

**Biological and Environmental Research Advisory Committee
(BERAC) Meeting Minutes
October 24-25, 2019
Hilton Canopy
940 Rose Avenue Bethesda, MD, 20852**

BERAC Members

Present

Bruce Hungate, Chair
Sarah Assman
Julie Biteen
Leo Donner
Robert Fischetti
Ann Fridlind
James Hack
Kerstin Kleese van Dam
L. Ruby Leung

Maureen McCann
Gerald Meehl
Gloria Muday
Himadri Pakrasi
Krista Jones Prather
James Randerson
Patrick Reed
Jeremy Schmutz
Daniel Segrè
John P. Weyant

Guest Speakers

Douglas Mans
Trent Northen
Jennifer Pett-Ridge

**Designated Federal
Officer**

Tristram West

Others

Maureen Leavitt, Science Writer

Approximately 60 others were in attendance during the course of the two-day meeting.

**Thursday October 24, 2019
Morning Session**

All presentations are posted to the BERAC internet site:

<https://science.osti.gov/ber/berac/Meetings>

BERAC Chair, Bruce **Hungate**, called the meeting to order at 8:33 a.m. Eastern Time (ET). At his request, Committee members introduced themselves and provided updates on current research activities.

The meeting was suspended for a break at 9:30 a.m. and reconvened at 9:40 a.m.

News from the Office of Science –Chris Fall, Director, Office of Science (SC)

Fall provided a summary of the variety of work assignments he has experienced in academia and federal service that informs his perspective of the importance of rigorous science and professional connections within and outside this country. After serving in his current position for 5 months, he appreciates SC plans are founded in good science with discipline to achieve these plans on schedule and within budget and he has no plans to change SC priorities. He emphasized the need for infrastructure updates at the laboratories and proposed a coordinated effort with the laboratories to develop renewal plans. He ended his presentation with the idea that DOE owes it to the country to explain why their work is so exciting for its citizens. He

believes improving communication to everyday people will lead to increased motivation for children to pursue a career within DOE.

Discussion

A question was posed as to SC strategy regarding the future of the USA's leadership position in science research in the context of recent international gains. **Fall** acknowledged competition is part of science. He indicated the primary resource for advancements in science is human and while others may have more people working on a given effort, he believes the American approach of unfettered, bottom-up research is ultimately more successful than top-down directed research.

In further discussion regarding biosecurity, **Fall** endorsed DOE's commitment to expanding biosecurity in a way that is unique to DOE and he expects to see the convergence of bio, energy and physics to meet these needs.

When asked how SC would achieve its goal to gain research advantage by collaborating with complementary research at other agencies, **Fall** explained the DOE strength is "science at scale"; DOE has the systems to conduct research quickly and rigorously. The NIH National Institute of Biomedical Imaging and Bioengineering (NABIB) is a good example of how the two agencies may benefit from working together.

In response to a question regarding SC's perspective of the human resource pipeline, and how young scientists would be recruited. **Fall** attributed SC's strength to DOE's Federally Funded Research and Development Centers (FFRDC) approach rather than staffing civil servants. **Fall** added encouraging the flow of professionals moving between government agencies, academia and the private sector is another valuable mechanism. **Fall** underscored the need for government to have intentional connections to universities who represent the frontier of the next generation. He cited the Intergovernmental Personnel ACT (IPA) agreements and similar contract vehicles that allow people to come into the agency mid-career, temporarily or eventually permanently as a valuable approach to garner talent.

News from BER – Sharlene Weatherwax, Associate Director, Office of Biological & Environmental Research (BER)

[Presentation posted]

Discussion

Discussion began with a question about the level of detail in BER budget submissions.

Weatherwax explained that guidance is provided, but as the budget moves forward, a lot of the language may be stripped out.

A question arose regarding the role of BER in the DOE systems commitment. **Weatherwax** responded saying it is a matter of providing information on what is available and what is needed. She believes having Gary Geernaert as a member of the committee provides guidance for climate specifically.

Discussion continued with focus on BER efforts to address workforce issues by inspiring science interest at the K-12 level. **Weatherwax** replied there is not a program for educational programs directly; however, the laboratory community has activities such as open houses, user facility educational products and tutorials. Her perspective is that the projects funded by BER have outreach elements.

Some members observed talent was attracted to jobs that pay highly (Silicon Valley as an example) rather than government and asked if there is a program to bring these students back to the university/government sector. **Weatherwax** responded that there is no program specifically. She mentioned mechanisms including the American Association for the Advancement of Science (AAAS) fellowships that engage new talent. She also believes many scientists see BER's positive impact on society and are attracted to contribute in that context. Members discussed importance of the private sector's role in attracting scientists and one example included a company's success supporting genetics curriculum in Alabama high schools and early college.

The ability to staff professionals when private sector labs can outcompete DOE is particularly difficult in Artificial Intelligence (AI) and earth science. **Weatherwax** acknowledged the concern of staffing professionals in earth science and especially in AI. She mentioned DOE often partners with businesses within its current supercomputer and other efforts and sees that relationship as a possible mechanism to fill this need.

The meeting was suspended for a break at 10:50 a.m. and reconvened at 10:55 a.m ET.

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

Discussion

Responding to a question on the percent of grants are funded, **Anderson** stated the success rate across all BSSD grants is 15%.

News from Climate & Environmental Sciences Division (CESD) –Gary Geernaert, CESD Director
[Presentation posted]

Discussion

When asked about improving the time-scale of predictability, **Geernaert** explained that the greatest challenge is within the sub-seasonal to seasonal timeframe which is the most desirable for utilities and other end users. The solution may come with machine learning.

Further discussion focused on the emerging issue of wildfire emissions and agricultural fine particle emissions being greater than coal sector emissions. **Geernaert** agreed these factors need to be incorporated into climate models.

The meeting was adjourned for lunch at 12:00 p.m. ET.

Thursday October 24, 2019
Afternoon Session

The meeting reconvened at 1:00 p.m. ET.

BERAC Science Talk: *How is Decadal Variability in the Tropical Pacific Linked to Sea Ice Variations in the Arctic and Antarctic?* –Gerald Meehl, National Center for Atmospheric Research (NCAR)
[Presentation posted]

Discussion

Noting the changes in the North Atlantic showed a strong aerosol impact, a question was raised as to how that would play in Atlantic Meridional Overturning Circulation (AMOC) control. **Meehl** replied that aerosol effects on Interdecadal Pacific Oscillation (IPO) were established in Booth et al., (Nature 484, 228-232, 2012). The extent of variability attributed to aerosols from North America is still debated, as is the connection to summertime sea ice.

The potential association of convective heating with shifting IPO was discussed. **Meehl** explained there is a paper in the works addressing this issue. He has found shifts from El Niño transition sustained for 10 to 15 years and refers to it as “interannual impacting decadal” oscillation.

If only 10 out of 260 model runs matched their prediction, do the models have a harder time on the Antarctic? **Meehl** explained that looking at the decadal timescale, the models are getting right and it really is completely different. The problem is there is only a century of data and mostly surface temperatures are available. There is not a lot of deep ocean data. He suggests the goal is to initialize prediction in decades, and the model will scale out beyond a season.

Asked if the shift is conditional attribution (such as a hurricane model) or if the new data could be a footprint, **Meehl** answered that although the initiation is improved, the data coverage is not there. He described conducting data reanalysis using data collected from random ship placement of Argo float sensors and stated hindcasting is a big part of prediction. For sub-seasonal top decadal prediction, 1960’s data are needed and they don’t have it. Argo sensors are needed to go deeper to quantify where the heat goes. Responding to a question about his reaction to the intensity of ice decrease. **Meehl** confirmed he was surprised by the intensity.

One member added their observation that during initialization, checking the depth and running the model over and over helps to address the depth data limitation. Model error and drift adjustments are big issues. Discussion concluded it is really open research given the first paper on initialized model prediction research was published in 2007.

Workshop Brief: *Precipitation Metrics* – Ruby Leung, PNNL
[Presentation posted]

Discussion

The classification of micro/macrophysical factors in clouds was discussed in the context of climate models. **Leung** explained they are considered an exploratory metric due to the availability of data.

Discussion continued on the topic of users having access to metrics packages where

hundreds of plots are provided by developers and users publishing those results. **Leung** replied she would like to see many users engaged to generate feedback and refine the metrics. She suggested some may use the tool, others may just look at the data. While it is possible to publish the plots, the authors would have to provide a lot of explanation behind them.

Regarding the biosphere, Amazon versus Sahara and sub-seasonal to seasonal forecasting teleconnections, **Leung** stated the data are not ready yet. More numbers are needed to compare and more research is needed to synthesize them into a metric.

Discussion continued with the consideration of using Intensity-Duration-Frequency (IDF) curves as a stationary baseline. The historic record is not reliable in outer quantiles plus the system is changing. Also noted was a tendency to underestimate the extremes of extremes. **Leung** acknowledged that as a very good point and stated a long data record is needed for metrics, therefore IDF cannot be used immediately as a baseline. However, **Leung** stated it is possible to design experiments more in line with baseline to address perturbations. Based on the extent of uncertainty, starting with observations was discussed. For example, the CloudSat satellite providing data at 95% significance level on precipitation from mixed base clouds and Nexrad (Next Generation Radar) still has 25% uncertainty. **Leung** agreed that some regions have more data, but global metrics are limited.

A break was called at 2:45 p.m. and the meeting reconvened at 3:04 p.m. ET.

Climate and Environmental Sciences Division (CESD) Committee of Visitors (COV) Report – Jim Hack, ORNL and COV Chair

Discussion

Regarding how the COV process could be improved, **Hack** explained his perspective comes from his 15 years of experience participating in Federal Advisory Committees. His primary concern is the large amount of material to absorb in a short time precludes any nuanced observation of the program. He stated to review the large amount of material for this COV, the committee worked in three groups. Once the material was reviewed, only one to two hours remained to pull the findings together. **Hack** suggests allotting more time to discuss the material rather than only collating PowerPoint presentations. Other members that were part of the COV commended **Hack** for his grace under pressure and suggested that if one more day were included in the visit, the draft report would finish faster. These members confirmed it is a gigantic task for all given the massive amount of material provided for the review. **Hack** agreed and requested guidance and advice from leadership on this issue. In contrast, **Hack** mentioned the Innovative and Novel Computational Impact on Theory and Experiment (INCITE) program review was a focused effort, much easier to complete in the time allotted.

Members inquired as to any specific recommendations from the COV to increase diversity other than just tracking diversity. **Hack** acknowledged tracking without soliciting for increased diversity is not the answer. One member suggested including more minorities on review panels so they see first-hand what DOE requires. Another member suggested that a shift may be related to the triennial application process. **Hack** responded that many committee members are sensitive to this idea. However, he said the impression is visceral, and statistics are not available to confirm. He recommended having statistics in future reviews.

Weatherwax introduced the next speaker, indicating that this introduction to AI was requested by the committee during previous meetings. The first presentation provides the landscape, with the second presentation describing federal opportunities.

Artificial Intelligence: Status and Opportunities – Kerstin Kleese van Dam, Director for Computational Science Initiative, BNL
[Presentation posted]

Discussion

Members asked for comment on data reproducibility given the variation in training the model. **Kleese van Dam** replied that some models are more resilient to changes. Others stated surrogate models are trained on real models to place details into the model. Further, machine learning (ML) models have a forcing function and can respond to the other model produced.

Members expressed concern that the human-machine interface is key when using ML for social science and data science. **Kleese van Dam** agreed, stating the human computer interface is a big unknown at this time. She described an example of the quality of reinforcement training and emphasized that scientists need to have mental models of how stuff works to be able to check if the model is a match or if there is trouble with the model. She also warned that given the extent of autonomy, bias can be a big issue. Kleese van Dam confirmed this is a big research area. The Rembrandt example in Kleese van Dam's presentation was cited to point out that ML has potential for creativity that may not be new knowledge. However, the LBNL materials genome project was cited as an example of new knowledge produced by ML because new materials were identified from the model.

Report from AI for Science Town Halls- Barbara Helland, Associate Director for Advanced Scientific Computing Research (ASCR)
[Presentation posted]

BERAC Discussion (AI in BER research areas; other business)

Discussion began with a general concern about scientists becoming obsolete (said in jest). The committee was asked to identify challenges to bring AI into BER. The potential strong bias of “not my science” among more senior researchers could be a challenge, but young scientists are “all in”. There was agreement from the members on importance of training for architecture, requiring deep science and mathematics. Another challenge was a commitment to data streams and data space. Data organization is 90% of the effort and the example of NASA using Amazon Cloud and Google Earth for data was cited to illustrate that DOE will need to consider data management. **Helland** replied there is a workshop planned in the next six months on distributed data storage. She mentioned the cost of putting data in a cloud is twice what it would cost to build for themselves.

Members expressed their belief that AI has to be a component of every biology degree, but there is a concern about how scientists will be trained to have a “gut check” of the outcome result so they will recognize when the model may be flawed. **Helland** agreed and stated ASCR has a program that requires taking applied math and machine learning courses. Another concern is how much of students' time will be dedicated to learning their science versus statistics or other mathematics. **Kleese van Dam** explained scientists may receive training in basics, but most likely they will collaborate with computer scientists to develop methods. **Helland** agreed emphasizing the need to understand the black box and to know if the answer is correct. Members were encouraged by the reinforcement learning approach to evaluate the model. **Kleese van Dam** agreed, saying if you do not bring the knowledge, you do not get the results.

Another challenge identified that many times it is often math people that develop the model that scientists want to use. As a result, claiming ownership and getting ML funding may

be difficult for scientists. Members countered that there will be more jobs for domain experts and competition will stimulate innovation. Members noted the small population of extremely talented people makes it difficult to attract and retain personnel. The right incentives are needed to strike a balance of ownership between private and public sectors.

Donner used the example of clouds and convection, two very energetic efforts in ML. The private sector spent a lot of money with very big efforts. The concept is not new given weather maps were produced in the 1950s. He predicts the path will not be smoothly paved, but it will be exciting. He also stressed the distinction between causation and correlation. He concluded saying ML will struggle without domain knowledge. Perhaps a hybrid, classical knowledge as a throttle for AI. It is a struggle to handle in climate, but it is potentially transformative.

Discussion continued with a concern about the potential for false confidence in the model and the development of best practices for reproducibility. **Kleese van Dam** replied there are models that are robust, but reproducibility is at a starting point. She emphasized the need to work with domain scientists. Another concern raised was how students will reconcile mechanistic knowledge, **Kleese van Dam** agreed with the need to formulate best practices.

Responding to a question regarding how much data is enough, **Kleese van Dam** stated the data quantity depends on the complexity of the problem. This prompted a discussion on the need to curate datasets and to be able to confirm their quality. Pattern recognition models already available, for example in the case of DNA, but there is a need for ML and AI working with 3-dimensional data. One member described her experience with modelling transcriptional data. The team could model faster than scientists could test. A collaborative team grew from that challenge. She also mentioned that computer scientist involvement is a requirement to get funding.

Another member explained ML helped break the gridlock of cloud modeling but she is concerned about scientists being totally removed from the process. Others agreed that a lot of the effort is ML, not AI. The challenge is how to ensure the tool is an intelligent system. The discussion concluded with the statement that this is not a cross-competitive situation.

Public Comment

Hungate asked for public comment and reminded commenters to identify themselves when speaking. **Julie Mitchell** (Director, Biosciences Division, ORNL) commented with information about plant phenotyping capabilities at ORNL and invited inquiries to collaborate.

Hungate dismissed BERAC for the day at 4:30 p.m. ET.

Friday October 25, 2019

Hungate called the meeting back into session at 9:00 a.m. ET and introduced the first of two Early Career Science Award presenters.

Early Career Science Presentation: Impacts of Dynamic Soil Redox on Tropical Soil Microbiomes and Biogeochemical Transformations – Jennifer Pett-Ridge, LLNL
[Presentation posted]

Discussion

Hungate suggested holding discussion until the break due to time constraints.

Early Career Science Presentation: Deconstructing the Metabolic Webs of Microbiomes within Biological Soil Crusts – Trent Northern, LBNL

[Presentation posted]

Discussion

Hungate suggested holding discussion until the break due to time constraints.

Environmental Molecular Sciences Laboratory (EMSL) Facility Update – Douglas Mans, PNNL

[Presentation posted]

Discussion

Discussion began with the statement that EMSL is a valuable resource given the convergence of science, including biogeochemical feedback and climate, emissions charge, the importance of viscosity. **Mans** agreed and added that FICUS (Facilities Integrating Collaborations for User Science) is doing a pilot study with the Atmospheric Radiation Measurement (ARM) user facility. Mans also mentioned development efforts for aerosol sampling launched this year.

One member inquired as to how the supercomputing analytics model ties into experimental projects. **Mans** replied there is a computer refresh in progress now because Cascade is past its lifetime. The new equipment will be able to take on more imaging and large dataset analysis. This system will be heterogeneous, able to run the model and simulation without compromising either.

A break was called at 10:40 a.m. and the meeting reconvened at 10:50 p.m. ET.

Diversity and Inclusion in the Office of Science – Julie Carruthers, Senior Science & Technology Advisor, DOE

Discussion

Members inquired as to the demographics within senior leadership including Lab Directors and Assistant Lab Directors. **Carruthers** responded it is one of the categories that is reported at <http://nationallabs.org/staff/diversity>.

The group was reminded of a suggestion from the last meeting to work with Persis Drell. Dr. Drell broke the glass ceiling when she became Director of SLAC and she became Dean at Stanford University and is now Provost. Dr. Drell has personally dedicated her time to both sexual harassment and diversity.

One member mentioned this was a big concern at the COV and having a comprehensive plan such as the one presented is very important. Many agreed this is an opportunity for SC to extend its leadership from executing big science projects to addressing these very complex problems. One of the most difficult problems is Universities' Title IX responsibilities.

The questions arose as to when the agency would sanction and would there be impact to the investigator's grants? **Carruthers** answered they have not encountered that challenge yet

where there was a finding and the faculty remained. She is unsure of SC's legal authority in that situation. Carruthers mentioned NSF had this situation. The institution determined it was more important for them to keep the PI than to lose the funding so the work was terminated.

Members asked for comment on the equity results at the national labs. **Carruthers** reported that using the Management and Operating (M&O) contract model, SC does not see the assessments. Lab leadership reports the results and plans to adjust pay levels. Carruthers explained that initially the laboratories were concerned that if they provided data to SC, they would incur FOIA requests resulting in increased liability. Carruthers believes it is a challenge that can be met, as demonstrated with processes developed to protect proprietary information in annual lab plans. She is confident the ongoing trust-building efforts with the laboratories along with the peer review will eventually produce essential information to improve oversight. In response to a question about salary information, **Carruthers** explained the laboratory employees are not federal employees so their salary information is not available.

Discussion continued on the challenge to "move the needle" significantly to attract traditionally underserved populations. There are so many people that do not know DOE exists and it was suggested that there might be a benefit to combining efforts of the national labs and DOE rather than conducting individual efforts. **Carruthers** agreed and stated this suggestion comes up frequently from labs wishing to work with other labs in recruitment strategy. SC may develop a community of practice for this topic so they can see the discussion and push the labs. She cited the challenge to expand lab-based human resource recruiters' efforts beyond their individual lab.

Members asked for clarification on how universities are selected for review. **Carruthers** answered it is not random, and there is a legal requirement to conduct at least two each year. The process begins with all institutions funded, and eliminating those that have had a Title IX review in the past 5 years. Then they look at who has the greatest funding, who is not under investigation by the Department of Education. Geographic diversity is the final selection factor. **Carruthers** noted collaboration with other agencies has helped achieve their goals.

Answering a question about the availability of demographics for grants, **Carruthers** stated it is an integral part of the working group, but it is not complete. Proposal submittals are not required to include that information, but sometimes they can gather it through their letter of intent. The Portfolio Analysis and Management System (PAMS) includes questions for this information, but the submitter can decline to answer.

Given the breadth of the scope of these efforts, a question was asked about the laboratories' sentiment since imposing these changes. **Carruthers** clarified the laboratories are only required to tell SC what they are doing and provide a process for SC to give them feedback. The external peer review process will be a formalized way to provide feedback to the laboratories.

One member described her observations of a cultural norm that the first priority is "getting the best science done". She suggested overcoming this culture, may be achieved by educating management on how the culture of underrepresentation robs the laboratories of talent. **Carruthers** replied she believes laboratory leadership understands the value of diversity, but translating that philosophy into real culture change in hiring for diversity and creating inclusive work environments at the laboratories is an ongoing challenge.

Citing some of the statistics provided on the website referenced by Carruthers, one member asked for possible explanations for the 15% reduction in women and 20% increase in people of color in the transition from undergraduate to graduate students. **Carruthers** replied

SC has not looked at it. She emphasized the website represents cumulative data for all 17 laboratories. Some laboratories are far ahead of others, raising the average. One member commented that Argonne National Laboratory is taking the diversity issue very seriously, from upper management down to group leader level, but there is a long way to go.

The question was asked if there was an equivalent to Title IX for institutions that are not academic. **Carruthers** replied yes, and explained the laboratories' contracts include compliance with civil rights laws. The most equivalent entity is the Employee Concerns Office, providing intake, investigation, or deferral to the legal team.

One member stated if an NSF-funded investigator has a finding of harassment, NSF now requires it to be reported to them directly. He suggested that under Title IX, the University could provide information related to findings for DOE research as a broad look. **Carruthers** confirmed SC has had discussions with NSF to gather information and they hope to follow their lead. She explained NSF has the advantage of setting requirements through policy. DOE's requirements for financial assistance (grants and awards) are set by regulations. This would require rule-making to make any changes at that level. However, if an investigator is placed on administrative leave and it affects their time on the grant, they are required to report that. Carruthers acknowledged there is a disconnect between Title IX offices at Universities and the Office of Research that is responsible for grant oversight and reporting.

The discussion ended with an inquiry on SC's end goal and their definition of success. **Carruthers** replied SC understands it is a long-term endeavor. Staff turnover and hiring varies a lot among the laboratories, so quotas are not appropriate. However they do see diversity of new hires and they look closely at that trend. SC expects laboratories to conduct culture and climate surveys, impulse surveys on campus culture, and report those results. From these reports, SC sees a shift over time. Institutionally, with respect to application and award processes, there are no data to determine the impact of implicit bias. There is a need to develop a baseline of so they have confidence in their future measurements.

BERAC Discussion (Diversity & Inclusion; New Charge, Other Business)

Diversity & Inclusion - Regarding diversity and inclusion, the need for pipelines was emphasized. One member stated back-end activities would not create a significant shift. One member recommended defining hiring success in the context of the pipeline as there is so much pipeline variation among disciplines. A detailed pipeline analysis at the beginning of any new search might be effective. Another member recommended tracking equity in pay within the labs and building metrics into contracts over the long-term. In addition, a parallel metric for harassment reports at the labs should be developed, with data reported to the SC. SC takes steps to attract diverse talent at all levels of the grant review process.

One member cited his experience where there are over 1700 new students every year and 300 of those are first generation college students. He emphasized this is a critical diversification factor and his institution places high weight on that factor in their admissions process. The result is an increase in minority representation.

Artificial Intelligence - **Hungate** asked for any synthesis or take aways from yesterday's presentations and discussions. He mentioned he first thought an AI algorithm could produce fear such as "Oh no, I'm going to be replaced". However, he believes the opportunities are exciting.

One member asked for leadership's vision for next steps in this process and what they might need from the committee. **Weatherwax** replied the discussion itself has been valuable. She pointed to ASCR recruiting for advisory committees. Weatherwax pointed out that if anyone

from BERAC is invited, they will have the benefit of this meeting's discussion and they will be able to reach out to members if more detail is needed. **Hungate** emphasized BERAC's discussions are important as they can lead to a charge.

Several suggestions were offered.

1. Eric Horvitz, head of Microsoft Research Labs and an AI guru who developed a decision pyramid framework for AI was identified as a possible resource for BERAC.
2. Activities such as workshops and hackathons are successful opportunities for users to immerse themselves and get help from experts in the computation realm while also bridging the knowledge gap for AI.
3. Bring computer scientists together with physicists and biological scientists to talk about integrating ML into their models.
4. Define the applicable problem space and data sets necessary, then present those to experts to extract information from the data.

One member stated DOE is well poised for AI due to their data systems leadership. However, aligning data for AI is a key to success.

Topics for Future Meetings - Hungate asked the committee for topics that should be discussed in future meetings. The following topics were suggested.

1. A quantum theme for biology and climate, basic computing and supremacies aspects. This discussion could include how BER will benefit from those developments.
2. Interagency cooperation given many members are using in-lab tools, computational methodologies, and user facilities to further DOE-based applications. Discussion focused on the Secretary of Energy Advisory Board Task Force for Biomedical Science Report from September 2016. This task force was charged with identifying new mechanisms for conducting research in coordination with scientists from government laboratories (both DOE and the National Institutes of Health [NIH]), universities, academic medical centers, and industry. It was noted that Dr. Weatherwax gave a presentation on light sources. This is a great opportunity to try to increase cooperation between federal agencies. One member suggested rather than taking a "moonshot" approach, it would be beneficial to look for smaller opportunities for people to work together and, benefit everyone. Planning in a more integrated way would benefit all in an increasingly competitive world DOE's culture of tapping into grass roots is valued and DOE could take a leadership role in this aspect to benefit other agencies.
3. Quantum supremacy and long-term implications of quantum computing.
4. Science communication and best practices developed in other agencies. A discussion about how DOE labs communicate science and what are capabilities. Is there standard across the labs or does each lab has a different approach? One member mentioned NASA's efforts with social media, YouTube and graphics and asked where SC is in this area.
5. DOE's potential role in re-engineering agriculture for sustainability. Two examples include larger scale organization of data and addressing considerations such as climate change.

6. There is a need to create a comprehensive list of facilities and capabilities that are available to biologists. People often ask about the resources and a list that is broad enough to attract attention would be useful in responding to these inquiries.
7. Rapidly changing relationships with the private and public sectors. One example is the flow of innovation across many areas within DOE including data and security.
8. Dissemination of information to the broader community on what user facilities can do for programs and how more people can become involved in DOE efforts. This topic would benefit diversity efforts.
9. Bioeconomy. **Weatherwax** asked **McCann** when the bioeconomy report would be complete. **McCann** replied it has to go through a review, so it will likely be available in the first quarter of 2020.

New Charge - **Hungate** introduced the new charge for a Biological Systems Science Division COV. Volunteers are encouraged to email their willingness to participate.

Public comment

There were no comments.

The meeting adjourned at 12:03 p.m ET.

Respectfully submitted,
Maureen Leavitt, ORISE
November 25, 2019