

# The Committee of Visitors for the Review of the Biological Systems Science Division

**BERAC Meeting**  
**November 2-3, 2017**

# Charge Letter



- On October 5, 2016, Dr. Cherry Murray, Director of the Office of Science, charged the Biological and Environmental Research Advisory Committee (BERAC) with assembling a COV to assess the processes used to create and manage the research portfolio in BER-BSSD.
- The charge letter asked the COV to assess the following aspects of the operations of BSSD's programs for FY 2014–2016:
  - National Laboratories' proposals;
  - Academic institutions' grants;
  - The quality of the scientific portfolio, including its breadth, depth and national and international standing;
  - The BSSD's management and oversight of the JGI and Structural Biology User Facilities;
  - The efficacy and quality of the processes used by BSSD for:
    - Solicitation, review, recommendation and documentation of applications and proposal actions; and
    - Monitoring active awards, projects and programs; and
    - How the award process has affected the breadth and depth of the portfolio elements and the national and international standing of the portfolio.

# COV Process

- **A COV was established in spring 2017, consisting of 13 scientists from around the country, with representation from academia (9), National Laboratories (3), and other federal agencies (1). Five of the COV members currently receive DOE funding. One of the COV members served on the prior BSSD COV that met in July 2014.**
- **To maximize the effectiveness of the analysis, three subcommittees of the COV were formed—each assigned to do an in-depth review of broad and diverse Programs or Projects within the overall BSSD research portfolio.**
- **The COV met on 10–12 July, 2017, at the DOE headquarters in Germantown, Maryland.**
- **The COV reviewed five elements of the BSSD science portfolio that were active since the prior COV review:**
  - **Two User Facilities (JGI and Structural Biology Infrastructure program);**
  - **Three National Laboratory SFA Programs;**
  - **The four University FOAs;**
  - **Three BRCs; and**
  - **Workshops.**
- **The COV members were assisted and supported by the BSSD staff.**
- **The Draft for COV report was submitted to Dr. G. Stacey in October 2017.**

# General Comments

- **The COV commends the BSSD program for maintaining a balanced portfolio of three different types of funding.**
  - **Longer-term support provided for facilities;**
  - **Stable support provided through the SFA process;**
  - **Flexible support that is provided via the FOA process.**
- **Balance is an important issue for BER-BSSD going forward, especially given the current uncertain funding environment.**
- **Increase in Program Managers (PMs) within BSSD is commended.**
- **During the COV review, the BSSD PMs were generous with their time and information.**
- **Most material was successfully accessed electronically through the newly adopted PAMs system.**



# Summary of COV Findings

- Overall, the COV was impressed with the quality and management of the solicitation of proposals and the review process.
- Merit reviews were uniformly conducted with an adequate number of highly qualified reviewers and generally good documentation of process.
- Similarly to passed COV reviews, sparse documentation was found supporting the decision in a limited number of cases.



# General COV Recommendations

- **The BSSD has done a commendable job in maintaining the broad science portfolio.**
- **BSSD should promote research continuity of productive and effective research groups and stimulate the entry of new researchers into the funding programs.**
- **An emphasis on the development of the next generation of scientists should be an ongoing mission of the DOE and BSSD.**
- **Plans should be developed to support the timely upgrades of BSSD-funded synchrotron and neutron experimental stations.**
- **Evidence of project alignment with the BER long-term goals and the Grand Challenges should be given in proposals.**
- **The travel funding to support PMs in attending technical meetings should be increased.**



# General COV Recommendations

- **Planning for responses to funding reductions should be in place to facilitate the necessary transitions.**
- **A mechanism to evaluate the occasional meritorious research idea that is not included under active FOAs is recommended.**
- **The Internal Comments section in PAMS should record proposals that the PM views as high-risk/high-reward at the time of award. Results correlate with predictions?**
- **Complete lists of all publications should be made available to the COV prior to the review and to the public on at least an annual basis.**
- **The pre-proposal process should be sufficiently selective to provide a reasonable percent of success for full submissions.**



# Joint Genome Institute

- The JGI model of a user facility is working well and is an efficient way to engage the broader scientific community in the DOE-BER mission, while providing infrastructure and scientific support.
- The Community Science Program engages the broader scientific community in the DOE mission.
- The DNA Synthesis Program enables users to test hypotheses.
- The Emerging Technologies Opportunity Program (ETOP) taps into expertise outside the Institute.
- The Facilities Integrating Collaborations for User Science JGI-EMSL Collaborative Science Initiative (FICUS) program is a successful collaboration run jointly by JGI and EMSL, building on JGI's sequencing capabilities and EMSL's proteomics capabilities.



# COV Recommendations (JGI)

- **The partner institution relationships need to be reviewed more rigorously to ensure that JGI is getting the expected level of productivity from its partners.**
- **If the investment in the ETOP program is significantly increased, enhanced oversight will be needed to ensure that it brings new technologies to JGI and the community, and that appropriate partners are chosen for the projects.**
- **The COV recommends that the FICUS program be reviewed.**
- **The COV recommends undertaking new strategies to integrate and coordinate JGI and DOE's Systems Biology Knowledgebase (KBase) activities.**



# Structural Biology Infrastructure

- The Structural Biology Infrastructure facilities and programs supported by BSSD (~3.4% of the BSSD budget in FY16) include the following:
  - Advanced Photon Source (SBC, ANL);
  - National Synchrotron Light Source II (BNL);
  - Advanced Light Source (LBNL);
  - Stanford Synchrotron Radiation Lightsource (SLAC National Accelerator Laboratory),
  - High Flux Isotope Reactor/Spallation Neutron Source (ORNL).
- The national structural biology facilities have resulted in world-leading transformative science.
- The reduced budget is hindering the ability of this program to support the science of the U.S. biological community.
- User demand will continue to be high at synchrotron and neutron facilities and XFEL sources into the foreseeable future.



# COV Recommendations (SBI)

- The DOE-BER-BSSD Structural Biology Infrastructure program is run for the benefit of the entire nation as a part of Cooperative Stewardship: Managing the Nation's Multidisciplinary User Facilities for Research with Synchrotron Radiation, Neutrons, and High Magnetic Fields.
- The COV is concerned about the recent decreases in support and emphatically encourages the continued co-funding of these facilities with NIH and other agencies.
- There is a lack of substantial funding for capital equipment needed to remain competitive.
- For example, a projected 1-year “dark period” is currently assumed to occur around 2022/23 because of the lack of budgeting for upgrades at the Advanced Photon Source.
- DOE-BER should continue its partnerships with other agencies in supporting the Protein Data Bank.



# Laboratory Scientific Focus Area (SFA) Programs

- SFA funding supports interdisciplinary research, larger projects and longer duration than individual PI lab projects. Topics for BER objectives of clean energy and environment include:
  - Genomic Sciences: Foundational Science
  - Genomic Sciences: Biofuels
  - Radiobiology: Radiochemistry and Instrumentation
  - Bioimaging
- The SFA program teams, with a longer time frame of support, can undertake complex, multifactorial scientific questions or “Grand Challenges” that could not be productively handled by a smaller group.

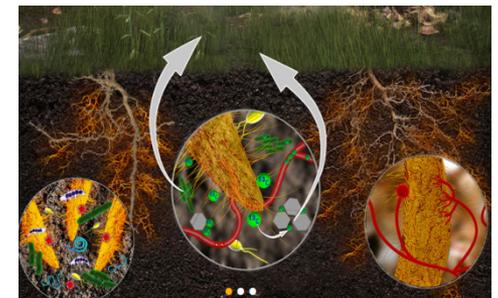
## Foundational SFAs (example)



## Bioimaging SFAs

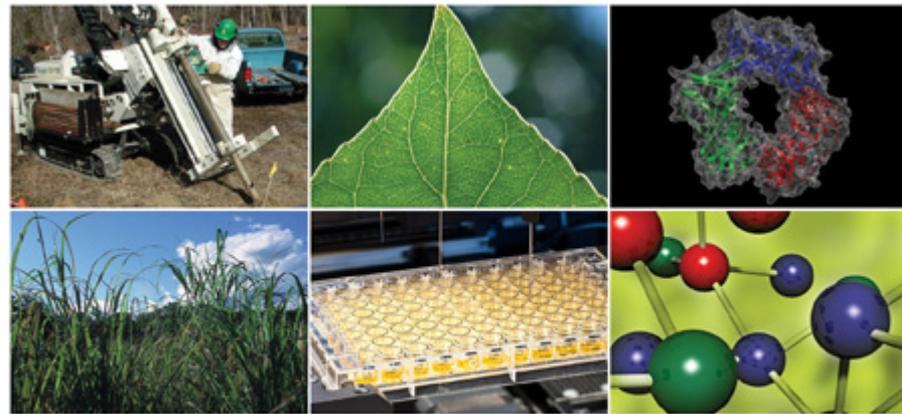


## Biofuels SFAs



# COV Recommendations (SFAs)

- The COV strongly valued the BSSD summaries provided with respect to the timelines of the SFAs and the decision processes.
- The “Grand Challenge” should be evident in each SFA plan.
- Numerical scores for proposal evaluations should be subjected to an appropriate statistical treatment before ranking.
- To perform an accelerated and consistent adjudication of proposals, maintain a standing pool of external reviewers willing to do reviews on short notice.



# COV Recommendations (SFAs)

- The Mesoscale to Molecules Bioimaging Program is primarily focused on technology development. Dissemination and licensing of the resulting technology should be introduced early in the support process.
- Careful consideration of SFA leadership should ensure that all the SFAs have suitable and inspired directors with sufficient time to devote to project management.

## Bioimaging SFAs



# Funding Opportunity Announcements (FOAs) to the University Community

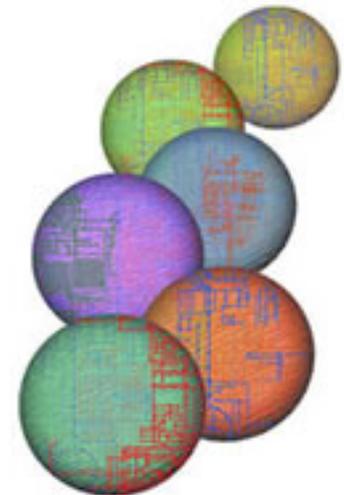
- The FOA calls for proposals fell into three categories for this review:
  - Standard Proposals (initiated by Genomic Science Program Managers);
  - Mesoscale to Molecules (M2M) Bioimaging Technology (Congressionally mandated program);
  - Radiochemistry, Imaging Instrumentation, and Nuclear Medicine (Congressionally mandated program).
- The BSSD FOAs have an essential leadership position in stimulating public-sector bioenergy research in the US, as well as being on the forefront of worldwide science.
- In summary, the COV felt that the funded proposals were of high quality and appropriate for the program.

DOE BER Grants Map FY 2016



# COV Recommendations (FOAs)

- **The PMs should use all possible strategies to gather input during the FOA development.**
  - **Annual DOE contractors meeting;**
  - **Hosting workshops;**
  - **Implement a public comment period on the FOA language;**
  - **Travel to scientific meetings, nationally and internationally (more support needed!).**

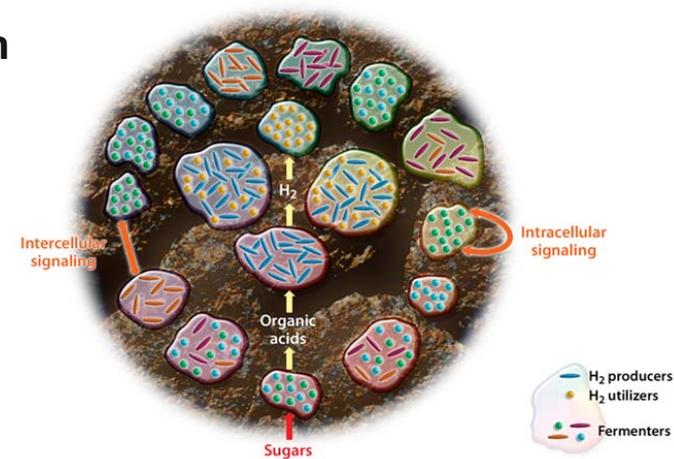


**Community of Cells**

# COV Recommendations (FOAs)

- The COV recommends dual attention to promoting research continuity of effective research groups and to stimulating entry of new researchers into the funding programs.
  - Implement an annual Open Call for pre-proposals in core research areas. A teleconference panel to review Open Call pre-proposals for technical merit is recommended to keep funding of full proposals at a reasonable percentage;
  - In all full proposals, allow extra page to describe the recent BER-funded research and a second to describe the qualifications of the team.

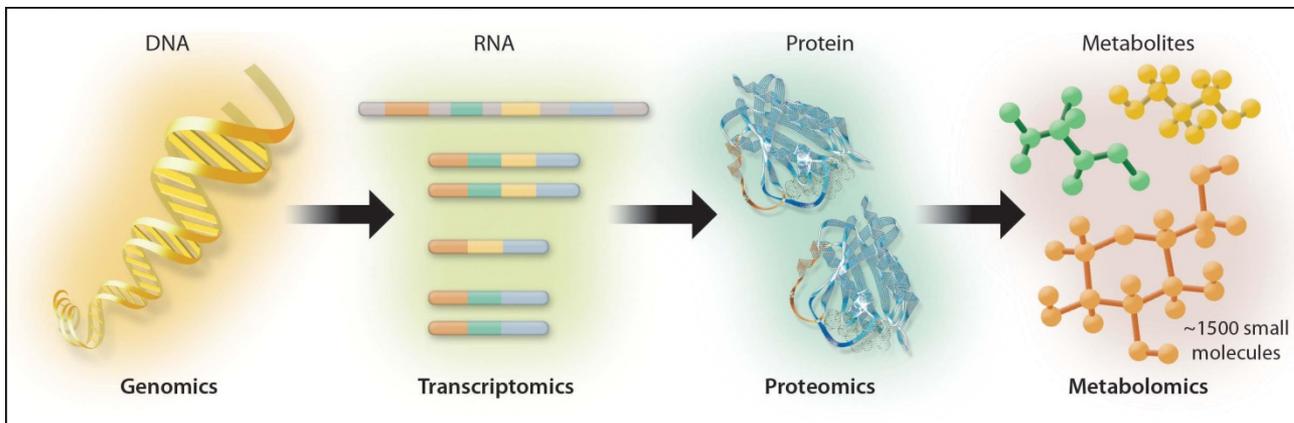
Microbial Biofilm



Adapted from a drawing by M. E. Davey and G. A. O'Toole. Source: Genome Management Information System, Oak Ridge National Laboratory

# COV Recommendations (FOAs)

- The COV recommends modifications of the scoring system to promote objectivity, fairness, and transparency:
  - Provide additional information to reviewers about the meaning of the numerical range of scoring;
  - Generate a rubric of key factors for reviewers to score;
  - Equalize the number of reviewer scores leading to the averaged ranked score;
  - Consider normalization of the composite scores for the proposal to the scoring range of each reviewer;
  - Provide an explanation (written by the PM) for aberrations from the ranking for funding of proposals.



US DOE. 2009. *New Frontiers in Characterizing Biological Systems: Report from the May 2009 Workshop*, DOE/SC-0121, US Department of Energy Office of Science

# COV Recommendations (FOAs)

- **The COV recommends further attention to dissemination and assessment of publications as follows:**
  - **All BER-funded publications must acknowledge the source of support;**
  - **All BER-funded publications and patents should be deposited in Office of Scientific and Technical Information (OSTI) 0-6 months after their acceptance for publication;**
  - **High-risk/high-reward should be noted and the project outcomes correlated to determine validity of assessment.**



The OSTI facility is located in Oak Ridge, Tennessee

# Systems Biology Knowledgebase (KBase)

- **KBase is an excellent program in principle, supporting the BER research programs and providing tools that could facilitate reproducibility of results.**
- **Kbase progress has been slower than anticipated, i.e., translating its many good ideas into working software.**
- **Many of the KBase milestones have not been achieved, and the reports are vague. The project is crippled by constantly changing priorities.**
- **The BER-BSSD management has spent extensive amounts of time and funds on the project.**
- **Continued communication has been necessary to ensure that KBase remains a mission-oriented project.**



DOE Systems Biology Knowledgebase

# COV Recommendations (KBase)

- **A serious modification of the KBase effort should be made to emphasize a subset of the analytical components where KBase can be the leader.**
- **KBase has made inroads in metabolic modeling that should be encouraged.**
- **KBase should be encouraged to publish its plans, results and software.**
- **KBase should be encouraged to participate in international competitions for software performance that might strengthen the brand name.**
- **The user base should be expanded beyond the BSSD and the current user base.**



DOE Systems Biology Knowledgebase

# COV Recommendations (KBase)

- **BSSD management should rigorously review the relationships among the consortium's institutions to ensure the level of collaboration and cooperation that is expected from this type of project.**
- **Researcher use should be motivated by the choice of the best resource not from the DOE's encouragement to use a particular resource.**
- **BSSD management should put into place key milestones for making a decision on whether to continue funding or not, or to re-compete the program.**
- **COV raised several questions including:**
  - **Where does KBase stand in the greater landscape of bioinformatics platforms?**
  - **Are the organization, vision and personnel of KBase still appropriate to support this program?**



DOE Systems Biology Knowledgebase

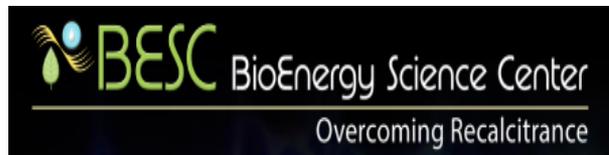
# Bioenergy Research Centers (BRCs)

- The previously funded BRCs showed high productivity with 89 patents, 175 licenses/options, 365 patent applications, 596 invention disclosures, and 2550 publications during review period.
- The BRCs are accomplishing the dual goal of generating knowledge and translating it to useful advances in the private sector.
- The annual reports of the BRCs were thorough. On-site reviewers were well-qualified scientists with relevant expertise.



# COV Recommendations (BRCs)

- **Any newly established BRC should have an annual site visit for the first five years of its operation.**
- **PMs should consider a specific review and reward system for meeting high-risk/high-reward objectives.**
- **Encourage BRCs to make available summary statements about major experimental thrusts not being pursued that may represent valuable knowledge for the broader scientific community.**



# COV Members

- **Zygmunt Derewenda**, University of Virginia School of Medicine
- **Bruce Dien**, United States Department of Agriculture, Bioenergy Research, Chemical Engineering
- **Adam Godzik**, Sanford Burnham Prebys, Bioinformatics and System Biology
- **Candace Haigler**, North Carolina State University, Department of Crop and Soil Sciences and Department of Plant and Microbial Biology
- **Britt Hedman**, SLAC National Accelerator Laboratory, Stanford Synchrotron Radiation Lightsource, Stanford University
- **Andrzej Joachimiak** (Chair), Argonne National Laboratory/University of Chicago
- **Ken Keegstra**, Michigan State University, MSU-DOE Plant Research Laboratory
- **Lukasz Kurgan**, University of Virginia Commonwealth, Department of Computer Science
- **Barbara Methe**, University of Pittsburgh, Department of Biomedical Informatics
- **Wladek Minor**, University of Virginia School of Medicine, Molecular Physiology and Biological Physics
- **Daniel Schachtman**, University of Nebraska-Lincoln, Department of Agronomy and Horticulture
- **Rhona Stuart**, Lawrence Livermore National Laboratory, Biochemical and Biophysical Systems Group
- **Judy Wall**, University of Missouri, Department of Biochemistry

**Thank you**