Enterprise Reporting within NSF’s Oracle Business Intelligence database were used to identify the full data set of 3879 proposals acted upon between FY2018-FY2021, to analyze the data and to create the graphs, tables, and statistics within this report.</p> <p>A stratified random sample of ~5% of the proposals was selected to include all programs and proposal types included in the full data set to upload into the COV module for the COV to review. For any of the randomly selected proposals that happened to be the non-lead of a collaborative project from multiple institutions, the lead proposal and any other non-lead proposals were included in the sample jackets as well. This brought the number of jackets in the sample up to 276 representing ~7% of the total.</p> <p>An Excel file entitled “All Proposals Data” is Document 6 in the COV module with information on all 3,879 proposals. The COV may filter on specific data columns to facilitate additional analyses and may also request other summary tables or figures to answer specific questions that have not been anticipated.</p>

COV Membership

Table 2 - COV Membership

Role	Name	Affiliation
COV Chair	Carey, Hannah V.	University of Wisconsin-Madison
BIO AC liaison	Santos, Scott R.	SUNY Buffalo
BI Pilot	Johnson, Matthew M.	Pennsylvania State University
COV Members:	Jander, Georg	Boyce Thompson Institute
	Hicks, Karen A.	Kenyon College
	Weissman, Tamily	Lewis & Clark College
	Bernal, Diego	University of Massachusetts Dartmouth
	Fernández-Juricic, Esteban	Purdue University
	Kinkel, Linda	University of Minnesota
	Bejsovec, Amy	Duke University
	Nemhauser, Jennifer	University of Washington
	Williams, Susan H.	Ohio University
	O'Connell, Lauren A.	Stanford University

MERIT REVIEW CRITERIA

An understanding of NSF's merit review criteria is important in order to answer some of the questions on the template. Reproduced below is the information provided to proposers in the Grant Proposal Guide about the merit review criteria and the principles associated with them. Also included is a description of some examples of broader impacts, provided by the National Science Board

1. Merit Review Principles

These principles are to be given due diligence by PIs and organizations when preparing proposals and managing projects, by reviewers when reading and evaluating proposals, and by NSF program staff when determining whether or not to recommend proposals for funding and while overseeing awards. Given that NSF is the primary federal agency charged with nurturing and supporting excellence in basic research and education, the following three principles apply:

- All NSF projects should be of the highest quality and have the potential to advance, if not transform, the frontiers of knowledge.
- NSF projects, in the aggregate, should contribute more broadly to achieving societal goals. These broader impacts may be accomplished through the research itself, through activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. The project activities may be based on previously established and/or innovative methods and approaches, but in either case must be well justified.
- Meaningful assessment and evaluation of NSF funded projects should be based on appropriate metrics, keeping in mind the likely correlation between the effect of broader impacts and the resources provided to implement projects. If the size of the activity is limited, evaluation of that activity in isolation is not likely to be meaningful. Thus, assessing the effectiveness of these activities may best be done at a higher, more aggregated, level than the individual project.

With respect to the third principle, even if assessment of Broader Impacts outcomes for particular projects is done at an aggregated level, PIs are expected to be accountable for carrying out the activities described in the funded project. Thus, individual projects should include clearly stated goals, specific descriptions of the activities that the PI intends to do, and a plan in place to document the outputs of those activities. These three merit review principles provide the basis for the merit review criteria, as well as a context within which the users of the criteria can better understand their intent.

2. Merit Review Criteria

All NSF proposals are evaluated through use of two National Science Board approved merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two merit review criteria are listed below. Both criteria are to be given full consideration during the review and decision-making processes; each criterion is necessary but neither, by itself, is sufficient. Therefore, proposers must fully address both criteria. ([PAPPG Chapter II.C.2.d](#) contains additional information for use by proposers in development of the Project Description section of the proposal.) Reviewers are strongly encouraged to review the criteria, including [PAPPG Chapter II.C.2.d](#), prior to the review of a proposal.

When evaluating NSF proposals, reviewers will be asked to consider what the proposers want to do, why they want to do it, how they plan to do it, how they will know if they succeed, and what benefits could accrue if the project is successful. These issues apply both to the technical aspects of the proposal and

the way in which the project may make broader contributions. To that end, reviewers will be asked to evaluate all proposals against two criteria:

- I. **Intellectual Merit:** The Intellectual Merit criterion encompasses the potential to advance knowledge; and
- II. **Broader Impacts:** The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

The following elements should be considered in the review for both criteria:

1. What is the potential for the proposed activity to:
 - a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and
 - b. Benefit society or advance desired societal outcomes (Broader Impacts)?
2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?
3. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?
4. How well qualified is the individual, team, or organization to conduct the proposed activities?
5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

3. Examples of Broader Impacts

The National Science Board described some examples of broader impacts of research, beyond the intrinsic importance of advancing knowledge.² “These outcomes include (but are not limited to) increased participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and mathematics (STEM); improved STEM education at all levels; increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society; development of a globally competitive STEM workforce; increased partnerships between academia, industry, and others; increased national security; increased economic competitiveness of the United States; and enhanced infrastructure for research and education. These examples of societally relevant outcomes should not be considered either comprehensive or prescriptive. Investigators may include appropriate outcomes not covered by these examples.”

INTEGRITY AND EFFICIENCY OF THE PROGRAM'S PROCESSES AND MANAGEMENT

Briefly discuss and provide comments for *each* relevant aspect of the program's review process and management. Comments should be based on a review of proposal actions (awards, declinations, returns without review, and withdrawals) that were *completed within the past four fiscal years*. Provide comments for *each* program being reviewed and for those questions that are relevant to the program(s) under review. Quantitative information may be required for some questions. Constructive comments noting areas in need of improvement are encouraged.

² [NSB-MR-11-22](#)

I. Questions about the quality and effectiveness of the program’s use of merit review process. Please answer the following questions about the effectiveness of the merit review process and provide comments or concerns in the space below the question.

Table 3 - Quality and Effectiveness of the Merit Review Process

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE
<p>1. Are the review methods (for example, panel, ad hoc, site visits) appropriate?</p> <p>Comments:</p> <p>The review process and methods are overall appropriate. IOS has been particularly thoughtful and flexible about merit review throughout the challenges of the COVID-19 pandemic. IOS is also commended for making notable efforts toward diverse representation on panels (e.g., gender, ethnicity, institution type, etc.).</p> <p>Most IOS proposals are externally reviewed. Of the 3,879 proposals considered during the review period, 3,608 (93%) were externally reviewed with an average of 4.7 reviews per proposal (combination of ad hoc and panelist reviews). The COV felt 4-5 substantive reviews per proposal was appropriate. NSF policy requires a minimum of three reviews, although some proposals received as many as eight reviews, especially when being co-reviewed. Some COV members expressed concern that very few or very many reviews may be deleterious to award outcomes; this general issue was also brought up by the previous COV.</p> <p>Recommendation: The COV committee suggests IOS analyze whether the number of external reviews influences funding decisions.</p> <p>The number of panelist or ad hoc reviews varies by proposal. EDGE proposals are only reviewed by panelists and no ad hoc reviews are solicited. Similarly, some proposals that are co-reviewed by two panels sometimes do not have ad hoc reviews. Program officers note that it is sometimes very difficult to get reviewers for both panels and ad hoc reviews. They have described their ongoing efforts to recruit junior community members into the NSF, which are noteworthy. The COV encourages program officers to further expand the reviewer pool by utilizing databases (e.g., NSF postdoc fellowship (PRFB) awardees, eLife’s Early Career Reviewer Database, BlackinNeuro, Plant Postdocs, DiversifyEEB, DiversifyPlantSci, 500queerscientists, etc), in addition to their established methods of reviewer recruitment. Moreover, some COV members feel that ad hoc reviews are not equally represented in the panel discussion and panel summary, although it was noted that some ad hoc reviews are obtained after the panel has met.</p>	<p>YES</p>

<p style="text-align: center;">QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS</p>	<p style="text-align: center;">YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE</p>
<p>Recommendation: The COV encourages ad hoc specialist reviews incorporated into all core program proposal evaluations.</p> <p>Most panels prior to the COVID pandemic were hybrid, with a few members attending remotely while all others were in person. During the pandemic, IOS transitioned mostly to virtual panels, where all 52 panels in 2021 were virtual. Virtual panels likely enable participation for individuals with limited ability to travel and/or greater personal obligations. In person panels allow for networking opportunities, which can be especially important for junior faculty, although it was noted that networking is not the primary purpose of panels. Some program officers also noted that in-person panels can be more efficient, where close proximity of panelists may facilitate communication. Moreover, it is the experience of some program officers and COV members that hybrid panels are less ideal as not every panelist has equal presence in the room.</p> <p>Recommendation: The COV encourages the use of both in-person and virtual panels moving forward. The COV also suggests IOS conduct an analysis on the demographics and acceptance rates of in-person versus virtual panels to determine if virtual panels broaden participation.</p> <p>Some proposal types are internally reviewed by IOS staff rather than panels, include EAGER, RAISE, RAPID, Supplements, or Conference/Workshops/Travel and tend to be <\$100,000. These represent a small proportion of requests, as IOS used internal review for 6.7% of non-supplement proposals during the review period. The total amount of funding for internally reviewed awards was below 5% of IOS’s budget and was mostly EAGER and Conference awards. Internal reviews allow rapid responses to applicants.</p> <p>IOS staff receive training in best practices for merit review and follow an internally developed Standard Operating Procedure. All new program officers receive training in program management and merit review basics. The COV felt this training was appropriate and needed, and encourages re-training every few years to maintain high standards and incorporate updates into the best standards of merit review.</p> <p>Data Source: Enterprise Reporting, COV Dashboard, Question 6</p>	
<p>2. Are both merit review criteria addressed</p> <p style="padding-left: 20px;">a) In individual reviews?</p> <p>Most individual reviews address both merit review criteria. Out of the 874 reviews surveyed in the IOS self-study, all but three address both intellectual merit and broader impacts. Of the three that do not address both, a review of broader impacts is missing. In general, intellectual merit is often much more</p>	

<p align="center">QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS</p>	<p align="center">YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE</p>
<p>developed (~10:1) than comments on broader impacts. Sometimes, reviews of broader impacts are only one sentence long. (See question 3 below.)</p> <p>b) In panel summaries? All panel summaries address both merit review criteria in the 172 projects surveyed in the IOS self-study. Similar to individual reviews, the comments on intellectual merit are more substantive than those for broader impacts.</p> <p>c) In Program Officer review analyses? All review analyses that were checked address both merit review criteria. This includes the 184 jackets surveyed for the IOS self-study, as well as jackets evaluated by COV members. The PDs often address any reviewer ratings that were outliers compared to the funding decision (but see #5 below).</p> <p>Data Source: Jackets</p>	<p align="center">YES</p>
<p>3. Do the individual reviewers giving written reviews provide substantive comments to explain their assessment of the proposals?</p> <p>Comments:</p> <p>Approximately 20 eJacket folders were reviewed to answer this question.</p> <p>Intellectual Merit. For the Intellectual Merit section, most reviewers provide solid justification of their opinions. This is particularly the case if they convey a negative opinion of the proposal. Reviews that are more negative tend to include comments relating to lack of novelty, poorly designed experiments, or incremental advances in the research area. Some positive reviews also go into detail to describe the outstanding aspect(s) of the proposal. However, compared to the negative reviews, positive reviews more commonly include generic statements that lack details to support the opinion.</p> <p>In some of the Intellectual Merit review sections, a considerable amount of text is devoted to re-stating what was written in the proposal, rather than justifying the reviewer’s opinions. In some instances, the Program Director (PD)’s analysis noted that a reviewer does not have expertise in a research area, which might explain the lack of detail in the reviewer’s comments.</p> <p>Recommendation: The COV recommends greater emphasis on recruiting additional ad hoc reviewers, as needed.</p> <p>Broader Impacts. Evaluation of the Broader Impacts is overall less insightful than evaluation of the Intellectual Merit. In particular, many reviewers describe the broader impacts as “adequate.” There are relatively few suggestions of</p>	

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<p>improvements or descriptions of the strengths and weaknesses for the Broader Impacts. The most frequent negative comment refers to a lack of novelty in the Broader Impacts. For some reviewers, there seems to be an expectation that something new and different has to be done with each proposal, rather than just continuing an already successful outreach program. This expectation does not seem to be shared by the program officers, however, who often emphasize "impact" over "innovation" and do not seem to list novelty as the main goal for proposal Broader Impacts. It is also apparent from the reviewers' comments that their evaluation of Broader Impacts is almost exclusively focused on student training and increasing diversity. Few reviewers comment on Broader Impacts in a way that did not fall into one of these two categories</p> <p>Additional instructions for evaluating Broader Impacts would be helpful for example reviewers could be asked the following: 1) Comment on the expected or potential impact of proposed Broader Impacts. 2) Is there a proposed mechanism for assessing the success of the Broader Impacts? 3) Does the proposal budget cover not only implementation of the Broader Impact plan but also assessment of the Broader Impact results? The latter may be difficult, as assessment of an educational program may need to extend beyond the end of the grant funding period. See Section V for more discussion of Broader Impacts.</p> <p>Recommendation: The COV recommends that reviewers be given more specific instructions for assessing Broader Impacts. Similar guidelines should also be shared with proposal writers.</p> <p>Data Management and Postdoc Mentoring. In most reviews, Data Management and Postdoc Mentoring do not get much attention. It is possible that reviewers do not know they should be evaluating these proposal sections. Perhaps the standards for these sections could be conveyed better to the reviewers. For example, a rubric or template could be created for reviewers to assess each component of the data management plan or postdoctoral mentoring plan that is considered important by IOS. For transparency, the same rubric could be provided to principal investigators when preparing proposals.</p> <p>Recommendation: The COV recommends providing more detailed instructions for evaluating Data Management and Postdoc Mentoring plans. For full transparency, these assessment strategies should also be shared with proposal writers.</p> <p>Results from Prior Support. Reviewers frequently provide comments regarding the prior record of the principal investigator and the success of previous funding. This generally includes specific reference to the number of publications. There are few comments regarding successful Broader Impacts from the prior funding. None of the reviews that we looked at specifically comment on the success of the Data Management or the mentoring success resulting from previous NSF-funded research. It is not clear how consistently</p>	<p style="text-align: center;">YES/NO</p>

<p style="text-align: center;">QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS</p>	<p style="text-align: center;">YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE</p>
<p>proposal writers are including this information in the results from prior NSF support sections of their proposals.</p> <p>Recommendation: The COV suggests that reviewers be prompted to address Broader Impacts, mentorship, and Data Management in addition to the Intellectual Merit of prior NSF support.</p> <p>Data Source: Jackets</p>	
<p>4. Do the panel summaries provide the rationale for the panel consensus (or reasons consensus was not reached)?</p> <p>Comments:</p> <p>To assess panel summaries, we evaluated a sampling of proposals through the eJacket system. In general, the panel summaries are informative. The most notable observation was that the summaries vary significantly in terms of length, detail, quality of writing, and level of helpful analysis for the principal investigator. Some panel summaries are very brief, providing a general summary statement for each of the major areas (e.g., Intellectual Merit, Broader Impacts, and Justification). Some panel summaries dive directly into details of specific experiments that were discussed in panel and provide less context for the discussion. Others are much more in-depth, well-written, and detailed, breaking down strengths and weaknesses of proposals, providing suggestions to principal investigator, and discussing concerns that came up during the panel.</p> <p>There is some concern that time has been a constraint for reviewers to write detailed summaries during panel. The traditional structure of panel schedules limited time for completing the summaries, and they are typically drafted while other proposals are being discussed in the room. Since moving to no-deadline submissions, however, program officers explain that the number of proposals assigned to each reviewer has decreased. This may increase the amount of time and attention that reviewers can give to panel summaries.</p> <p>We did not find examples of panels not having a consensus in the panel summary.</p> <p>Recommendations:</p> <ol style="list-style-type: none"> 1. Reviewers should continue to be reminded in panel that the panel summaries are meant to help principal investigators to improve their proposals. 	<p>YES</p>

<p align="center">QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS</p>	<p align="center">YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE</p>
<p>2. Perhaps a unified structure for the panel summary, including required prompts and suggested word counts, would help to make the summaries more consistent.</p> <p>3. Consider more dedicated time during panel for reviewers to write and focus on summaries. A shared group document (e.g., Sharepoint) could also be considered for multiple reviewers to contribute simultaneously to a draft (as opposed to summary written mainly by one reviewer and approved by others).</p> <p>4. One suggestion for future self-studies is to track the quality of the panel summaries over time as specific changes are made (e.g., switch to no-deadline structure, any changes to panel template, etc.)</p> <p>Data Source: Jackets</p>	
<p>5. Does the documentation in the jacket provide the rationale for the award/decline decision?</p> <p>[Note: Documentation in the jacket usually includes a context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), program officer review analysis, and staff diary notes.]</p> <p>Comments:</p> <p>To assess this question, 10 proposals were reviewed across several years (2021=3, 2020=2, 2019=3, 2018=2). The same proposals were reviewed for questions #5 and #6.</p> <p>In general, there appears to be a solid rationale behind the decision to decline or award. The eJacket contains the necessary information (individual reviews, Panel Summary, and Review Analysis by the PD) to support the decision to award/ decline. For funding decisions, however, there are noticeable differences in the level of detail given in the Review Analysis document across years, proposal types (e.g., CAREER, normal), and program officers.</p> <p>The COV found the detailed statements to be most informative, particularly those addressing outlier reviews. In these statements, program officers indicate the consistency/inconsistency between the external reviews (ad hoc + panel), and include an additional statement that the program recommendation followed (or differed) from that of the reviewers. This statement is particularly useful when followed by a justification of why the program decision differed from the original reviews. One effective strategy the COV observed is for program</p>	<p align="center">YES</p>

<p style="text-align: center;">QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS</p>	<p style="text-align: center;">YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE</p>
<p>officers to state explicitly that the panel disagreed with the ad hoc reviewer comments after considering them.</p> <p>Recommendation: Future COV might be given a way to more easily find proposals that include outlier or inconsistent reviews, for instance those that the panel gives an outstanding rating but did not get funded. For example, perhaps a searchable filter could be added to the eJacket system for proposal score.</p> <p>Furthermore, the COV noted that the current scoring system (e.g., P, F, G, V, E, etc.) could be improved upon. One particular weakness of the current system is that borderline/split scores (e.g., V/G) are not included with the other scores in the “Average Review Score” column. Averaging these scores is therefore difficult to interpret.</p> <p>Recommendation: One suggestion is that the COV receive more guidance on how to interpret the “Average Review Score”. Split scores should be included in this average.</p> <p>Data Source: Jackets</p>	
<p>6. Does the documentation to the PI provide the rationale for the award/decline decision?</p> <p>[Note: Documentation to PI usually includes context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), and, if not otherwise provided in the panel summary, an explanation from the Program Officer (PO) (written in the PO Comments field or emailed with a copy in the jacket, or telephoned with a diary note in the jacket) of the basis for a declination.]</p> <p>Comments:</p> <p>To assess this question, 10 proposals were reviewed across several years (2021=3, 2020=2, 2019=3, 2018=2). The same proposals were reviewed for question #5.</p> <p>In most cases, there appears to be adequate rationale behind the decision to decline an award that is given to the principal investigator, particularly when there is consistency between the panel decision and the PD’s final decision. However, the COV noted some cases where the review panel rated a proposal "outstanding" but the PD did not recommend funding. In some of these, it is not apparent how the rationale of the PD was conveyed to the principal investigator, although sometimes there is a comment recorded in the jacket.</p>	<p style="text-align: center;">YES/NO</p>

<p style="text-align: center;">QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS</p>	<p style="text-align: center;">YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE</p>
<p>Recommendations: The COV suggests that reviews be labeled as “panel” versus “ad hoc” for increased transparency when feedback is given to the principal investigator. We also recommend that a clear statement from the PD is consistently shared with the principal investigator helping to explain any such aspects of the review process and final decision. This statement can help the principal investigator better understand any discrepancies. In addition, we suggest some PDs include their contact information in the text of their comments to the principal investigator, which the COV notes is an effective mechanism for encouraging direct communication.</p> <p>While the Intellectual Merit and Broader Impacts are clearly split into two sections (strengths & weaknesses), sometimes they resemble more of a general statement with vague weaknesses embedded in the text. For each, clearer statements on strengths and weaknesses can better assist the principal investigator in improving subsequent proposals. As mentioned elsewhere in this report, there is significantly more detail regarding Intellectual Merit than Broader Impacts.</p> <p>Data Source: Jackets</p>	
<p>7. Additional comments on the quality and effectiveness of the program’s use of merit review process:</p> <p>Recommendation: Create a structure for principal investigator and reviewer feedback:</p> <p>The current COV process invites a committee of visitors to access all proposals and evaluate the review process overall. By design, the COV members are further removed from the proposals/reviews they are evaluating. This is beneficial in terms of objectivity; however, it can be more challenging to understand the nuances of individual proposals. The committee recommends creating a formal structure for principal investigators to provide more individual and direct feedback about the review process – either after their proposal has undergone review or at another time during the year. For example, principal investigators themselves should be invited to rate the quality of the panel summary rationale they received, whether or not reviewers provided comments they viewed as substantive, whether or not both merit review criteria were equally addressed by the reviewers, panel, etc. There are at least two clear benefits of such a feedback system. First, principal investigators will have an opportunity to share directly their views on the review process, which may lead to important insights. Issues may come up that the current review process cannot currently access. Second, applicant-generated feedback would provide the COV with a direct method for identifying problematic proposals (perhaps those that receive lower ratings from the principal investigator).</p> <p>Similarly, panel reviewers should be invited to provide feedback after panel in order to assess and optimize the review process. Evaluation forms could be</p>	<p style="text-align: center;">NOT APPLICABLE</p>

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE
created that ask panel reviewers to comment on the timing of the panel, the number of proposals reviewed, whether or not comments were substantive, strengths and weaknesses of the process, and other topics that IOS may wish to optimize.	

II. Questions concerning the selection of reviewers. **Please answer the following questions about the selection of reviewers and provide comments or concerns in the space below the question.**

Table 4 - Selection of Reviewers

SELECTION OF REVIEWERS	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE
<p>1. Did the program make use of reviewers having appropriate expertise and/or qualifications?</p> <p>Comments:</p> <p>We examined a selection of the proposal jackets (142) focusing specifically on the list of reviewers in the review record and specific reviews from ad hoc and panelists. Appropriate expertise of ad hoc and panelists was evaluated by looking at individual scholar profiles (researcher web pages, publication lists, etc.) and weighing information provided in these sources against the project summaries and abstracts. We also read reviews to gauge specificity and quality of the review. Expert reviewers in areas close to the proposal subject are essential for providing feedback on the quality, originality, and impact of the proposal topic/questions, the appropriateness of the approaches proposed by the investigators and any potential pitfalls in approach, the quality of preliminary data, and the qualifications of and resources available to the team.</p> <p>In our review of the review records, it is clear that all programs make a significant effort to solicit ad hoc reviews for proposals unless the funding mechanism or other factors calls for panel review only. Moreover, in some cases, additional ad hoc reviews and co-review by another panel are utilized to evaluate the strength of proposals, especially those that were interdisciplinary or cut across NSF programs. From the reviewer records, it appears that obtaining expert ad hoc reviewers can be challenging as demonstrated by the number of review requests that are declined or receive no response. Additionally, data obtained on the number of external reviews per proposal (All Proposal Data spreadsheet) reveal that 13% of proposals receive 3 reviews, which could all be from panelists. 31%</p>	<p>YES</p>

<p>of proposals receive 4 reviews, suggesting that at least 1-2 ad hoc reviews are available. This highlights the importance of the expertise of the panelists in addition to ad hoc reviewers in providing substantive and helpful reviews to investigators. Despite these challenges, our comparison of the expertise of individual reviewers and their reviews of a subset of proposals with the proposal topic strongly suggests that PDs do engage reviewers with the appropriate expertise in the proposal review process through ad hoc and panelist reviewers.</p> <p>The 2018 COV raised the issue of the number of reviews and “urge[d] the Division to consider mechanisms to limit the variability in the number of reviews per proposal”. This issue was highlighted as it might indicate inequity in the review process across proposals. It was not clear from our analysis whether any steps were taken to address this concern, although the average number of external reviews was higher for the previous 5 years (4.8; mode=5). Therefore, the COV recommends that IOS continue to make every attempt to get a minimum of 4 reviews (2 ad hoc and 2 panel) per proposal.</p> <p>The self-study described ways in which PDs attempt to identify reviewers with appropriate expertise (p. 49). We felt that these strategies were appropriate and were most likely to yield expert reviewers.</p> <p>Recommendation: Consider additional approaches to identify additional expert reviewers to obtain at least 3 expert reviews, including but not limited to reconsidering COI restrictions and making reviewer training more available. Specific details for these recommendations are provided in Section 2.3.</p> <p>Data Source: Jackets</p>	
<p>2. Did the program recognize and resolve conflicts of interest when appropriate?</p> <p>Comments:</p> <p>The process for identifying and resolving COIs during the selection of ad hoc reviewers and throughout the whole review process is effective. Of the sample jackets evaluated, many proposals had panelist and ad hoc COIs and a small number had COIs with PDs (PDs). It was clear that panelist COIs were consistently not present for discussion of proposals.</p> <p>Out of subset of 65 eJackets sampled, 5 contained no COI information in Diary Notes, Review Records or Review Analysis.</p> <p>Recommendation: For consistency and transparency, COIs should be documented similarly in the jackets across all proposals.</p> <p>Data Source: Jackets</p>	<p>YES</p>

3. Additional comments on reviewer selection:

Because so many proposals receive 3-4 reviews, it is essential for each review to provide specific details on proposal strengths and weaknesses following the merit review criteria and specific questions asked within each. This emphasizes the impact that reviewer selection and training can play in obtaining high quality reviews, even from individuals with the appropriate expertise. Some journals now allow co-review or assisted reviews within a lab (e.g., by a post-doctoral associate or graduate student) as long as it is indicated on the reviewer form. This could be one way to train new NSF reviewers as well as lessen the burden on the invited ad hoc reviewer.

PDs are commended for noticeable efforts to diversify panels (gender, ethnicity, institution type, career stage). They are encouraged to make use of publicly available lists of experts to further enhance the reviewer pool. (See specific suggestions in Section I.)

Effective reviewer training may entice individuals to participate in the review process, particularly for individuals who are inexperienced. During the COV, it was discovered that a reviewer training video “The Art and Science of Reviewing Proposals” is available in Fastlane after a reviewer has accepted to participate but perhaps this should be distributed more prominently with the invitation to review if it is not already. It is unclear whether all programs consistently publicize and require this training video for ad hoc and panelist reviewers. Members of the COV watched the video and felt that it does provide adequate training and noted that it highlights different types of biases that may impact a review. Nevertheless, the COV also saw discrepancies in the guidance given in the video and in the written and verbal instructions given to reviewers/panelists regarding discussing funding recommendations in the written review.

Finally, the COV discussed concerns about the burden placed on reviewers, especially given the increasing demands on faculty in other areas of their work. NSF IOS programs are encouraged to consider reducing the proposal length and providing more specific guidance in project description format to help alleviate the burden of proposal review in an effort to encourage increased participation in the review process.

Adjustments in COI restrictions may also make it easier to find expert reviewers. For example, co-editors and the length (48 months) someone is considered a COI could be re-evaluated with feedback from the scientific community on how changes to these COI rules might alter the perception of fairness in the review process. Additional recommendations about reconsidering the breadth of the NSF COI policies were made in the 2018 COV report and the current COV supports these recommendations as well.

NOT
APPLICABLE

III. Questions concerning the management of the program under review. Please comment on the following:

Table 5 - Management of the Program Under Review

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1. Management of the program.

Overall management: The leadership at IOS has shown remarkable flexibility with several people stepping into very effective acting roles to fill vacated positions. High turnover of staff and senior management was an issue highlighted in past COV reports. Turnover at the senior level appears to have stabilized in the summer of 2018, with the arrival of a division director who served for 3 years of the review period, and with a new division director expected in August of 2022. We learned that much of the high staff turnover was due to upward career movements, and so should be regarded in a positive light. The recruitment of a large cohort of new staff members at the beginning of the review period required some adjustment. The leadership took steps to smooth the transition by organizing an IOS-wide virtual retreat in August 2021 and establishing working groups to develop best practices for coordination between staff and PDs. A working group for developing and updating standard operating procedures is still operational and is expected to continue. The leadership has also recently provided an anonymous suggestion box for the staff, so that comments and suggestions can be emailed anonymously to the Division Director's email inbox. This mechanism has already resulted in tweaks to improve harmony in the division. This is a good step toward an even more effective and collegial work climate; the COV supports and encourages this proactive approach. We note that four of the rotating PDs have converted to permanent positions, which suggests that the work climate at IOS is welcoming. The balance of permanent and rotating PDs seems to be working well and the increase in permanent positions should provide more stability.

The transition to a no-deadline proposal submission system seems to have been successful, with no major changes in funding rates. The transition has resulted in a more dispersed schedule for review panels, with roughly 3 review cycles per year for each core program. This has increased the number of panels, with fewer proposals per panel. While this allows a more thoughtful consideration of each proposal, it has increased the workload for the IOS staff. At the beginning of the review period, the high staff turnover, combined with increased number of panels, placed stress on the remaining staff. However, IOS management found creative ways to compensate and reward staff members for the extra effort that was required. We also note that NSF requires 6-month reviews for staff, and in IOS, these reviews include questions about workload, morale, and connections and communication in the virtual work environment. These mechanisms for obtaining feedback from the staff are critical for maintaining the high level of satisfaction and productivity that we observed at IOS.

Recommendation: The COV encourages IOS to continue a tradition of retreats, whether virtual or in-person, to manage expectations and improve communication among staff and PDs.

We note that during the COVID-19 pandemic, onboarding of new staff was virtual and IOS continues to allow staff and PDs to work remotely. IOS deploys a variety of technologies to foster teamwork including Zoom, Microsoft Teams, Jabber for phone calls, and email. The ability to work remotely using these tools for collaboration and communication allows better work/life balance. We support the continued use of remote options to aid in staff retention as well as efficient work flow. Enabling permanent remote options, rather than sequential 90-day telework extensions, would reduce stress

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levels and would allow IOS to recruit and retain administrative staff and program officers from a much larger pool nation-wide. This would bring greater life-stage, geographic, and socioeconomic diversity to the team, especially to the rotating PDs. Given the long-standing challenges in recruiting rotating PDs, maintaining a virtual option seems especially useful for these positions.

Recommendation: The COV encourages NSF to establish a remote work policy so that at least some of the staff/PDs can continue to perform their duties in the virtual environment.

One notable change in operations included merging two separate positions, Operations Specialist (OS) and Program Support Manager (PSM), into a single position, Operations Manager (OM). The OM appears to be well-supported with the assistance of senior specialists, and provides a career ladder for these assistants to move upward as they gain experience. The new administrative structure appears to offer more flexibility, promoting cross-over skills and shared responsibilities.

Interaction with other funding entities: The emphasis on finding areas for connection with other divisions and directorates is a strength. The IOS self-study includes many examples of exciting collaborations within the directorate, as well as across NSF and with other federal agencies (e.g., USDA, NIH). The shift to a no-deadline model from submission has rendered co-reviewing between divisions and directorates more difficult. Because panels are scheduled at different times, the opportunities for panel participation are more limited. In general, PDs from other programs spoke highly of IOS's flexibility and helpfulness in the co-review process. There was a strong sense that the PDs in IOS go above and beyond to ensure that co-reviewed proposals are considered fairly and that funds can be found to support the most highly ranked proposals. The Spring of 2022 seems to have been an exception to this positive view of the co-review process with IOS, apparently due to very late notification of funding levels and perhaps an expectation that levels from Congress might have been higher.

Recommendation: The COV encourages the IOS PDs to continue their exemplary work in coordinating with other divisions and directorates, with an eye toward communication that better manages the expectations of their fellow PDs.

Interaction with applicants: IOS responded robustly to the challenges presented by the COVID-19 pandemic. No-cost extensions, deadline extensions, and grant supplements all worked to reduce stress and preserve expertise. The supplemental funding of post-baccalaureate opportunities (REPS) was particularly important to maintain the pipeline of young scientists. These efforts were essential to keep the scientific enterprise afloat during a very difficult time. We applaud the speed and effectiveness of these initiatives. The COV would like to emphasize that the effects of the pandemic will be felt for a long time. Disproportionate impacts on productivity, for example, will be a form of bias that the PDs, Division Director (DD), and Deputy Division Director (DDD) will have to find ways to counteract for years to come.

During the review period, the pandemic-related shutdowns increased the need for Virtual Office Hours (VOHs). The COV saw this as a great strength—VOHs with PDs help to build relationships, especially since the pandemic limited or eliminated conference participation by PDs. We note that attendance at VOHs has increased since they were initiated in 2019. That first year, a total of 495 individuals attended IOS VOHs in 2019. This increased to 871 in 2020, and 1310 in 2021, suggesting that word has spread about their utility. VOH attendance is broad, representing PIs from 41 states, the District of Columbia, and Puerto Rico. We note that PDs made extra efforts to reach out to Minority-serving Institutions, scheduling special VOHs in 2020 and 2021. While it is too early

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to determine whether these will result in increased submissions from these institutions, we support continued efforts in this direction.

Recommendation: The COV encourages IOS to continue these outreach efforts beyond the pandemic (however long it lasts), as VOHs lower the barrier to PIs with less social capital. We also recommend that PDs caution panels about bias against applicants with reduced productivity due to the pandemic.

Poor levels of self-reporting by PI/co-PIs and reviewers are an issue in tracking the demographics of submissions and success (awards) versus declinations. What sort of remedies can be considered? There are recent calls for changing collection of demographic data in regard to gender and sexual orientation of applicants/awardees (<https://www.scientificamerican.com/article/nonbinary-scientists-want-funding-agencies-to-change-how-they-collect-gender-data/>; <https://www.science.org/content/article/how-many-scientists-are-lgbtq-federal-survey-delays-frustrate-researchers>). Even if there are not top-down changes in data collection practices, it would be a significant step for IOS to adopt the suggestion of using ‘Men’ and ‘Women’ in place of ‘Males’ and ‘Females’ in all communications going forward, and including fill-in-the-blank (or at a minimum a non-binary/trans choice) wherever possible. Race/ethnicity questions should also be moved to a fill-in-the-blank option. In the modern era of natural language processing, there is no reason to force respondents to choose among old-fashioned and often imprecise terms to describe their identity. We also encourage tracking the first generation undergraduate and/or graduate student demographic. Because NSF also collects demographic data on STEM involvement nationwide, it would be useful to place the proposal demographic data in the context of the broader scientific community in future self-studies.

Recommendation: The COV encourages IOS to pilot efforts to change demographic information language while the long process of changing these policies institute-wide is underway. We also encourage the addition of a pronouns designation, perhaps in the Biosketch, so that PI/co-PIs can be referred to appropriately in reviews and panel discussions.

The demographic data show a growing “unknown” category for both PI/co-PIs and reviewers that correlates with a decrease in the “white” and “male” demographic categories. There is a possibility that some individuals may be concerned that privilege will count against them in reviews and award decisions. Wording on the demographic information page should make clear that these data are for internal NSF use only, and are not provided to reviewers or panelists.

Recommendation: The COV encourages IOS to provide text on the demographic information request page to make clear why NSF need these data and how they will be used.

2. Responsiveness of the program to emerging research and education opportunities.

Comments:

IOS has done an *outstanding* job of embracing opportunities to capture research and education priorities from different stakeholders. This is a challenging task given the substantial differences in perception of priorities among stakeholders. PD’s regularly attend professional society meetings, get ideas from panels, meet with awardees, monitor proposals for gaps in infrastructure or available

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data, and organize focused workshops, among other activities to learn about new trends and community needs. PD's specifically look for alignment between bottom-up ideas from community with top-down priorities to garner more funding so that new programs can be supported.

There are significant efforts to coordinate across agencies to leverage funding to support cutting edge research when there is common interest in a research area. An interest group or interagency working group can hold workshops at conferences or request white papers from communities to inform this effort. PDs often seek feedback formally or informally from the scientific community (e.g., invitations to reach out to PDs at the end of outreach presentations to discuss proposal ideas or reviews from a decline). The COV is encouraged by this approach, which ensures that funding priorities are aligned with the needs of the nation and the scientific community. Proof of that is the successful establishment of strategic priorities (e.g., 10 Big Ideas), multiple new innovative programs and solicitations (microbiome, functional genomics, agriculture, mentoring, culture change in professional societies, etc.), and the timely response IOS showed to support critical research needs when the COVID-19 pandemic started. Overall, IOS has successfully addressed and expanded on all of the suggestions made by the prior COV.

The last few years have seen pronounced changes in research practices and academic culture aimed at improving sound science and promoting diversity and inclusion. Part of this change is the response to the so-called replication crisis in STEM (DOI: 10.17226/25303) and the increasing public distrust in scientists. The reproducibility crisis is associated with a culture of flawed research practices (e.g., biases in the design of experiments, gathering data, and statistical analysis to produce flashy research results) and flawed academic incentives (biases in research assessment, paper citation, professional recognition, etc.) (DOIs: 10.1371/journal.pone.0010271; 10.1371/journal.pone.0200303; 10.3758/s13428-015-0664-2; 10.3389/fsoc.2021.792198). These practices have negatively affected the credibility of many published results as well as the representation of underrepresented groups in academia (DOIs: 10.1002/jnr.24631; 10.1073/pnas.2020508118; 10.1038/d41586-019-03688-w). Some recent work suggests that actively elevating the standards of research transparency and reproducibility could indirectly increase the representation of women and under-represented groups in STEM (DOI: 10.1073/pnas.1921320117).

Given the mission of the NSF, the COV believes that there is room for strengthening the already high position of the agency as the leader of supporting robust, credible, and inclusive science by incorporating evidenced-based practices (DOIs: 10.1038/s41562-016-0021) that have been recently developed (e.g., Center for Open Science: <https://www.cos.io/>; Declaration on Research Assessment: <https://sfdora.org/>).

Recommendation: IOS should consider adding incentives in the evaluation of the proposals that are associated with reducing questionable research practices in the research design phase. Examples could include: adopting new standards in the justification of sample sizes (DOI:10.1525/collabra.33267), encouraging Principal Investigators to freely define research aims as following confirmatory or exploratory approaches and reviewers to avoid biases against exploratory methods (DOIs: 10.2307/2682991; 10.1111/1365-2664.13571); emphasizing the need to focus not only on P-values but also effect sizes when interpreting preliminary data (DOI: 10.4300/JGME-D-12-00156.1); suggesting the explicit incorporation of strategies in the research plans that will avoid P-hacking (reporting of only significant results), HARKing (hypothesis after results are known), hypothesis myopia (focusing data collection and statistical analyses on only the hypothesis of

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interest); funding of replication studies that have had a large impact on a given field (DOI: 10.1126/science.aat0224); etc.

Recommendation: IOS should consider expanding efforts to enhance the reproducibility of NSF-funded research. This can be attained by ensuring Principal Investigators make data available to the community following FAIR principles (<https://www.go-fair.org/fair-principles/>), as well as making published results computationally reproducible by sharing, during the peer-review process and after publication, the code to replicate statistical results and figures (DOIs: 10.1007/s00265-021-03036-x; 10.1038/s41562-021-01190-w). The new NIH Policy for Data Management and Sharing (<https://grants.nih.gov/grants/guide/notice-files/NOT-OD-21-013.html>) coming into effect at the beginning of 2023 can be a potential model to follow, given the shift of incentives towards Institutions and their Principal Investigators to meet research reproducibility expectations. The overall idea is that having the potential to reproduce the results of any NSF-funded study will elevate the credibility of the research.

Recommendation: IOS should consider enhancing the training of PD's, ad-hoc reviewers, and panelists to minimize different types of biases (e.g., gender, race, cognitive, etc.) during the proposal assessment process (both before and during panel meetings). As mentioned above, reduced productivity due to the pandemic is not uniform across demographics, and potential bias resulting from these disproportionate effects will need to be addressed in reviews/panels for many years to come.

IOS does an excellent job of enhancing the funding opportunities for under-represented groups by adopting a balanced portfolio approach when awarding grants, and by requesting that PDs attend video training sessions on biases. Requiring even more training will incur some costs (e.g., time investment), but the COV believes that the costs may be worth paying given the potential benefits in terms of diversity and inclusion during the proposal assessment process, given the known biases against under-represented groups in grant proposal review (DOI: 10.7554/eLife.65697). Examples could include: covering a wider range of biases (with specific examples) during the training process (e.g., status quo bias, Matthew effect, Campbell's law; <https://sfdora.org/resource/rethinking-research-assessment-unintended-cognitive-and-systems-biases/>), and allowing PD's to modulate the panel discussion to minimize biases (gender, race, etc.) by avoiding idiosyncratic remarks about principal investigators, discussing the prestige (based on impact factors or similarly biased metrics) of the journals in which research has been published, and considering multiple contributions to the research endeavor besides published papers (data, code, protocols, replication studies) (DOIs: 10.3389/fsoc.2021.792198; 10.3389/fnhum.2018.00037; 10.1098/rsos.160384). Some of these initiatives could be tested via pilot programs before making broad procedural changes.

3. Program planning and prioritization process (internal and external) that guided the development of the portfolio.

Comments:

The program planning appears to be well-aligned with the community's "growth edges" and national priorities. Defending support for fundamental research can be challenging, and we urge IOS to continue to hold true to this unique aspect of the NSF's funding portfolio. The COV was impressed with the breadth of new initiatives that IOS is either leading or supporting, including initiatives aimed at specific research objectives like the BIO-wide EDGE program, and new programs that help fill in a

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continuous pipeline of opportunities for support at every career stage. IOS leadership is actively reflecting on, evaluating, and responding to changes in community focus. This includes on-going improvement to algorithms to guide the fair distribution of funds among the clusters, using historical data over multiple years that consider number of proposal and funding levels requested.

There were a number of strengths of the program that came through in the discussion with PDs from outside IOS. It is clear that IOS PDs have strong relationships with PDs in other units both within and outside BIO. Communication, flexibility, and willingness to collaboratively problem-solve were themes mentioned multiple times. These good relationships undergird the impressive breadth of new programs that IOS has contributed to, as well as helping ensure that excellent science happening in the “interstitial spaces” (where many emerging disciplines find themselves) is finding the appropriate audiences for review and funding. This is also an area where the move to no-deadlines is having an unanticipated positive impact, as PDs reported that there was overall more time to identify and set up potential co-reviewing opportunities.

Outreach to diverse institution types, including a pilot program to build relationships with MSIs in Alabama and Georgia, appears promising.

Recommendation: Listening sessions where PDs elicit information about pain points and specific needs in grant submission/management at MSIs, and perhaps at bachelors and masters-granting institutions more generally, could be informative. This is a complementary approach to ongoing outreach efforts where information about IOS/NSF is conveyed. These listening sessions might inspire new future funding mechanisms or priorities.

The new Postbaccalaureate programs (REPS and RAMP) seem both popular and a great career stage for investment.

Recommendation: Following the example of REU programs, it would be useful to have more granular information on the demographics of awardees of the REPS and RAMP programs. Such data would ideally include information like: how many REPS postbacs stayed at their baccalaureate institution vs. moved to a new institution to do their research? Did funded postbacs go on to enroll in a graduate program, either at the institution where they participated in the funded research (if applicable) or elsewhere? Did funded postbacs enter the STEM workforce, either at a RAMP industry connection or elsewhere? Longitudinal data collection about career trajectories of recipients would also be useful to gauge the impact of funding, which we anticipate will be significant in terms of STEM workforce development.

4. Responsiveness of program to previous COV comments and recommendations.

Overall, the COV felt that the response to the previous COV report was both thoughtful and comprehensive (e.g., new programs like the MCA that were closely aligned with COV recommendations). A few topics that need additional consideration are discussed below.

Broader Impacts: One area highlighted as an on-going concern is the place of BI in evaluating grants. This seems to be an evergreen area of challenge, and a source of concern in the community as well. One thing to consider is that while assessment has been added as a core aspect of proposing a new BI-related program, results from assessments rarely appear in proposals. It is also

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the case that many reviewers seem to want new programs with each grant, which also works against the inclusion of assessments.

Recommendation: IOS should consider explicitly asking for a more retrospective accounting of BI activities [for those who have received grants previously], and a more minor role for future activities. An approach that looks for “proof in the pudding” rather than the shiny new thing would likely result in more meaningful reviews. A similar approach might also be useful to consider for mentorship plans (e.g., an emphasis on trainings, evidence-based practices and activities that the PI/co-PIs have been doing versus what are they promising to do in the future). Of course, appropriate measures would need to be put in place to avoid bias against early career PIs.

Recommendation: IOS should consider establishing uniform guidelines/SOPs, across programs and clusters, for how PDs discuss the weighting and evaluation of IM and BI at the beginning of panels.

Recommendation: IOS should consider piloting the use of new rubrics for evaluating BI (e.g., <https://aris.marine.rutgers.edu/wizard/rubric.php>). Please see Section 5 for more information on this topic.

Number of reviews: The previous COV was very concerned about the number of reviews per proposal. The self-study states that proposals receive at least 3 reviews but that one of those three can be the panel summary. The spreadsheet shows that almost 14% of the externally reviewed proposals (491/3609) had 3 reviews, but does not indicate for how many of these the third review was the panel summary. When asked, several PDs said that using a panel summary as one of the “external reviews” was not standard practice in IOS, but it was not clear if that is universally true.

Recommendation: If IOS does not use panel summaries as a third review in practice, this should be stated as explicit policy.

The 2018 report recommended a process to develop mechanisms to reduce the variability in number of reviews per proposal. It was not clear if any specific actions had been undertaken to address this concern, and the concern was raised again by this COV (see section I and II). The self-study provided the new average (4.6 reviewers per full proposal—which seems like a reasonable number, especially given the difficulties in getting reviewers for some proposals), but the variance was not included.

Recommendation: IOS might consider developing a pilot program to recruit and train NSF-funded postdocs to serve as ad hoc reviews or panelists. This would also serve to build relationships with Early Career Researchers in IOS-relevant research areas, a priority mentioned by PDs.

Communication with PIs: The 2018 report recommended guidance for feedback to the PI when a proposal is declined. This is an ongoing problem, and it was not clear from the self-study what actions may have been taken to address this. The concern was raised again by this COV (see section I).

Recommendation: IOS should consider development of an SOP around using PO comments more effectively (something that sounds like it was attempted after the last COV), as for many of

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the proposals in the Jacket, the PO comments were unused or only contained generic information. See also Section I.

The 2018 report also recommended a uniform process to inform PIs who re-submit that they can include response to prior reviews if they wish. IOS declined to do this.

Recommendation: IOS should consider a compromise position where more information is given on the website and/or in a VOH about the pros and cons of including this information in a revised proposal. This would further IOS's mission of increasing transparency in the review process without committing the PDs to a "one size fits all" solution that may not be appropriate in all cases.

Communication from PIs: The 2018 COV recommended that "IOS should also evaluate ways to encourage grant submissions that relate to current and emerging BIO priorities". The response did not address the request to "evaluate", stating that "we do not have the ability to connect individual submissions to specific modes of information". While making changes on the submission side might require an NSF-wide discussion, perhaps these data could be acquired using a post-panel information gathering effort.

Recommendation: IOS should consider piloting a post-panel survey that would include a question like "how did you hear about this opportunity?". Such a survey could also include more appropriately worded and more detailed demographic questions. It would be interesting to see if asking for this information post-panel yields a higher response rate. These questions could easily be added to the post-panel survey about review satisfaction proposed in section I.

Evaluation of outcomes: We appreciated the exchange between the last COV and the response around the question of how to effectively capture and convey IOS's impact in terms of the outcomes stemming from funded (and unfunded) proposals. In particular, the point in the response about the need for taking a long-term (certainly >4-year increment of the COV cycle) perspective is absolutely true.

Recommendation: IOS should continue to explore ways to highlight and disseminate the impressive impact of IOS-funded research to the public, including asking PIs to use #IOS_funded or similar in social media posts about IOS-funded research.

Recommendation: IOS should evaluate whether it is feasible to integrate at least some of the findings of the Evaluation and Assessment Capability (EAC) Section in the self-study, as these are the data that could inform definitions of hard-to-grapple-with terms like "appropriate" that are found throughout the template.

Postdocs: The 2018 COV highlighted the success of the cohort model for postdocs funded through PGRP, and suggested that "the post-doctoral stage be given more attention for the development of collaborative research experiences." The COV were excited to read about the expansion of the number of IOS-funded postdoctoral scholars, but did not see any evidence for building a cohort mentoring model for these new appointments. Finding ways to support this career stage is even more critical now given the widely-reported national shortage of postdocs (e.g., doi:10.1126/science.caredit.add4693). Creative thinking about how to make positions in IOS-related

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disciplines more attractive (given that wages will likely never be able to compete with industry) could have a big impact in recruitment and retention of the next-generation.

Recommendation: IOS should consider the 2018 COV recommendation for incorporating cohort-building activities for IOS-funded postdocs. These could include relatively low-complexity offerings like a one-day online conference where the postdocs present Ignite-style short research talks to one another and/or more sophisticated programs like the opportunity to act as a reviewer or panelist (associated with training as described above).

IV. Questions about Portfolio. Please answer the following about the portfolio of awards made by the program under review.

Table 3 - Resulting Portfolio of Awards

<p align="center">RESULTING PORTFOLIO OF AWARDS</p>	<p align="center">APPROPRIATE, NOT APPROPRIATE, OR DATA NOT AVAILABLE</p>
<p>1. Does the program portfolio have an appropriate balance of awards across disciplines and sub-disciplines of the activity?</p> <p>Comments:</p> <p>The IOS acting Division Director provided the COV with an overview of how programmatic budgets within the Division are established via algorithms that take into consideration both the distribution of funds in previous years (to maintain consistency) and the proposal number received by the various clusters and/or programs in the current year. The COV found this information helpful when evaluating award balance across disciplines and sub-disciplines in IOS.</p> <p>Overall, the percentage of both proposals received and awards made per cluster closely aligned, with subsequent success rates ranging from 27-41% (Table 27). While EDGE appeared as an exception relative to other clusters, the provided data excluded proposals from the initial solicitation where funding came from the IOS core programs. The COV noted that IOS contributed significant funds to both other BIO divisions and different Directorates with related programs (Figures 15 & 18). Likewise, IOS received substantial monetary support from other BIO divisions and NSF Directorates as well (Figures 16 & 17). The COV felt that IOS is a “good neighbor” in this regard, which was also reflected in conversation the COV had with PDs from other BIO divisions, NSF directorates and governmental agencies (although an exception to this seemed to be Spring of 2022, as raised in Topic III, Part 1 above), and that the Division maintains a good balance in its portfolio across clusters as well as NSF in general.</p> <p>Data Source: Enterprise Reporting, COV Dashboard, Question 8</p>	<p align="center">APPROPRIATE</p>

<p style="text-align: center;">RESULTING PORTFOLIO OF AWARDS</p>	<p style="text-align: center;">APPROPRIATE, NOT APPROPRIATE, OR DATA NOT AVAILABLE</p>
<p>2. Are awards appropriate in size and duration for the scope of the projects?</p> <p>Comments:</p> <p>The COV noted that across years, the average size and durations of projects funded by IOS modestly increased. In the case of award size, IOS requested budget reductions of ~17% for ~1/3 of projects in order to align those with others within programs. In screening of the subset of funded projects, these reductions did not appear to impact the scope of projects and levels of funding appropriately matched the planned activities. As in the previous COV report, this COV noted that significant direct costs were attributed to salaries for graduate students, post-doctoral associates and PIs/co-PIs/senior personnel and this will likely contribute to the majority of future budget requests. Overall, the COV found levels of funding to appropriately match the scope of projects awarded by IOS.</p> <p>Regarding the average recommended award duration increasing by ~0.5 years, this was most notable in FY2021. This a modest increase that likely reflects the higher success rates in FY2020 and FY2021 of CAREER awards with 5-year durations that were made to off-set the impacts on early-career investigators due to the COVID-19 pandemic. Thus, durations of awards were seen to be consistent with the scope of proposed projects.</p> <p>Data Source: Enterprise Reporting, COV Dashboard, Question 4</p>	<p style="text-align: center;">APPROPRIATE</p>

<p style="text-align: center;">RESULTING PORTFOLIO OF AWARDS</p>	<p style="text-align: center;">APPROPRIATE, NOT APPROPRIATE, OR DATA NOT AVAILABLE</p>
<p>3. Does the program portfolio include awards for projects that are innovative or potentially transformative?</p> <p>Comments:</p> <p>The COV recognizes that NSF has several mechanisms in place to promote, encourage, and support work with innovative and potentially transformative Intellectual Merit. Panels are encouraged to identify potentially transformative research (PTR) during proposal reviews, which are retained in the eJackets. A higher-than-average success rate was noted in these proposals identified as PTR compared to the average success rate across IOS. EAGER, RAISE, and RAPID programs enable the program to be responsive to and fund important, time-dependent work. Other mechanisms noted in the self-study include a joint venture with USDA and BBSR to fund EAGER grants focused on overcoming crop breeding barriers in highly innovative and transformative ways.</p> <p>Broader Impacts of each proposal are also intended to be evaluated to the extent they “suggest and explore creative, original, or potentially transformative concepts.” However, there is no similar mechanism for reviewers to denote <i>potentially transformative impact</i>. It is also likely much easier for reviewers to identify which research agendas are needed, innovative, and potentially transformative because the field discusses these topics at conferences, in journals, in department meetings, etc. Broader Impacts are not discussed as frequently in these forums, making it difficult for reviewers to answer this question (although COV noted there are more such programs at conferences). A video describing evaluation of Broader Impacts is used by some PDs, but when reviewing the comments from the eJackets, it does not seem to be very effective in helping reviewers identify and assess the BI in a way similar to the ways they evaluate Intellectual Merit. A change in approach by IOS to support reviewers in better understanding Broader Impact topics, guidance during proposal review (prior to the panel), and/or use of available tools for evaluating Broader Impacts may be helpful. An example of such a tool is the <i>Broader Impacts Plan Rubric</i> (See section III.4)</p> <p>Recommendation: IOS should consider pilot testing tools to support reviewers in evaluating broader impacts and their potential to be “creative, original, or potentially transformative.”</p> <p>Data Source: Jackets</p>	<p style="text-align: center;">APPROPRIATE</p>

<p style="text-align: center;">RESULTING PORTFOLIO OF AWARDS</p>	<p style="text-align: center;">APPROPRIATE, NOT APPROPRIATE, OR DATA NOT AVAILABLE</p>
<p>4. Does the program portfolio include inter- and multi-disciplinary projects?</p> <p>Comments:</p> <p>The COV felt the proportion of inter- and multi-disciplinary projects in the IOS portfolio has increased in recent years (Figs 22 and 23). Some of this is due to more inter- and multi-disciplinary activities that traditional IOS PIs engage in (e.g., utilization of NEON), but also because IOS, especially with the shift to no deadlines for proposal submission, now has the time and staff “bandwidth” to engage in some of the existing cross-cutting initiatives already in place in BIO and NSF overall. An example of the latter is the recent engagement of IOS with the Ecology and Evolution of Infectious Disease program. IOS also engages in several new cross-cutting programs that have been formed during the review period of this COV, including BIO Integration Institutes BII and RECODE. IOS’s primary focus on the central role of the organism in biology makes it a logical participant in most cross-cutting programs, certainly in BIO, and for many multi-disciplinary programs that involve other Directorates, as displayed in Figs 24 and 25. To support involvement in cross-cutting programs, IOS program staff participate in a variety of working groups throughout NSF as well as with interagency (e.g., EDGE-NHGRI partnership) and international groups that foster joint funding programs.</p> <p>Data Source: If co-funding is a desired proxy for measuring inter- and multi-disciplinary projects, the Co-Funding from Contributing Orgs and Co-Funding Contributed to Recipient Orgs reports can be obtained using Enterprise Reporting, COV Dashboard, Question 7</p>	<p style="text-align: center;">APPROPRIATE</p>

<p style="text-align: center;">RESULTING PORTFOLIO OF AWARDS</p>	<p style="text-align: center;">APPROPRIATE, NOT APPROPRIATE, OR DATA NOT AVAILABLE</p>
<p>5. Does the program portfolio have an appropriate geographical distribution of Principal Investigators?</p> <p>Comments:</p> <p>The COV found that Principal Investigators are well distributed in terms of geography, based on evidence provided in Figures 26–28. States with a higher number of awards (Figure 26) and/or PIs (Figure 28) are those that also have a higher number of educational institutions, and in particular a higher number of Ph.D. granting institutions, which receive the majority of NSF funding. Funding rate was generally similar across states (Figure 27), although the funding rate was somewhat lower in Texas (22%) than in other states with a comparable number of Ph.D. granting institutions and substantially lower than the overall funding rate (31%). NSF and IOS have EPSCoR in place to better distribute awards to states with less representation. Funding rate across EPSCoR states was highly variable, perhaps due to the relatively small number of proposals from (and awards to) these states. The COV recognizes and appreciates the improvement in data quality and quantity provided in the 2022 IOS Self-study in response to the 2018 COV request, including reporting of success rates.</p> <p>Data Source: Enterprise Reporting, COV Dashboard, Question 2</p>	<p style="text-align: center;">APPROPRIATE</p>

<p style="text-align: center;">RESULTING PORTFOLIO OF AWARDS</p>	<p style="text-align: center;">APPROPRIATE, NOT APPROPRIATE, OR DATA NOT AVAILABLE</p>
<p>6. Does the program portfolio have an appropriate balance of awards to different types of institutions?</p> <p>Comments:</p> <p>As was the case in the previous COV, the majority of proposals/awards (79%) are from/to Ph.D. granting institutions, with Bachelor's and Master's granting institutions represented at a much lower rate (11% of proposals, 10% of awards). More granular annual data did not show clear trends, except for a drop in submissions from Bachelor's institutions in FYs 2019 and 2020, with a rebound in FY2021.</p> <p>The success rate for Bachelor's granting institutions during the COV period was slightly higher (35%) than that of proposals from Ph.D. granting institutions (31%); however, the success rate of Master's granting institutions was somewhat lower (27%). More granular annual data indicated that success rate varied year to year without a clear pattern.</p> <p>The previous two COV reports recommended that IOS encourage more proposals from Bachelor's and Master's granting institutions given their low numbers in the IOS portfolio. During the current COV period, IOS engaged in several outreach efforts intended to broaden the participation from institutions that are under-represented in the portfolio. These outreach efforts include 1) Virtual Office Hours (VOHs), including VOHs specifically targeted towards programs that might be of greater interest to PIs at institution under-represented in the IOS portfolio, 2) outreach to PUI faculty at scientific conferences through targeted materials and interactions with PUI focused society groups, 3) a pilot study by the IOS Outreach Working Group focused on MSIs, 4) participation in the HBCU-EIR program.</p> <p>Recommendation: We encourage IOS to continue the important efforts that they have been making to encourage proposals from Bachelor's and Master's granting institutions. In addition, we encourage IOS to experiment with listening sessions focused towards underrepresented institutional types, as suggested in III.3 regarding MSIs.</p> <p>The COV recognizes and appreciates the improvement in data quality and quantity provided in the 2022 IOS Self-Study in response to the 2018 COV request, including reporting of success rates.</p> <p>Data Source: Enterprise Reporting, COV Dashboard, Question 3</p>	<p style="text-align: center;">APPROPRIATE / NOT APPROPRIATE</p>

<p style="text-align: center;">RESULTING PORTFOLIO OF AWARDS</p>	<p style="text-align: center;">APPROPRIATE, NOT APPROPRIATE, OR DATA NOT AVAILABLE</p>
<p>7. Does the program portfolio have an appropriate balance of awards to new and early-career investigators?</p> <p>NOTE: A new investigator is an individual who has not served as the PI or Co-PI on any award from NSF (with the exception of doctoral dissertation awards, graduate or post-doctoral fellowships, research planning grants, or conferences, symposia and workshop grants.) An early-career investigator is defined as someone within seven years of receiving his or her last degree at the time of the award.</p> <p>Comments:</p> <p>The IOS portfolio of awards shows that 43% of all awards went to investigators receiving NSF funding for the first time. Another 30% of the awards went to “early career” (<7 years from earning their last degree), and CAREER awards (Table 31, IOS Self-Study). The self-study reports that the PDs prioritize proposals from early-career investigators when balancing their program portfolios, suggesting that IOS is actively aware of and promoting the balance of awards to new and early-career investigators. The self-study also includes a histogram that demonstrates the distribution of awards binned by years from last degree. Figure 29 demonstrates the plurality of awards are received by investigators 11-20 years since degree, and that investigators 0-20 years have similar success rates in funding. The most successful PIs are 21-40 years since degree, which is not surprising given their experience in academia.</p> <p>The virtual office hours are being used, in part, to support faculty planning to submit proposals, and the IOS blog includes videos to help investigators identify common barriers to getting funded.</p> <p>Recommendation: The COV recommends expanding their efforts in supporting beginning and early-career investigators in better understanding the proposing and reviewing of awards, as it will likely lead to higher-quality proposals and reviews in IOS.</p> <p>Data Source: Information on new PIs available via Enterprise Reporting, COV Dashboard, Question 6</p>	<p style="text-align: center;">APPROPRIATE</p>

<p style="text-align: center;">RESULTING PORTFOLIO OF AWARDS</p>	<p style="text-align: center;">APPROPRIATE, NOT APPROPRIATE, OR DATA NOT AVAILABLE</p>
<p>8. Does the program portfolio include projects that integrate research and education?</p> <p>Comments:</p> <p>There are several awards that integrate research and education. CAREER and RUI grants must explicitly demonstrate how research and education are integrated, but this is not required in the majority of the solicitations. The IOS Self-Study describes post-doctoral programs, Broader Impact programs, and supplemental awards as the main evidence for this question, but little description exists for this integration in core programs, except with funding trainees.</p> <p>Unfortunately, the level of integration of research and education is not as easily evaluated by reviewers or demonstrated in annual reports. Funding graduate students is not necessarily evidence of such integration. And it is unclear as to the breadth of education students funded by these core program grants receive. Some graduate students receive little education outside of the research, particularly when they are done with coursework. IOS has the potential to fund a better integration of research and education. For example, solicitations could require the inclusion of a graduate student mentorship plan similar to the postdoctoral mentorship plan required in many solicitations. In this way, graduate students could potentially learn more of the skills of being a professional scientist beyond technical research activities (i.e., grant writing, journal/grant review, science communication, mentorship, tech transfer, teaching, etc.).</p> <p>Recommendation: Consider supplements to proposals to further elucidate the integration of research and education in programs other than CAREER and RUI.</p> <p>Data Source: Jackets</p>	<p style="text-align: center;">APPROPRIATE</p>

9. Does the program portfolio have appropriate participation of underrepresented groups³?

Comments:

IOS has been proactive in its efforts to increase representation across the areas of the biological sciences that the Division supports. This includes, for example, implementing suggestions from the previous COV to institute activities like virtual office hours (VOH) and advertising this to the broader community. The current COV applauds these and encourages IOS to continue such efforts.

According to the IOS Self-Study, 8-10% of projects were funded to PIs from under-represented groups during the review period (Table 35). This was consistent with data reported to the previous COV. However, the IOS Self Study only presented data on awards and the COV requested additional information regarding overall submissions from under-represented groups. This additional information suggested that the total number of proposals from under-represented groups remain flat.

Recommendation: the COV suggests that IOS continue to employ established and novel efforts to both increase the number of submissions from, and the overall success rate of, individuals from under-represented groups.

Regarding gender (but see discussion on alternative definitions including non-binary/trans choices in Topic III, Part 1), investigators who identify as women had an award success rate of 36% relative to representing 32% of all submitted proposals (Figure 31). This is a modest increase relative to the 31-34% reported in the previous COV and might suggest additional measures are needed to increase representation in this area.

Recommendation: Further efforts should be considered by IOS to increase gender representation.

The COV was surprised by the apparently recent trend of applicants, reviewers and institutions not self-reporting demographic information to NSF and IOS. This was noticeable in that the % of awards to Whites is higher than the submissions from this demographic group while those from other demographic groups do not reflect the same trends. While the most likely possibility for this pattern is that more senior faculty are White and award rates in IOS are higher for senior faculty, another possibility is that proposals from under-represented groups are less competitive due to implicit biases and/or structural inequities.

Recommendation: To address the possibility, the COV recommends that IOS expand efforts to educate the community on the impacts of, and best practices to minimize, implicit biases and/or structural inequities.

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<p style="text-align: center;">RESULTING PORTFOLIO OF AWARDS</p>	<p style="text-align: center;">APPROPRIATE, NOT APPROPRIATE, OR DATA NOT AVAILABLE</p>
<p>Recommendation: Overall, while the COV recognizes that NSF and federal policies determine the available categories to those for self-reporting, IOS is strongly encouraged to actively employ all avenues (i.e., solicitations, websites, virtual office hours (VOHs), symposia presentations, addition of new or additional language/text to the demographic request to inform how the information is utilized, etc.) to inform constituents on the importance of such information to the mission of NSF in general (and by extension, IOS).</p> <p>Data Source: Enterprise Reporting, COV Dashboard, Question 5</p>	
<p>10. Is the program relevant to national priorities, agency mission, relevant fields and other constituent needs? Include citations of relevant external reports.</p> <p>Comments:</p> <p>The COV recognized the impressive number and diversity of interactions and collaborations IOS has across the BIO Directorate, other NSF directorates in general as well as governmental agencies that support biological sciences research aligned with the priority areas of the Division. These interactions and the collaborative outcomes demonstrate the importance of the science that IOS supports that address a broad swath of societal and global issues.</p> <p>Data Source: Jackets</p>	
<p>11. Additional comments on the quality of the projects or the balance of the portfolio:</p> <p>The COV did not feel that moving to the no-deadline system negatively impacted the quality of projects or balance of the IOS portfolio. In contrast, this move appears to have freed up time and resources that could be redirected to further serving the scientific community.</p>	

³ NSF does not have the legal authority to require principal investigators or reviewers to provide demographic data. Since provision of such data is voluntary, the demographic data available are incomplete. This may make it difficult to answer this question for small programs. However, experience suggests that even with the limited data available, COVs are able to provide a meaningful response to this question for most programs.

OTHER TOPICS

1. Please comment on any program areas in need of improvement or gaps (if any) within program areas.

Broader Impacts Data: COV commends NSF for placing some emphasis on Broader Impacts (BI) in analyzing the impact of the agency's portfolio. The self-study included a 2-page document with a general description of BI, collapsed the 10 categories from the PAPPG (section III.A.2) into 7 categories, and then ran textual analysis of all proposals to compare: 1) percentages of BI categories proposed vs funded; 2) themes proposed over the reporting period; 3) and a bar graph to compare IOS BI to all NSF awards from 2018-2021 (Self-Study 08_IOS_BI_Themes). The BI within IOS focus mostly on broadening participation and developing workforce, similar to NSF as a whole. There are fewer projects that intend to impact economic competitiveness, industry participation, and national security. While this data snapshot provides a good starting point and comparison with the agency, more information collected with the proposals would better clarify the alignment of reviews with proposals, the distribution of impacts, etc. In the previous COV report, a suggestion was made about the requirement of assessment of BI, and the self-study points us to the updated PAPPG that includes an expectation to assess success of both intellectual merit and BI.

Recommendation: The COV recommends developing a system of collecting and aggregating BI assessments as a way for IOS to clearly demonstrate the societal impact of their portfolio. IOS may consider sub-contracting this work to groups who are interested in research impacts as a way to better understand and document these societal benefits.

Broader Impacts Priorities: Data provided in the Self Study (08_IOS_BI_Themes) are a snapshot of BI across the program. However, there is no indication of any priorities IOS has about the types of BI they prefer or aspire to move toward. As a comparison, the Directorate for Computer Information Science and Engineering now requires the inclusion of a description of how their awards will help broaden participation. COV recommends IOS discuss whether to prioritize any BI categories. If so, moves should be made to help achieve those goals. If not, they should state they want a balanced suite of impacts across IOS and should document impact through the assessment provided from annual reports.

Recommendation: The COV encourages IOS to consider whether they want to prioritize certain broader impacts goals or if they want a balanced portfolio, and consider setting goals to achieve in this area. More engagement with the IOS community through VOH or other mechanisms to explore the full breadth of BI might also be fruitful.

2. Please provide comments as appropriate on the program's performance in meeting program-specific goals and objectives that are not covered by the above questions.

The COV recognizes that the review period has involved tremendous challenges. We commend the IOS for the heroic efforts they have made to not only continue but expand the work of the IOS in funding and supporting research activities at diverse levels across the nation.

3. Please identify agency-wide issues that should be addressed by NSF to help improve the program's performance.

Remote work options: **The COV encourages NSF to establish a permanent remote work policy extending beyond pandemic-related restrictions.** This would allow recruitment and retention of administrative staff and PDs from a much larger pool nation-wide, with greater life-stage, geographic, and socioeconomic diversity (please see section III, part 1 for details).

Implicit bias training: **The COV applauds the level of implicit bias training for PDs, but urges a more formal training for panelists before they begin reviewing proposals.** This could be included as a short online module within the reviewer instructions. Most academic researchers have participated in implicit bias training and would only need a short but timely reminder to re-calibrate (please see section III, part 2 for details).

Demographic data collection: **The NSF demographic request terminology needs to be updated, and the “do not wish to provide” option, which has made this information less useful, should be reconsidered.** One suggestion is to remove the “do not wish” option and replace it with an “other - fill in the blank” option for both gender and race/ethnicity. While this would be more challenging to track, it would provide the NSF with more granular data about the applicant pool (please see section III, part 1 for details).

Open access publication: **The COV recommends that NSF consider implementing an open access publication policy.** Similar to NIH-funded research, research published by NSF-funded scientists should be publicly available in a reasonable amount of time without a journal paywall.

Early-career training and experiences: The COV recognizes the efforts IOS has invested into creating opportunities for early-career scientist engagement in NSF activities. **The COV recommends that NSF consider developing additional mechanisms to provide opportunities for post-doctoral and early-career scientists to receive focused training and experiences that provide a foundation for long-term engagement with NSF activities and mission.**

4. Please provide comments on any other issues the COV feels are relevant.

5. NSF would appreciate your comments on how to improve the COV review process, format and report template.

NSF staff perspective on review panels: The COV notes that NSF staff members involved in panel reviews may have useful insights into the review process, particularly in terms of panel logistics and efficiency. This perspective may have been incorporated into the 2022 self-study, but it is not emphasized or described as such. In future self-studies, we recommend a brief but dedicated section that reports how staff perspective and feedback was encouraged and incorporated into the IOS internal review.

Suggestion for future COV members: The panel recommends creating a brief information sheet or Q & A for COV members to receive early in the process, which simply walks through the COV process, what is expected of COV reviewers in advance, approximate time commitment, etc. Perhaps also consider providing a 30-minute presentation describing/summarizing the IOS response to the previous COV as well as any area/s where the IOS might want the current COV to focus.

The Committee of Visitors is part of a Federal advisory committee. The function of Federal advisory committees is advisory only. Any opinions, findings, conclusions, or recommendations expressed in this material are those of the Advisory Committee, and do not necessarily reflect the views of the National Science Foundation.

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For the IOS COV
Hannah V. Carey
University of Wisconsin - Madison
Chair

Integrative Organismal Systems
Committee of Visitors Meeting
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July 1, 2022



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Georg Jander
Boyce Thompson Institute

Amy Bejsovec,
Ph.D.

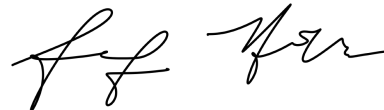
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Amy Bejsovec
Duke University



7/1/2022

Karen A. Hicks
Kenyon College



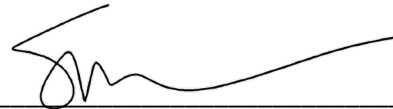
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Jennifer Nemhauser
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Susan H. Williams
Ohio University



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Matthew M. Johnson
Pennsylvania State University



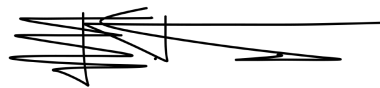
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Lauren O'Connell
Stanford University



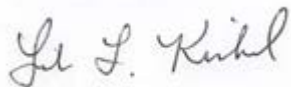
7/1/2022

Diego Bernal
University of Massachusetts - Dartmouth



7/1/2022

Esteban Fernández-Juricic
Purdue University



7/1/2022

Linda Kinkel
University of Minnesota

Friday, July 1, 2022

As the designated Advisory Committee Representative to BIO/IOS 2022 Committee of Visitors, I hereby submit the attached Fiscal Year 2022 COV Report to the Directorate for Biological Sciences Office of the Assistant Director.



07/01/2022

Scott R. Santos
State University of New York - Buffalo
Advisory Committee Representative

Date