

## FY 2013 REPORT TEMPLATE FOR NSF COMMITTEES OF VISITORS (COVs)

The table below should be completed by program staff.

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| <b>Date of COV:</b> September 10 – September 12, 2013   |
| <b>Program:</b> Plant Genome Research Program (PGRP)  |
| <b>Division:</b> Division of Integrative Organismal Systems (IOS)   |
| <b>Directorate:</b> Directorate for Biological Sciences (BIO)   |
| <b>Number of actions reviewed by COV:</b> 121<br><br><b>Awards:</b> 22<br><br><b>Declinations:</b> 99<br><br><b>Other:</b> 0  |
| <b>Total number of actions within Program during period being reviewed by COV:</b> 1267<br><br><b>Competitive Awards:</b> 97<br><br><b>Competitive Declinations:</b> 722<br><br><b>Other Actions:</b> 448   |
| <b>Manner in which reviewed actions were selected:</b><br><br><p>The program selected a random jacket sample of 121 competitive awards and declines. For qualitative measures (such as recommendation completeness), 121 jackets is a sufficient sample to provide examples of the styles and procedures of all the program activities. There is a representative number of actions per fiscal year, proportionate to the total number of awards or declines, and including Basic Research to Enable Agricultural Development (BREAD), National Plant Genome Initiative (NPGI) Postdoctoral Research Fellowships, Grants for Rapid Response Research (RAPIDs)/EARly-concept Grants for Exploratory Research (EAGERs, conferences and workshops, Faculty Early Career Development (CAREER) proposals, and proposals submitted to all program solicitations covered by the review period. The COV will be able to access the sample jackets via the COV module on eJacket. In addition, eJacket contains a list of all 1267 actions reviewed by the Program over the last three years, including supplements, proposals returned without review, and withdrawn proposals. The COV can request to see any proposal on this list during the meeting. However, COV panelists will not have access to jackets/proposals for which they are in conflict. For the convenience of the COV, a list of commonly used acronyms is available in the DOCUMENTS section of the eJacket COV module.</p> |



COV Membership

|                                | <b>Name</b>             | <b>Affiliation</b>                         |
|--------------------------------|-------------------------|--|
| <b>COV Chair or Co-Chairs:</b> | Suzanna E. Lewis        | Lawrence Berkeley National Lab             |
| <b>COV Members:</b>            | Gustavo Caetano-Anollés | University of Illinois at Urbana-Champaign |
|                                | Alice C. Harmon         | University of Florida                      |
|                                | Edward Kaleikau         | United States Department of Agriculture    |
|                                | Beth Krizek             | University of South Carolina               |
|                                | John D. McPherson       | Ontario Institute for Cancer Research      |
|                                | Gaetano T. Montelione   | Rutgers University                         |
|                                | Antoni Rafalski         | University of Delaware                     |
|                                | Elizabeth R. Waters     | San Diego State University                 |

## 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, and withdrawals) that were *completed within the past three 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.

**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.

| QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS  | YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE |
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| <p>1. Are the review methods (for example, panel, ad hoc, site visits) appropriate?</p> <p><i>Comments:</i> The COV examined 121 jackets representing a random sample of the 1267 actions within the program during the study period. The COV noted that the program uses different review mechanisms for different types of proposals. The review analysis for each proposal carefully summarizes the information obtained from the panel ad hocs and site visits if appropriate. The process of review with assembled panels, ad hoc reviewers to expand expertise and site visits when warranted is an effective mechanism and should be continued.</p> <p>There are increasing financial pressures to utilize virtual review processes. Few studies are available to support the effectiveness of this approach (e.g. <a href="http://www.plosone.org/article/info:doi/10.1371/journal.pone.0071693">www.plosone.org/article/info:doi/10.1371/journal.pone.0071693</a>). Mixed panels, comprised primarily of on-site reviewers with a few experts joining virtually, provides a useful mechanism to include additional panel members who otherwise could not attend the meeting. However, the concentrated attention and dynamic interactions that are the hallmark of an on-site review panel are not captured in WebEx virtual meetings.</p> <p>In discussions with the program officer on the use of virtual panels it was mentioned that for small panels (6 or less panel members) virtual panels are sometimes used. This is primarily due to the mandated 30% cost savings for panels that the program has to meet. While the COV understands that budget reductions impact all programs at NSF and that the PGRP does a laudable job in trying to reduce costs in ways that minimizes the reduction of funds available for projects we are concerned about the increasing use of virtual panels. In particular the COV was concerned about the use of virtual panels for the review of post-doctoral fellowship proposals. Further, the PGRP should</p> | <p><b>Yes</b></p>                              |

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| <p>monitor the ability of virtual panels to adequately review proposals.</p> <p><i>Recommendations:</i> (i) The PGRP should try to use on-site review panels, or hybrid panels, rather than exclusively virtual panels, whenever possible. (ii) A plan for carefully monitoring the use of virtual panels should be developed to ensure the existing high quality of PGRP reviews are not compromised. (iii) We also suggest that because of their long-term research impact, that either in-person or hybrid panels are utilized for the review of post-doctoral fellowship proposals.</p>  |                   |
| <p>Are both merit review criteria addressed</p> <ul style="list-style-type: none"> <li>• In individual reviews?</li> <li>• In panel summaries?</li> <li>• In Program Officer review analyses?</li> </ul> <p><i>Comments:</i> The COV reviewed all of the 121 jackets provided and found that the two merit review criteria were addressed for all proposals. In many <i>ad hoc</i> and panel summaries Intellectual Merit was discussed in greater detail than Broader Impacts.</p> <p>The COV discussed concerns that individual reviewers and panels may have varying concepts of what constitutes appropriate Broader Impacts (this was also mentioned in the previous COV report). This can lead to confusion among PIs and discrepancies in the review process. Broader impact for society, including proactive involvement of underrepresented minorities and outreach to K-12 education, are important goals and responsibilities for NSF-funded investigators. However, other kinds of broad scientific impact, such as development of new reagents or technologies that can impact the research programs of large numbers of investigators, are also a very important form of Broader Impact. The COV felt that the value of these “scientific broader impacts” was not being uniformly conveyed to applicants and reviewers, and not generally appreciated by reviewers.</p> <p><i>Recommendation:</i> (i) Clarification of what constitutes acceptable Broader Impact, to both review panels and applicants. (ii) We further suggest that NSF might consider an institute-wide reassessment of the definitions and public descriptions of the kinds of activities that constitute high-value Broader Impacts.</p> | <p><b>Yes</b></p> |

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| <p><b>3. Do the individual reviewers giving written reviews provide substantive comments to explain their assessment of the proposals?</b></p> <p><i>Comments:</i> Over the three-year review period 97-99% of individual reviews address Intellectual Merit and 94-97% address Broader Impacts. In general we noted that most reviews are of high quality. However, the COV noted that the program is aware of the uneven nature of individual <i>ad hoc</i> reviews. When a proposal receives a non-substantial review the program does request additional reviews. However, we have also noted that for many proposals the vast majority of <i>ad hoc</i> review requests are declined. The review process would certainly be improved if every proposal received the same quality of reviews. While we recognize that this is difficult to achieve we were wondering if there were ways to improve the quality of individual reviews.</p> <p><i>Recommendation:</i> The PGRP should provide additional guidelines on what represents a quality review. In particular, examples of past representative reviews redacted for identifying content could be included in the advance package to provide an indication of the quality of review that is expected. The examples should include 'good', 'adequate', and 'poor' reviews.</p>                                 | <p><b>Yes</b></p> |
| <p><b>4. Do the panel summaries provide the rationale for the panel consensus (or reasons consensus was not reached)?</b></p> <p><i>Comments:</i> This is quite variable. The summary is frequently short and in particular when there are large discrepancies among the individual reviews does not provide guidance on the reviews that carried more weight with the panel. The COV acknowledges that the summaries are written essentially real-time but suggest that the program impress on the panel members the need to provide sufficient detail in the panel summary so that the PI can understand the dynamics of the review discussion and subsequent panel rating.</p> <p><i>Recommendation:</i> The COV suggests that all panel summary forms include solicitation-specific sections that, for example, prompt the panel to comment specifically on the transformative nature of the proposal if that is a major factor for funding decisions. Further, we recommend that, for the BREAD proposals, a section on the relevance to smallholder farmers is included. This information is present in the Review Analysis and it is clear from these notes that the panels considered these criteria in their evaluation of the proposals. This information, in particular for proposals that are declined, is crucial for PIs in planning new submissions.</p> | <p><b>Yes</b></p> |

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| <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><i>Comments:</i> Overall there is sufficient information within the jacket. The inclusion of the PO's Review Analysis generally makes the funding decisions clear. Inclusion of Diary Notes is also helpful in completing the package, particularly for EAGER proposals and workshop proposals that do not have external reviews.</p> <p><i>Recommendation:</i> The jackets provide a comprehensive documentation of the rationale for award decisions. No recommendations for changes are made.</p> | <p><b>Yes</b></p> |
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6. Does the documentation to the PI provide the rationale for the award/decline decision?

Yes/No

[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 (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.]

*Comments:* The applicant receives several documents explaining the rationale for the award/decline decision, typically including multiple reviews, Panel Summary, the PO Comments, and the generic Context Statement. Taken together, this information generally fully justifies the decision to fund or not fund the application. The PO makes a special effort to convey the key information on which the funding decision was made in the PO Comments.

However, the COV panel observed some examples in which the information provided back to the applicant was less complete than the information available in the PO's Review Analysis. Comparing the Panel Summary, the PO Comments, and the generic Context Statement with the Review Analysis, concerns were raised that in some cases all of the key criteria used for making a decision to decline funding the proposal were not conveyed back to the applicant. For example, a comment that is often made in Review Summaries

*"This proposal was not considered to be potentially transformative by the panel nor by the Program Director"*

is sometimes not included in the Reviews, Panel Summary or PO comments. Specific cases include proposals [REDACTED] (Plant Genome Research Project) and [REDACTED] (Plant Genome Research Resource).

The COV observed that the POs Review Analysis (which is not provided to the applicant) generally tends to provide a more complete explanation for the funding decision than the Panel Summary (which is provided to the applicant). This is understandable, since Panel Summaries are written during the Panel meeting, and are often quite brief and succinct. The PO Review Analysis generally provides a more comprehensive summary of how the decision evolved from initial reviews through the panel discussion. Although the PO supplements the Panel Summary by providing PO Comments to the applicant, efforts should be made to ensure that the combination of Panel Summary and PO Comments provides the applicant all of the key information that impacted the funding decision (which may even contradict statements in the written reviews). The aim should be to provide the applicant with as much information as possible to inform their decision and strategy for resubmission. See the suggestions under the previous section (4) for changes to the Panel Summary template that will prompt the panels to address the transformational nature of each proposal as well as other important criteria for individual panels (e.g. relevance for smallholder farmers for the BREAD proposals).

*Recommendation:* Make use of the PO Comment to clarify funding decisions in more applications than is the current practice. The PO should ensure that the combination of the Panel Summary and PO Comment covers all the key information in the internal Review Analysis used to justify the funding decision.

**7. Additional comments on the quality and effectiveness of the program's use of merit review process:**

*Comments:* Overall the PGRP is quite effective in using its merit review process. The review process is very high quality. Most proposals have several written reviews - all have at least 3, some as many as 6. Outlier reviews are generally (though not always) justified in the Panel Summary. The internal Review Analysis, justifying the basis for the funding decision, provides a summary of the evolution of the funding decision from initial written reviews from outside reviewers and panel members, panel discussion and recommendations, and site visits when appropriate, to the final decision by the PO, which includes programmatic criteria and a synthesis of all other reviews.

*Recommendation:* The PGRP is doing an excellent job in using its merit review process. No recommendations for changes are made.

**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.

| 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><i>Comments:</i> The COV noted the difficulty in getting reviewers, particularly due to the large number of collaborators and consequently COIs. The PGRP self-study indicated that reviewers are selected based on Program Officers own knowledge of the subject, suggestions provided by the PI in the proposal, references in the proposal, the NSF reviewer database, other databases, the web, colleagues, and other Program Officers. In examination of the jackets the COV thought that the expertise and qualifications of the reviewers were appropriate as well as the process by which reviewers are selected. In many cases individual reviewers do not have expertise in all aspects of multidisciplinary proposals, but full coverage of the proposal is provided by an array of reviewers having focused expertise.</p> <p><i>Recommendation:</i> Despite lengthy discussions the COV was unable to generate any new ideas for engaging qualified reviewers. We strongly commend the PGRP for their current track record in obtaining qualified reviewers.</p> | Yes  |
| <p>2. Did the program recognize and resolve conflicts of interest when appropriate?</p> <p><i>Recommendation:</i> The program has appropriate procedures in place for handling the COIs of panel members and reviewers. The program is careful to identify and resolve COIs. COI arising during the review panel process are documented.</p>   | Yes  |
| <p>Additional comments on reviewer selection:</p> <p><i>Recommendation:</i> The COV acknowledges the great efforts the program goes to obtain reviews. One suggestion is to write an editorial for a journal/society newsletter on the "apathy of reviewers". The decreasing participation in the review process is in contrast to the increasing number of applicants. A second suggestion is to remind stakeholders in the review process that identifying qualified reviewers is a critical to maintain the quality of the awards process.</p>  |  |

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

**MANAGEMENT OF THE PROGRAM UNDER REVIEW**

**1. Management of the program.**

*Comments:* The PGRP highly benefits from experienced leadership with a comprehensive perspective. The dedication of the leadership to achieving the program mission is clearly evident and they are extremely well respected by the community. The IOS Director and PGRP PO have been involved with the program for many years. The PRGP falls under IOS yet it appears to be somewhat set apart from the other subgroups, as evidenced by its separate COV. This is understandable as PGRP represents a substantial increase in budgetary oversight since its incorporation under IOS. The 2010 COV recommended hiring an additional PO, potentially with expertise in bioinformatics. Two temporary POs are joining soon with a second full-time PO to start shortly. A new IOS Executive Officer has just joined. These additions will help to alleviate bottlenecks and address the concerns raised by the previous COV. The IOS Director was asked about staffing levels for the program management and indicated that it was appropriate. The COV concurs with this assessment; however, the increasing number of virtual review meetings may further tax the staff. As described, the checks and balances in place for vetting funding decisions are well thought out.

*Recommendation:* Keep up the good work, it's highly appreciated. Expertise in the PRGP staff in bioinformatics could be supplemented by identifying and bringing in one or more Experts with training in this area.

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

*Comments:* The PGRP has maintained a diverse portfolio that has responded well to changing technology landscapes. While providing resource level funding embracing such technologies as next-generation sequencing the PGRP has not lost sight of supporting basic biological functional studies and environmental interactions. In addition, there is a good balance of economically important species and model systems. The BREAD program is an example of adaptability with incorporation of a co-funded program aimed at a global need.

In the longer term the research resources (reagents, data, and technologies) being produced through PGRP awards must be managed and maintained while they continue to offer value to the community. The PGRP, while not becoming a data repository itself, could take on a stewardship role to ensure that the resources are a) locatable and b) interoperable. More attention towards public availability of data generated with PGRP funding is needed. Increased public awareness and access to these data would also provide broader recognition of the PGRP for its leadership role in the field. Additional work is needed towards resource integration.

*Recommendation:* The recommendations for data management, data interoperability, and public accessibility of PGRP-funded data are outlined under Other Topics – Point 3, below.

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

*Comments:* The IOS and the PGRP are well connected with the National Plant Genome Initiative (NPGI) with full representation in the Interagency Working Group. The PGRP has played a major role in advancing the NPGI goals, especially with respect to expanding genomic resources in major economically important plants. The involvement in this external infrastructure clearly shapes PGRP prioritizations in an appropriate way.

Internally, the program responds to national objectives through contribution to the 5-year NPGI plan. Review of the portfolio through the annual meeting reports shows a diverse portfolio that overall meets the general objectives. The program also responds to the challenges of agriculture, elaborated for example in the 2012 Report to the President on Agricultural Preparedness and the Agriculture Research Enterprise. This includes managing new pests, pathogens, and invasive plants, increasing the efficiency of water use, reducing the environmental footprint of agriculture, growing food in a changing climate, managing the production of bioenergy, producing safe and nutritious food, and assisting with global food security and maintaining abundant yields. Much attention must be placed in fostering continued innovation in areas of research that provides transformative ideas that address the major challenges in agriculture.

A concern of the COV is the uniform quality of the genomic data that everyone uses, especially in regard to bioinformatics projects. Correct gene annotation remains as one of the biggest challenges. It is essential to ensure that the resources developed through PGRP awards provide maximal value for this investment. The COV recognizes that genome improvement and centralized database development is currently driven by the research community's requests, but there is a concern that the investment already made in generating the vast amounts of data may be diminished if the various kinds of data generated in the PGRP program is not comprehensively archived in standardized formats.

*Recommendation:* (i) A clearer summary of PGRP accomplishments distilling major milestones achieved in the portfolio and highlight research results and major accomplishments would be helpful. The self-study serves as a good starting point for such a report. Coupled with a research highlights this would be highly informative to the scientific community, as well as the general public and other stakeholders. (ii) A satellite workshop at PAG could be used to solicit feedback in leveraging existing data resources to enable research & analysis, and to make it clear that the impetus for supporting such efforts must be a community driven activity. (Additional recommendations for a data management and dissemination workshops are outlined under Other Topics.3 below).

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

*Comments:* The written response clarified many COV concerns pointing out NSF and external programs that complement PGRP efforts. The addition of a second full-time PO has been implemented directly addressing that staffing concern. Overall the PGRP has responded well to the previous COV recommendations.

The previous COV strongly recommended that PGRP expand its portfolio to "encompass the diversity of both agronomic and non-agronomic plant species best suited to address the biological process under study." In response, BIO reminded us that they are congressionally mandated to focus on crops and plant processes of potential economic value. Furthermore, that BIO does support some of these types of projects through the Transferring Research from Model Systems program. Potential economic value cannot solely be defined according to whether a plant is currently a crop plant (or its close relative) or not. Maintaining an environment in which plants can thrive is clearly crucial in any determination of economic value. Therefore the COV strongly recommends that value determination for supporting a genomic resource not be based solely on whether the plant under study is a crop plant, but is the system for a key environmental determinant

in sustaining optimal growth conditions.

***Recommendation:*** Expand the range of proposals considered to include proposals of future agronomic value even if they are studies of non-crop species.

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

| <p align="center"><b>RESULTING PORTFOLIO OF AWARDS</b></p>  | <p align="center"><b>APPROPRIATE,<br/>NOT<br/>APPROPRIATE,<br/>OR DATA NOT<br/>AVAILABLE</b></p> |
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| <p><b>1. Does the program portfolio have an appropriate balance of awards across disciplines and sub-disciplines of the activity?</b></p> <p><i>Comments:</i> The 2012 applications represent a wide range of subdisciplines of plant science: abiotic stress (oxidative, heat, drought, cold, salinity) (15), biotic stress (bacterial, fungal, oomycete, insect) (16), biochemistry (4), biology of rare alleles (1), cell wall biology (3), chromatin structure (3), computational biology (7), epigenetics (4), evolution of adaptive traits (5), fruit biology (5), genetic variation of cis-regulatory DNA (1), genome organization and evolution (10), heterosis (4), meiotic recombination (1), metabolism (9), nutrient uptake and availability (3), non-coding RNAs (3), organelle structure and function (2), parasitic plant biology (1), plant breeding (4), plant development (14), plant physiology and signaling (14), post-transcriptional regulation (1), post-translational modifications (3), resource development (14), symbiosis (7), transposons (1).</p> <p>Overall, the balance of awards seems appropriate. Among the awarded grants, 7 (\$25.7M) are in biotic/abiotic stress, while 3 (\$11.5M) were in resource development (data from 2012 panel debriefing document), proportionate to the applications received. The COV noted that finished genomic sequence of major species of fundamental and applied interest, while well represented, could perhaps be further encouraged. Resource needs continue to be very large, including the need for completion of major reference genome sequences. One of the major goals for the PGRP is providing the research community with the genomic resources that are needed to support basic research in plant genomics. It is the availability of such accurate genomic resources that enable the elucidation of fundamental biological processes in plants. While we appreciate the urge to move quickly into new areas it is equally important to ensure that fundamental research resources are sufficiently completed.</p> <p><i>Recommendations:</i> We recommend that the PGRP take a leadership role to ensure that the incomplete state of genomic resources is not an impediment. To this end we suggest a survey of the community requesting input on where roadblocks now exist.</p> | <p><b>Yes</b></p>  |
| <p><b>2. Are awards appropriate in size and duration for the scope of the projects?</b></p> <p><i>Comments:</i> The size of the awards represent the budget proposed by the applicants with some adjustment by the PGRP program leaders. In some cases major adjustment to the award size is made, due to reduction in the scope of work relative to the original proposal. This is appropriate. The size</p>   | <p><b>Yes</b></p>  |

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| <p>of the awards ranges from \$500,000 to over \$7,000,000. This is appropriate. Average size of the proposals is not the best statistics, because of strong skewing towards large awards. Median would be a better measure. The largest awards represent major resource development programs such as wheat genome sequencing. Award duration of 3-5 years is in general appropriate. In some cases duration of 3 years may be too short to achieve all objectives. A graph representing award size on one axis and award duration on the other axis would be very informative.</p> <p><i>Recommendations:</i> None</p>  |                   |
| <p><b>3. Does the program portfolio include awards for projects that are innovative or potentially transformative?</b></p> <p><i>Comments:</i> Some highly innovative projects are necessarily high risk, which is appropriate. A number of innovative awards have been made (examples include Springer /epigenetics, White / TAL effectors, Poland / high throughput phenotyping). Some highly rated innovative proposals have not been funded (e.g. ██████████ - plant nectar genes). In conclusion, a number of innovative and/or potentially transformative proposals have been funded.</p> <p>Asking review panels to identify what is transformative is extremely useful as a mechanism for encouraging them to fund projects that lie outside their comfort zone.</p> <p>The COV would like to emphasize that Resource projects themselves are transformative. While often mundane in implementation, the technologies, data, and reagents generated in these resources changes the research environment dramatically and can lead to transformative discoveries.</p> <p><i>Recommendations:</i> None</p> | <p><b>Yes</b></p> |
| <p><b>4. Does the program portfolio include inter- and multi-disciplinary projects?</b></p> <p><i>Comments:</i> The portfolio includes a number of self-identified inter- and multi-disciplinary projects that include the following disciplines: computer science, chemistry, mathematics, earth sciences, engineering and social sciences. As expected, computer science was the top discipline reflecting the importance of bioinformatics in genomic research. This was followed by chemistry and mathematics. It appears that this number is decreasing between 2010-2012 but it is unclear if this is due to the changing nature of funded projects or changes in self-identification.</p> <p><i>Recommendations:</i> None</p>   | <p><b>Yes</b></p> |
| <p><b>5. Does the program portfolio have an appropriate geographical distribution of Principal Investigators?</b></p> <p><i>Comments:</i> Examination of the distribution of PIs and Co-PIs among the awards shows a wide distribution across the United States. The concentration of awards in the Midwest (143 out of 333) is consistent with the importance of this region for agriculture. The top states receiving awards are NY and CA with 67 and 35, respectively, which probably reflects the concentration of genomic resources, technologies, the infrastructure for</p>  | <p><b>Yes</b></p> |

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| <p>plant genomic research and the number of research universities in these states. This is an appropriate distribution. In this regard, the PGRP is doing a good job of meeting the needs of the entire scientific community.</p> <p><i>Recommendations:</i> None</p>   |                   |
| <p><b>6. Does the program portfolio have an appropriate balance of awards to different types of institutions?</b></p> <p><i>Comments:</i> The portfolio includes awards to all types of institutions (4-Year, Master's, Ph.D., Research Foundation, and Other). As expected, fewer proposals involve 4-Year and Master's institutions and we expect that many of those submitted are in collaboration with Ph.D. institutions. The success rates for different types of institutions vary per year with typically Ph.D. institutions having higher success rates than 4-Year and Masters institutions. The portfolio appears to have an appropriate balance of awards to different institutions given the infrastructure, resource needs and capability of carrying out the work of these types of proposals.</p> <p><i>Recommendation:</i> Continue to encourage collaborative projects that include a variety of types of institutions. Support for the maintenance and support of broadly useful software applications will also remove what is often a barrier to independent research being carried out in smaller research laboratories.</p>  | <p><b>Yes</b></p> |
| <p><b>7. Does the program portfolio have an appropriate balance of awards to new investigators?</b></p> <p><b>NOTE:</b> A new investigator is an investigator who has not been a PI on a previously funded NSF grant.</p> <p><i>Comments:</i> The portfolio includes both beginning investigators and investigators new to NSF. Out of 97 total awards, on average almost all awards include a PI and/or Co-PI that is new to NSF. 28% of the total numbers of investigators are new to NSF. Approximately 6% of the awards are to beginning investigators as PI. The low number of awards to beginning investigators as PI seems reasonable given that these proposals typically involve collaborative research and it takes time to build collaborations. We expect that many of the awards involve beginning investigators as Co-PIs or collaborators and believe that this is a valuable experience for these young researchers that can have an important impact on their careers. However, this information was not easily obtained.</p> <p><i>Recommendation:</i> The value of new investigators as Co-PIs on collaborative applications should be considered in the assessment of these criteria.</p> | <p><b>Yes</b></p> |
| <p><b>8. Does the program portfolio include projects that integrate research and education?</b></p> <p><i>Comments:</i> Most PGRP proposals include integration of research and education. These activities range widely from interaction with K-12 schools, undergraduate and graduate student mentoring, training of faculty at PUI, RETs, as well as outreach to the research community and the public. Some</p>   | <p><b>Yes</b></p> |

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| <p>particularly interesting programs included introduction of children and their caregivers to plant volatiles (Michigan State University) in a lecture/lab demonstration and participation of undergraduate students in the University of Missouri's program in Plant Science and Public Policy to enhance their understanding of scientific public policy advocacy.</p> <p><i>Recommendation:</i> none</p>  |                   |
| <p><b>9. Does the program portfolio have appropriate participation of underrepresented groups<sup>1</sup>?</b></p> <p><i>Comments:</i> The portfolio includes participation of both minority and women as defined by self-identification. The success rate of minority PI or Co-PI proposals ranged from 9-15% and was similar to the overall success rate (9-16%). The success rate of women PI or Co-PI proposals ranged from 13-18%. In addition, a number of awards to minority serving institutions were made but the success rate varied considerably (0-36%) in 2010-2012. The participation of underrepresented groups is appropriate.</p> <p>Interestingly, among the 2012 reviewed proposals, 112 were by male PIs while 26 by female PIs. Perhaps the proportions are more equal among beginning investigators.</p> <p><i>Recommendation:</i> We appreciate the efforts of PGRP in including full representation of all groups and continue to encourage these efforts to increase the number of proposals that include women and underrepresented minorities.</p>   | <p><b>Yes</b></p> |
| <p><b>10. Is the program relevant to national priorities, agency mission, relevant fields and other constituent needs? Include citations of relevant external reports.</b></p> <p><i>Comments:</i> The PGRP is part of the National Plant Genome Initiative (NPGI) that is coordinated by a Federal Interagency Working Group on Plant Genomes (IWG). The PGRP developed its priorities for FY 2010-2012 based on the NPGI's goals (NPGI 5-year plan 2009-2013), the NSF strategic plan, and an array of stakeholder input.</p> <p>COV review of funded proposals for the years 2010-2012 support the important role the program is playing with regard to national priorities in plant genomics, agency mission and constituent needs. For example, awards have been made to develop genomic resources, advance systems biology, translate basic discoveries to the field and develop solutions to data access and analyses. A number of press releases and research highlights also speak of the significance and impact of the PGRP. Research examples align with NSF external and internal programmatic objectives.</p> <p>Examples of fulfillment of NPGI's 2009-2013 long-range plan:</p> | <p><b>Yes</b></p> |

<sup>1</sup> 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.

- (1) Expanding genomic resources for every major plant of economic importance: the development of a large publicly available set of ~20,000 mutant soybean lines useful to study gene function and chromosomal rearrangements (highlight 22127); the generation of a transcriptomic atlas for rice (21466), the development of wheat lines with enhanced resistance to rust-causing fungal pathogens (22482); and capturing ~30,000 plant genetic and developmental responses to gravity using images recorded from flatbed scanners (23843),
- (2) Advancing plant systems biology: development of an interdisciplinary systems biology approach that completes knowledge of biosynthetic pathways and metabolic roles of vitamin B synthesis in plants while enhancing the SEED database (23823).
- (3) Translating basic discovery to the field and broadening societal impacts (examples of research under the BREAD program): the impact of natural selection on nitrogen fixation of legumes such as bean, soybean and chickpea (22507); helping African beekeepers in their fight against parasites that are devastating bee populations worldwide (22526); and revealing how Kenyan stoves can be used to produce charcoal additives to soils (biochars) for improvement of crop yields (22504). ) (These examples are under the BREAD program); understanding how plants use single molecules and chemical barriers as toxic defense against pest and pathogens (21101 and 23831) and the identification of gene sets that affect corn leaf architecture and its impact on pest resistance ( 22122).

Similarly there are examples fulfilling the agency's internal goals (e.g. advancing basic research fundamental to the engineering process and strengthening the scientific and engineering research potential):

- (1) analysis of thousands of transcripts reveal about how cotton fibers were altered by thousands of years of selection during domestication (21852);
- (2) understanding evolution of sex using papaya as model system (23819);
- (3) identification of a transposon-mediated horizontal gene transfer event of evolutionary adaptation taking place between bacteria and a beetle that causes devastating losses in coffee production (23872).

*Comment:* A full-blown focus on systems biology appears at present underrepresented in proposals and highlights. We expect however that the discipline of genomic biology will unfold into a shift towards more integrative approaches that interface with systems and synthetic biology (e.g. synergies with MCB), computational science, molecular engineering, and biological mathematics.

*Recommendations:* The PGRP should stress innovation and accomplishments in these new cross-disciplinary fields. Press releases and highlights should take a leading role in discussion of external and internal priorities related to these emerging disciplines with other programs and divisions.

11. Additional comments on the quality of the projects or the balance of the

|                               |  |
|-------------------------------|--|
| portfolio:                    |  |
| <i>No additional comments</i> |  |

## OTHER TOPICS

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

*New opportunities in plant genomics that the PGRP should address.*

While the PGRP should not duplicate funding in areas of plant biology that are overlapping with funding by other agencies, if there are external projects that involve the development of genomic tools or resources then PGRP should coordinate with these project to ensure that any tools and resources being generated can be broadly disseminated to the community by integration within the PGRP repertoire. The PGRP should place an emphasis on proactively supporting development of essential resources for data generation, data management, and data dissemination. While these may be less innovative their availability can be highly transformative. For example, correlating quality genomic sequences with high resolution genetic maps, understanding genome and epigenome diversity and evolution, etc. As genomics becomes a more mainstream activity permeating many areas of research, PGRP will further evolve, embracing additional scientific disciplines, addressing all dimensions of the science related to plants of economic and environmental importance and their use as biofuels, sources of fertilizers, pharmaceuticals, plastics and many other products of societal relevance, including uses related to improving the environment. Consequently, PGRP will be uniquely positioned to leverage advances in computational biology, systems and synthetic biology, and other emerging fields. Plants have unique properties when compared to other eukaryotic organisms, including the extraordinary ability to rearrange their genomic makeup, their unique modes of reproduction, and the deployment of unique chemical diversity that is being fostered by PGRP supported research.

*Recommendation:* PGRP should continue their efforts to seek collaborative interactions and joint funding for these expanding synergistic activities with other NSF programs and other funding agencies.

*Effective approaches for ensuring that scientists at all levels are equipped with appropriate skills to participate in multidisciplinary, collaborative, and integrative research and how the program can expand to cover a wider representation of types of institutions and types of investigators.*

The COV feels that the Postdoctoral program is an excellent approach and should be continued / extended but noted that despite the need, the number of submissions in 2012 is relatively low (26 proposals) and may be due to the lack of awareness about the program.

*Recommendations:* Perhaps an undergraduate scholarship directed specifically towards underrepresented minorities could be initiated. Small undergraduate research awards allowing PIs to offer summer research experience to minorities could be put in place (similar to the Howard Hughes existing program). In addition, sabbatical Grants could provide an opportunity for faculty to enhance their research, education, and/or other capabilities by funding sabbatical leaves or support for "mini-sabbaticals" for faculty and researchers desiring short-term training to learn new techniques. Sabbatical Grants to support faculty at minority serving institutions to train at and collaborate with research intensive universities would have many benefits in the long-term.

*It is clear that NSF staff already pays attention to major trends by participating in meetings, following trends in applications, etc. Looking forward, focus is rapidly shifting to genome diversity, functional organization, evolutionary genomics, environmental genomics and systems biology .*

EAGER is a good program enabling rapid response as these are not assessed by the normal merit review process, but rather awarded based on assessment by PGRP staff. In general, the COV was very enthusiastic about providing the PGRP staff discretion in awarding a small number of EAGER awards without using the standard merit review process, so long as this represents a very small percentage of the program budget. The basis for funding EAGER projects is justified in the Diary Notes provided in the Electronic Proposal Jackets, which are not provided to the EAGER applicant. In one example that the COV studied, these notes were helpful to understand the rationale of the funding decision. However, the justification could have been made more strongly considering the high potential impact of the proposal.

*Recommendations:* With respect to EAGER proposals, PGRP staff is encouraged to consult external experts (e.g. directly by telephone) to aid in areas where detailed expertise within the NSF staff is limited.

**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.**

First and foremost the COV strongly commends the PGRP for organizing the PI joint meetings which have proven to be so effective in fostering collaborations across the plant genomics community, keeping awardees on track, and motivating achievements.

The expectation is that all categories of research products must be included in progress reports. For example, data repository links. Close follow-up is needed to ensure the accessibility of the research end products, especially in resource projects.

*Recommendations:* PO's should make it uniformly clear and explicit to panel reviews that the required research products goes beyond publications.

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

NSF PGRP investigators are generating large quantities of genomic and proteomic data, including raw and processed sequence data, functional genomics, ChIP-Seq, phenotype data, and other primary data and analysis results. PGRP applicants are required to provide a Data Management Plan for their data, including a data archive plan. The data generated by funded projects are summarized in prose in their Annual Progress Reports, and in publications.

The COV expressed concerns that it is often difficult to determine where these data can be found or have been archived. Some data are archived in databases with no long-term support, and become inaccessible when the funding for a particular project ends. Other data are deposited in public databases, but cannot be easily tracked as results of the PGRP. The vast majority of plant phenotype data are not archived at all. In some cases, valuable genomic data generated by PGRP investigators may already have been lost.

Based on discussions with Dr. Melissa Cragin in the Office of the Assistant Director, Directorate for Biological Sciences, the COV learned of efforts in progress to identify data management and archive needs of the broad NSF BIO directorate, and how these relate to the NSF-wide BIG Data Initiative. Dr. Jane Silverthorne and the PGRP play a leading role in these discussions, ensuring that the needs of the PGRP are represented in this planning process.

The COV feels that data management and archiving are important agency-wide issues that should be addressed to help improve the PGRP program's performance and long-term impact. A process needs to be developed for connecting the Data Management Plans that are provided with an application, with the repositories of data that result from PGRP funded projects. As mentioned above under Management of the Program, the COV strongly recommends the adoption and enforcement of a structured Data Management Plan along the lines of the Data Curation

Consortium (<http://www.dcc.ac.uk/>). The formats of both Data Management Plans and Progress Reports need to be standardized to make it easier for PGRP staff to track performance of funded investigators in delivering their data to the public as proposed in their Data Management Plans. This would also ensure the integrity of data resulting from PGRP funding, and simplify the process of summarizing the impact of the PGRP program as a whole.

It might also be useful for PGRP, either on its own or together with other divisions of the BIO directorate, to organize workshops to address the following important questions:

1. How can the PGRP support development of core infrastructure, technologies, and standards needed to preserve, archive and data mine the various genomic, functional genomic, proteomic, and phenotypic data that is being generated by PGRP-funded investigators? How do these activities relate to the currently funded iPlant Collaborative program?
2. Where are investigators archiving their data now? Will these mechanisms satisfy the long-term goals of the PGRP program?
3. Which core technologies are needed to support data archiving, data mining, data analytics, and databases that meet the long-term goals of the PGRP? How can data be organized and formatted to ensure interoperability with different software tools.
4. Can these needs be met by funding cross-divisional research projects and/or resources as part of the NSF BIG Data initiative and in coordination with other Federal Agencies through the NPGI?

*Recommendations:* (i) Data Management Plans and Progress Reports need to be standardized to make it easier to track performance of funded investigators in delivering data to the public as proposed in their Data Management Plans. Plans for providing public access to the data generated in a proposed project and outlined in the Data Management Reports should also be assessed as part of the grant review process. The COV strongly recommends the adoption and enforcement of a structured data management plan along the lines of the Data Curation Consortium (<http://www.dcc.ac.uk/>). This will have the added benefit of making it possible to automate what is now a manual process in reviewing data access compliance in the annual progress reports. (ii) One or more workshops should be organized (perhaps at the annual Plant and Animal Genome conference) to assess the state of field with respect to data archiving, interoperability and other core technologies, and to what degree these needs of the PGRP can be addressed as part of the NSF BIG Data Initiative.

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

The COV considers the management of *in silico* resources of critical importance. Currently *in silico* resources are very fragmented, distributed between different data bases and private data stores, and are not jointly searchable. The iPlant initiative is addressing some of these issues, but room remains for additional innovative approaches, for example to database searches and modes of data display. A PGRP directive should be to encourage data standards and uniformity to facilitate integration of genomic resources across funded projects. A PGRP web page is needed that has links to the program outputs. A simple start is to list the URLs for Major Resources as indicated on the PGRP pamphlet. This should be readily accessible from the main PGRP page.

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

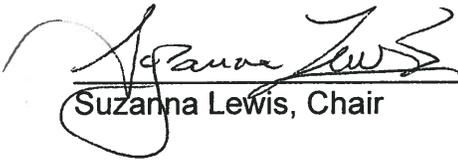
1. Providing earlier access to the eJacket website; this would allow panelists an opportunity to read documents and prepare prior to the meeting.
2. A profile of the PGRP portfolio based on relative financial investment would be very useful.

3. For the next COV the PGRP should recommend that the first step be to examine the previous COV report and perhaps the PGRP Self Study. Provide guidance in the COV template indicating which documents would be most helpful to answering the questions.

## **Overview**

The COV is very impressed by the excellent manner in which this program is run, the high level of professionalism in proposal review and project management, and their leadership in advancing the field of plant genomics. This field is quickly evolving and the PGRP has been both instrumental in facilitating these changes and in being responsive to the scientific community. In our report we suggest some minor changes in review and report processes. In looking to the future we outline an action plan for dealing with the increasing amount of data and the need for data integration across species and research groups. We also suggest that while keeping within the Congressional mandate the program be more open to agriculturally important research that is conducted in non-crop species.

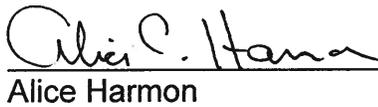
SIGNATURE BLOCK:

  
Suzanna Lewis, Chair

Sept 12, 2013  
Date

  
Gustavo Gaetano-Anollés

Sept 12, 2013  
Date

  
Alice Harmon

Sept 12, 2013  
Date

  
Edward Kaleikau

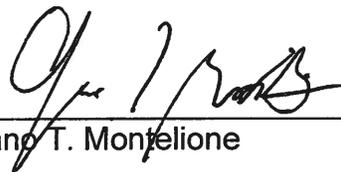
Sept 12, 2013  
Date

  
Beth Krizek

Sept 12, 2013  
Date

  
John D. McPherson

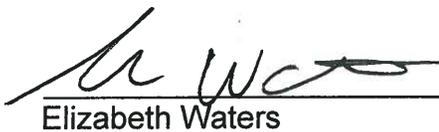
Sept 12 2013  
Date

  
Gaetano T. Montelione

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Date

  
Elizabeth Waters

Sept 12 2013  
Date

