

**Biological and Environmental Research Advisory Committee
(BERAC) Meeting Minutes
April 16, 2020
Remote Access Meeting**

BERAC Members Present

Bruce Hungate, Chair	Gerald Meehl
Sarah Assman	Jerry Melillo
Julie Biteen	Gloria Muday
Amy Bruner	Himadri Pakrasi
Robert Fischetti	Kristala Prather
Ann Fridlind	James Randerson
Katherine Calvin	Patrick Reed
Robert Fischetti	Jeremy Schmutz
Kerstin Kleese van Dam	Phil Robertson
Cheryl Kuske	Daniel Segrè
Maureen McCann	Matt Shupe

Dave Stahl
John Weyant
Huimin Zhao

Guest Speakers
Harriet Kung

Designated Federal Officer
Tristram West

Others

T. Reneau Conner, Science Writer

Approximately 120 others were in attendance during the course of the meeting.

All presentations are posted to the BERAC internet site: <https://science.osti.gov/ber/berac/Meetings>

**Thursday April 16, 2020
Morning Session**

BERAC Chair Bruce **Hungate** called the meeting to order at 11:00 a.m. Eastern Time (ET) and conducted a roll call for BERAC members.

News from Office of Science – Harriet Kung, Deputy Director for Science Programs
[Presentation posted]

Discussion

Kung was asked about budgetary responses to COVID-19 opportunities. **Kung** said in the Coronavirus Aid, Relief, and Economic Security (CARES) Act (S.3548 - CARES Act, 116th Congress), the Office of Science (SC) was allotted \$99.5M for S&T (Science & Technology) response activities for SC and NNSA (National Nuclear Science Agency). SC is in the process of vetting proposals related to additional needs. Dr. Fall issued a Dear Colleague Letter that includes a request for suggestions for potential opportunities; SC is also evaluating those.

Responding to an inquiry about the Office of Workforce Development for Teachers and Students (WDTS), **Kung** explained that WDTS already exists but is being transitioned into the Deputy Director for Science Programs office. She expects that there will be more opportunities for WDTS to interact with the SC programs and offices and Kung noted her interest in exploring

this more as the SC-3 office further develops.

A BERAC member expressed thanks for keeping facilities open and stated that the light sources have displayed an unprecedented amount of cooperation between all of the facilities, including the neutron and cryo-EM facilities. A portal for researchers was created to quickly identify the capabilities that were available and running at facilities. As an example the Advanced Photon Source (APS) has had 24 groups express interest in conducting research on COVID-19. **Kung** stated that the structural characterization work and high performance computing (HPC) at the APS have been repeatedly held up as the two shining examples of how DOE is responding to COVID-19. Kung thanked BERAC members and their colleagues for making DOE proud of the accomplishments to date.

Kung was asked about the budget and appropriation differences experienced over the past few years. Specifically, because of the greater financial constraints across country whether the budget numbers might level out and if so, what impact that will have on future BER work. **Kung** said it is hard to predict the future trend. In recent years SC has benefitted from Congress reaching a budget deal that provided some certainty in the overall level of funding. The only golden rule is to continue to perform well, that is the most important thing. BER is the most extreme case of the low budget request versus the much larger appropriation; this community should be proud.

Kung was asked to talk about the next-generation biology vision. **Kung** deferred to Weatherwax, but stated that BES also has a relatively modest role in the next-generation biology program. Because of her interactions with the National Virtual Biotechnology Laboratory (NVBL) COVID-19 group, Kung imagined this type of initiative and activity will be vitally important for the DOE, the overall science mission, and the nation as a whole.

News from Office of Biological and Environmental Research (BER) – Sharlene Weatherwax, Associate Director
[Presentation posted]

Discussion

Weatherwax indicated that BER is hoping for an appropriation for the Next-Generation Biology Initiative, but BER has also generated ideas for ways the three program offices, Advanced Scientific Computing Research (ASCR), Basic Energy Sciences (BES), Biological and Environmental Research (BER), will come together. She added that biology has historically seemed like it was a discipline unto itself. Next-generation biology is a path forward for the domain with many new ideas coming out of synthetic biology and biodesign. This opportunity, to link hard and soft materials together using computational prowess, is very exciting for BER.

Weatherwax shared that Program Manager Joseph Graber's current responsibility, related to COVID-19 research, is as the liaison point with the NVBL Working Group. BER anticipates special, detailed reporting requirements for the Office of Management and Budget with regards to the supplemental appropriations. Using his program manager experience and team lead experience, Graber will generate the necessary materials to effectively liaise with the lab community and senior management. While the reporting lines for the large variety of reports are still being defined, Weatherwax has seen several of the reports. SC's goal is to capture what the labs are doing in a meaningful way without being overly burdensome.

A BERAC member asked if an opportunity exists to redirect the COVID-19 S&T funding for other purposes. **Weatherwax** explained that the \$99.5M is for S&T and specific deliverables

are laid out by the appropriators, focused mainly on the use of the facilities. Congress does not expect SC to redirect all efforts to focus on COVID-19 even though it is currently an important societal problem. BER is privileged to be able to spend the supplemental funds Congress has provided; BER has unique programmatic expertise to help with this research.

With respect to SC's Artificial Intelligence (AI) Initiative and BER priorities **Weatherwax** noted that Graber serves in a liaison role across DOE and with other federal agencies for the DOE Under Secretary for Science's new AI office. BER's specific contribution to AI in the domain is through the Energy & Environmental Systems Sciences Division (EESSD) program. Additionally, Kleese van Dam is working on a report for ASCAC (Advanced Scientific Computing Advisory Committee) to identify scientific opportunities to expand AI efforts and benefit BER by leveraging the ASCR facilities and HPC.

News from Energy & Environmental Systems Sciences Division (EESSD) – Gary Geernaert, EESSD Director
[Presentation posted]

Discussion

Geernaert, who represents DOE on the NSTC FTAC (National Science and Technology Council/ Fast Track Action Committee), provided EESSD's perspective on the committee. The FTAC is an Office of Science and Technology Policy agenda to make major progress in future prediction methods. FTAC identified a need to step back and look at predictability constraints on modeling procedures – evaluating at the theoretical constraints and determining if there are ways to push those constraints by developing parameterizations, using pre-exascale computing, machine learning, or other kinds of approaches. DOE's tactic is that predictability has the potential to be extended, not just in novel modeling techniques, but in pre-exascale and exascale computing, employing machine learning, and having hybrid modeling approaches based on traditional techniques and machine learning. Additionally, DOE will work broadly with the community, including NOAA (National Oceanic and Atmospheric Administration), NASA (National Aeronautic National Aeronautics and Space Administration), NSF (National Science Foundation), etc., to ensure significant progress can be made. A BERAC member noted that some of the assumptions in the short-wave cloud feedback parameterization strategy are not supported at the process level.

Concerning the faster-than-anticipated travel of the Polarstern, polar research ship, being closer to the projected August position, Geernaert was asked if repositioning was being considered. **Geernaert** speculated that the pace of the Polarstern may be attributed to the setup and the anomalous arctic currents this year. Because the researchers have transected the ice pack so quickly, they have collected more data than anticipated. **Shupe** said that a high arctic oscillation index enabled the Polarstern to maintain a faster pace. Although ahead of schedule, discussions about the speed and repositioning are occurring now.

The tragedy of COVID-19 is also an earth system experiment due to the changing pollution levels, the diffuse light across AmeriFlux, and the changes in ways to interact with ecosystems. Geernaert was asked if EESSD was taking advantage of the earth system perturbation. **Geernaert** has participated in the weekly calls on the reduced greenhouse gasses and reduced air pollution as a result of the COVID-19 pandemic. However, EESSD has not had discussions on taking advantage of this scientifically. NASA, NOAA, DOE, and NSF scientists

behind the scenes are observing what is going on; all the agencies, as a collective, need to figure out how to take advantage of the anomaly.

News from Biological Systems Science Division (BSSD) – Todd Anderson, BSSD Director
[Presentation posted]

Discussion

Anderson explained that while the COVID-19 legislation is separate from the BSSD budget, there are capabilities being worked on within the lab programs – an epidemiology project and lab testing and instrumentation. The epidemiology project is a four-lab collaboration that is using data from virus propagation and coupling that with supply chain models on different economic outcomes. The labs are also investigating the production of new types of instrumentation or adaptation of existing instrumentation to address virus-type situations. BSSD is also looking at other reagents and higher throughput methods that could be used for testing now and in the future. Both the epidemiology and lab testing and instrumentation efforts began within the last week (mid-April). Those efforts were originally supported by the BSSD budget, but have been taken over by the COVID specific funds.

A BERAC member asked about developing combinatoric knock-outs and over-expressers for yeast for plant genomes. **Anderson** said the four Bioenergy Research Centers (BRCs) are looking at transformation techniques that could be incorporated into the portfolio. For example, in the Center for Advanced Bioenergy and Bioproducts Innovation (CABBI), the plant-as-factories concept is involved in engineering plants that yield a range of products. The Great Lakes Bioenergy Research Center (GLBRC) is working to modify plants for bioenergy purposes. While the momentum is currently in the BRCs, BSSD has several funded projects in plant genomics.

With respect to COVID-19, Anderson was asked about the impact on the science – in terms of new proposals and existing experiments. **Anderson** explained that BER has been urged to work with researchers and be understanding to the current situation. There will be a lag and SC will be very sympathetic going forward. Timelines will shift and if researchers need no cost extensions BER will be receptive. A BERAC member expanded on the question and inquired about the availability of data at the facilities and how the researchers' ability to move forward on grants will be impacted. **Weatherwax** said those discussions are occurring at a high level in DOE. There is a need to maintain staff to enable an immediate start-up when operations resume. In addition, there have been discussions concerning funded extensions and the length of time for these. SC recognizes that a disruption will take time to reconstitute; a lot of the facilities cannot restart easily. SC is trying to calculate actual costs including all these types of issues and considerations.

The meeting was suspended for a break at 1:15 p.m. ET.

Thursday April 16, 2020
Afternoon Session

The meeting reconvened at 1:30 p.m. ET.

Safeguarding the Bioeconomy – Maureen McCann, Purdue University
[Presentation posted]

Discussion

McCann was asked to comment on panel discussions about biological services in nature (ecosystem services or valuation of nature) and how this is part of a bioeconomy. **McCann** said the biological services are intangible benefits. The economists consider these important to factor into the calculation, however, putting a value on those is extremely difficult. While it is undeniable that those ecosystem services should be calculated in as economic benefit, it is not clear how to do that, or whether there are mechanisms to do that.

One BERAC member asked if the group considered the environmental safeguards of the bioeconomy from the standpoint of protecting and advancing the bioeconomy. Failure to consider the environmental consequences and tradeoffs could hobble some of the technologies being developed and employed. **McCann** said this was considered in the larger report. The environmental safeguards that are embedded in the bioeconomy have significant value. One might imagine that growing a bioenergy crop that does not require as much nitrogen input could have down-stream benefits for runoff into the Gulf. This would eliminate, or slow, the algal blooms and so forth. Calculating the worth of that is an important aspect of valuing the bioeconomy. McCann was unsure if there is a clear path forward for how to value those services and integrate them into the calculation on the bioeconomy's value.

McCann was asked to address the geography and hidden costs of the bioeconomy in the developing world. **McCann** explained the charge was to look through lens of the U.S. bioeconomy. She acknowledged that that was almost impossible to do without taking a global perspective because trade and climate change are global. A limitation of the study was the confinement to the U.S. bioeconomy. A global evaluation needs the all-of-government approach to conduct horizon scanning. One example is the case study of synthetic biology. There are hubs of activity around the east and west coast. Lots of startup companies are in those localized innovation ecosystems. The committee's conclusion was because resources are distributed nationally, economic activity is not confined to those areas, and in fact can broadly benefit rural and urban economies in the U.S. Looking globally both the United Kingdom and China have a growing number of start-up companies in synthetic biology. The committee viewed the bioeconomy as geographically distributed.

In the process of defining the bioeconomy there is an inherent risk of a myopic definition and self-reinforcing boundaries that do not exist in terms of how it connects to the critical supply chain and natural and physical resources. Risk and resilience within a bioeconomy is not in the typical lexicon of economics. But risk/resilience could be a driving force when there is a lack of sufficient redundancy or reliability in a system. **McCann** responded that the group's definition of the bioeconomy was required to focus on economic activity was very broad. Many other benefits were discussed, but the committee needed to find ways of valuing those benefits to fit into an economic framework. Activity that is enabled by fundamental discoveries in life sciences, and their interconnections with engineering, data science, computation, and biotechnology is a key

element of the definition. From that perspective it is a definition that puts the focus on the front-end, on the R&D effort.

BERAC Business [Vote on EESSD (formerly CESD) COV report; Other] – Bruce Hungate, BERAC Chair

Randerson reviewed a brief list of the main topics in the COV report: program management, community engagement, for computation, lab/ university portfolio balance, science focus areas, and diversity and inclusive excellence. Top findings highlighted were the impressiveness of the CESD science portfolio management and its high quality outcomes over the past 3 years, establishment of CESD as a leader in climate and environmental science in the U.S., the level of professionalism and dedication of the program managers, and the outstanding CESD leadership.

BERAC members shared comments and questions about the report. One BERAC member pointed out that the labs sometimes get more priority than the universities. Additionally, it seems that in certain areas integrative work between social sciences, natural sciences, physical sciences, and decision sciences is becoming more prominent. **Randerson** explained that the COV indicated it is important for BER to be open and transparent with respect to trends, but more data is needed to track the evolution of BER. The COV noted there is a critical pipeline as many labs are experiencing retirements. **Donner** added that there was quite a bit of discussion on the lab-university issue but not from a portfolio balance perspective; it was more general. There is a strong recommendation to obtain information on funding trends across lab and university programs over the past 10 years to create a basis for discussion. The impression that the trend has drifted away from the academic side exists, but there was no data.

A question was asked about the driving force of the funding divide between labs and universities. Support was expressed that training the next generation of scientists is critical. **Donner** responded that there was discussion on the optimal balance between the labs and universities speculating that the distribution may be changing because of specialized capabilities, but the data was not available to enable the committee to determine the cause. He speculated that some big scope problems might be hard to do in a traditional academic setting and are instead addressed through the labs. The COV report calls for DOE and BER to improve the incorporation of the academic community into lab-based Science Focus Areas (SFA). If the labs indeed have unique resources to address certain problems, then it becomes extremely important to entrain the academic communities into joint academic/lab activities. **Randerson** added that the impression of the COV members was the SFAs enabled a lot of CESD budget growth, for example the success of the E3SM project. Mechanisms for engaging the broader university community are not always apparent, which may be one of the reasons for the change in the balance of the portfolio.

One BERAC member inquired about proposal reviews and the need for better communication with applicants. **Randerson** said extensive documentation exists on the review process, panel composition, information collection, review decision-making, and information transmission to proposers. BER's commitment to a fair and open review process was impressive. The minor comment in the report simply noted that a final step needs to happen faster – to communicate back to the principal investigators. **Donner** added that there was a high degree of confidence in the nature of the review process, but the communication to proposers needs to be enhanced. The process itself was considered in good shape.

Stating that things pursued by ASCR are not necessarily the same as those required for climate simulation, Randerson was asked how the COV proposed to overcome the mismatch. **Randerson** said the perspective of some of the COV members was that ASCR is committed to cutting edge machine learning and AI applications. The configuration of hardware for machine learning was considered dissimilar to that needed for large, serial climate simulations. There is a lot of pressure on computational resources in EESSD. Whether BER and EESSD needs to build greater capacity for climate is something that the COV report highlights.

One BERAC member added that over the last decade a severe shift has occurred in the computing industry. HPC and computer architectures were historically driven by the research community, now they are driven by consumers and big business. Researchers have lost the ability to influence where the HPC systems are going. Building a custom system for specific requirements is very expensive. ASCR wants to build systems that work well for their constituents, but the cost is too high.

Another BERAC member noted that the COV recognized that BER deserves to be commended for their remarkable success in partnering with ASCR. However, quite legitimately there are some mission differences, such as the powerful computing that is important to the Environmental Molecular Sciences Laboratory (EMSL). Computing is regarded as an important part of EMSL; it is there, it is maintained, it is essential, and it is available. Without that same kind of reliability for things like E3SM, the effort will falter.

Randerson was asked about the recurring recommendation to hire additional program managers and staff. **Randerson** said it is encouraging to see BER has hired new permanent federal staff members that address this recommendation. The COV suggested that taking advantage of new opportunities and integrating across programs was a way to help increase the number of program managers.

Hungate moved to a vote on BER receiving the COV report. There was unanimous approval to accept the COV report.

At **Hungate's** request, BERAC members shared updates and information about their science and activities. **Hungate** closed stating this meeting worked quite well and that he would be rethinking travel.

Public Comment

None.

Hungate adjourned the meeting at 3:20 p.m. ET.

Respectfully submitted,
T. Reneau Conner, PhD, PMP, AHIP, ORISE
April 30, 2020