

# **Biological and Environmental Research Advisory Committee (BERAC) Meeting**

**October 27–28, 2016  
Rockville Hilton, Rockville, Maryland**

## **BERAC Members Present**

Dennis Baldocchi (via telephone)  
James Ehleringer  
James Hack  
Bruce Hungate  
Anthony Janetos  
Andrzej Joachimiak  
Cheryl Kuske (via telephone)  
L. Ruby Leung  
Jerry Melillo (Friday only, via telephone)  
David Randall  
James Randerson  
Karin Remington (Thursday only)  
G. Philip Robertson  
Karen Schlauch  
Daniel Segre  
Gary Stacey, Chair  
David Stahl  
Judy Wall  
John Weyant  
Huimin Zhao

## **DOE Staff Present**

Todd Anderson  
Joanne Corcoran  
Jared DeForest  
Patricia Dehmer  
Gary Geernaert  
Renu Joseph  
Amy Swain  
Robert Vallario  
Sharlene Weatherwax  
Tristram West

## **Guest Speaker**

Michael Kuperberg

## **Others**

Betty Mansfield, Recording Secretary  
About 70 others were in attendance during the course of the two-day meeting.  
About 30 people viewed the webcast.

## **Thursday, October 27, 2016 Morning Session**

BERAC Chair Gary Stacey called the meeting to order at 9:02 a.m. At his request, Committee members introduced themselves and provided updates on current research activities.

**[See presentations at <https://science.energy.gov/ber/berac/meetings>]**

### **Update from Patricia Dehmer, Office of Science Deputy Director for Science Programs**

[Presentation posted]

Sharlene Weatherwax introduced Patricia Dehmer, Deputy Director for Science Programs, Department of Energy (DOE) Office of Science (SC), who updated the Committee on SC. This was Dehmer's last presentation to BERAC as she is retiring after a 9-year stint in her current role as deputy, often serving as the Director in the absence of a senate-confirmed Office of Science director. Weatherwax said her own federal career began working with Dehmer, whose leadership will be missed.

Dehmer emphasized to the Committee the importance of working with the broader scientific community to develop grand challenge long-range plans for BER that drive strategic planning for facilities and research. The voices of all the scientific communities that SC serves help set a balanced prioritization for each office and, in turn, for SC. Typically, research priorities are informed by the Federal Advisory Committee Act (FACA) committees and sometimes from other independent groups such as the National Academy of Sciences (NAS). In the last 3 plus years, five of the six FACA committees in SC have delivered strategic plans. Weatherwax said BERAC will deliver a report in the fall of 2017. This community prioritization supports budget requests that go to OMB and Congress. Dehmer said the BERAC plan would be submitted as part of the next administration's strategy for investment in energy research within DOE.

Dehmer, a chemist, thanked the Committee for teaching her biology. BERAC presented Dehmer with a card of appreciation for her years of service and support to the Committee.

### **Update from Sharlene Weatherwax, Associate Director for BER**

[Presentation posted]

Dr. Sharlene Weatherwax introduced new BER staff, and acknowledged a subset of the many awards and recognitions received by those associated with the BER program. She discussed the execution of FY 2017 under a continuing resolution, and described major new programmatic opportunities in the president's request. A summary of FY 2016 programmatic activities was provided. FY 2016 selections for the Early Career Research Program were presented. Finally, Weatherwax presented the October 5, 2016, letter from SC director, Cherry Murray, charging BERAC to convene a Committee of Visitors (COV) review for BSSD.

### **Discussion**

In response to a question referencing whether the low (14%) success rate for proposals was driven by a large demand and whether BER is taking steps to increase the success rate of applicants, Weatherwax responded that the shift to full funding for new 3-year projects resulted in a reduction in the number of new awards. BER is considering this issue in future FOAs in both divisions (BSSD and CESD), through sharpening the research scope and using pre-applications, a measure endorsed by recent COVs.

A question was asked whether BER's plans for the microbiome interfaced with the BER mission innovation initiative. Weatherwax said that the initiatives are complementary and that most of the foundational microbiome work is counted within the mission innovation space.

## **Update from Climate and Environmental Sciences Division – Gary Geernaert**

[Presentation posted]

### **Discussion**

A question was posed asked about potential integration of BSSD and CESD priorities. What might be the approach? Geernaert said there is a potential area between BSSD and CESD in environmental genomics, microbial community research, and carbon cycle understanding. Bioenergy is a priority for SC. CESD's modeling in agriculture within other climate modeling investments has a direct contribution to aid in understanding future bioenergy potential.

A break was declared at 10:49 a.m. The meeting was called back into session at 11:05 a.m.

## **U.S. Global Change Research Program: Overview of Multiagency Efforts — Michael Kuperberg**

[Presentation posted]

### **Discussion**

A question was asked as to the best way to track activities within USGCRP. Kuperberg said USGCRP has a communications team, and opportunities for engagement with USGCRP are on the website ([www.globalchange.gov/](http://www.globalchange.gov/)). Besides major activities, there currently are calls, for example, for authors to provide input to the Intergovernmental Panel on Climate Change (IPCC) sixth assessment report.

A member inquired about whether there are State Department representatives on USGCRP, and have there been any requests for scenarios with which BER scientists could help to meet commitments from the Conference of the Parties (COP) 21 (also known as the Paris Climate Conference) or other such commitments. He also asked to what extent those commitments are being made. Kuperberg replied that the State Department is one of the 13 USGCRP member agencies, with the lead U.S. negotiator for climate being the State Department representative.

Additional discussion from BERAC commenced on interagency efforts around methane cycling, challenges in organizing modeling efforts among agencies, and research on climate resilience and adaptation.

The meeting adjourned for lunch at 11:57 a.m.

## **Thursday, October 27, 2016 Afternoon Session**

The meeting was called back into session at 1:15 p.m.

### **Update from the Biological Systems Science Division – Todd Anderson**

[Presentation posted]

#### **Discussion**

The discussion included coordination between BER and NIH on complimentary research efforts, Zip-lignin capabilities, connections between lignin and climate change, metrics of success for KBase, and what steps BER is taking to promote the success of KBase.

### **Committee of Visitors Assessment of the Climate and Environmental Sciences Division**

[Presentation posted]

#### **Discussion**

Chair Gary Stacey thanked the COV for their in-depth analysis of CESD programs and facilities. Conclusions of the COV were discussed and included desire for a balanced user base for EMSL, high vs low resolution modeling within the CESD ESM program, and clarification of future funding levels for the SBR program.

Stacey asked BERAC members to vote on acceptance of the COV report. The vote was unanimous in favor of the COV report.

### **DOE Exascale Requirements Review for BER Briefing — James Hack**

[Presentation posted]

#### **Discussion**

Discussion focused on the ASCR-BER requirements report, due in 2017, and whether parts of this could be leveraged for use in the upcoming BERAC Grand Challenges report. There was agreement on leveraging the report, but also that there were notable differences between the report charges.

### **Terrestrial-Aquatic Interfaces Workshop Briefing — Jared DeForest**

[Presentation posted]

#### **Discussion**

There was agreement with the presentation that modeling peat and high latitude dynamics in ACME and TES NGEE is challenging, and that this is an important area of research to understand globally. There was additional discussion on the coordination of this effort with other agencies, including NASA, USDA, NOAA, and USGS.

### **Technologies for Characterizing Molecular and Cellular Systems Relevant to Bioenergy Workshop Briefing — Amy Swain**

[Presentation posted]

A break was declared at 3:17 p.m. The meeting was called back into session at 3:30 p.m.

## **2016 International Land Model Benchmarking Workshop Briefing — Renu Joseph**

[Presentation posted]

### **Discussion**

Discussion on grant money and funding to validate model results using field data and to archive data for use by the greater science community. There was interest noted in using BER supersites, AmeriFlux, and FLUXNET, to evaluate model inputs and results.

## **Integrated Assessment and Impact, Adaptation, and Vulnerability Modeling Briefing — Robert Vallario**

[Presentation posted]

### **Discussion**

It was questioned whether this type of modeling looks at the difference in cost between mitigating climate change and moving away from burning fossil fuels. Vallario clarified that such work typically falls under what is referred to as social cost of carbon, and this is being addressed by those who work on policy, not by DOE Science; he referred to the IPCC Fifth Assessment Report by Working Group 3 for more information on this topic. Additional discussion and clarification was communicated on the difference between IA modeling and IAV, along with how data is handled in these models and how that may translate to data handling in genomic network infrastructure and vice versa. This may be an area to pursue further.

## **Grand Challenges Long Term Vision Workshop Subcommittee Briefing – Gary Stacey**

Stacey was asked to present a brief on the work of the Grand Challenges Subcommittee.

Over the summer, the Subcommittee worked with members of the research community to develop three white papers, which Stacey has shared with the Committee. Considering the white papers and today's discussion, BERAC members expressed the need for a workshop. Weatherwax and West have set a workshop date for March 6–8, 2017, as well as a location. A committee is needed to invite participants.

A discussion followed on the workshop's focus and objectives. One option was to start with the premise of the previous workshop report, focusing on gaps and new ideas and technologies that have come forward since 2010. Another was to concentrate on emerging new areas, also filling gaps. Others suggested doing the first two but also being open to additional ideas, such as redoing the full effort put forth last time, which perhaps is needed to put the objectives in context.

There was general consensus that much has changed and, as such, future directions will change. A new report using the framework of the old report would be advisable. Plenaries should focus on the large base and cross-cutting issues to feed discussion on respective parts of the report.

Stacey asked participants to name other gaps and new emerging areas that need study. Suggestions, with additional BERAC comments in parentheses, included:

1. Exascale computing
2. Nanotechnology
3. Gene editing
4. ACME modeling effort
5. Bioenergy (Indications that this area needs a lot of elaboration.)
6. Tropical and arctic SFAs
7. Microbiomes and their interactions (A fair amount of improvement has taken place.)
8. Trend detection of deposition in response to land use change (Needs better attribution.)
9. Predicting protein function (Unsolved; and a larger problem now is that there are more genes of unknown function.)

10. Multiscale modeling and how to do it.
11. Integrated impacts and feedbacks to the climate system (Without integration at the right level, priorities will be hard to set.)
12. Bioreporters acting as sensors to indicate environmental conditions such as levels of CO<sub>2</sub>, moisture, or volatile chemicals to generate near-real time data for models (Indications that there is enough known now that they could be used.)
13. Diversity of microbial life and microbial dark matter (How deep does research need to go to understand this dark matter? Is predictive understanding needed? In a way, the black box is getting darker.)
14. Uncertainty characterization (Priorities cannot be set without understanding uncertainties.)
15. Energy sustainability (Deserves attention, as well as addressing some of the consequences such as biomass capture and sequestration that were not on the radar 6 years ago.)
16. Replacing the Haber-Bosch (HB) process to produce fertilizer (About 2% of global energy is used in the HB process. More fundamental research in biology is needed, for example, research using biosystems coupled to nanosurfaces for nitrogen fixation.)
17. Physics of microbial communities. (Synthetic colonies to engineer communities and controlling communities that are different from synthetic organisms themselves.)

Additional areas, such as nanotechnology, computational needs, and communication of the final product were discussed.

Weatherwax offered that BER would provide support for logistics; Tristram West will be the designated federal official beginning with the next BERAC.

The floor was opened for public comment.

The meeting was adjourned for the day at 5:45 p.m.

## **Friday, October 28, 2016 Morning Session**

The meeting was called to order at 9:00 a.m.

### **BERAC's Low Dose Radiation Subcommittee Briefing — Judy Wall**

[Presentation posted]

#### **Discussion**

Discussion occurred on how there are many causes of cancer and it is difficult to separate background noise and causes. Very sensitive analyses would be needed to detect cause. It may be possible that additional research could change the low dose response curve down and get more predictive power at the low end. However, general consensus was that an additional small program, or even large program, would not change the existing conclusions. There was additional discussion on funding levels among agencies that worked in this space, and where this type of research belonged. Stacey commended the Subcommittee for its report and asked whether BERAC should accept and forward the report with a cover letter stating that conclusive results are not obtainable, especially with a small program, and that it is not a productive line for BER to pursue. The letter could suggest that a better option would be to approach those agencies tasked with understanding medical effects to request some insight into this problem. The Committee voted affirmatively to support the low dose radiation report and send the letter. Stacey will draft the letter and send it to BERAC members for comments.

### **The Microbial Ecology of Soil Carbon Across Scales – Bruce Hungate**

[Presentation posted]

A break was declared at 10:25 a.m. The meeting was called back into session at 10:40 a.m.

### **Discussions on the next BERAC Grand Challenges Long Term Vision report**

Stacey asked BERAC members to provide ideas for key topic areas, plenary speakers, and participants.

Short plenary talks on new ideas or cross-cutting topics can inform and stimulate thinking. Stacey asked BERAC members to send him names of potential speakers. The format and topics from the 2010 grand challenges report were discussed.

Topical ideas falling under biological systems included the application of nanotechnology to biology; single-cell analysis and modeling; community dynamics; microbiomes; linking genome, annotation, and physiology; the need for new mathematical theories for living systems, including microbial communities and microbial ecology; models for whole cells, connected to synthetic organisms; future applications of genome editing; and adaptive evolution processes in microbial systems.

Topical ideas falling under climate and environment included decision making and risk analysis frameworks, climate feedbacks such as permafrost thawing as tipping points, strategies for understanding the intersection between energy-water-land use, and integration from molecular to global scales.

Cross-cutting ideas included integrating across systems such as permafrost, microbial communities, carbon cycle, and climate; studying natural processes and modeling in the continuum from terrestrial to aquatic and from soil to plant to atmosphere and also adding urban environments; having a plenary speaker to discuss data mining, data storage, algorithm management, and cloud computing; and understanding microbes in the Earth system (atmosphere and ocean) to pave the way for more comprehensive, whole-system thinking. The Subcommittee will have a follow-up call within a week to refine ideas.

Stacey asked for public comment. No additional comments.

The meeting adjourned at 11:32 a.m.

Respectfully submitted,  
Betty Mansfield  
Recording Secretary  
February 10, 2017