REPORT TO THE
BIOLOGICAL AND ENVIRONMENTAL ADVISORY COMMITTEE
(BERAC)

BY THE COMMITTEE OF VISITORS
FOR THE REVIEW OF THE
BIOLOGICAL SYSTEMS SCIENCES DIVISION

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EXECUTIVE SUMMARY

On 30 August 2010, Dr. W. F. Brinkman, Director, Office of Science, charged the Biological and Environmental Research Advisory Committee (BERAC) with assembling a Committee of Visitors (COV) to assess the processes used to create and manage the research portfolio in the Biological Systems Sciences Division (BSSD) of the Office of Biological and Environmental Research (BER). The BSSD current portfolio of scientific awards includes the following Programs, Projects, Centers and Institutes: (1) Genomics:GTL Program (GTL), (2) Structural Biology Facility Program (SB), (3) Low-Dose Radiation Research Program (LDR), (4) Radiochemistry and Instrumentation Program (RI), (5) Ethical, Legal, and Social Issues Program (ELSI), (6) Bioenergy Research Centers (BRC), (7) Joint Genome Institute (JGI), (8) Artificial Retina Project (AR), and (9) Computational Biology. In addition, BSSD runs a variety of workshops that engage the research community in defining the most pressing questions and approaches needed to tackle the key questions within BSSD's research portfolio.

In response to this charge, a COV was established consisting of 17 scientists from around the country, with representation from academia (9), the National Laboratories (4), and other federal agencies (4). Nine of the COV members currently receive DOE funding. Three of the COV members served on the prior BSSD COV that met in June of 2008. The COV met on 13 – 15 June 2011, at the DOE headquarters in Germantown, Maryland. Assistance and support were provided, as needed, by the BSSD staff. To maximize the effectiveness of the analysis, 3 subcommittees of the COV were formed – each assigned to review carefully and deeply a different Program or Project of the overall BSSD research portfolio. The entire COV evaluated and analyzed the portfolio, as a whole, and provided comments and recommendations.

The charge letter asked the COV to assess the efficacy and quality of the processes used by BSSD programs to fund DOE National Laboratory projects and university grants during the past three years. The COV was specifically asked to examine the processes BSSD used to solicit, review, recommend and document application and proposal actions, and how BSSD monitors active awards, projects and programs. Moreover, the COV was asked to comment, within the boundaries defined by DOE mission and available funding, on how the award process has affected the breadth and depth of the portfolio elements and the national and international standing of the portfolio elements. For the DOE Bioenergy Research Centers (BRC), the COV was asked to assess the Division's management and oversight of the science and operations, including progress towards key scientific milestones and deliverables. For the Joint Genome Institute (JGI) user facility the COV assessed the Division's management and oversight of this facility, including facility operations tracking and review, user proposal solicitation, review and recommendation procedures. Finally, during the three years under review, BSSD instituted a new management system for

research projects at the National Laboratories known as the Scientific Focus Area (SFA) concept. The COV reviewed this process and explored its impact on BSSD programs.

General Comments and Recommendations

For the review of the preproposals and proposals received in response to Funding Opportunity Announcements (FOAs), the COV is impressed with the overall quality and management of the review process. The program managers (PMs) should be commended for their role in implementing what we perceive to be a very fair and equitable review process that uses the highest standards of the competitive funding community to maintain a vigorous research portfolio. The funded programs appear to have a good balance of risky, solid and innovative science.

FOAs and proposal processing procedures:

- The COV strongly endorsed the preproposal concept. Reducing the number of full proposals reviewed is a good way of reducing burden on the reviewer community. **The COV recommends** that the criteria for judging preproposals be spelled out in writing for the COV and for the research community (programmatic fit, duplication of effort, balance etc.).
- In terms of preparing materials for the COV, documentation for some of the FOAs was very thorough, whereas others were not. **The COV recommends** that a standard spreadsheet containing essential information on every project be developed for all the programs. This overview information will be useful for both PMs and future COV reviewers.
- Some proposals are funded based on reviews conducted by other agencies. It was difficult for the COV to determine the nature of the interactions between DOE and other agencies in multi-agency reviews, or what criteria are used for making decisions. **The COV recommends** the preparation of a standard operating procedure for making these decisions that will guide PMs and inform future COV reviewers.
- The COV was impressed with the high quality and effectiveness of the review procedures and management within the Feedstocks program. This program could serve as a model for others that are not as well organized.
- It was not clear that reviewers were always prompted to address program relevance in their comments. **The COV recommends** that review guidelines ask reviewers to include comments about the relevance of the proposal to priorities and criteria articulated in the FOAs.

Computational Biology

- Because many new computational projects are underway with KBase support, it is very important to establish clear communication with the user community to ensure the widest possible engagement and use of these resources. Therefore, **the COV recommends** that the PMs continue to

provide public updates on progress and available resources in a general format to the scientific community.

- **The COV recommends** that the KBase program continue to emphasize common interfaces among the partners and good communication between all the projects and institutions, including JGI.
- **The COV recommends** that the roles and research contributions of KBase and the JGI be clearly defined and maintained so they are easily recognized as separate entities with different goals, and that very clear communication between them be maintained to emphasize synergisms and avoid unnecessary duplication of efforts.

Bioenergy Research Centers (BRCs)

- The COV is impressed by the extensive and well-documented process that is in place for evaluating the BRCs and for subsequently providing feedback and guidance. This ranges from frequent phone conversations between the BRC directors or senior personnel and BSSD staff, to annual reports and site visits. The documentation of the evaluation is thorough, well structured and clearly presented by the BSSD staff.
- **The COV recommends** that priority be given to increasing openness and public engagement of the BRCs to avoid confusion and redundancy in the larger bioenergy research community, as well as between BRCs. One valuable forum is the public websites, which currently provide minimal detail regarding the research activities and are mostly geared towards a non-scientific audience. To this end, the carefully prepared annual reports should be accessible on the websites and available for download. Selective editing would help avoid release of sensitive data, but this comprises only a small portion of the entire reports.
- **The COV recommends** that BRCs report interactions with the JGI, including: a summary of the samples that were processed; a projection for samples to be analyzed in the upcoming year; a qualitative and quantitative summary of any sequence data that have been generated; and a statement of the proportion that is in the public domain. Such information should be made available through the respective BRC websites.
- As the BRCs look toward project renewals in 2012, it is essential that they continue to address the mandate of original FOA: to pursue ‘high-risk high-return’ approaches, reflecting the value of developing large centers, rather than multiple small research groups. Accordingly, **the COV recommends** that each center be encouraged to prioritize new innovative science and to be prepared to terminate less productive activities. This could result in some turnover of participants and collaborators and the involvement of new groups.
- Given the significance of this juncture for the BRCs, **the COV recommends** that BSSD consider holding a workshop with all the BRCs and select members of the larger research community to discuss new directions in the bioenergy arena and opportunities for inter-agency interactions, particularly with the USDA.

Structural Biology Facility Program

- **The COV recommends** establishing a standing panel of experts to help the PMs to evaluate new opportunities and set future priorities in this program. This is especially important because of upcoming opportunities for new science based on a variety of new light sources in the works. BSSD has anticipated these new opportunities and is in the process of preparing a report from a recent workshop, “Applications of new DOE User Facilities in Biology”.

Radiochemistry and Instrumentation (RI) Program

- The RI program was redirected during this review period from biomedical focused research, to research that supports the bioenergy and bioremediation mission of BSSD. The COV commends the PM for a well-conceived process to implement the redirection for the RI program.
- It is widely recognized that there is exceptional synergy between radiotracer and imagining instrumentation development and research in both the medical and plant & microbial molecular imaging fields. **The COV recommends** that nuclear medicine related investigators continue to be invited participants at program workshops to encourage interactions across fields of inquiry.

Joint Genome Institute

- The COV felt that there is an urgent need for JGI to be proactive in adapting to a rapidly evolving technological and scientific landscape if it is to maintain a leadership role as a premier genomics facility and a unique user resource.
- **The COV recommends** that the JGI and the BSSD would benefit through the establishment of a standing external advisory panel to provide continuous technical evaluation of the strategic plan and advise the BSSD program staff in future planning and prioritization. A workshop addressing Future Directions in the Genomic Sciences would help illuminate the future JGI should aim for, and such a gathering would be a good place to identify members for this committee.
- JGI should consider expanding BSSD's partnership in feedstock genomics with the five new USDA-ARS Biomass Research Centers (ARS BRCs). The ARS BRCs are using “genotyping-by-sequencing” to genetically identify genes that control feedstock yield, composition and biomass conversion efficiency to biofuels.

Scientific Focus Areas (SFAs)

- Funding of research at the National Laboratories over the review period has changed from funding individual, single investigator projects to integrated research programs focused on collaborative research among several investigators and larger, interdisciplinary teams. The COV reviewed this change because it also represents a change in BSSD program development and management. As such, much of our review asks a series of questions for the PMs to consider as they implement and manage this new approach.

- What is the role of the PMs in overseeing all aspects of the SFAs since they are managed by the National Laboratories? Are there different criteria in terms of expectations, reporting and review for large versus small SFA projects? What is the PM's role in requesting reports and providing feedback? From the documentation provided, there seemed too little standardization across the multiple program directors who are managing the SFA programs. Thus, **the COV recommends** a standardized operating procedure be developed for all PMs that manage SFAs.
- How will the success of the SFA versus funding individual investigators (previous funding system) be assessed? What metrics for success have been considered? One obvious measure of success would be an increase in the number of interdisciplinary and collaborative efforts as evidenced by publications, grant applications and novel approaches. **The COV recommends** that the program managers develop a plan with well-defined criteria for assessing the impact of the SFA program.

A final concern

- The COV notes that program managers have huge workloads, with very little administrative support staff. Budgets for staffing and travel have been reduced in recent years. The COV is very concerned that continued reduction in support will have a significant negative impact on the PMs ability to stay in touch with the research community and support, monitor and manage successful research programs that address the research agenda of this Division.

BIOLOGICAL SYSTEMS SCIENCES DIVISION
OVERVIEW AND RECOMMENDATIONS

On 30 August 2010, Dr. W. F. Brinkman, Director, Office of Science, charged the Biological and Environmental Research Advisory Committee (BERAC) with assembling a Committee of Visitors (COV) to assess the processes used to create and manage the research portfolio in the Biological Systems Sciences Division (BSSD) of the Office of Biological and Environmental Research (BER). The BSSD current portfolio of scientific awards includes the following Programs, Projects, Centers and Institutes: (1) Genomics:GTL Program (GTL), (2) Structural Biology Facility Program (SB), (3) Low-Dose Radiation Research Program (LDR), (4) Radiochemistry and Instrumentation Program (RI), (5) Ethical, Legal, and Social Issues Program (ELSI), (6) Bioenergy Research Centers (BRC), (7) Joint Genome Institute (JGI), (8) Artificial Retina Project (AR), and (9) Computational Biology. In addition, BSSD runs a variety of workshops that engage the research community in defining the most pressing questions and approaches needed to tackle the key questions within BSSD's research portfolio.

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and review, user proposal solicitation, review and recommendation procedures. Finally, during the three years under review, BSSD instituted a new management system for research projects at the National Laboratories known as the Scientific Focus Area (SFA) concept. The COV reviewed this process and explored its impact on BSSD programs.

BSSD is administered by the acting Division Director, Todd Anderson, 13 program managers (PMs), and three support staff. Given the diverse portfolio of research areas supported by this Division, this is a remarkably lean operation. A major concern from the previous COV is the ability of PMs to adequately engage the scientific community. Attending meetings and discussions with investigators in the field are essential for science managers to stay ahead of the "state of the art" in any given arena. This remains a concern. In addition, several PMs have exclusive responsibility for essential programs. As these PMs move toward retirement, the lack of effective plans for successful transition to new leadership remains a concern. In spite of these challenges, it must be noted that the administration of BSSD programs remains a first class operation that keeps BSSD research portfolios at the cutting edge of a diverse array of research questions that are critically important to national needs.

1. Efficacy and Quality of the Review, Funding and Monitoring Processes

For the review of the preproposals and proposals received in response to FOAs, the COV is impressed with the overall quality and management of the review process. The PMs should be commended for their role in implementing what the COV perceives to be a very fair and equitable review process that uses the highest standards of the competitive funding community to maintain a vigorous research portfolio. The funded programs appear to have a good balance of risky, solid and innovative science.

The COV strongly endorses the preproposal concept. Reducing the number of full proposals reviewed is a good way of reducing burden on the research community, including both researchers and reviewers. The **COV recommends** that the criteria for judging preproposals be explained more clearly in the FOAs for the research community (programmatic fit, duplication of effort, balance etc.) and for future COV reviews.

The COV is impressed that the average turnaround time between submitting a proposal and hearing a funding decision is generally very short. This turnaround time compares favorably with other federal agencies.

The composition of panelists for the programs was judged to be appropriate and diverse, with good representation of experts in the respective fields. Panelists are recruited from a spectrum of institutions that reflect the institutions of the

funding portfolio. This includes research-intensive institutions, as well as institutions with historically less emphasis on research. In some cases where the FOA is new and has a very narrow focus, the COV observed that all the experts in the field might submit proposals for consideration. That leads to challenges finding appropriate expert panelists. The COV was pleased to see that BSSD program managers often turned to international panelists to address this problem. This is a good strategy endorsed by the COV.

Clear guidance is provided for reviewers to indicate conflicts of interest (COI) when they are specifying which proposals they would like to review from a list provided by the PM. Any other COI arising can be communicated at the start of the review panel. Reviewers in conflict leave the room when a COI proposal is discussed. The process seems to run very smoothly. The COV did not see instances where a COI raised concerns about the review process.

In terms of preparing materials for the COV, documentation for some of the FOAs was very thorough, whereas others were not equally well documented. The COV recommends that a standard spreadsheet containing essential information on every project be developed for all the programs. This would be useful for both PMs and future COV reviewers.

Some proposals are funded based on reviews conducted by other agencies. It was difficult for the COV to determine the nature of the interactions between DOE and other agencies in multi-agency reviews, or what criteria are used for making decisions. The COV recommends the preparation of a standard operating procedure for making these decisions that will guide PMs and inform future COV reviewers.

The quality of research is high and fits well within the scope of the solicitations. The amount awarded typically seems to be what the investigators requested. In some cases, award amounts are adjusted in concert with changes in the project scope as recommended by the reviewers. Duration for most of the awards the COV examined was 3 years.

High-risk projects were identified as such in the summary of awards funded by each solicitation. The number of these projects appears to be appropriate.

Proposals that represent new areas for the BSSD portfolio are identified in the award summary. Funding decisions seem to be made with an eye to creating a portfolio that emphasizes breadth and depth with minimal redundancy. Importantly, new investigators are included in the funded awards.

The COV notes PMs have huge workloads, with very little administrative support staff. Budgets for staffing and travel have shrunk every year. The COV is very concerned that continued decreases in support will have a significant negative impact on PMs ability to stay in touch with the research community and to

support, monitor and manage successful research programs that address the research agenda of this Division.

2. Breadth and Depth of Portfolio and Standing

BSSD maintains a high visibility and vigorous research portfolio in a wide range of research areas. BSSD programs are generally to the forefront of most areas because of the Division's proactive outreach to the research community. Program priorities within BSSD are adjusted annually to respond to emerging research, national priorities and technological needs. Workshops are used as an effective mechanism for identifying emerging research areas and directions for future research activities. Ideas for these workshops originate with the various programs, but the organization, activities, and resulting reports are driven by members of the research community. In some cases, multiple workshops on a single topic have been held. For example, in developing the plan for Knowledge Base (KBase), two workshops were held, one focusing on inception and the other on implementation. The outcome from this extensive effort is a massive document outlining a multi-year plan for DOE investment, which has led already to FOAs, awards, and plans for future calls for proposals. Many programs also use annual PI meetings, that frequently include outside experts, as a useful management tool to examine progress on various BSSD projects and, at the same time, get a snapshot of the hot topics and future direction in a given field. Additional evidence of the prioritization process in BSSD is evident in the review of preproposals. Only those preproposals that are viewed as responsive to the solicitation with potential to enhance the portfolio are invited for the submission of full proposals.

3. Program Overviews: Comments and Recommendations

Genomic Science Program

The Genomic Science Program consists of four areas with independent solicitations during the current review period: 1) Plant Feedstock Genomics for Bioenergy, 2) Biological Systems Research on the Role of Microbial Communities in Carbon Cycling, 3) Systems Biology, Model Organism Development, and Enzyme Discovery for Biological Hydrogen Production, and 4) Computational Biology and Bioinformatic Methods to Enable a Systems Biology Knowledge (KBase). Comments about the outcomes of these solicitations are given below.

- *Feedstocks*
  The Plant Feedstocks for Bioenergy Program, a joint program of BSSD and USDA, seeks to improve biomass and plant feedstocks for the production of bioenergy through the support of research based on genomics approaches. Fundamental research that seeks to improve biomass characteristics, yield,

or sustainability is the focus. The program encourages systems-based approaches to identify genetic markers that enable efficient breeding or manipulation, as well as work toward contributing basic knowledge of the structure, function, and organization of plant genomes to enhance characterization of plant feedstocks and their sustainability.

The COV reviewed the results of three FOAs: 08-03, 09-03, and 10-223. These FOAs continue the commitment of the program to provide a foundation for the development of lignocellulosic crops for bioenergy and biofuels. The specific priorities and exclusions of the FOAs were re-evaluated from year to year by program directors from DOE and USDA in response emerging research, input from the research community, and national needs. This mechanism was considered very effective by the COV. The COV is impressed with the high quality and effectiveness of the review procedure and its management.

The preproposal process is extremely efficient in providing investigators with a "yes" or "no" response within two weeks. The calls generated a little over 100 applications of which 18-26 were invited for full proposals. Preproposals were reviewed by a team of 4-6 PMs from the relevant (and sometimes related) programs. The major criterion used for judging the suitability is good fit with the elements of the specific FOA and the mission of the program in general. Full proposals were evaluated by panel reviewers, with the goal of obtaining a minimum of three reviews per proposal. On occasion, ad hoc reviews may be solicited to meet this minimum requirement. Reviewers addressed key questions through well-guided questionnaires. Reviewers score and group the proposals into categories, providing information used to guide but not dictate the PM's decisions. USDA uses the ratings and groupings as a stronger influence in decisions than does BSSD.

The two-stage use of preproposals and full applications is a good mechanism. Although reviewing the preproposals is a lot of work for the PMs, this screening step results in reduction of the number of full proposals that must be subject to panel review.

The individual panel reviews are thorough and substantive. They follow a set format, which serves to standardize the feedback on the various parts of the proposal. The number of reviewers is adequate. Reviewers are assigned up to 10 proposals which seems reasonable. Each proposal has a minimum of three reviews, most of which come from panelists. The reviewers are generally experts in the field. They are chosen based on the science and techniques included in the preproposals that were encouraged to submit full proposals. To match proposals to reviewers, reviewers are given the opportunity to select the proposals they wish to review. The program managers use this information to assign proposals to reviewers. It was not clear, though, that reviewers are prompted to address specific aspects of the

solicitation in their written reviews before the panel. Yet, these points are often addressed in the first (scientific merit) question on the review questionnaire. The COV recommends that review guidelines ask reviewers to include comments about the relevance of the proposal to priorities and criteria articulated in the FOAs.

In most cases, the documentation provided to the COV was thorough and complete. In some cases, where items appeared to be missing, the PMs were able to supply copies of the missing documents. Justification for decisions and awards was well explained. The justification for selecting a proposal for funding is well described with highlights of the proposal strengths and excerpts of the individual reviews and their scores included. The significance of work that addresses program priorities is emphasized. For highly rated proposals, concerns of the reviewers are noted by the panel manager and communicated to the investigators. Proposals with clear documentation of the responses to concerns of the reviewers were evident including submission of a revised narrative and new budget on occasion. In cases where high-rated proposals were declined, the rationale for the decision was explained well.

The program is extremely relevant to the BSSD mission (which in turn is relevant to national priorities). Materials presented, together with discussions with PMs, clarify that fit with program priorities is a major criterion by which awards are made.

Program management is a complex multi-faceted endeavor that includes:
Identification of research areas to support
Writing and issuing FOAs
Reviewing preproposals and full proposals
Making funding decisions
Managing existing awards
A key activity for awardees is the annual PI meeting in the DC area, which brings together the PIs and coPIs of existing awards. This meeting is structured much like a conference, with emphasis on participation by postdocs and students and sharing of results of DOE-sponsored research. Overall, the management of the program is both well developed and well documented.

- *Microbial Communities in the C-cycle*
  Similar to other programs, there is a pre-proposal screening to identify those proposals which fit the fundamental bounds of the program. There is no scientific quality assessment at this stage — just a test of fit of the research objectives to the program goals and for redundancy within current funding. The full-proposal review process was a panel in which three reviewers read each proposal. They discuss the proposals but are not expected to come to

any consensus about the overall quality of the proposal. The PM distills the discussion to produce the summary, which forms the basis for a decision. The summary statements that were examined did a good job of capturing the reviewer comments.

One issue for this new FOA was that it is a broad-based call and many of the experienced and qualified reviewers submitted pre-proposals and thus were excluded from serving on the review panel. Consequently, it was difficult for the PM to find experienced reviewers and a number of the panelists were relatively junior. This raises potential concerns about the overall qualifications of the panel. However, the quality of the reviews appears to be consistently high, so the problem, should it exist, was not apparent. The COV recommends the PMs continue to have a majority of panelists that have experience with the U.S. funding system.

Reviewers generally appeared to have been selected because they had expertise in genomics and microbial ecology, rather than specializing in C-cycling and biogeochemistry (i.e. process measurements and modeling). Thus, in cases, there is more focus on evaluating the genetic methods and information, rather than on whether it will be useful in improving our understanding of large-scale C-cycling.

Overall, the COV considered the review and funding process used for this program was high quality and achieved the goals of the program.

- *Systems Biology, Model Organism Development, and Enzyme Discovery for Biological Hydrogen Production*
  The COV reviewed one FOA centered on the molecular mechanisms underpinning microbial hydrogen production. This originated in support of the Hydrogen Fuel Initiative of 2003 to continue research on the diversity of natural systems related to microbial hydrogen production, and in so doing, realize the potential to advance biological hydrogen production.

  Summary jackets lacked an adequate description of each project and Co-Investigators were not listed. In addition, no description of the reviewers' qualifications was included as noted for several other programs. Reviews are consistent with FOA criteria, well documented, and fairly well justified overall. Time to decision was only two months for approval from receipt of proposals – very good!

  Awards did not always track entirely with reviewer ranking. For example a proposal that ranked low was eventually funded. This was explained in the jacket for the proposal. It was noted that the reviewers' were enthusiastic about this proposal while having specific concerns that brought the overall score well below the "fund line". The PM asked the PI to respond to the

panels concerns. The PI explained some reviewer misconceptions and removed a section based on the reviewers' comments. In another case a moderately ranked proposal was given one year funding to establish experimental evidence for a critical proof of concept. In addition to providing that essential data, the PI and Co-PI were switched, and the project was then fully funded. The COV believes this kind of direct intervention by the PMs is desirable, when well justified, to achieve the goals of the BSSD programs.

- *Computational Biology*
  The 2008 COV recommended that the nascent Computational Biology program be (a) considered for a significant increase in funding, and (b) decoupled from DOE's supercomputing program. Both of these recommendations were implemented in the past three years.

  The program, now called Knowledge Base (KBase), has emerged as a major effort in BSSD over the past three years with programmatic funding, ARRA (2009 Stimulus funds) support and leveraging with the JGI. A new PM, Susan Gregurick, was hired to establish and manage the new portfolio. To solicit ideas and buy-in from the computational and experimental scientific communities, the PM held five workshops and published two documents (an executive summary followed by a detailed implementation plan to provide guidance for research proposals). ARRA funds were used to solicit and implement pilot projects through the National Laboratories (5 proposals received in response to call and all 5 were funded). Three additional efforts were funded using ARRA money: (1) Each of the BRC's was funded to foster communication and collective data management among the three large centers, (2) The Camera project, the JGI, and MG-RAST (ANL) were each funded to begin to work collaboratively on establishing platforms for common genomic analysis platforms, (3) The JGI was funded to pilot cloud computing analysis on a very large (cow rumen) dataset. This collection of initial activities is entirely appropriate for development and implementation of a collective KBase resource. Although necessarily conducted on a short turn-around, the documentation of the process was reasonable and logical. These efforts should accomplish the essential step of getting people to work together across institutional boundaries.

  Programmatic funds were used to support a university call for proposals in 2009. One hundred thirty-four preproposals were received in four categories; sixty were encouraged for full proposals. Of the 57 proposals that were received, ten were funded with a nearly even distribution across the four solicitation topics. Fourteen proposals had similarly high scores while the rest were considerably lower so the delineation of a superior fundable set was clear. Reviewer comments on unfunded proposals noted issues that supported the decision not to fund those projects. The metrics used to evaluate proposals were clear, and the declination information to proposals appeared appropriate and sufficient (short summary plus all reviewer

comments). This last note addresses another 2008 COV recommendation to provide more thorough declination information to applicants.

Specific Comments and Recommendations
Because many new computational projects are underway it is very important to establish clear communication with the user community to ensure the widest possible engagement and use of these resources. Therefore, the COV recommends that the PM continue to provide public updates on progress and available resources in a general format to the scientific community, as this will be an important metric of program success in the next review cycle. This will require adequate funding for PM travel and workshops to promote interactions.

The KBase portfolio is now being established as a national laboratory SFA program plus a collection of separately funded, university led projects. It will be essential for these elements to coalesce into a single user resource, which poses challenges for 'fitting' all the parts together. All partners will need to be clear about the final expectations of the program. **The COV recommends** that the KBase program continue to emphasize common interfaces among the partners and good communication between all funded projects.

The KBase effort and the 'omics analysis/synthesis efforts at the JGI appear to overlap and KBase funding has been and will continue to provide funds to the JGI. This interaction is an important link of the sequence-generating user facility, with the downstream analysis tools for users. The delineation of scope and activities of the two programs is not completely clear and will likely adjust over time. **The COV recommends** that the roles and funded efforts of the two programs be clearly defined and maintained so they are easily recognized as separate entities with different, complementary goals, and that very clear communication between the two be maintained to avoid unnecessary redundant efforts.

Bioenergy Research Centers

The BRC program represents a unique initiative. The large scale and funding level is associated with distinct challenges in terms of oversight, governance and evaluation. The COV recognizes that the centers operate unlike other BER funded initiatives in a number of ways:

- There is an expectation of unusually rapid translation of basic research to an applied arena
- Three centers have been funded to work on similar problems and so there are inherent potential problems with overlap and duplication that need to be carefully addressed
- Close interactions between academic and industrial partners are essential
- The expectation of success is extremely high and yet the metrics of such success are not always easy to define or convey

The COV recognized numerous strengths of the program and also identified a number of areas for careful future consideration.

Comments and Recommendations
An extensive and well-documented process is in place for evaluating the BRCs and for subsequently providing feedback and guidance. This ranges from frequent phone conversations between the BRC directors or senior personnel and BSSD staff, to annual reports and site visits. The documentation of the evaluation is impressive, well-structured and clearly presented by the BSSD staff. For example, the evaluations by members of the Annual Review Committees are based around a framework of specific questions, the responses to which are then condensed into a panel summary. The quality of the reviews is extremely high. Some reviewers have been common to consecutive Annual Review Committees, which is a valuable means to maintain institutional memory. When taken together with the annual reports provided by each center, extensive documentation has been collated to allow rapid evaluation of the BRCs at various levels of resolution.

There appears to be excellent interaction between BSSD PMs and the internal management of each BRC center, resulting in a generally rapid response by each of the BRCs to outside feedback. This is a further indication of rigorous oversight by the BSSD. This is exemplified by the early appreciation that extensive laboratory information management system (LIMS) support is needed for each center and, following direction from the Annual Review Committee, the rapid adoption of such systems and sharing of such resources between centers. Such dynamic and close interactions are critically important.

The BSSD PMs provides exemplary feedback and assistance to the BRCs at all levels. The quality of support and oversight is outstanding. In addition, BSSD has an appropriately high level of oversight and management and is well placed to move forward with the first renewal phase.

The BRCs are large centers of excellence but, even collectively, they can only occupy a finite portion of the bioenergy research field. It is critical that there is a greater degree of transparency regarding the research portfolios and foci of each center, such that members of the larger research community outside the centers can target their own research activities, to avoid overlap and redundancy. The COV strongly recommends that priority be given to increasing openness and public engagement. One valuable forum is the public websites, which currently provide minimal detail regarding the research activities and are mostly geared towards a non-scientific audience. To this end, the carefully prepared and beautifully presented annual reports should be accessible on the websites and available for download. Selective editing would help avoid release of sensitive data, but this comprises only a small portion of the total report.

In a similar vein, the success of the program will depend to a great extent on interactions between the centers. There were clearly initial concerns regarding competition versus collaboration and, while some of these have partially dissipated, there are still communication barriers and areas where there needs to be better coordination. The COV recommends that closer ties and openness be fostered between the BRCs. This would be greatly helped by including members of each center on the advisory boards of the other two.

The impact of the centers will be heavily influenced by the ability and willingness to place data in the public domain beyond manuscript publications. For example, it is not clear whether the 6-month policy for DNA sequence information release is being followed. One of the Annual Review Committee members commented that the interaction between the BRCs and JGI, which dedicates 30% of its sequencing capacity to the BRCs, are not well coordinated and that neither organization is 'watching the clock' regarding sequence data release to public databases. The COV recommends that BSSD PMs work with the BRCs to develop a mechanism to ensure prompt public data release, enforcing the existing policy.

The COV recommends that the annual report should include a specific section describing the interaction with the JGI, including: a summary of the samples that were processed; a projection for samples to be analyzed in the upcoming year; a qualitative and quantitative summary of any sequence data that have been generated; and a statement of the proportion that is in the public domain. Such information should be made available through the respective BRC websites.

Annual Review Committee members have not been provided with a summary of previous annual reports, or areas of concern that have arisen during the previous funding periods, whether or not the issues were resolved. This means that any given committee cannot determine whether a particular problem has arisen recently, or is long term and entrenched. In this regard there needs to be a more robust and long term tracking system. The COV recommends that a summary of all the annual reviews, problems and outcomes be provided to each Annual Review Committee

While each BRC is evaluated in great detail, there is little evidence of comparative analysis of the BRCs by BSSD. The COV recommends that more focus be placed on increasing complementarity of the activities in the BRCs and documenting the success of the program as a whole, rather than just each center individually.

As the BRCs gear up to preparing project renewals in 2012, it is essential that they continue to address the mandate of original FOA: to pursue 'high-risk high-return' approaches, reflecting the value of developing large centers, rather than multiple small research groups. Accordingly, the COV recommends that each center be encouraged to prioritize new innovative science and to be prepared to

terminate less productive activities. This could result in some turnover of participants and collaborators and the involvement of new groups. Several mechanisms to identify new participants might be considered, such as setting aside a portion of the budget for a competitive grant program. Such an approach has been successfully administered by the NSF's iPlant Collaborative initiative. Forward looking workshops organized by individual BRCs that engage the larger community might be another way to identify innovative projects and new collaborators.

Given the significance of this juncture for the BRCs, the COV recommends that BSSD considers holding a workshop with all the BRCs and select members of the larger research community to discuss new directions in the bioenergy arena and opportunities for inter-agency interactions, particularly with the USDA.

Artificial Retina Project

The Artificial Retina Project is a mission-oriented project aimed at restoring visual input to the blind using a new generation of micro-devices and microelectronics. The ultimate objective is a wearable device and an intraocular prosthesis that (i) enables orientation and unaided mobility for the totally blind and (ii) restore reading and face recognition to the functionally/legally blind. The project was initiated as a pilot project in the Life Medical Sciences Division in 2000 and as a full funded project in 2005. The project was funded by the Life and Medical Sciences Division (LMSD) until 2008 and is scheduled to terminate in 2011 under a special funding mandate from the Congress. Originally the project involved five DOE National Laboratories (Argonne, Lawrence Livermore, Los Alamos, Oak Ridge and Sandia), four universities (University of Southern California, University of California at Santa Cruz, Caltech and North Carolina State University) as well as a private organization, Second Sight.

Through the duration of the project advances have been made in key physical sciences areas such as materials science and thermal modeling. Technological advances include electrode design, packaging and ultra-low power electronics and applications-specific integrated circuits. Through complementary funding from NIH significant advances have been made in neural modeling and retina physiology, psychophysics and the living tissue/materials interface.

The final design involved a 240-electrode implant using micro/nano scale packaging, ultra-low power microelectronics with high-density flexible electrode arrays and a real-time image processing algorithms. Over the duration of the project, three generation of implantable devices have been engineered, Argus I, II and the final Argus III. While Argus I was only employed in six implants, it demonstrated the feasibility of chronic retinal stimulation with NO device failures. Argus II was employed in clinical studies with 32 subjects in 12 medical centers in 5 countries and based on this studies Argus II was approved for commercial sale in Europe.

Through scientific breakthroughs and technological innovations coupled to a rigorous management and coordination schedule and external scientific program reviews, what seemed to be a “science-fiction” project in 2000, is today reality! The project has yielded over one hundred journal articles and 89 patents with 39 more pending and has received national and international visibility with over 600 TV, newspaper and magazine articles.

In summary the artificial retina project is an excellent example of a DOE funded high profile effort to a focus problem of significant importance to the quality of life of thousands of people.

Structural Biology Facility Program

The structural biology programs overseen by BSSD encompass a broad scientific and technical scope. The goal of the program is to develop advanced technologies to maximize effective use of DOE National User Facilities by the biological research community. This goal is accomplished in part by equipping and staffing these facilities.

BSSD management of these programs is complicated by joint funding arrangements with other agencies including NSF and NIH, and the fact that construction and some operational components are overseen primarily by BES. In spite of the management complexity, these facilities have enabled transformative science in many fields. User demand exceeds capacity in spite of an increase in the experimental facilities technological development to enhance throughput and improve efficiency. This progress is attributable in large part to BSSD management working with PIs and other agency co-funders to enable user access at synchrotron and neutron sources.

The Structural Biology and related facilities programs supported by BSSD include programs at 1) Argonne National Laboratory supporting structural biology, 2) Brookhaven National Laboratory supporting structural biology on several beam lines, 3) Cornell University supporting x-ray sensitive detectors for biological and organic materials, 4) Berkeley National Laboratory supporting x-ray spectroscopy of biological and environmentally important materials, a facility for x-ray microscopy and for x-ray diffraction of protein crystals and scattering from macromolecules in solution, 5) Oak Ridge National Laboratory supporting structural molecular biology and the neutron crystallography station at the Spallation Neutron Source and 6) at Stanford Linear Accelerator Center supporting structural biology. In addition, SBBD co-funds the Protein Data bank at Rutgers University. The support that BSSD provides enables access to National User Facilities by a broad community of biologists, chemists and environmental scientists.

Comments and Recommendations

The community does benefit from the enhanced access to user facilities as a result of the co-funding of many of these facilities by NIH. This is effective since the needs of the research communities overlap strongly. The COV believes the co-funding of these facilities with NIH and other agencies is advantageous to the research community and should be continued.

The COV feels it would be beneficial to establish a standing panel of experts to help the PMs to evaluate new opportunities and set future priorities. This is especially important because of upcoming opportunities for new science on the horizon, including chemistry and biology experiments at the femtosecond time scale using the Linear Coherent Light Source and LCLS-II, the 3rd generation storage synchrotron source at NSLS-II which will provide x-rays of exceptional brilliance and high coherence in the soft to hard x-ray regime. The proposed soft x-ray laser source at LNL - the Next Generation Light Source (NGLS), and the APS upgrade at ANL are other examples. BSSD has anticipated these challenges and is in the process of preparing a report from a recent workshop "Applications of new DOE User Facilities in Biology". The COV recommends establishing a panel of experts to advise the BSSD program staff in future planning and prioritization.

There is a need for BSSD to develop a succession plan to enable the projects to continue to operate as smoothly as possible when Roland Hirsch retires. Planning is crucial at this point because of the many exciting scientific opportunities that will be presented by the advances described above so that BSSD is able to exert optimal allocation of resources to take advantage of new opportunities.

Review of programs
The reviews of several structural biology programs were coordinated by NIH/NCRR or other sponsors. For these programs, BSSD participated in the review and received all appropriate review documentation. In several other programs BSSD managed the review.

Overall, the COV concludes the management of the review process by BSSD used mechanisms appropriate for the scientific and technical scope of the programs. The expertise of the review panel was appropriate for the programs and no diversity issues were noted. In programs with joint funding, the reviews are organized by one of the major sponsors but all funding agencies participate in the review. The PM should be commended for the coordination and management of a complicated multi-sponsor program. The actions have facilitated the access of the scientific user community to these structural biology resources and provided a foundation for scientific achievement.

Low Dose Radiation Research Program
The DOE Low Dose Ionizing Radiation (IR) Program is a unique program in the Federal Government that supports research vital the DOE mission. The general

public is very concerned about the risks associated with the generation of power by nuclear reactors, especially since the recent nuclear reactor accidents in Fukushima, Japan, and also the earlier accidents at Three Mile Island and Chernobyl. Whereas most of our information on radiation risk comes from studies of cancer incidence following relatively high doses to the survivors of the A-bombs in Japan in 1945, as well as other populations exposed to radiation, little is known about the risks at low doses of <0.1 Gy (10 cGy or 10 mSv). Epidemiological studies require increasing numbers of subjects for statistical validity with decreasing radiation doses, but these studies can only be carried out retrospectively in exposed populations, which don't exist in large numbers. Yet, this information is vital to guiding remediation efforts, setting remediation standards, and determining costs, following radiation accidents or following a terrorist incident involving radioactive materials, as well as radiation exposure during space flights.

Specific Comments and Recommendations:
Working with the scientific community the program recognized the new opportunities in the field, particularly the need to encourage research to move away from traditional cell culture-based models to models with characteristics more like those in humans. The COV is pleased that a part-time PM is now assisting the PM in running this program. Co-funding of projects of common interest with NASA has enabled this program to leverage the limited BSSD funds.

The PM has thoroughly documented all procedures involved in announcing funding opportunities (FOAs), reviewing pre-applications and applications, assembling peer review panels, and selecting awards based primarily on peer-reviewed merit, but also on programmatic relevance and avoidance of overlap and duplicative funding. Awards were based not only on reviewer's priority scores, but also on programmatic goals. The decisions made were fair and logical, and achieved a better balance in the portfolio than would have occurred if the PM had used only priority scores. The breadth and expertise of the reviewers has been increasing over the years, and is now outstanding. They continue to be diverse with respect to gender, geographic distribution, field of expertise, and included members from both universities and National Laboratories. Progress of awarded R01-like and Integrated Program Project grants was monitored in an orderly manner.

Reasons for not selecting a proposal for funding despite a meritorious priority score were well documented and logical. These reasons included: principal investigators participating on another project that was to receive DOE funding, overlap with another project funded by the DOE or another agency, project not within the scope of the FOA, and programmatic balance (where only one proposal received funding, among several on the same topic). In some cases, meritorious projects from unfunded proposals were substituted for projects in successful proposals.

The COV felt that the smaller Basic Biology and Modeling (R01-like) grants represent a better value, as measured by productivity, than large Program Projects. The COV recommends that the Basic Biology and Modeling grants be extended from 3 to 5 years.

The requirement that investigators attend an annual investigators' meeting provides opportunities for researchers to present their research and exchange ideas, as well as to discuss possibilities for collaboration. These also represent an effective mechanism for the PM to keep abreast of innovative ideas and research opportunities within the field. The meetings include representatives of stakeholder community groups, which aids in communication between the government and the general public.

The Program supports an appropriate balance of investigators from National Laboratories and universities, new and experienced investigators located throughout the United States. Various disciplines are represented, as well as multidisciplinary teams.

Radiochemistry and Instrumentation Program

A previous COV documented the major advances in development of radiotracers and nuclear medicine instrumentation over many decades due to the Radiochemistry and Instrumentation Program (RI). However, a recent decision was made to refocus the RI program on plant and microbial imaging in service to the bioenergy and bioremediation programs of BER as part of an overall refocusing of DOE efforts. The COV recognizes that the RI program has supported fundamental research into radiopharmaceuticals, detector materials and novel imaging detector configurations that might not be covered in programs at other agencies that have also refocused their missions (e.g., the translational emphasis at NIH).

The change of direction in the RI program from nuclear medicine research to the exclusive service of biofuels research goals has caused considerable consternation in some sectors of the academic research community. This is because little rationale has been provided by BER to the research community for the policy change. After all, other programs with medical utility (e.g. The Artificial Retina and the genome program) remain an important part of BSSD's repertoire. Historically, nuclear medicine developed out of research funded by the RI program at DOE and its predecessor agencies. Surely, this is one of DOE's greatest success stories. The great productivity and social utility of the RI program continues down to the present time with recent advances in PET radiotracers and the development of a whole new regime of scintillation detectors with novel useful properties. Given the significant prospects for synergy between nuclear medicine research and the new RI direction of plant-radiotracer development and plant-radiotracer imaging technology, it would be valuable if

BSSD could find ways to support both communities and promote their active collaboration.

The COV commends the PM for a well-thought-out implementation of the change in direction for the RI program. First, a workshop was held in November 2008, that brought together radiopharmaceutical chemists, nuclear instrumentation developers and researchers in plant and microbial science to answer the question of whether radiotracer imaging can be effectively used to improve understanding of plant and microbial physiological processes. This question was answered, resoundingly, in the affirmative. Subsequently, the programs at national laboratories that previously supported nuclear medicine were redirected toward the new mission. This change is now well underway and has, in general, been quite successful. A similar change of direction was phased in over the three years since the last COV meeting for investigator-initiated research at universities. The change here has been slower, as might be expected, but the availability of funding opportunities in the new area will probably eventually attract a significant portion of the radiochemistry and instrumentation researchers.

Specific Comments and Recommendations
The COV considers the overall quality of the RI-supported research programs at both universities and National Laboratories to be outstanding. The RI program portfolio has an appropriate balance of innovative proposals from different research areas and the relative proportion of funding at universities and National Laboratories, about 50% each, is reasonable.

The RI application-review procedures were appropriate and, in particular, were well matched to the priorities and criteria cited in the program solicitations. The quality of the scientific review panels was superb, and they each had an appropriate mix of expertise. The proposals that were funded closely followed the relative ranking of scores by peer review, and the reasons for occasional deviations were well documented. The most significant criteria for funding appeared to be innovation and the potential for advancing the technology in the targeted field.

The COV commends the PM for his leadership and thoughtful management of the RI program and, in particular, its transition to a new direction. The PM has considerable personal experience in the field of radiochemistry and he has acquired an excellent working knowledge of the complex field of radiotracer imaging instrumentation.

The RI program has had four solicitations during the period since the last COV report (08-11, 09-08, 09-18&19 and 10-265). Preproposals were not required for the 08-11 FOA, but a total of 119 preproposal applications were received for the other FOAs. A total of 143 investigator-initiated proposals were reviewed. These resulted in 47 funded grants. In all cases, the number of reviewers was deemed

sufficient to get a good cross-section of opinion and expertise for review and the ranking of funded proposals closely followed the priority scores from the peer review process.

Despite the change in program direction that occurred during this period, peer review and grant administration maintained the same high standards that have traditionally characterized the RI program.

During the period since the last COV report, the BSSD's approach to funding research at the National Laboratories adopted a new Science Focus Area (SFA) approach that grouped different research programs at a given laboratory into a single program similar to an integrated program project. This change had little impact on the RI program because the new approach is similar to the Field Work Proposal (FWP) used previously by the RI program.

The current RI program has satisfactorily addressed an issue raised by a previous COV concerning long-term funding of specific programs, the FOA and review process has now resulted in a broader spectrum of PI's and institutions. It is commendable that awardees now include a greater number of young PI's.

It is widely recognized that there is exceptional synergy between radiotracer and imaging instrumentation development and research in both the medical and plant/microbial molecular imaging fields.

4. Ethical, Legal, and Social Issues Program

The original focus of the Ethical, Legal, and Social Issues (ELSI) program, which started with the Human Genome Project, was on education, research on the implication of patenting genes for commercialization of genomic knowledge, on complex traits, and human subject protection issues. Throughout 2007 to 2010, ELSI-funded projects have concentrated on issues brought about by bioenergy and synthetic biology technologies, with an emphasis on understanding the risks to society; for example, on the risks of introducing engineered organisms into the environment. In 2007, an interagency FOA (BER/EPA/NSF) was released that called for studies on the impact and risk of nanoparticles, and especially how these nanomaterials affect the fate and transport of radionuclides and heavy metals. Six National Laboratories and one university were funded. Also, in 2010 ELSI funded an ORNL SFA project centered on the societal issues surrounding bioenergy- and nanoscience- related technologies. From 2010 on, the ELSI program will be eliminated, and the risk-associated studies will be folded in to the GenSci and BRC projects, where risk and societal factors become part of these larger projects.

Summary jackets included pertinent information on all 19 proposals received, the 6 that were funded, and their review scores. Nanomaterials projects did not appear to be "risk-based" research (i.e., adhering to the ELSI FOA instructions) as much as fundamental studies on fate/transport. The COV found after the

discussions with PMs that this project was a one-time obligation imposed by the OMB. Reviews of ELSI proposals were consistent with the stated criteria, well documented and justified.

5. Joint Genome Institute

The Joint Genome Institute (JGI) mission is to serve the diverse scientific community as a user facility, enabling the application of large-scale genomics and transcriptomics analyses of plants, microbes and communities of microbes in the context of DOE mission in the areas of bioenergy and the environment.

The JGI DNA sequencing facility is one of the 'crown jewels' of the DOE's modern genomic core facilities and a clear success story for the DOE and the larger scientific community. JGI provides quality sequencing service for users, as well as value added services such as assembly, annotation, analysis, and tool development and in combination with the National Energy Research Super Computing Center (NERSC) at LBNL serves as a sequencing data repository. Since the last COV review, the JGI has expanded its network of collaborations with a diverse community of users and established a leading role in the genome sequencing of environmental organisms of interest. During this period, the facility has had an exponential increase in sequencing output on a yearly basis. Furthermore, the JGI has developed user tools and resources for access to and analysis of sequenced genomes and metagenomes. In addition, the JGI has expanded technical capabilities for challenging biological projects such as single cell sequencing, short read assembly, and analysis of complex communities.

The PM and the JGI should be commended for scientific and technological accomplishments since the last COV review. These achievements occurred in parallel with a transition to short read sequencing instrumentation and implementation of bioinformatic structures to meet increased sequence volume and more demanding user requirements. The rapid advances in sequencing hardware over the last few years as well as the development of sophisticated bio-informatics software, brings to the spotlight challenges and opportunities for the JGI. These considerations suggest that JGI needs to consider moving beyond sequencing services to fulfill its mission of enabling genome/transcriptome biology for the broader scientific community.

The COV believes that there is an urgent need for JGI to be proactive in adapting to this rapidly evolving technological and scientific landscape if it is to maintain a leadership role as a premier genomics facility and a unique user resource.

Comments and Recommendations

The JGI should develop a comprehensive and dynamic strategic plan. The COV is aware that the JGI is drafting a strategic plan to address the technological and scientific challenges of using the DNA/RNA sequences it produces to solve the most relevant energy and environmental problems by applying genomics to

advance the DOE missions in bioenergy, carbon cycling and biogeochemistry, and to advance understanding of the biological functions of genomes. To facilitate the planning exercise, the COV recommends the JGI organize a "Future Directions in Genomic Sciences" workshop to evaluate the full spectrum of technology options and specifically how these capabilities would support the BER mission and ultimately the goals of the extended scientific community. A comprehensive evaluation of possible technological opportunities and their scientific impact would support the development of a more long-term strategic plan for the JGI.

The COV suggests that the JGI and the BSSD would benefit through the establishment of a standing advisory panel to provide continuous technical evaluation of the strategic plan and advise the BSSD program staff in future planning and prioritization. The "Future Directions in Genomic Sciences" workshop recommended above would be a good place to identify members for this committee.

JGI should consider expanding its partnership in feedstock genomics with the five new USDA-ARS Biomass Research Centers. The ARS BRCs are using “genotyping-by-sequencing” to genetically identify genes that control feedstock yield, composition and biomass conversion efficiency to biofuels. By linking JGI sequence production, assembly and analysis to the production of new layers of metadata by USDA and its public and commercial network of collaborators (a multistep feedstock supply chain R&D system) in an “Integrated Data Platform” enabling genotypic to phenotypic to systems level analyses, the intrinsic value of JGI sequence production will continuously be enhanced.

The COV felt there is a need to define the nature and scope of interactions between the newly establish KnowledgeBase (KBase) program and the JGI. KBase, funded by DOE separately from JGI is specifically involved in helping develop software for integrating the various OMICS platforms (e.g. RNA-seq, ChIP-Seq, proteomics, and metabolomics). JGI should provide a mechanism to insure that the format and organization of the sequence data, and associated metadata, is compatible for the needs of KBase and the scientific users.

JGI is currently implementing a commercially obtainable laboratory management information system (LIMS). The COV recommends that the JGI partner with one or all of the BRCs to provide a practical and mission relevant evaluation of DNA sequence project tracking, quality control, throughput and user satisfaction. Concentrating on the three centers, rather than on the 1000 or so outside PI’s seems to be a more manageable and traceable, and an intermediate step that could facilitate a rapid solution to the overall problem of reporting these metrics.

The rapid development of sequencing instrumentation and methods has led to a precipitous decrease in sequencing cost per base and a parallel increase in the amount of sequence data generated per run. Consideration must be given to prioritization of resources and emphasis for the sequencing service itself, versus sequencing and downstream services to users (e.g., annotation, analysis and tool development). This is a concern that many sequencing facilities are

struggling to maintain bioinformatics capabilities while transitioning through the increase in sequence data provided by the new machines (e.g., the JGI is going from 2 gigabases per week to 2000 gigabases per week). For the JGI, transitioning from 100 Sanger machines to 8 HiSeq machines resulted in a severe reduction in the need for instrument technicians. In other words, there were previously 50 FTEs running the Sanger instruments, but since these instruments are all discontinued, and only 8 FTE's are needed for the new HiSeqs, the resources that supported the other 42 FTEs have gone elsewhere in the budget. It is hoped that this salary support could be used to expand sequencing capacity and to hire sufficient informatics personnel with expertise in new genome sequence assembly strategies, sequence annotation (e.g. metabolic pathways, regulatory and interaction networks for crops and microbial communities) and meta data analysis, and purchase software, to fully support the terabases that are now streaming out. There are many other challenges facing JGI (from other centers, new technology, etc.) which emphasize the need for a "Future Direction in Genomic Sciences" workshop and a visionary advisory board to help the institute remain a premier genomics establishment.

Problems in timely delivery of quality service have occurred in the recent past and in response to previous COV recommendations the JGI instituted changes in the past two years to correct these problems ('JGI Operational Improvement Plan'). Critical to this were two events: (1) Hiring an individual to ensure that the quality and timeliness of service was met on a routine basis, and (2) procurement of a commercially obtainable LIMS. In addition to these changes, the COV recommends that the JGI should use the smaller number of heavy users within the 3 Biofuel Research Centers to optimize the new procedures in terms of project tracking, quality control, throughput and user satisfaction.

The previous COV review raised questions about the administrative oversight that DOE had for the JGI. This has been addressed in the past three years by weekly phone calls and other changes. In addition, the identification of metrics to judge how much impact that JGI sequencing has had is a very difficult affair. There were user satisfaction surveys performed to help at least in the management questions, but the more difficult question of how to judge impact, remains a problem. But this is an ongoing problem for all core facilities since research involves world changing creativity and innovation, and is not just an assembly line production.

Questions were raised as to whether JGI interacts well with the companies that are developing and selling the DNA sequencing instruments. Just as the beam line operators at DOE Labs work closely with the manufacturers of these high end machines, it may be useful for DOE upper management to engage the DNA sequencing companies in more detailed discussions on, e.g., the opportunity to lease large numbers of instruments with the understanding that the companies will make money from the reagents, not on the hardware upgrades that are inevitable given the current infrastructure.

A much larger number of centralized facilities, such as at the Broad Institute and Washington University, are being funded by NIH and these, as well as several other locations, have substantial investments in informatics, as well as the instruments. This is a critical area that needs attention. KBase, funded by BSSD separately from JGI is specifically involved in helping develop software for integration of the various OMICS platforms (e.g. RNA-Seq, ChIP-Seq, proteomics, and metabolomics). JGI and KBase should work together to provide a mechanism to insure that the format and organization of the sequence data is compatible for the needs of the scientific users.

Scientific Focus Areas

Overview

Funding of research at the National Laboratories has changed in the period reviewed by this COV. Rather than funding individual, single investigator projects, BER now funds integrated research projects focused on collaborative and multidisciplinary research. The rationale for adopting this new funding method is based on several factors. First, the National Laboratories are well positioned to conduct collaborative, coordinated and sustained research in specific focus areas. Second, such collaborative research should result in synergistic research activities and outcomes that are greater than the sum of the components. Third, the shift will enable the National Laboratories to plan future research directions in a coordinated, strategic manner that is responsive to changing research needs and national priorities.

Initial science plans for the BSSD were reviewed by a panel that met in July 2009. A total of 15 SFA projects were reviewed by a panel of ~30 experts (some by remote participants). It is important to note that the submission and review of science plans for SFAs is not competitive. Each science plan was evaluated independently from the others, both by members of the review panel and by PMs in making funding recommendations. Only one project was rejected. The others were accepted, accepted with revisions, or advised to revise and resubmit for review in a future year. Five projects, for which revisions were requested, were resubmitted and reviewed in 2010. At least one of these secondary reviews (Doktycz, ORNL) was done on site, with a review team that included 6 external reviewers and several PMs. The outcome for this secondary review was to fund. At the time of the COV review, 19 SFAs are funded, with the bulk in the Genome Science Program (10) and for some, in the RI program for example, the switch represented a minor change in the previous management/ funding system.

Comments/Questions and Recommendations

Research focus and team building

SFAs take advantage of team-oriented research in a multidisciplinary environment for which the labs are particularly well suited. How SFAs are defined and research teams assembled was not clear to the COV. The COV

assumed this occurs via communication between PMs and PIs at the National Laboratories. It was also not clear how "teams" are built and how team members are selected. Do the larger-scope proposals allow for participation of more scientists / research staff with different expertise? Do the very focused proposals preclude participation by more individuals? Clarification of how the multidisciplinary nature of the SFA was evaluated in the review process would be appreciated.

Some of the research in the National Laboratories is overlapping in scope and focus. How much communication is there between National Labs in determining SFA directions and activities? How do the PMs deal with potential duplication of efforts among the SFAs?

The PIs of the SFAs reviewed by the COV appear to be established investigators. To what extent will the SFA mechanism encourage development of new leadership? Will SFA funding mechanisms favor or disfavor participation of young investigators? What happens to investigators whose expertise does not align with SFA objectives?

Review of SFA proposals
SFA proposals from different National Laboratories differ in formatting and structure. Did the FOA provide sufficient guidelines for proposal preparation?

Some SFA proposals are written in a very general way with little detail, making it difficult to fully evaluate individual science components. By contrast, others are very specific and focused. What criteria are used to judge these very different proposals relative to one another?

For some of the larger interdisciplinary projects, the COV questioned whether the review panels were diverse enough to adequately cover all the topics involved in the project. More information on the qualifications of the reviewers would have been helpful.

For some of the proposals, PIs were given multiple opportunities to address reviewer comments and tweak proposal details until program managers were satisfied with the end product. Was this process uniformly applied across all SFAs?

Management of SFA projects
The management plan outlines a requirement for annual reports, but it is not clear from the documentation provided that this requirement is evenly applied to all SFAs.

What is the role of the PMs in overseeing SFA progress? Are there different criteria for large vs. small projects? In one case examined, the PI is providing reports on a monthly and quarterly basis. How was this frequency of reporting

established? What is the PM's role in providing feedback? Whereas the COV acknowledges that large-dollar projects deserve more oversight than less-expensive projects, this level of oversight runs the risk of being perceived as micro-managing. In spite of a well articulated document outlining the review and evaluation process for SFAs, there seemed to be little standardization implementing those reviews across the multiple PMs who are managing the SFA programs. Thus, **the COV recommends** that a standardized operating procedure for reviewing SFAs be developed for more even-handed management of this new system. Finally, transparency of research efforts through open communication between different SFAs is pivotal to avoid competition and duplication, and to maximize the overall impact of the SFA program.

Assessing the impact / success of the SFA program
How will the success of the SFA versus funding individual investigators (previous funding system) be assessed? What metrics for success have been considered? One obvious measure of success would be an increase in the number of interdisciplinary and collaborative efforts as evidenced by publications or grant applications. **The COV encourages** BSSD to develop a plan with well-defined criteria for assessing the impact of the SFA program so that benefits (and costs) compared to the previous funding system can be documented.

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Office of the Director

August 30,2010

Dr. Gary Stacey
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Dear Dr. Stacey:

By this letter I am charging the Biological and Environmental Research Advisory Committee (BERAC) to assemble a Committee of Visitors (COV) to assess the processes used by the Biological Systems Sciences Division (BSSD) within BER to manage BSSD research programs and its user facility, the Joint Genome Institute (JGI).

The COV should provide an assessment of the processes used to solicit, review, recommend and monitor proposals for research submitted to BSSD programs for FY2008 – FY2010. This includes funding at national laboratories and universities and other activities handled by the program during this time period. It should also assess the quality of the resulting scientific portfolio, including its breadth and depth and its national and international standing. Additionally, the COV should also assess the division's management and oversight of the JGI user facility for the same time period. Specifically, I would like the panel to consider and provide an evaluation of the following:

1. For both the DOE national laboratory projects and university grants, assess the efficacy and quality of the processes used by BSSD programs during the past three years to:
   a) solicit, review, recommend and document application and proposal actions, and
   b) monitor active awards, projects and programs.
2. Within the boundaries defmed by DOE mission and available funding, comment on how the award process has affected: a) the breadth and depth of the portfolio elements and,
   b) the national and international standing of the portfolio elements.
3. For the DOE Bioenergy Research Centers, assess the division's management and oversight of the science and operations, including progress towards key scientific milestones and deliverables.
4. For the JGI user facility, assess the division's management and oversight of this facility, including facility operations tracking and review, user proposal solicitation, review and recommendation procedures.

For BSSD research programs, topics to be investigated can include but are not limited to: the selection of an adequate number of qualified reviewers who are free from bias and/or conflicts of interest; use of the Office of Science merit review criteria; adequacy of documentation; characteristics of the award portfolio; usefulness of progress reports on previously funded research; quality of the overall technical management of the program; relationships between award decisions, program goals and the DOE mission; significant impacts and advances that have

developed since the previous COV review and are demonstrably linked to DOE investments; and the response of the program to recommendations of the previous COV review.

COY members will be given access to all program documentation completed during the period under review including applications, proposals, review documents and other requests. COV members may also request, at their discretion, a representative sample of the program portfolio be provided. In response, BSSD may suggest a sample of actions, including new, renewal and supplemental applications and proposals, awards and declinations. In addition, COV members may also choose to review files through a random selection process.

A primary requirement is that the COY have significant expertise across all covered areas within BSSD programs and that tllis expertise not rely upon one person alone. A second requirement is that a significant fraction of the committee receives no direct research support from DOE. A guideline is that approximately 25 percent of the members receive no direct support from DOE. Any person with an action pending (e.g., application or proposals under review, progress report pending approval) in a BSSD program under review cannot participate as a COV member for that program. Some, but not all members of a COV, may be selected from a previous COV. A least one COY member must be a member of BERAC. The committee should be balanced and drawn from a broad field of qualified reviewers from academia, DOE national laboratories, other federal agencies, private sector entities, and other appropriate institutions. The BERAC chair should also consider a number of other balance factors including, institution, geographic region, diversity, etc. In the end, the COV should constitute an exceptional group of internationally recognized researchers with broad research expertise in the program areas within the BSSD as well as deep familiarity with DOE programs. Additional guidance on COY reviews within the Office of Science can be found at http://www.science.doe.gov/SC-2/Committe_of_Visitor.htm and attachments therein.

The COY should take place in the third quarter of FY 2011 (Summer 2011) at the BER/DOE location in Germantown, Maryland. A discussion of the COV report by BERAC should be held no later than the Fall 2011 BERAC meeting. Following acceptance of the full BERAC membership, the COV report with findings and recommendations is to be presented to me, as the Director, Office of Science.

If you have any questions regarding this charge, please contact Sharlene Weatherwax, 301-903-3213 or by email Sharlene.Weatherwax@science.doe.gov.

Sincerely,

W. F. Brinkman
Director, Office of Science

cc. David Thomassen
Anna Palmisano

Department of Energy
Office of Science
Office of Biological and Environmental Research
Biological Systems Science Division's Committee of Visitors
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Department of Energy
Office of Biological and Environmental Research
Biological Systems Science Division
2011 Committee of Visitors' Meeting Agenda
June 13-15

Monday, June 13

8:00-8:30 am	Breakfast (Darnestown Room at Hilton Gaithersburg Hotel)
8:30-8:40 am	Introduction (John Houghton)
8:40-8:50 am	Overview of BER (Sharlene Weatherwax, BER Associate Director)
8:50-9:20 am	Overview of BSSD (Todd Anderson, Acting Division Director)
9:20-9:45 am	Review of Charge Letter and Agenda (Dan Bush)
9:45-10:00 am	Review of Meeting Logistics (John Houghton)
10:00 am	Reviewers and Staff Depart for DOE in Germantown
10:15-10:45 am	Badging and Security
10:45-12:00 am	Day One Topics/Breakout Sessions/Briefings by Program Staff Group 1: G207 Group 2: E114 Group 3: G426
12:00-1:00 pm	Lunch (Provided for COV in E301)
1:00-3:00 pm	Day One Topics/Breakout sessions continue/BSSD staff as needed Group 1: G207 Group 2: E114 Group 3: G426
3:00-3:15 pm	Break (Refreshments Provided in Room E301)
3:15-5:00 pm	Day One Topics/Breakout sessions continue/BSSD staff as needed Group 1: G207

	Group 2: E114 Group 3: G426
5:00-5:30 pm	Meeting with BSSD Staff (Questions/Requests for Further Information) Room E301
5:30 pm	BSSD Staff transport Reviewers to the Hotel
5:30-7:30 pm	Dinner on your own
7:30-9:00 pm	Executive session: Reviewers at Hotel Darnestown Room

Tuesday, June 14

7:00-7:45 am	Breakfast on your own
7:45 am	Reviewers Leave with DOE Staff from Hotel Lobby
8:30-9:30 am	Day One Topics/Breakout Sessions continue/BSSD staff as needed Group 1: G207 Group 2: E114 Group 3: G426
9:30 am-12:00 pm	Day Two Topics/Breakout Sessions/Briefings by Program Staff/BSSD staff as needed Group 1: G207 Group 2: E114 Group 3: G426
12:00-1:00 pm	Lunch (Provided for COV in Room E-301)
1:00-3:00 pm	Day Two Topics/Breakout Sessions continue/BSSD staff as needed Group 1: G207 Group 2: E114 Group 3: G426
3:00-3:15 pm	Break (Refreshments Provided in Room E301)
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5:00-5:30 pm	Meeting with BSSD Staff (Questions/Requests for Further Information) Room E301

5:30 pm	Staff transport Reviewers to the Hotel
5:30-7:30 pm	Dinner on your own
7:30-9:00 pm	Executive session: Reviewers at Hotel (redundant with Wed am) Darnestown Room

Wednesday, June 15

7:00-7:45 am	Breakfast on your own
7:45 am	Reviewers Leave with DOE Staff from Hotel Lobby
8:30-10:00 am	Review/Executive Session Room E301
10:00 am-12:00 pm	Committee Report Preliminary Findings to BSSD Staff Room E301
12:00-1:00 pm	Lunch (Provided for COV in Room E-301)
1:00-3:00 pm	Writing Final Report/One-on-One Discussions with BSSD Staff as Needed Room E301
3:00 pm	Meeting Adjourn

Biological Systems Science Division (BSSD), SC-23.2

Name	BSSD Lead	Phone Number	Room Number
Robert T. Anderson	Acting Division Director	301-903-9817	J-111
Terry Jones	Secretary – Calendar items, travel, meeting coordination; office manager & principal administrative support	301-903-3213	J-115
Joanne Corcoran	Program Specialist –program budget, BERAC, grants and procurement, financial plan, ORISE, BSSD Grant and Lab Project Files, RIMS, webmaster	301-903-6488	G-147
Shireen Yousef	Support for program reviews and evaluation processes, program analysis, outreach	301-903-6020	J-104
Dean Cole	Artificial Retina Radiochemistry and Instrumentation Genomic Sciences Program SBIR	301-903-3268	J-122
Dan Drell	Joint Genome Institute (JGI) Genomic Sciences Program Ethical, Legal, and Societal Issues (ELSI)	301-903-4742	G-149
Joe Graber	Genomic Sciences Program Bioenergy Research Centers	301-903-1239	G-142
Susan Gregurick	Genomic Sciences Program Computational Biology, Bioinformatics Bioenergy Research Centers SciDAC	301-903-7672	G-143
Cathy Ronning	Plant Feedstock Joint Genome Institute (JGI) Genomic Sciences Program Bioenergy Research Centers	301-903-9549	J-123
Roland Hirsch	Structural Biology Genomic Sciences Program	301-903-9009	J-125
John Houghton	Bioenergy Research Centers Genomic Sciences Program Joint Genome Institute	301-903-8288	G-136
Arthur Katz	Genomics Sciences Program	301-903-4932	G-157
Noelle Metting	Low Dose Radiation Research	301-903-8309	G-150
Pablo Rabinowicz	Plant Genomics and Bioinformatics Genomic Sciences Program	301-903-0379	G-140
Prem Srivastava	Radiochemistry and Imaging Instrumentation	301-903-4071	J-121
Mike Teresinski	Lab Safety and Facilities	301-903-5155	J-124
Sharlene Weatherwax	Bioenergy Research Centers	301-903-6165	G-143
Elizabeth White	Human Subjects Protection Ethical, Legal, and Societal Issues (ELSI)	301-903-7693	J-113

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Firstname.Lastname@science.doe.gov
Mailing Address for Express Mail:
U.S. Department of Energy, SC-23.2
19901 Germantown Road
Germantown, Maryland 20874-1290

Mailing Address for all BSSD Staff:
U.S. Department of Energy, SC-23.2
Germantown Building
1000 Independence Avenue, SW
Washington, DC 20585-1290
BSSD Fax Number: 301-903-0567

Reviewer Assignments

Group	Program Areas	Funding Opportunity	Reviewers
1	Genome Science Program (includes ELSI, Computational Biology, Plant Feedstocks)	FOA: 10-223, 09-143, 09-25, 09-03, 08-12, 08-03, 07-27; GSP Biofuels SFAs, GSP Foundational SFAs	Cone, Green, Kuske, Loeffler, Rose, Schimel, Thelen
	Bioenergy Research Centers	Prior to this COV	
2	Low Dose	FOA: 08-20, 08-21	Barber, Boothman, Stone, Volckert
	Radiochemistry & Imaging Instrumentation	FOA: 10-265, 09-19, 09-18, 09-08, 08-11	
3	Joint Genome Institute	Prior to this COV	Andreou, Collart, Okamuro, Smith, Sussman
	Artificial Retina	Prior to this COV	
	Structural Biology	Prior to this COV	
Not reviewed by COV	Small Business Innovation Research, Human Subjects Protection, Congressional Direction		

* The Chair rotated bewteen the three groups to gain insight into the most critical ares/ topics dicsused by every group.

A. Questions about the quality and effectiveness of the program's use of merit review procedures. Provide comments in the space below the question. Discuss areas of concern in the space provided.
QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCEDURES
YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE

1. Is the review mechanism appropriate? (Panels, ad hoc reviews, site visits)
Comments:

2. Is the review process efficient and effective?
Comments:

3. Are reviews consistent with priorities and criteria stated in the program's solicitations, announcements, and guidelines?
Comments:

4. Is the documentation for recommendations complete, and does the program officer provide sufficient information and justification for her/his recommendation?
Comments:

5. Is the time to decision appropriate:
Comments:

6. Discuss any issues identified by the COV concerning the quality and effectiveness of the programs use of merit review procedures:

B. Questions concerning the selection of reviewers. Provide comments in the space below the question. Discuss issues or concerns in the space provided.
QUALITY AND EFFECTIVENESS OF SELECTION OF REVIEWERS
DATA NOT AVAILABLE, or NOT APPLICABLE

1. Did the program make use of an adequate number of reviewers for a balanced review?
Comments:

2. Did the program make use of reviewers having appropriate expertise and/or qualifications?
Comments:

3. Did the program make appropriate use of reviewers to reflect balance?
Comments:

4. Did the program recognize and resolve conflicts of interest when appropriate?
Comments:

5. Discuss any concerns identified that are relevant to selection of reviewers.

C. Questions concerning the resulting portfolio of awards under review.
Provide comments in the space below the question. Discuss areas of concern in the space provided.
RESULTING PORTFOLIO OF AWARDS APPROPRIATE,
NOT APPROPRIATE, OR DATA NOT AVAILABLE

1. Overall quality of the research projects supported by the program.
Comments:

2. Are awards appropriate in size and duration for the scope of the projects?
Comments:

3. Does the program portfolio have an appropriate balance of high-risk proposals?
Comments:

4. Does the program portfolio have an appropriate balance of multidisciplinary proposals?
Comments:

5. Does the program portfolio have an appropriate balance of innovative proposals?
Comments:

6. Does the program portfolio have an appropriate balance of funding for awards to individuals and the national laboratories?
Comments:

7. Does the program portfolio have an appropriate balance of awards to new investigators?
Comments:

8. Does the program portfolio have an appropriate balance of geographical distribution of Principal Investigators?
Comments:

9. Does the program portfolio have an appropriate balance across disciplines and sub-disciplines of the activity and of emerging opportunities?
Comments:

10. Is the program relevant to national priorities, agency mission, relevant fields and other customer needs?

Comments:

11. Discuss any concerns identified that are relevant to the quality of the projects or the balance of the portfolio.

D. Management of the program under review. Please comment on:

1. Management of the program.

2. Responsiveness of the program to emerging research.

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

4. Concerns identified that are relevant to the management of the program.