REPORT TO THE
BIOLOGICAL AND ENVIRONMENTAL ADVISORY COMMITTEE (BERAC)

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

2014

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

On October 23, 2013, Dr. Patricia Dehmer, Acting 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 COV reviewed five elements of the BSSD science portfolio that were active since the prior COV review:

1. Two Facilities (JGI and Structural Biology Facilities)
2. Four Laboratory Science Focus (SFA) Program Areas comprising 18 individual SFAs: 1) Ethical, Legal, and Societal Issues; 2) Genomic Science (Knowledgebase, Biofuels, Foundational); 3) Low-Dose Radiation, and 4) Radiochemistry.
3. Six University Funding Opportunity Announcements (Genomic Science Program, Plant Feedstocks, Radiochemistry and Instrumentation)
4. Three Bioenergy Research Centers (BRCs)
5 . The Artificial Retina Project (AR), completed in 2011.

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 16 scientists from around the country, with representation from academia (13), industry (1), and other federal agencies (2). Six of the COV members currently receive DOE funding. None of the COV members served on the prior BSSD COV that met in 13 – 15 June 2011. The COV met on 9-11 July 2014, 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.

The COV was impressed with the overall quality and management of the solicitation of proposals and the review process. Although the PMs are currently short-staffed, the COV commends their role in implementing what we perceive to be a fair and equitable review process that uses the highest standards of the competitive funding community to maintain a vigorous research portfolio. The funded programs have a good balance of risky, solid, and innovative science.

No serious concerns were raised by the COV concerning consistency with priorities and criteria stated in the program's solicitations, announcements, and guidelines. However, we have made a few suggestions in our review of different programmatic areas

regarding the importance of preparing very focused FOAs, in order to alleviate possible investigator confusion about FOA scope at the preproposal or full proposal stages of response. This would also assist the reviewers.

Merit reviews were uniformly conducted with an adequate number of highly qualified reviewers, without obvious conflicts and having appropriate expertise that together provided appropriate panel breadth. In most instances, the time between issuing the FOA, submission and decision of preproposals and proposals was satisfactory, providing investigators ample time for preparation. There was generally good documentation of the proposal review and evaluation process. However, the COV noted in a limited number of cases sparse documentation supporting the recommendation for funding or declination of submitted proposals. Note, the COV did not feel these awards were inappropriate, just that the documentation for the justification of the award was absent from the files.

II. Biological Systems Sciences Division Overview and General Recommendations

The COV reviewed five elements of the BSSD science portfolio that were active since the prior COV review:

1. Two Facilities (JGI and Structural Biology Facilities)
2. Four Laboratory Science Focus (SFA) Program Areas comprising 18 individual SFAs: 1) Ethical, Legal, and Societal issues; 2) Genomic Science (KBase, Biofuels, Foundational); 3) Low-Dose Radiation, and 4) Radiochemistry.
3. Six University Funding Opportunity Announcements (Genomic Science Program, Plant Feedstocks, Radiochemistry and Instrumentation)
4. Three Bioenergy Research Centers (BRCs)
5 . The Artificial Retina Project (AR), completed in 2011.

The following comments and recommendations by the COV pertain generally to the BSSD and the COV review process. We reserve specific comments and recommendations to our review of individual programmatic elements.

Staff Transitions and Travel Restrictions. There are serious effects of anticipated retirements and recent departures of program staff on programs. Limited staff will increase the difficulties of running programs and, if not rectified, affect program quality. Greater flexibility and support for PM site visits and participation in contractor meetings is also essential for stimulating interactions among the variously funded research programs.

Recommendations: There is an urgent need to develop and implement a plan to hire additional staff. There is also a need to provide greater flexibility and budget support for PM and staff attendance at scientific meetings, site visits, and contractor reviews. This is essential to insure that Program Officers optimally manage their projects by keeping up to date on scientific advances and have the opportunity to interact more directly with investigators.

The COV review process. Significant time was lost during the COV review because of documentation that varied in organization and depth. The committee recognizes that current staff shortages and heavy PM and staff workloads may also have impact the COV review process. However, the previous COV noted that additional organization of review materials in advance of the COV meeting would have facilitated a more efficient review. For example, the

jackets describing the SFAs and their reviews for the most part were not uniformly organized, and sometimes there was disorganized material. This made it difficult to determine when initial reviews and triennial reviews had taken place or were scheduled. To expedite the COV review process, one solution would be to have a summary sheet and/or table of contents for the provided files. This would include: PI, grant number, project start date, scores, annual reviews by year and decision, triennial review scores and decisions, and program/plan revisions. Since electronic file organization (PAMS) is pending, this information could be incorporated into the design/functionality of that information system. This overview information would help to save the extensive time needed to track the fate of individual projects and provide more time for reviewing the fit of the projects to DOE missions, and other programmatic considerations.

It would also be very helpful to provide the COV with this information prior to the meeting of the COV, and less extensive background materials on the science and program descriptions. Documents provided could be organized according to working groups (folder for Working Groups), including the summaries needed for working group discussions. It was noted that the summary documents provided were not consistent between SFA, FOA and facilities (i.e., there was a list of SFAs, but this was different information and format than lists of FOAs). The KBase file, while well documented, was particularly hard to navigate, especially as proposals were fused resulting in four national labs being involved – some paper documentation of this process (cover sheet, table of contents, some summary of this program's history etc.) would make the documents easier to comprehend.

Recommendation: Electronic records, when developed, should be designed to facilitate the review and record keeping of this process.

Recommendations: Organize and provide materials differently for future COVs to enable efficient program review and project oversight. This would include a cover document with a table of contents and summarize project personnel and collaborations. For SFAs, include an outline of the chronology of each SFA providing times of review and outcomes, and the reasons for the decisions regarding funding/termination. Also, to better assess the quality/impact of the funded efforts, it would also be very useful if appropriate program-level metrics (e.g., publications, # students/postdocs trained, significant recognition of PI's such as election to NAS/NAE) could be provided to the COV.

Recommendation: Provide greater background information relating to FOA and SFA development, integration, and prioritization.

III. BSSD Program Administration

Given the diverse portfolio of research areas supported by this Division, this is a remarkably lean operation. In addition to the Division Director, the current staffing includes 9 PMs, one AAAS Fellow, and 2 support staff. Several PMs have exclusive responsibility for essential programs. As some PMs move toward retirement, it will be critical to develop a plan for transition to new leadership. The current staffing shortage will be partly alleviated by a search for a new computational biologist PM and anticipated solicitations and hires of two new PMs and a science assistant. However, the COV thinks this remains minimal staffing in consideration of the very considerable PM and staff workloads.

The COV was impressed with the rigor of the FOA solicitation, review, and monitoring

activities by the PMs, especially considering the limited funding for the FOAs and for support staff to administer the FOAs. The COV recommends more clarification in FOA solicitations such that the topic is more focused with the intent to direct submissions more in-line with the DOE mission and FOA topic area. The COV also recommends that the pre-proposal process be more selective and that a smaller number of pre-proposals be advanced to a full submission. This would serve several purposes: reducing the effort of PIs in preparing proposals that will not likely be funded, reducing the workload of the reviewers, and permitting more discussion by the review panel on which proposals should be funded.

In addition, a major concern of this COV, as well as 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 seems particularly critical for the KBase program, a nascent program that would benefit tremendously from more frequent direct interactions with the PM. Over the whole of BER, $600M/yr in research funds may be jeopardized by the lack of a few thousand dollars in travel funds to allow program officers and reviewers to travel to contractor sites and ensure that spending, progress and direction are on track and appropriate.

In spite of the current staffing and travel challenges, we note that the administration of BSSD programs remains a first class operation. The BSSD research portfolios are at the cutting edge of a diverse array of research questions that are critically important to national needs.

IV. Review of DOE Programs In the Biological Systems Sciences Division

To maximize the effectiveness of the analysis, 3 subcommittees of the COV were formed – each assigned to review carefully and deeply a different Program, Facility, or Project of the overall BSSD research portfolio. The entire COV evaluated and analyzed the portfolio, as a whole, and provided comments and recommendations. Each area of review considered: 1) the review and monitoring processes, 2) breadth and depth of the science portfolio and standing, and 3) comments and recommendations.

A. Facilities: Joint Genome Institute (JGI)

Efficacy and Quality of the Review, Funding and Monitoring Processes

The efficacy and quality of the review, funding and monitoring processes as well as breadth, depth and program oversight of the DOE JGI scientific facility was examined by the COV. The DOE-JGI is managed by the LBNL and in collaboration with LLNL, ORNL, PNNL and the Hudson-Alpha Institute. The COV reviewed the user programs maintained by the DOE JGI listed as follows:

- Community Science (formerly Sequence) Program, (CSP)
- Emerging Technologies Opportunity Program (ETOP)
- JGI EMSL Collaborative Science Program
- Bioenergy Research Center (BRC) Science Program
- DNA Synthesis Program

The COV commends the PM and JGI for its overall commitment to undertaking

significant scientific and technological accomplishments and for continuing on a path to expand these capabilities since the previous COV and accomplishing this despite the dynamic funding and administrative climate within which these efforts have taken place. These issues have certainly added to the challenges and complexities faced in their execution. The PM is essentially allowed only one trip per year to visit the JGI facility and to meetings relevant to JGI involvement and the COV sees this as a significant barrier to the management of this program that should be removed. The COV recommends that DOE should reconsider their definition of "essential" in essential travel, and make sure that the budget request reflects this. The ability for the PM and other staff to travel to user facilities and to conferences to remain current in scientific trends is essential. Further, the COV recognizes and appreciates the JGI's efforts to meet the recommendations of the previous COV of 2011. For example, the JGI has continued to adopt new "next generation" sequencing technology (including the long-read PacBio platform).

While the COV recognizes the basic success of the JGI sequencing facility, the ability to review this in detail is difficult to complete as most summary information is related to number of base pairs generated, users statistics, and number of operating hours. The definition of a user of the JGI facility was to the COV somewhat vague and would benefit from clarification to better track this metric as a part of judging facility impact within the scientific community. The JGI clearly tracks other QA/QC metrics ("Dashboard" QA/QC) such as library success rates, throughput per sequencer, quality base pairs, etc. that help leadership internal to JGI judge their progress. More information could be provided on a regular basis to the PM and it would be helpful to have more of this information made available to subsequent COV and other review teams of the JGI to better establish competitiveness with other large-scale facilities.

The existing Scientific Review Board for the JGI serves JGI well, but is charged by JGI management, and not responsible to DOE. Further, that board is charged with the assumption that the JGI is a flagship facility of BER. It was not clear to the COV how/when this assumption is reviewed. There does not appear to be an external advisory process to periodically consider this question.

Community Science Program (CSP). Of the community user programs maintained by the JGI, the longest standing program is the CSP, established in 2004. Currently 50% of the JGI sequencing capacity is dedicated to this program. The goal of this program is to provide the community with access to a state-of-the-art high throughput sequencing facility for the generation of DNA and RNA sequence data in support of mission relevant science. The CSP conducts an annual call that typically commences with a user submission of a letter of intent (LOI) stating the resolve to submit a full proposal (exceptions are submissions to small-scale microbial/metagenome or synthetic biology projects which are completed in one step). LOIs are reviewed by JGI staff and BER PMs for relevance to DOE missions. Full proposals are reviewed for technical merit and feasibility by JGI science and technical staff followed by a peer review that ranks the proposals based on scientific merit and then given to JGI management for final approval.

Upon examination of the CSP review process, the COV agrees that the overall process is generally efficacious and the quality of the reviewers is typically strong. The Project Manager is well versed in all of the JGI projects and remains actively involved in supporting further developments. As long as he continues to lead the facility, the COV feels that there is excellent stewardship. However, continued effective stewardship will require appropriate travel support to meet with scientists within and outside the JGI. The

COV appreciates that more reviewers are being drawn from sources outside of the JGI and encourages further development of this activity to ensure that the best possible scientific expertise is being captured and utilized in the review process.

New JGI Initiatives. The Emerging Technologies Opportunity Program (ETOP), JGI-EMSL Collaborative Science Program, and DNA Synthesis Program represent important steps forward for the JGI. Further, the success of these programs to evolve into resources that are beneficial to users beyond the JGI and not simply serving as research programs for selected intramural members, is critical to determining the relevance of the JGI as a true user facility in the future.

The COV appreciates that since these are such new programs the initial review of proposals and selection of projects may need to have been handled through JGI staff as part of a "learning curve." However, a continued and expanded effort should be made to advertise the presence, purpose and results of these programs to the wider scientific community to encourage both a greater pool of researchers to be engaged in the use of these facilities in their research, and in the peer review process.

The COV appreciates that the ETOP has only recently (2012) been undertaken to identify new strategic partners and unique scientific capabilities in areas such as high throughput functional genomics, microfluidic enabled molecular biology, and DNA synthesis technology. The first funding decisions (6 funded) were only just awarded in approximately June of 2013. The review and selection process for this first effort consisted of an ETOP funding announcement for LOIs (69 received) from which a JGI Management team selected 9 LOIs for full proposal submissions. The 9 proposals were reviewed for funding by a JGI Management team. The criteria for selection included relevance for JGI strategic directions, scientific and technical merit, and utility of approach and methods for JGI users.

Breadth and Depth of Portfolio and Standing

The COV also appreciates the CSP's changing emphasis from a largely sequence generator of model organisms (e.g., single microbe) to undertaking more complex projects (e.g., microbial communities), and an increasing focus on the ability to analyze and interpret the sequence data generated. The COV appreciated that there has been a trend towards greater flexibility for DOE extramural awardees to determine what facilities (JGI or a core facility available at their home institution) and arrangements best meet their sequencing needs. The COV views this as a positive step. However, the **COV recommends** that it is important for the JGI to continue to evaluate the core sequencing services they provide against the continuing rise in sequence capacity at many institutions (e.g., University Core Facilities) and the impact this may have on future emphasis of DOE resources in this area.

Sequencing support of Bioenergy Research Centers. The BRCs receive 30% of the JGI sequencing capacity and this includes the completion of large plant genomes (e.g., of switchgrass, *Panicum virgatum*) that the COV notes are not simple genomes that could be easily completed at a typical university core facility. The COV in general recognized that the JGI is providing an appropriate contribution to this effort. However, the **COV recommends** that the impact of this work continue to be carefully balanced against the needs of smaller projects and users outside of the BRCs.

Emerging Technologies Opportunity Program (ETOP). The COV appreciates the tremendous promise of ETOP but also recognizes that its ultimate impact on JGI advancement and relevance are still to be determined. Therefore, this program offers both a tremendous challenge and opportunity and careful oversight of this program is important. As an observation, for example, although the COV cannot rigorously evaluate the breadth and depth of ETOP since only six projects are currently funded the projects in microfluidic single-cell genomics and the high-throughput sort of microbial cells with specific functional traits were viewed as especially interesting. However, the project funded to generate a pipeline for high throughput recovery of microbial genomes from the assembly of metagenomic data sets appears to overlap more with the missions of the JGI and KBase development. Therefore, this project was viewed as less relevant in terms of meeting the goals of this program. Thus, care will need to be taken in the future to better focus this program which can be achieved in part by developing more robust proposal solicitation and peer review mechanisms along with soliciting input on overall program relevance from the wider scientific community.

JGI-EMSL Collaborative Science Initiative. The COV appreciates the importance of this program as a new initiative to increase the relevance of each of these DOE supported facilities and that further; this is a significant opportunity to facilitate new approaches to answer questions in the biological sciences relevant to DOE missions. As with the ETOP, this is a new initiative with the first call for LOIs in 2013. A total of 34 LOIs were received from which 29 were invited for full proposal submission after review by a joint JGI-EMSL management team with full proposal review (27 submitted) taking place by a JGI/EMSL management team. As with the ETOP, this program may need to have a period in which an internal review process is acceptable to learn how best to continue to formalize the program. However, the COV **recommends** opening both the proposal solicitation and review process to generate interest from the wider scientific community include scientific expertise in a more robust peer review.

The DNA synthesis program. The DNA synthesis program represents another initiative by the JGI to transition from largely a sequence facility into new areas of genome-based science. Synthetic biology and biological engineering represent new frontiers in microbiology and the COV appreciates the JGI's recognition of this fact and efforts in this area. However, this is also a technology area that is being rapidly developed in other commercial, private, and public sectors.

JGI Comments and Recommendations

Recommendations: The COV recommends that the continued development of analytical capabilities should not occur in a vacuum (i.e., within house) and that in particular the overlap with the development of KBase as an analytical resource needs to be conducted and monitored carefully and in a strategic manner so as to leverage JGI and KBase resources in the most efficient manner. The current COV recognizes that the description, development and management of this overlap and interface were commented on by the previous COV of 2011 and progress in this area remains a concern to the COV 2014. The JGI also recently organized a session on "Current and Future Directions of Sequencing Technologies" as part of the Microbial Genomics and Metagenomics workshop to evaluate technology options in genome-enabled science and how these capabilities would support the BER mission and the extended scientific community. The COV notes that the evolution of JGI in response to the changing analytical and computational landscape will require appropriate travel support for the PM to meet with scientists within and outside the JGI.

Recommendation: COV recommends that the review process for the new initiatives (ETP, JGI-EMSL, DNA Synthesis) be developed into a robust peer review process that reaches out and includes outside scientific expertise. Due to the rapid pace of change in sequencing technology, the COV recommends that this review should include regular documented evaluation addressing specifically whether the facility is the best use of program resources.

Recommendation: Since there is an increasing array of commercial options for cost effective DNA synthesis products and support, care needs to be taken in determining the best path in developing this program to best employ resources in the service of both JGI and the larger scientific community. The COV recommends that adjusting this program accordingly is critical to generating a program that is truly responsive as a user facility supportive of community research.

B. Facilities: Structural Biology Facility Access Program

Efficacy and Quality of the Review, Funding and Monitoring Processes

The structural biology programs overseen by BSSD encompass broad scientific and technical scope. The goal of the BSSD Structural Biology Facility Access 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.

These BSSD programs jointly fund the national structural biology facilities and infrastructure through arrangements with other agencies including NIH and NSF. The ability to coordinate with the NIH and NSF is attributable to the outstanding leadership provided by Roland Hirsch at the DOE. His communication skills with the relevant PIs are exemplary.

Breadth and Depth of Portfolio and Standing

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 (ended in FY2011), (4) Lawrence Berkeley National Laboratory supporting x-ray spectroscopy of biological and environmentally important materials, facilities for infrared and 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 BioSANS station at the High Flux Isotope Reactor, (6) Los Alamos supporting the neutron Protein Crystallography Station, and (7) Stanford Linear Accelerator Center National Laboratory (SLAC) supporting structural biology. In addition, BSSD co-funds the Protein Data Bank at Rutgers University. The BSSD support enables access to National User Facilities by a broad community of biologists, chemists, and environmental scientists.

The national structural biology facilities have, indeed, resulted in world-leading transformative science in a wide range of fields. A perusal of any biochemical or cell biology textbook shows the extent of how these facilities have revolutionized our understanding of protein structure and function, enzyme mechanisms, and cellular processes. The entire field of structure-based drug design has been critically dependent

upon the ability to collect high quality X-ray data at rapid rates on small crystals. User demand will continue to be extremely high at synchrotron and X-ray Free Electron laser (XFEL) sources in the foreseeable future. The demand for neutron applications is expected to grow as the new beamlines become operational for structural biology at the Spallation Neutron Source at Oak Ridge National Laboratory.

The NIH conducts the reviews for the synchrotron sources at Brookhaven, the Stanford Linear Accelerator Center National Laboratory (SLAC) and X-ray tomography at the Berkeley Advanced Light Source (ALS). Facilities at Argonne (Structural Biology Center (SBC) and Advanced Photon Source), Berkeley (Small-angle X-ray scattering (SAXS), spectroscopy, and infrared spectromicroscopy), Oak Ridge, and Los Alamos are reviewed solely by the DOE. The PM is well versed in all of these projects and remains actively involved in supporting further developments of XFEL, synchrotron radiation, and neutron scattering facilities. On the basis of the documents provided to the COV members, the qualities of the chosen referees and their written reviews are excellent. The COV members have no concerns regarding the appropriateness of the reviews or program management.

Structural Biology Facilities Comments and Recommendations

Recommendations: The research community benefits enormously from the structural biology facilities supported by the DOE. The COV emphatically encourages the continued co-funding of these facilities with NIH and other agencies. Continued support of the Protein Data Bank is essential given that this data bank influences a wide range of bioenergy research from enzymology to cell biology, nationally and internationally.

COV enthusiasm for continued support of the Oak Ridge National Laboratory neutron program is high. The COV committee found the paper published in the Journal of Biological Chemistry (2013), which addresses the role of Glu166 in the catalytic mechanism of a beta-lactamase, a perfect example of the type of data that can ultimately be obtained when the Spallation Neutron Source (SNS) protein crystallography facility at ORNL becomes operational.

A major bottleneck that concerns the present COV is the lack of substantial funding set aside for capital equipment. Although this has been partially alleviated by cooperation with other programs within BER and in some cases, with other funding agencies, this prevents long term planning of new beamline facilities or major upgrades. For example, an upgrade of the SBC sector at Argonne Advanced Photon Source (APS) will be required in conjunction with the overall APS upgrade scheduled in ca. 2019. This is critical for SBC to remain internationally competitive

Recommendation: The COV recommends that the BSSD put in place a mechanism to prepare for the timely upgrades of BER funded synchrotron and neutron experimental stations.

Recommendation: Given uncertainty about the timing of PM retirement, the COV expressed some concern about planning for leadership transition. The COV strongly recommends that the BSSD management prepare a timely succession plan and at the same time establish a panel of experts to help prepare for both a smooth transition of leadership and for the establishment of a road map to guide future facility development and operation.

C. Laboratory Science Focus Area (SFA) Programs

Funding of research at the National Laboratories changed in the period reviewed by the previous COV. BER moved from funding individual, single investigator projects to funding integrated research projects. These Scientific Focus Areas (SFAs) are designed to encourage collaborative, multidisciplinary research within the labs. The rationale for adopting this new funding method was 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. There are currently 18 SFAs funded by BSSD in the National Laboratories distributed among four general program areas.

1. Ethical, Legal, and Societal Issues (ELSI)
2. Genomic Science (KBase, Biofuels, Foundational)
3. Low-Dose Radiation
4. Radiochemistry

All 18 SFAs were covered in this review: 1 in ELSI, 3 in Low dose radiation, 4 in Radiochemistry, and 10 in Genomic sciences (5 in Foundational, 1 in Systems biology (KBase), and 4 in Biofuels research). With the exception of KBase, the 18 projects reviewed by this COV existed at the time of the last review.

Efficacy and Quality of the Review, Funding and Monitoring Processes

The National Laboratory is responsible for ensuring that the research performed within each SFA is more than a loose collection of individual projects directed by separate investigators. Rather, the SFA programs must be coherent and cohesive programs that reflect coordination and collaboration among individual researchers and teams of investigators, at scientific and management levels across National Laboratory divisions and among other institutions, when applicable. The National Laboratories are also expected to develop and evolve their research programs over time to identify, build and anticipate new areas of science and future research needs and challenges. Additionally, as BER's strategic goals change and as science progresses, the National Laboratories are expected to reconfigure SFA programs to meet these changing research needs.

The COV discussed with PMs the process by which topics for SFA's were identified and how teams were invited to apply. With the exception of KBase, this process happened prior to the time period covered by this COV and was not a specific subject of our review. The committee was supportive of the KBase solicitation and review process, as follows, and recommends this general process serve as a template for the solicitation of future SFAs. PMs are doing an excellent job managing the SFA programs. DOE PMs communicate important project reporting due dates for revisions, budgets and/or annual or final project reporting requirements.

KBase was the only new SFA program solicited during the 2011-2014 period. A well-defined and documented system was employed to solicit proposals from the national laboratories, obtain written reviews from high-quality reviewers, conduct reverse site visits, make awards and declinations, and obtain budget revisions. The call was made public to national laboratory managers, and a competitive process was used to make a final decision on the KBase SFA. BER identified the area of need and invited letters of

intent to submit. On reading of the letters of intent, a few groups were invited to submit full proposals. The COV found it harder to determine the timing and rationale behind the decisions within DOE Program staff by which this key funding decision was made. Specifically, the COV was unsure whether the decision to combine a poorly reviewed proposal with a well-reviewed proposal happened during review, panel discussion, or afterwards among PMs and whether there was further outside input. It seems likely such decisions were made at the level of program management as opposed to in response to reviewer suggestions. While this is regarded as an advantage for BSSD leadership and provides flexibility for directing the portfolio of research supported by DOE-BSSD, these decisions are more difficult for the COV to evaluate. The decision process could be better documented.

The other SFAs underwent their first triennial review during the period reviewed by this COV, and several were examined by the COV. The triennial reviews were in the form of a progress report/proposal defended during one or half-day reverse site visits. The external scientific review team included experts in relevant areas of technology and science. Reviews provided important insights and in some cases constructive suggestions. The reviews of the SFAs scrutinized by the COV were largely positive and supportive of continued funding of the SFAs. The quality of the review and the qualifications of the reviewers were both, in general, excellent. Although the current level of oversight of the SFAs may be somewhat impacted by limitations in the travel budgets of BER, the program staff were achieving appropriate oversight for the existing SFAs in spite of these restrictions.

The triennial review process involved identification of scientists with expertise relevant to the activities of the SFA and establishment of a peer review group to carry out the review. One or more primary and secondary reviewers were identified and the review discussed among all members of the review group. In all cases examined, the primary and secondary reviewers were well chosen with expertise in the relevant research areas. The reviews were thoughtful and occasionally included constructive suggestions. Discussion of the proposals was documented and it is clear from the documentation that the discussion raised a number of issues. These were discussed in detail by members of the peer review group and for the most part resolved. Where the peer review members agreed on a concern, annotation was added to make the PI aware of these concerns. None of the concerns noted was considered a 'show stopper', but rather provided the opportunity to improve the expected outcomes of the project. The reviews appeared to have been well managed in all aspects. Given the staff shortages within the BER Program, the detailed interaction with PIs is commendable and additional staff to replace current vacancies will assist future reviews.

The COV examined all three SFA dossiers in the **Low Dose Radiation Area** for the years covered in our remit (2011-2013) and extended our review to include active programs for which the most recent full review fell outside 2011-2013 timeframe. The PM thoroughly documented all procedures involved in the management of this portfolio. The SFA review process is thorough and proceeds at a pace that is commendable, with minimal intervals between application submission, review and funding. The breadth and expertise of the reviewers are outstanding with coverage of the needed areas of expertise. Revised applications and/or responses to reviewers were requested and documented as appropriate. Progress of awarded SFAs was monitored and documented thoroughly. Site visit reports and e-mail correspondence were included in the files as appropriate.

The four **Radiochemistry and Imaging** SFAs (BNL, LBNL, ORNL and TJ) are well organized and managed. The review and award process is clear and there is a thorough review process for all proposals (4-7 reviewers per proposal) with consistent high quality reviews. The PM has each SFA well documented (except ORNL, annual reports missing) and is in close communication with the PIs. All SFAs are consistent with the DOE mission and focus radiochemistry and instrumentation development towards the understanding of plants and microbes for producing biofuels, cleaning up waste and sequestration of carbon.

Foundational Genomic Science research supports 5 SFAs that cover varied aspects of microbial ecology using different approaches. All projects were examined by 4 to 6 reviewers. Four of the 5 projects passed the triennial review. One of the projects (PNNL) appears to be a 5-year GTL project that was not reviewed in its third year. Initial rankings of the projects reviewed varied substantially, with at least one project ranking poorly on initial submission. There were no rankings found for the Biofuels SFA proposal from PNNL. It was very difficult to determine the numbers of PIs involved in each project and how the projects related to each other. For example, the PNNL proposal refers to an ANL scientist as a contributing investigator, but it is difficult to determine his specific role in the project from the available documentation [although members of the committee were aware who this individual, both a collaborator on the PNNL project and the lead PI on an SFA at Argonne, was – this was not clear from the documentation available]. It was also unclear to the COV whether the summary of the review panel was generated by the PM or the panel. Thus, although the review and management of these SFAs appear to be very good, some lack of detail in documentation (e.g., PI composition and SFA relationships) may leave the program management open to criticism or scrutiny.

Review documents and communication among PIs and DOE PMs related to the **Ethical, Legal, & Societal Issues** (ELSI) SFA are very well organized. An organized cover sheet outlining the evolutionary history of the ELSI Program, now focused on upcoming societal challenges related to bioenergy and nanoscience, was extremely useful and should be provided for each SFA in future COV reviews. Such a document provides a quick accessible summary of the history of a specific SFA and major recommendations from DOE PMs. Three ELSI projects were funded during the current COV timeframe, 2 to national labs) and one to a not-for-profit institute. According to the information in the 3 packets, this was an SFA solicitation (although no solicitation was included). The 3 seem to have been reviewed by mail (not clear) and it was not clear how the decision to fund was made. This SFA will not be renewed for the next triennial and will be replaced with a project at ORNL, which supports goals related to the SC-23 Biosystems Design program.

BER Staff identified one Foundational Sciences SFA as struggling to become an integrated project on the basis of regular reporting mechanisms. Reviews at the start of the SFA expressed concern about the commitment of some of the scientists to form an integrated team with common research objectives. These concerns were communicated to the SFA leadership, but the problems did not diminish during the first year of the SFA. On the basis of the first year review, BER staff decided to move up the first three-year review to occur after two years. This review took the form of a site visit. During the site visit the chronic problems in project integration were revealed to be undiminished. After extensive discussion with the site visit team and subsequently among the BER staff, it was decided that the core research of the SFA was making valuable contributions and should continue to receive full funding whereas one segment of the effort should be terminated. This appears to have been a fair process in which concerns were

communicated to the SFA team who were provided with significant opportunities to adjust their activities accordingly. Nonetheless, one team (or a subset of that team) remained unresponsive to the guidance received and on the basis of that non-response, funding to this team within the SFA was terminated. The COV considered this action to be fully appropriate in the circumstances.

Breadth and Depth of Portfolio and Standing

Foundational Genomics. Foundational Genomic science research supports 5 SFAs. These SFAs are distributed among ANL, LANL, ORNL, LBNL, and PNNL. Research in foundational science is focused primarily on terrestrial microbial communities (soils, subsurface, microbial mats). The projects provide new information for understanding organisms, their roles in the environment and for developing tools with implications for carbon cycling, remediation of contaminated sites, and assessing the responses of ecosystems to environmental change. The projects in this portfolio are collaborative, interdisciplinary and use state-of-the-art techniques and novel approaches. These projects are among those leading the field in environmental microbiology research.

Biofuels. This is a major part of the SFA research portfolio, and complements the Bioenergy Research Centers that are managed separately. The scientific quality and breadth of these programs is very impressive. The current SFAs in this program are of appropriate scientific depth, of high overall quality, and well managed. However, the COV was divided in their opinion of the potential for the various biofuel-related projects to ultimately benefit the nation. Some felt that future promise in this area will primarily be in the generation of starting materials for organic synthesis. Others felt that increased understanding of photosynthetic systems and their potential to contribute to sustainable sources of feedstocks and fuels is essential to moving towards a sustainable economy. The divided opinion among committee members may reflect the lack of a high level rationale for support of the individual projects and the expected synergy among projects.

Low Dose Radiation. The Low Dose Program currently focuses on the effects of low dose radiation from the molecular and cellular level to the organismic level with *in vivo* (murine and porcine) models of low dose radiation effects seen as a significant and unique strength of the program. The research investigates both the targets of transformation (epithelial cells) and the stroma that impact tumor growth. Program productivity has been high with over 700 peer-reviewed publications in its 15-year history. The relative contribution of the SFAs versus University-centered research was not determined by this COV.

The Low Dose Program is unique in addressing issues central to potential health effects from environmental, occupational, and accidental as well as low-dose medical exposures to ionizing radiation that are a significant and continued concerned of the US public. Past research has led to changes in how the risk of radiation and the mechanisms of radiation carcinogenesis are perceived. Most studies of radiation risk have focused on cancer incidence following relatively high doses to the survivors of the A-bombs in Japan in 1945, as well as other populations exposed to acute high doses of radiation.

Much less is known about the risks at low doses of <0.1 Gy (10 cGy or 10 mSv), which are frequently encountered as the result of occupational, medical or environmental exposure. Thus, the acquisition of solid scientific evidence regarding the effects of low dose exposure is vital to guiding public policy including exposure limits and radiation remediation standards. Despite the vital importance of the information generated by this program the budget has been reduced from $21.7M to $6.2M in the time span covered by

this review (2011-2013). The allocation has been evenly divided between National Lab SFAs and the remaining University research groups. Unfortunately, the absence of new low dose SFA solicitations in this review period will compromise the future of this important program.

Radiochemistry and Imaging. The goal of the SFAs are to support the DOE mission related activities in bioenergy and bioremediation as well as develop fundamental methodologies that lead to transformational new technologies for medical research.

Ethical and Legal and Societal Issues (ELSI). The goals of the ELSI program were originally related to societal implications and issues arising from the human genome project, and during the last decade, the ELSI Program evolved to include social and legal issues related to nanoparticles, bioremediation, bioenergy development and the regulatory synthetic biology. From 2010 on, the ELSI program was eliminated, and the risk-associated studies were folded into the Genomic Science Program and BRC projects, where risk and societal factors become part of these larger projects. These remain pressing societal issues and the program remains an important component of the SFA portfolio.

KBase. The grand, ambitious goals of KBase include solving many critical software needs for interdisciplinary genomic science including molecular biology, systems biology, and genomics. This project is scientifically exciting and at the cutting edge of the discipline. This is high risk, high potential impact research, but also has a significant service/outreach component to ensure the methods and tools developed are actually used. It is a major effort with a budget over $12m/y. Given the broad breadth of KBase goals and its diverse audience, it is unclear what mechanisms have been put in place to communicate with possible users, interface with DOE JGI, and/or involve other FOA grants. Although the current investigator composition insures this program will deliver high quality science, there are significant challenges to achieving a “one stop” computational resource, as highlighted in the following section.

SFA Programs Comments and Recommendations

A number of concerns regarding the SFA programs became apparent during the review. These are itemized below.

• **SFA selection, review, and termination processes.** In general, the review process of the Genomics Foundational SFAs was thorough. However, the basis for selection and summary documentation are difficult to obtain from the available documents. For example, the process used to initiate the KBase call, formulate the goals of the KBase SFA, and formalize the interaction with the Joint Genome Institute (with perhaps similar or overlapping goals in data processing and interpretation) was not at all clear to the COV. This project was initiated in 2011, so the COV review covered only the initial round of review. The initial call appears to have been sufficiently broad and/or rather vague so that the proposals received were too diverse to easily compare directly. Nonetheless, for this SFA there appears to be detailed reviews by a sufficient number of experts.

As typical for peer review, reviews are often mixed and initial Science plans are not necessarily highly ranked. PI responses are usually appropriate, but sometimes brief, given the nature of the comments and the levels of funding requested. Programs are monitored by annual (in one case early in the SFA program, monthly and quarterly)

reports. There is at least one example of program intervension when progress and reporting were inadequate or poor, indicating that the monitoring process works. Triennial reviews are at least as intensive as initial review and in at least one case, showed that a sub-par project improved substantially from its initial state, most likely as a result of the modifications made in response to the triennial review.

Recommendation: A formal, documented and reviewed process for the creation of new SFAs should be created and made available to future COVs for review.

The COV was acutely aware that in most fiscal years total funding for SFAs represents a zero sum game. In the absence of new funds, the formation of a new SFA or increase in funding to a particular SFA would need to be matched by an equivalent decrease in funding to one or more existing SFAs. This raised the question as to the process by which funding for an SFA might be cut back or terminated.

Recommendation: Develop a clear process and documentation of the decision process when redirecting or terminating an existing SFA.

• **Strategic planning and SFA integration.** There is naturally some redundancy across and within SFAs funded at National laboratories. For example, the 'biofuel' SFAs are not clearly linked (or vice versa) with the Bioenergy Research Center goals. While multiple thrusts in the bioenergy area are useful to DOE programmatic goals, it is sometimes unclear how the activities within the same agency may relate to one another, and whether different national laboratories are brought together to develop a unified strategic plan. This might assist in minimizing programmatic overlap, and at a minimum, will provide greater clarity to the mission of each SFA. BSSD program management should do everything possible to develop a more coordinated research effort across the SFAs and this is especially relevant for evaluating the unique programmatic thrusts and funding mechanisms specific to each National Lab.

Recommendation The committee endorses the freedom of the individual National Laboratories to conduct independent lines of research within the SFA funding structure. However, it was not clear to the COV that a mechanism existed to prevent redundancy and promote dialog between related projects. We encourage BER management to develop mechanisms to produce ongoing dialog between related SFAs when appropriate, and to request collaboration and synergy between related SFAs. This particularly applies to the (non-BRC) biofuel SFAs and their relationship to the BRCs, and to KBase and JGI.

• **KBase.** KBase is a good example of the strengths and weaknesses of the SFA funding structure. The strengths include the ability to perform long-term, potentially high impact research that would be very hard to accomplish with the standard university NSF/NIH funding model. The SFA structure provides for the oversight necessary to encourage collaboration and eliminate overlap among multiple, geographically dispersed, programs. Extensive and multiple revisions of the SFA were performed, demonstrating the flexibility to make adjustments in the scope and organization of what is clearly an evolving program. The ongoing dialogue between PMs and PIs and the ability to alter funding structures, objectives and participants during the grant period is commendable and a strength of the SFA structure over traditional grant programs. This type of funding mechanism, at institutions like national labs with both significant numbers of permanent, professional staff and substantial compute infrastructure, is likely necessary to have a substantial impact on the problems of computational biology.

The challenge for both the program staff and COV review is that there has clearly been a very significant need for direction by program staff to ensure that KBase remained an appropriately mission-oriented project. The PM's input was essential to the COV understanding the extensive management and direction during the evolution of this program during the period before the first triennial review. Our review found that this extensive program staff involvement was not only appropriate but also essential to keeping this program aligned with DOE goals.

Even after the award, the form that KBase was to take appears to have been fluid. Initial reviews for the eventually funded KBase proposal were strong, but both the reviewers and PM voiced the lack of plant expertise in the strongest proposal. The COV also notes that a collaborative effort that did not receive strong reviews was funded while other proposals receiving similarly weak reviews were not. The substantive action taken to address this was fusion of the main project with another one that provided plant expertise. Given the predominance of plant biology within BER as a whole, the plant portion of KBase still appears to be a poor relation in funding and emphasis relative to the microbial portion, yet is arguably a more challenging problem that will require more resources to solve.

Recommendation: The balance of plant to microbial emphasis within KBase should be revisited.

It is apparent that the expectations in some quarters of this program do not always meet the reality of the progress made. This is a very challenging area, and the research is still at the stage of developing workable tools. Nonetheless, certain FOA funded projects were provided funding to link data to KBase with the expectation that KBase would provide useful software within the timeframe of these grants. At the same time, the KBase milestones and reports do not reflect a timeframe by which software will be widely used and adopted for specific purposes, and this does not seem to be an immediate priority for the groups involved, which appear to be more focused on developing new tools. The reviewers were asked to comment on the likelihood of a public beta release in 18 months and a 1.0 release in 36 months, but not on whether such releases would be useful to anyone. The initial focus on release milestones seems to have shifted the main effort to software and algorithm development, which is understandable given the apparent challenge to deliver software that will attract a wide user base. Metrics and scientific review of the utility and usage of the tools developed will need to be a focus of the process as the tools mature in the immediate future. Going forward, rather than focusing on numbers of registered users, the best mechanism for evaluating tools is to solicit reviews by potential or current users, and the best mechanism to measure impact is to count peer-reviewed publications that cite or acknowledge KBase. Detailed oversight of KBase on infrastructure and integration in the future is likely to continue to be essential so that it remains an appropriately mission-oriented project

Recommendation: A plan should be put in place to provide necessary computational resources for any tools developed under this program that are both successful and computationally intensive. Without these resources, the tools will not be useful within the KBase framework. Such a plan should be focused on resources and infrastructure provision rather than being a focus of the KBase program itself.

Recommendation: Evaluate and budget for future incorporation of a flexible cloud compute allocation (from elsewhere in DOE or an external provider such as a commercial cloud computing supplier) in anticipation of widespread adoption of KBase.

• **Collaboration between KBase and JGI.** The KBase PMs have clearly made significant efforts to encourage collaboration between the KBase group and JGI, which has been working on related tools for some time. However, this appears to be embraced only reluctantly by both sides. JGI was not able to submit a proposal to the KBase SFA solicitation, since only one proposal from LBNL was allowed (led by Adam Arkin). In the future, the mission may be better served by allowing individual labs to submit multiple proposals (for instance, LBNL has multiple capable units.

Recommendation: Establish a formal mechanism to insure that KBase and JGI collaborate productively and avoid duplication with ongoing computational biology efforts (both within and outside DOE).

• **Biofuels SFA**. The Initial proposal of a biofuels SFA (Genome-enabled studies of phototrophic microorganisms for bioenergy applications) was not included in the documentation**.** Although the 2011 annual report was positive, with numerous milestones achieved and 6 publications in the first year, a weak triennial review resulted in termination of this SFA. It was difficult for the COV to evaluate the reasons for the termination. A new submission for 2014-2016 was included in review materials but not evaluated by the committee.

• **Low dose radiation**. Program Management is actively involved in inter-agency efforts and radiation working groups. Efforts have been made for co-funding of research with other agencies and initiatives (e.g., NASA and the LBNL SFA).

There were three active SFAs in the period of this review - Oak Ridge National Laboratories (ORNL): Systems Genetics of Low Dose Radiation Response; Pacific Northwest Nuclear Laboratories (PNNL): Linear and Non-Linear Tissue Signaling Mechanisms in Response Low Dose/Low Dose-Rate Ionizing Radiation; and Lawrence Berkeley National Laboratories (LBNL): A Systems Biology Approach to Assessment of Responses to Low Dose/Low Dose-Rate Ionizing Radiation. The ORNL SFA was terminated in 2011 due to defunding of the animal facility required for this study at ORNL despite a positive review in 2009 and positive program reports in 2010 and 2011, including an on-site visit. Funding for alternative sites was not provided. There are no new SFA calls, or active FOAs for the Low Dose Program, and this is a significant weakness in the DOE scientific portfolio.

The limited and decreased funding to this research area has resulted in loss of research momentum (ORNL) and reduced the critical interaction of the various investigators in this portfolio (the last investigator meeting was held May 2011). In a more general sense, the reduction in this portfolio has caused the loss of training and employment opportunities in an area that is critical to public health. Substantial effort should be made to preserve this unique and important program.

Recommendation: COV recommends exploring the possibility of intra-agency co-funding from other scientific programs (e.g., NASA, NIH, Navy), or possibly international coordination in order to recover momentum and expand efforts in this highly focused research area.

Recommendation: New initiatives in the low dose program are essential for retaining the balance between Federal Laboratory and university efforts

• **Radiochemistry and Imaging Instrumentation.** The reduction in appropriation of funding to these SFAs is a huge concern ($17.7million-$9.9 million), particularly the significant cut to the Brookhaven program, the premier group for radiochemistry.

Although the 2011 and 2012 annual reports were not available for COV review, the quality of these programs was clearly reflected in recent reviews. For example, reviewers of the Brookhaven National Laboratory program noted it is an outstanding interdisciplinary program developing radiochemistry and instrumentation for advancing methodologies for improved use of renewable energy sources. COV reviewers also noted that is a travesty to lose a stellar PI from the field because of reduced funding.

Another concern is the lack of cross-pollination with the nuclear medicine community and FOAs. It appeared to the COV that the mission for the labs and academia are divided. This is likely to have serious consequences in the future with regard to the US workforce for nuclear science in general (national labs, academia and industry will need experts in radiochemistry in the future, where are they going to get the training?).

Recommendation: The committee finds it a National priority to retain expertise and training in radiochemistry and radiation science, including low dose. Thus, the COV recommends increasing the priority for funding the radiochemistry SFAs.

Recommendation: The program would be more effectively leveraged through better integration of SFA and FOA portfolios (e.g., don't have one focusing on plants and the other human health).

• **ELSI.** The goals and objectives of the ELSI program are clearly different than the majority of other BSSD projects that support science mission objectives. The ELSI program has evolved to include social and legal issues related to nanoparticles, bioremediation, bioenergy development, genetically modified crops, synthetic biology, and evacuation policies and public safety risks associated with nuclear incidents. These remain pressing societal issues. Thus, ELSI has the potential to contribute significantly to public education and awareness of the DOE scientific portfolio, and thereby assist in the adoption and support of specific technologies by communities.

Recommendation: Encourage BSSD to continue support for ELSI as an integrated component of ongoing scientific programs.

D. Funding Opportunity Announcements (FOAs) to the University Community

There were seven targeted solicitations to the university community issued as Funding Opportunity Announcements (FOAs)

The Genomic Science Program issued 6 FOAs during this review period

1. Genomic Science and Technology for Energy and the Environment (Notice 10-368)
2. Plant Feedstocks for Bioenergy, Joint with USDA (Notice 11-417)
3. Genomic Science: Biosystems Design to Enable Next Generation Biofuels (Notice 12-640)
4. Plant Feedstocks for Bioenergy, Joint with USDA (Notice 12-598)
5. Systems Biology Enabled Research on the Role of Microbial Communities in Carbon Cycling (Notice 13-866)
6. Plant Feedstocks for Bioenergy, Joint with USDA (Notice 13-770)

Nuclear Medicine issued one FOA

1. Nuclear Medicine Research and Training Grants of Excellence (Notice 12-646)

The COV members reviewed FOAs in their individual areas of expertise. A typical review involved reading the FOA, reading the panel summary, and selecting 3-5 proposals for review. Typically, a COV member would select a highly rated proposal that was not selected for funding, a lower ranked one that was funded, and a top ranked proposal. If the PM made specific notes about funding or not funding a proposal, that proposal was also selected for review by the COV.

Efficacy and Quality of the Review, Funding and Monitoring Processes

The FOAs reviewed during this COV originate from congressional mandates, workshops, white papers, strategic plans, and/or other community engagement by the PMs. The FOAs are written and composed by the BSSD PMs as a committee. From discussions with the PMs, the FOAs became more focused over the COV review period to better guide proposal development.

The FOA solicitation process is heavily affected by the budget cycle and the PMs are challenged with respect to timing needed to get the FOA released, pre-proposals reviewed, full proposals solicited and reviewed, and awards recommended by a DOE deadline of July 1st. The Genome Sciences PM team meets and formulates the FOAs with all relevant PMs being engaged in reading the pre-proposals and sitting-in on the review panels. Thus, the PMs are involved in all procedural aspects of the FOAs and resulting funding decisions.

Some of the FOAs had a broad focus and required two separate panels. This created problems in that the proposals had to be split into two groups and reviewed separately. The COV questioned the rationale for having a single FOA and whether the mission would be better served with two separate, better-focused FOAs. These two FOAs were the most heavily subscribed and the COV felt that there were some inconsistencies between the scoring by the review panel and selection of the awards for funding. The rationale for selecting funded proposals was not always apparent based on reviewer scores, as some higher scoring proposals were not funded while some lower scoring proposals were funded. The COV felt there should be more written justification for funding proposals that were not top-ranked.

The monitoring process involves review of the annual progress report by the PM that is tied to incremental funding of the projects. Monitoring can also involve reports at the annual awardees/contractors meeting such that all projects provide a compiled update of progress. The COV thought that for the 5-year projects, a third year review would be beneficial. The COV did note that for the Low Dose and Radiochemistry & Imaging & Instrumentation, there were no annual progress reports in the jackets, nor were there any annual meetings. The only reporting requirement was a final progress report.

The COV was impressed with the rigor of the review process for the three Plant Feedstock FOAs and felt that the proposals selected for funding were the most meritorious proposals. The PM had solicited responses from the PIs to specific review comments and clarified budgets when necessary. The annual progress reports were reviewed by the PM and used to justify incremental funding. The previous COV reported a high cull rate at the pre-proposal stage for the Feedstock program (~75-80%). In the three FOAs reviewed in this COV period, the cull rate is much lower (37-52%) resulting in nearly double the number of full proposals being reviewed by the panel (range 53-60 full proposals per FOA). This seems to be an inefficient use of the pre-proposal process

and the COV recommends a more rigorous set of criteria be used to select proposals for a full review. The PM was in regular contact with the awardees through email correspondence, annual reports, scientific meetings, and the annual awardees meeting. This personal involvement with the projects is commended.

The COV was concerned over one "orphan" project ("Microbial Ecology, Proteogenomics, and Computational Optima",) that receives a significant amount of funding per year without substantial review. The level of funding provided to this single project without an open competition was seen as not efficiently serving the BSSD mission.

The COV was confused whether the proposal scores were the original or the revised scores following panel discussion. The COV also had concerns that only the proposals chosen for funding appeared to be targeted for inquiries by the PM to the PI for addressing reviewer comments. Thus, would it be a better approach to ask a wider range of top ranked proposals for responses to the reviewer comments. Would this result in selection of better proposals for funding? The BER PMs have a lot of work to do themselves; they have very few non-PM staff. This led to many boxes of FOA information/files being quite disorganized.

Breadth and Depth of Portfolio and Standing

The breadth and depth of the FOA program portfolios are highly focused on the topic areas for the FOAs. Due to limited funds, the FOAs are cycled through multiple years to broaden the science funded in the BSSD focus areas. Due to limited funding, the BSSD portfolio cannot cover all areas of research relevant to the mission and as a consequence, the FOAs are highly focused. The high number of pre-proposals coupled with the limited funding in general for scientific research in the U.S. suggests that the existing BSSD portfolio is not capturing all relevant research. Indeed, the numbers of full proposals rated with high scores yet not funded suggest excellent research was not captured in the BSSD portfolio. It would have been helpful for the COV to see an overall summary of the number of publications, personnel trained, and major impacts of the funded FOAs to date.

The joint DOE-USDA Plant **Feedstock program** was seen as strategic and a powerful way to leverage funds, interest, and expertise between DOE and USDA - thereby having projects with basic and applied components in a single portfolio. For the Plant Feedstock program, the FOAs have addressed different aspects of genomics of biofuel feedstocks in each year of the FOA to broaden the overall scope of the program.

For the **Genomic Science Program**, a strategic plan is being closely followed and investment is occurring in the relevant areas. For the **BioSystems Design**, the selection of only one project each per organism type may not give sufficient depth to cover this field. Thus, this program seems to be broad but not deep. For the **Radiochemistry, Imaging, & Instrumentation** and the **Low Dose** programs, funding levels are so limited that this clearly cannot cover the field to any reasonable level.

While the **BioSystems Design** program is in the early stages, it may be useful to strategically plan to interweave that program with the Plant Feedstock Genomics program in the future.

FOA Program Comments and Recommendations

The FOA program has a standard template for soliciting proposals in which the scientific scope of the FOA is tailored for each solicitation. The COV felt that the high number of full proposals for some FOAs (highest 289) required a lot of work by submitters, the review panel, and the PM. The time investment was disproportionate to the small chance for funding for the majority of the submissions. In part, this appears to reflect lack of clarity in the FOA. The COV felt that some of the FOAs' scientific scope needed to be clearer and explicitly state not only the topics of interest but topics or foci that would not be consistent with the DOE mission and/or the PM's portfolio. The criteria for evaluation of the pre-proposal should be explicitly stated in the FOA. In addition, the COV felt that while the preproposal process was essential, too many were accepted for full proposals resulting in a substantially high number, the overwhelming majority of which will not be funded. Preproposals should be carefully scrutinized for relevance to topic, choice of organism and/or microbial process to minimize invitation of proposals that didn't explicitly address DOE problems/mission areas. This process should greatly reduce the need to decline full proposals based on non-responsiveness to the specific FOA.

Recommendation: A more focused solicitation and/or more rigorous screening of pre-applications is advised such that the funding rate is elevated to 20-25%. For example, more narrowly focused FOAs would clearly articulate not only what is sought, but also what is not, would be beneficial (e.g., no "food" plants), and will ensure the correct panel expertise is invoked for each proposal.

Based on the merit reviewer comments, awarded projects possess a high level of innovation and will fill knowledge gaps. A subset of projects was categorized as being risky. Specific focus on inter-disciplinary science is evident within the program as well as within the FOAs. However, it was difficult to assess the quality/impact of the projects based on the materials available. The COV felt that the statistics for all of the FOAs, including the "orphan" projects and workshops, should have been provided in a central document to the COV rather than have this information de-centralized and associated only with individual FOAs. This is especially important for the orphan and workshop/conference funding and projects and larger FOAs. Review required sifting through several pages of project lists to find those that were marked "funded", especially if they were not ranked amongst in the top 10

Recommendation. Make available a single spreadsheet that lists each FOA, "workshop", and "orphan project". For each proposal received, list the title, investigator names and institutions, ranking, and rationale for funding lower ranked proposals (e.g., high-risk but potentially high-impact). Provide summary information for each funded project, including and total and annual budgets. Workshop information would specify the specific program or exploratory area addressed by the workshop.

• **Feedstocks**. The COV reviewed three Plant Feedstock FOAs (13-770, 12-598, 11-417). The Plant Feedstock program has continued to fund strong proposals in collaboration with the USDA. This joint initiative has permitted BSSD to have a balanced portfolio in this focus area where DOE can emphasize "omics" oriented projects and USDA emphasizes genetics oriented projects. The program has matured in the last few years and while individual FOAs are focused, they have spanned a number of topic areas of relevance to establishment of economically viable plant-based feedstocks for biofuels. The number of proposals reviewed in the FOAs has remained relatively constant yet the number of funded proposals (DOE and USDA) has declined from 10 to 7 over the COV period. This is presumed to be attributable to funding limitations in both

DOE and USDA.

• Low Dose Radiation Research Program

There were no FOAs over the 2011-2013 COV period. This was seen as a major weakness.

• Radiochemistry and Instrumentation Program

This area has suffered severe cuts in funding during this COV review period. When the overall BSSD budget was reduced, the Radiochemistry/Radiation Science areas seemed to take the brunt of the cuts. It was unclear to the COV whether this reflected the least internal resistance of a small program or intent by the BER/BSSD Director/Associate Director to phase out these programs. Unfortunately, this area is also unique within the Federal funding arenas, and should not be allowed to disappear.

Only one FOA (12-646) in Nuclear Medicine was announced during the 2011-2013 time period of this COV, compared to 5 for the previous 3 year COV cycle. There were budget cuts to the overall BER budget during this time period, however the cuts were particularly weighted to the Radiochemistry and Instrumentation and Low Dose Radiation Research Programs. It appears that the Division Head/upper administration wants to cut these programs completely, and were it not for the Congressional nuclear medicine mandate, might have done so.

For FOA 12-646, all submitted proposals were examined. There were 24 pre-applications (1 from a national lab was not eligible) and 19 were encouraged to submit. Of those encouraged, 17 submitted full applications and those receiving the top 5 scores from the review panel were funded. The PIs of the 5 applications selected for funding were sent the reviewers' comments and asked to respond to the critiques, and they did so. The 12 declinations all had summary statements and critiques indicating the weaknesses and primary reasons for the declination. The reviewers were highly qualified and trained in both basic science (radiochemistry and/or imaging) and nuclear medicine. There is good communication between the PM and the PIs, and the turnaround time between the review panel meeting to awards seemed reasonable.

In 2013, only $2,659,000 was available for the university program; $7,270,000 was set aside for the national laboratory programs. This makes it very difficult for FOAs, and marginal for the SFA funding situation.

No biological systems (plant) radiochemistry FOAs were available during this funding period (2011-2013). The previous COV report indicated that a balance between the previous focus (nuclear medicine) and the new focus area (plant/microbe biology) regarding radiochemistry and imaging instrumentation was needed. The 2014 FOA was also nuclear medicine, which was a Congressional mandate, so this area was otherwise not funded in the university FOA area. The previous COV committee encouraged supporting both communities (nuclear medicine and plant/microbe imaging), and promoting their collaboration. During this COV funding cycle, only a nuclear medicine FOA was available and no clear involvement of the plant/microbe imaging community was enlisted. One reviewer from this review panel could be considered to represent the biology community, but the reviewer's specialty is in gene expression imaging and molecular biology. It was not appropriate to enlist scientists from the plant/microbe area to review the nuclear medicine proposals so this is not a negative in that regard. Perhaps the plant/microbe imaging groups at the national labs (SFAs) were promoted since nuclear medicine research is no longer supported at the national labs.

Overall, the deep cuts in the Radiochemistry and Imaging Instrumentation Program and the Low Dose Radiation Program are troubling. The BER obviously wants to zero out this area based on their funding actions; this is very unfortunate and short-sighted. There is a clear need for radiochemistry and radiation science training (as advised by many NAS and other workforce reports over the years since about 1980). With very limited funding available to this critical area (both PI support and training), this area will continue to be underfunded, resulting in an even more reduced workforce and PIs in the future.

The Radiochemistry/Radiation Science area within the BER is unique within the Federal System (not only within the DOE) and as such seems to be the easy one to slash since there is not as much internal pushback. This is very troubling, and is reminiscent of the treatment the Isotope Research Program received while it was under Nuclear Energy. Apart from some investment by NASA and the Armed Force Radiobiology Research Institute, other federal agencies (NIH, NSF) do not fund this area. In fact, there is a large divergence in the research areas funded by DOE and NIH. NIH must be disease specific and will have no interest in supporting the plant/microbe areas of significant interest to DOE and USDA. This will impact the number of scientists at universities in this area (universities do not hire faculty in areas not funded well) and thus in the workforce trained in these areas. The National Laboratories, the Nuclear Regulatory Commission, the Department of Homeland Security, the Department of Defense, among others need workforce trained in this area.

Recommendations. Retain appropriate level of funding to both universities and national labs as needed to maintain essential training and workforce development in key radiochemistry areas (nuclear medicine and plant/microbe imaging and radiochemistry). Funding of both universities and national laboratories is necessary to provide for interactions and collaborations, as well as offer graduate student and postdoctoral trainees access to facilities and instrumentation in both research environments.

• Biosystems Design/Systems Biology (FOAs 10-0368, 12-0640, 13-0866)

Development of the three FOAs during this reporting period [10-0368 (Genomic Science and Technology for Energy and the Environment); 12-0640 (Genomic Science: Biosystems Design to Enable Next Generation Biofuels); 13-0866 (Systems Biology Enabled Research on the Role of Microbial Communities in Carbon Cycling) appears to have been guided by the 2009 GTL Strategic Plan and the Biosystems Design workshop held in 2011. The FOAs were developed and reviewed by the Genomics Science team PMs, with all involved in pre-application and merit panel reviews. A focus on support of systems biology and biological system design to address energy solutions, subsurface processes and terrestrial carbon cycling is clear, and appropriate to DOE's mission. While the Genomics Science Team jointly developed the FOAs, it might be useful to articulate a vision to eventually connect/translate the systems biology aspects of the portfolio to the Plant Feedstocks Program portfolio in the future.

The focus of the 3 FOAs is distinct, and the program has evolved over time to address new scientific areas (e.g., wedding systems biology to the study of terrestrial carbon cycling) as well as attracting new investigators to DOE. The choice of format for some projects solicited under these FOAs (e.g., large, multi-disciplinary 5-year efforts versus single PI, 3-year efforts) was guided both by the PM and the complexity of research areas of interest defined by the FOA. The program appears to have a balance with respect to breadth, although it was hard to judge depth when large, collaborative projects are funded for a small number of organisms (e.g., FOA 12-640 awards covered a broad range of organisms (for "subtopic a" - bacteria, diatom, yeast, macroalga; for "sub-topic

b" - *Arabidopsis*, C4 grass *Setaria*, poplar, switchgrass, *Brachypodium*). Tradeoffs between breadth and depth may occur when soliciting larger, multidisciplinary, longer duration projects. The success rate for proposals submitted to these FOAs was highly variable, ranging from 9% to 29.4% (average: 14.8%).

FY10/FY12 FOAs were rather broad or contained disparate scientific topics. The rationale for having broad FOAs with disparate topics appears to be driven in part by the highly condensed schedule driven by Federal Budget timing as well as the high workload of PMs. For these two FOAs, some lower-ranked proposals were selected for funding and higher-ranking ones declined. A common theme of these declinations was that they didn't address organisms or processes of DOE relevance, or fell outside the scope of the FOA. Ideally, appropriate scope would have been identified before the submission of full proposals.

FOA 13-0866 was the second for the BER-BSSD addressing the topic of microbial carbon cycling, the first being offered in 2010. The preproposal screening worked well to solicit a range of highly qualified proposals that fit the programmatic goals. The COV noted, through conversation with the PM, that the majority of funded proposals had been funded by the previous FOA on the same topic. While these proposals are not considered renewals, there does appear to be an advantage for investigators with prior funding from this program. The review process was handled well with substantive reviews from a diverse panel of experts with eight of the 10 funded proposals ranking at the top. The time from proposal solicitation to funding decisions was quite rapid, considering the workload, for which the PM should be commended. Unlike the other FOAs in Biosystems Design/Systems Biology, this call offered supplemental funds (up to $300K per year) to develop systems biology and ‘omics data in collaboration with KBase. Eligibility for this supplement required a clear application and integration for KBase, a plan to establish partnership with KBase personnel, and a letter of support. It would have been helpful to have been provided with the summary for this FOA, showing fund/decline decisions as well as indicating which projects proposed to collaborate with KBase.

The COV felt that the inclusion of $300k targeted funds for collaborations with KBase for one FOA was not well thought out, especially as it was based only on a short description of the activity, integration of KBase with the project, and a support letter within the proposed work. As there were no progress reports for this FOA, it is unclear whether this supplement resulted in a positive synergy between the data generators and KBase.

V. Bioenergy Research Centers

The U.S. Department of Energy (DOE) established three Bioenergy Research Centers (BRCs) in September 2007 – the Bioenergy Science Center (BESC), Joint BioEnergy Institute (JBEI), and Great Lakes Bioenergy Research Center) - with a second 5-year phase beginning in 2012. Each center represents an integrative, multidisciplinary partnership with expertise spanning the physical, chemical, biological, and computational sciences, including genomics, microbial and plant biology, analytical chemistry, computational biology and bioinformatics, and engineering. The scientific rationale for these centers and for other fundamental genomic research critical to the biofuel industry was established at a DOE workshop involving members of the research community. The BRCs were structured to facilitate knowledge sharing among multiple disciplines so that breakthroughs in one area can be capitalized on and translated to other areas of

emphasis. In these integrated and collaborative environments, the BRCs pursue the necessary fundamental research to improve the processes needed for large-scale, cost-effective production of advanced biofuels from cellulosic biomass. Additionally, as each center approaches biofuel production challenges from different angles, the types of knowledge gained are diversified, new questions revealed, and new avenues of research pursued, ultimately accelerating the pathway to improving and scaling up biofuel production processes.

A team of BER/BSSD PMs is responsible for management of the BRCs, with one PM specifically assigned to BRC management. Communication between DOE and the BRC's is facilitated by monthly conference calls with the individual BRC directors and program staff. There are also quarterly conference calls with all three directors and open email communication. External annual reviews of the centers are conducted in the autumn and involve topical experts and program staff. Through the third to fifth years of the centers, reviews have been conducted both as on site visits and reverse site visits. Review committees have been unique to each center as well as one review that used a single committee for all reviews. Centers received written summaries of the individual reviewers as well as specific recommendations formulated by DOE staff. Centers must report back on what actions were taken in response to the recommendations. Other face-to-face meetings between program staff and the BRC directors are organized around the annual Genomic Science Program Meeting. The program renewal review was conducted in the fourth year of the centers' activities. The review involved external reviewers and refocusing of the centers' research activities.

Prior to the second 5-year phase a decision was made to carry out a comprehensive review of each of the BRCs rather than a competitive review. This decision was based on favorable evaluation of annual reports from each of the Centers as well as other mechanisms of oversight established by BER/BSSD to track the very substantial investment reflected in these Centers. These included, for instance, reverse site visits in year three. On the basis of the ongoing oversight of activities in the BRCs, a decision was made to request renewal proposals from each of the three teams. New applicants for BRCs were not invited, but each Center was informed that a 'thumbs up/thumbs down' decision would be made on each Center.

Decisions to renew were based on a combined 4th year progress and renewal review of the science and management of each Center conducted at a site visit during late 2012. The site visit teams consisted of highly regarded experts in the various fields represented in the BRC activities, with between 8 and 12 scientists on each site visit team. The COV judged these reviewers to include experts in relevant areas of science with a broad view of the field, capable of judging the potential for successful impact of the proposed research. Five-year progress review reports were prepared on the basis of a site visit including approximately 5 external scientific reviewers. The productivity of the Centers was judged to be appropriate to excellent for an investment of the level required for the BRCs.

Oversight of the BRCs appears to be appropriate for the level of investment in these Centers. The BRCs in general showed both strong oversight and strong site-level management producing excellent and well-organized proposals, reports and reviews. However, one troubling development was an issue raised by reviewers of one of the BRCs, that the PIs had mixed the research within their groups funded by the BRC and research funded by other sources to the extent that the PIs themselves were unsure which efforts were part of the BRC and which weren't. Not only does this possibly

compromise the ability of DOE to obtain and maintain credit for the (excellent) scientific progress, but it also suggested that much of a given BRC's activity is the type of basic research commonly conducted in a university setting and thus not substantially enabled or synergized by the funding of the BRC. This observation was clearly a matter of significant concern to the program staff and generated appropriate action.

Recommendation: Maintain appropriate review and oversight to insure that BRC research remains focused and consistent with the funded BRC research programs, and not overlapping or competing with other funded programs, including related SFA initiatives.

Recommendation: On a related point, the goals of the BRCs and 'biofuel' SFAs are not clearly linked, and it is sometimes unclear how the activities within the BSSD may relate to one another, and whether different national laboratories are brought together to develop a unified strategic plan. The COV recommends that a unified strategic plan be developed for the BRCs and biofuel SFAs.

VI. The Artificial Retina Project

In addition to, but outside of the scope of the BRC or SFAs, we would like to highlight the success of the Artificial Retina project that was completed in 2011. Although there was no review or process on this project that is relevant to the charge of the COV, we felt it appropriate to recognize the success of this project. Since termination of the project in 2011 a commercially available artificial retina received FDA approval for broad clinical use in 2013 and was ranked as the number one medical technology breakthrough for 2014. This seems to us to be an example of an important biomedical outcome that would not have occurred without the commitment and resources of the DOE.

VII. Workshops

Support for conferences and workshops (5 in 2011, 12 in 2012, and 9 in 2013) was provided through the open FOA in consultation between the requestor and individual PMs. Decisions for funding were made internally based on availability of funds and fit with programmatic goals. A large variety of conferences and workshops were supported with funds ranging from $5-40K. The COV felt that this was a good use of discretionary funds and supported a worthy range of meetings on topics relevant to the DOE.

Appendix A

Department of Energy
Office of Science
Washington, DC 20585

October 23, 2013

Dr. Gary Stacey
Associate Director, National Soybean Biotechnology Center
Department of Microbiology and Molecular Immunology
271E Christopher S. Bond Life Sciences Center
University of Missouri
Columbia, MO 65211

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 review the processes used by the Biological Systems Science Division (BSSD) within the Office of Biological and Environmental Research (BER) to manage BSSD research programs and its user facility, the Joint Genome Institute (JGI).

The COV should assess the operations of the BSSD's programs for fiscal years 2011, 2012, and 2013. 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 defined 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.

COV 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. The guidance for all COV reviews within the Office of Science can be found at http://science.energy.gov/sc-2/committees-of-visitors/ and attachments therein.

The COV should take place in the third quarter of FY2014 (Summer 2014) at the BER DOE Germantown location at 19901 Germantown Road, Germantown, Maryland 20874-1290. A discussion of the COV report by BERAC should be held no later than the Fall 2014 BERAC meeting. Following acceptance of the full BERAC membership, the COV report with findings and recommendations is to be presented to me, as the Acting Director, Office of Science.

If you have any questions regarding this charge, please contact Todd Anderson, 301-903-3213 or by email todd.anderson@science.doe.gov.

Sincerely,

Patricia Dehmer
Acting Director, Office of Science

cc. David Thomassen
Sharlene Weatherwax

Appendix B

2014 COV Reviewers

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Appendix C

Department of Energy
Office of Biological and Environmental Research
Biological Systems Science Division
2014 Committee of Visitors' Meeting Agenda
July 9-11

Wednesday, July 9

7:30 – 8:15 am	Breakfast at the Hotel (on your own)
8:15 - 8:45 am	Transit to DOE (in vehicles with DOE staff member in each car)
8:45 - 9:30 am	Badging and Security at DOE Front Desk Transit up to larger meeting room **E-301**
9:30 – 9:40 am	Welcome and Brief Overview of BER (Sharlene Weatherwax, BER Associate Director)
9:40 - 10:15 am	Overview of BSSD (Todd Anderson, Division Director)
10:15 – 10:30 am	*Break (**E-401**)*
10:30 - 10:45 am	Review of meeting logistics/rooms/organization (Dan Drell)
10:45 – 12:00 pm	COV Discussion/Review of Charge Letter/Breakout Groups/Agenda (Dave Stahl)
12:00 – 1:00 pm	*Lunch **(E-401)***
1:00 - 1:15 pm	Move to Breakout rooms Facilities group to room **J-108** Lab SFA and University FOA group stay in main room **E-301**
1:15 - 2:15 pm	Program Staff presentations and Q&A with Breakout groups
2:15 - 2:30 pm	Lab SFA and University FOA groups move to Breakout rooms BSSD staff on call Lab SFA room **G-207** University FOA room **E-301**
2:30 - 3:30 pm	Breakout groups begin review of materials (BSSD staff on stand-by)
3:30 - 3:45 pm	Break (Refreshments Provided in Room **E-401**)
3:45 - 5:00 pm	Breakout groups continue to review materials (BSSD staff on stand-by)
5:00 - 5:15 pm	All breakout groups move to main meeting room (**E-301)**
5:15 – 5:45 pm	Meeting with BSSD Staff (Questions/Requests for Further Information)
5:45 – 6:00 pm	BSSD Staff transport Reviewers to the Hotel
6:00 - 7:30 pm	Dinner on your own

Appendix C

Thursday, July 10

7:00-7:45 am	Breakfast on your own
7:45 am-8:15am	Reviewers Leave with DOE Staff from Hotel Lobby
8:15 - 10:00 pm	Breakout groups report to breakout rooms and continue review of materials (BSSD staff on stand-by)
10:00am – 10:15am	Break (Refreshments Provided in Room **E-401**)
10:15am – 12:00pm	Breakout Sessions continue review of materials (BSSD staff on stand-by)
12:00 - 1:00 pm	Lunch (Provided for COV in Room **E-401**)
1:00 - 3:00 pm stand-by)	Breakout Sessions continue review of materials (BSSD staff on
3:00 - 3:15 pm	Break (Refreshments Provided in Room **E-401**)
3:15 - 5:00 pm stand-by)	Breakout Sessions continue review of materials (BSSD staff on
5:00 - 5:30 pm	COV reconvenes in main meeting room (Questions/Requests for Further Information) Room **E-301**
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

Friday, July 11

7:00-7:45 am	Breakfast on your own
7:45-8:15 am	Reviewers Leave with DOE Staff from Hotel Lobby
8:15-11:00 am	Review/Executive Session/Writing Main meeting Room **E-301**
11:00 am-12:00 pm	Committee Report Preliminary Findings to BSSD Staff Main meeting Room **E-301**
12:00pm	Meeting Adjourn

Appendix D

05/2011

Biological Systems Science Division (BSSD), SC-23.2

Name	BSSD Lead	Phone Number	Room Number
Robt. T. (Todd) Anderson	Division Director	301-903-9817	J-111
Terry Jones	Admin Assistant – 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

Appendix D

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 (now Associate Director of BER)**	**301-903-6165**	**G-143**
Elizabeth White	Human Subjects Protection Ethical, Legal, and Societal Issues (ELSI)	301-903-7693	J-113
Kent Peters	Bioenergy Research Centers	301-903-5549	J-120

*No longer with BSSD

Appendix E

Dr. Dave Stahl (chair)

Group	Program Areas	Materials	Reviewers
1	***Facility Group*** *(JGI, Structural Biology)*	Annual reports Triennial reviews Operational issues (ITS, CSP review summaries, SB reviews) DOE guidance	Dr. Johnathan Zehr Dr. Karin Remington Dr. Hazel Holden Dr. Soichi Wakatsuki
2	***National Laboratory SFA Group*** *(GenSci, Radiochem, Low Dose)*	BRC Review materials Science plans Annual reports Triennial reviews Reviewer recruitment Review process DOE guidance	Dr. Matthew Hudson Dr. Lee Makowski Dr. Eric Bernhard Dr. Julie Sutcliffe Dr. Bill Inskeep Dr. Barbara Methe
3	***FOA Group*** *(GenSci, Feedstocks, Radiochem)*	Notices Pre-app info Proposal list Reviewer recruitment Instructions to reviewers Selection summaries Award/Declination letters Workshops One-off projects	Dr. Silvia Jurrisson Dr. Linda Chrisey Dr. Robin Buell Dr. Joe Noel Dr. Lisa Stein