

**Minutes of the
Biological and Environmental Research Advisory Committee Meeting
September 5, 2008
Crystal City Marriott at Reagan National Airport, Arlington, VA**

BERAC members present:

Michelle S. Broido, Chair
Eugene W. Bierly
Janet Braam
Robert E. Dickinson
James R. Ehleringer
Joanna S. Fowler
Andrzej Joachimiak
David T. Kingsbury
Steven M. Larson
Margaret S. Leinen

Joyce E. Penner
Gregory Petsko
Karin Remington
Margaret A. Riley
Gary Saylor
Gary Stacey
James M. Tiedje
Warren M. Washington
Raymond E. Wildung
Mavrik Zavarin

BERAC members absent:

S. James Adelstein
Raymond F. Gesteland
Stephen R. Padgett

David A. Randall
John C. Wooley

Approximately 60 other individuals were in attendance during the course of the meeting.

Chairwoman **Michelle Broido** called the meeting to order at 8:28 a.m. The next meeting will be held in late February. The members were asked to introduce themselves.

Margaret Riley was asked to report on the Committee of Visitors (COV) review of the Life and Medical Sciences Division (LMSD). The COV met June 8–11, 2008 at DOE headquarters in Germantown, MD. Eleven subcommittees were formed in order to review each program. The entire COV evaluated and analyzed the portfolio as a whole, provided answers to the specific charge questions, and gave overall recommendations.

<http://www.science.doe.gov/ober/berac/Riley09-08.ppt>

The LMSD research portfolio continues to support cutting-edge, high-priority research in areas of critical national concern. The LMSD Program Managers (PMs) are deeply committed to the research and work tirelessly to ensure the LMSD portfolio maintains a diverse mix of timely, sound, and exceptional research in areas specifically relevant to DOE missions. LMSD leadership has been rotating every 120 days. At the time of the review there was no succession plan in place. Program managers also have a lot of work on their plates. This COV feels that levels of financial and personnel support are not adequate to maintain the exceptional levels of productivity and quality of efforts that have been the hallmark of this program.

The PMs have successfully addressed most of the recommendations of the previous COV. The prior COV noted that staffing levels are inadequate for the tasks at hand, which resulted in too little documentation of the review process. Unfortunately, the

staffing levels have not appreciably increased. However, this COV found that, in most cases, the levels of documentation were appropriate and enabled a thorough assessment of the LMSD review process.

The Genomics: GTL program is a 'crown jewel' in the repertoire of LSMD-funded research. The quality of the planning, management, and oversight by PMs and the quality and utility of the resulting scientific and technological products are outstanding. The GTL Program is pro-active in identifying and funding emerging technologies. The COV recommends that DOE recognize this remarkable talent and provide more substantial support in terms of staff, time, and travel resources for PMs.

The quality of the research portfolio of the Bioenergy Research Centers (BRCs) is outstanding. The COV recommends the PMs responsible for managing the BRCs receive additional support staff and be released from some significant amount of their remaining duties to help manage that complex combination of awardees. The COV recommends that there be extensive oversight of the BRCs, that strong scientific advisory committees be created, and that a rigorous set of evaluation procedures be established that will provide frequent feedback and ensure that the activities of the BRCs remain on track.

The Computational Biology Program should play a major role in the automated annotation of genomic sequence and metagenomic data being generated, coordinate the development of genomic and metagenomic tools, and oversee uniform data formats that permit integration of disparate data sets. Currently, the Program has no direct line of funding. A clarification of the roles and responsibilities of this program and a thoughtful definition of the objectives of the program are required. The COV recommends that the Computational Biology Program be emancipated from the program objectives and solicitations of the supercomputing programs at the national laboratories and that scale- and platform-appropriate software development and modeling be encouraged.

LMSD does not have a budget large enough to build, maintain, and operate all of the beamlines that the biological research community is actually using, so the Structural Biology Program must coordinate its funding activities with those of other sponsors, most notably the National Institutes of Health (NIH). On the whole, the *ad hoc* system that has evolved for handling these intra- and interagency challenges has worked extremely well. The PMs have been making good decisions about how the Structural Biology Program should proceed in this area. The COV recommends that BERAC consider creating a subcommittee for the Structural Biology Program, whose primary purpose would be to provide expert advice on a regular basis with regard to strategic planning. The COV recommends that BER have a much stronger presence at the Spallation Neutron Source in the areas of neutron scattering, neutron reflectivity, and neutron crystallography for structural biology.

The COV affirms that the research supported by the Radiochemistry and Instrumentation Program is of fundamental importance in the development of nuclear medicine and molecular imaging and that it has provided many of the basic technologies necessary for the advancement of these fields. The decision to keep one strong project alive (at Brookhaven National Laboratory) was a good one in that it maintained an internationally recognized multidisciplinary team that covers all the major disciplines in this field.

The Artificial Retina Project involves four national laboratories, three universities, and one private company, which has presented numerous challenges to the project

management. The PM has produced a team whose results have surpassed all expectations for the program. The COV was surprised and somewhat disturbed that such a stunning success story will soon be terminated (in FY 2010). The rationale behind this decision was not clear to the COV.

The COV applauds the Office of Biological and Environmental Science (BER) for its significant investments in the Carbon Sequestration Program. However, the COV recommends that the level of funding should be increased to more adequately fund research in this area of critical national need. The COV enthusiastically supports continued joint funding opportunities between DOE and the U.S. Department of Agriculture (USDA).

The Joint Genome Institute (JGI) continues to provide superb access to complete genome sequences for the community. The COV recommends that the JGI maintain this high level of community involvement. The JGI should be at the forefront of innovative informatics efforts to support its growing sequencing capacity. As more complex genomes enter the JGI sequencing pipeline and next-generation sequencing becomes the norm, JGI must position itself to provide high-quality sequence data that is immediately usable for its stakeholders. The COV recommends that JGI's investment in informatics be increased significantly and that JGI consider how its resources could be used to support some "big science" sequencing efforts that no other agency could tackle.

The Low Dose Program supports animal, tissue, and cell-culture studies of molecular responses to ionizing radiation. The COV applauds the continued efforts in this area. As the nation (re-)considers increasing the use of nuclear energy, the importance of this critical area of research (not funded by NIH) increases.

The original focus of the Ethical, Legal and Social Issues (ELSI) Program concerned genetic privacy, complex traits, human subjects, intellectual property, and education. The most recent solicitation concerns the ethical, legal, and societal implications of research on alternative bioenergy technologies, synthetic genomics, and nanotechnologies. The COV recommends that BERAC consider creating a subcommittee for ELSI that would aid the PM in the development of solicitations. The COV recommends the gradual expansion of this important program.

Discussion

Broido initiated a discussion of the COV recommendations. Subcommittees on computational biology and ELSI were suggested. Such subcommittees have been established under the direction of SC before. Palmisano noted that the Office has 30 days to study and respond to the report. It would like to use those 30 days to consider any actions or responses.

Gary Stacey wanted to highlight the fact that the scientific community has anxieties about the roles and allocation of resources of the JGI and the BRCs; membership of the JGI's Community Sequencing Program review committee was not geographically balanced; informatics support is needed by the JGI. Riley replied that these issues were discussed by the COV, and a lot appears in the report, although some is outside the purview of the COV. Tiedje added that the JGI just had a planning retreat that dealt with a number of these issues.

Steve Larson was concerned about the focusing of radiochemical effort on plant genomics. Riley said that the COV shares that concern. Anna Palmisano noted that health

efforts were not being eliminated, but support for plants and environment was being increased.

Gary Sayler commented that the Computational Biology Program sounds more like bioinformatics and databasing and analysis, but the broader area intersects with metabolic flux and synthetic biology. Should this new thinking in computational biology deal with those topics? Riley replied that there was a lot of discussion about computational biology serving user needs, but it needs its own line of funding to do that.

Broido asked for approval of the COV report subject to editorial changes. Petsko moved to approve the report; Larson seconded the motion. The vote was unanimously in favor of approval.

David Kingsbury was asked to report on the joint Advanced Scientific Computing Advisory Committee (ASCAC)–BERAC Subcommittee on Genomics:GTL. The joint Subcommittee sought a clear and unified view of the goals of the program. The language used in the draft report that was discussed on the previous BERAC meeting was divergent, especially in regard to the Office of Management and Budget Program Assessment Rating Tool (PART) statement. The new version has a unified vision, and the language has been made more explicit. A series of recommendations was also made for funding the program. Broido asked for BERAC’s acceptance of the revised report. Sayler moved to accept the report, and Petsko seconded the motion. The vote was unanimous to accept the report.

Patricia Dehmer (Deputy Director for Science Programs, Office of Science) was asked to summarize the activities of the Office of Science (SC). (<http://www.science.doe.gov/ober/berac/Dehmer09-08.ppt>)

The House Energy and Water Development Committee recommended additional funds over the request of SC and supported the doubling of this area of R&D funding between 2006 and 2016. The House committee members stressed (1) certain research priorities and (2) coordination. Previous SC planning activities include: completion of 20 planning workshops arranged by SC in consultation with the applied technology programs; integrated budget documentation for six key research and development areas; and the proposal to fund more than two dozen Energy Frontier Research Centers (EFRCs).] The Committee directed the Department to continue to support and expand these efforts and take the steps needed to ensure that R&D integration is implemented at all levels across the Department in planning, budgeting, and execution. It also directed the Department to provide the Committee with a report detailing progress on these efforts no later than March 1, 2009. Both SC and Renewable Energy (EERE) are well funded under the House markup. However, a continuing resolution until the swearing in of the new Administration is a certainty and it may be continued for the entire year. The House Committee wants SC to work with the energy-technology programs. Under the recommended Senate mark, SC would receive more than \$4.649 billion, which is \$623 million above FY08.

2006 was a difficult year for SC; 2007 was the first year of the America Competes Initiative (ACI), which called for doubling research funding in 10 years; the year-long continuing resolution nullified this increase. In FY08, SC received a supplemental appropriation, half of which went to the Office of High Energy Physics (HEP), and most

of the rest being split between the light sources and the International Thermonuclear Experimental Reactor (ITER). The 2008 appropriation was significantly above the President's request after the supplemental appropriation was made. The FY09 request for SC is about \$1 billion more than the current appropriation. The House mark added money to SC and many other programs, \$115 million over the President's request. The Senate mark cut funding for the Office of Basic Energy Sciences (BES) by one-half of the increase requested and moved a \$60 million program in basic solar research away from BES. It also cut federal-staff increases and boosted climate-change funding. Under the supplemental appropriation, two programs (BER and ASCR) are on track to double in 10 years. An additional supplemental appropriation is being discussed. The 2009 budget brings all SC programs up to the ACI's doubling levels, with a \$750 million increase being requested. To a person, the committees asked how such an increase could be funded. But in the end, the House recommended \$100 million more, and the Senate reduced the amount requested for SC (by \$150 million, transferring \$60 million to EERE). BER is the only program that got an increase from the Senate (by \$10 million), particularly for radiochemistry and nuclear medicine. Climate is very important to both the House and Senate. These numbers are only markups; this is not spendable money.

The 12-year history of SC offices' funding indicates that computing had large growth; the fusion program had a large increase of requested funds for ITER; BER, HEP, and the Office of Nuclear Physics (NP) are down a little bit or flat; and BES is up largely because of major new initiatives.

SC has been reorganized to include three deputy directors (<http://www.science.doe.gov/about/Organization.htm>). Three new permanent Associate Directors have been named (Harriet Kung in BES, Anna Palmisano in BER, and Dennis Kovar in HEP). Fusion Energy Sciences and NP still need permanent Associate Directors.

Discussion

Greg Petsko asked if there was any sense about how this budget would play out under a new administration. Dehmer replied that she had a sense that the support for this budget is bipartisan; a key decision is the selection of the Secretary of Energy.

Warren Washington asked if she were willing to speculate what will happen when Congress returns. Dehmer replied that there will be a continuing resolution until after the new administration is in place.

Ray Wildung noted that it had been suggested that additional funds might be made available and asked how that appropriation might be allocated. Dehmer replied that contingency plans have been made.

Larson noted that there is contradictory language about nuclear medicine in the budget documents and asked where nuclear medicine stood in the Department. Dehmer replied that Palmisano would talk more about nuclear medicine's future during her presentation. Dehmer herself would like to see an expansion of the tools developed by that program to other programs. A successful program should not be terminated.

Stacey noted that the EFRCs were originally part of an Advanced Research Projects Agency (ARPA) model and asked why Congress is interested in an ARPA model. Dehmer replied that the centers have not been coupled with ARPA. A series of workshops were held on hydrogen and other energy research topics. Ten workshops were held. Concomitant solicitations were seen to be not the way to go. Multiple disciplines

had to be funded. The idea of the EFRCs was borrowed from the National Science Foundation (NSF), where such centers had a magnet effect for students and others. That was the genesis of the EFRCs. The concept was then moved into the budget. It does not have anything to do with ARPA.

Gene Bierly asked if it was fair to say that SC is hurt by the funding of EERE. He noted that the budget of SC is doubling in 7 years, a stunning change from previous years. Congress is very supportive of SC. The trick is to get more money into those committees to allow them to increase EERE funding.

Andrzej Joachimiak asked how to increase the relationships between agencies in computational biology. Dehmer replied that the key is to make the benefits well appreciated. This can be done by studies, interagency working groups, and shared responsibilities (for facilities and resources). The situation is not as broken as the question might imply.

Wildung asked if any thought had been given to the benefits that would accrue from integrating the efforts of all these divisions and programs. Dehmer replied that coordination among programs was desired and that her position had been created to do just that. She will take an active role in fostering such coordination.

A break was declared at 10:22 a.m. The meeting was called back into session at 10:45 a.m.

Todd Anderson was asked to review the BER Scientific Focus Area (SFA) program at the national laboratories. (<http://www.science.doe.gov/ober/berac/Anderson09-08.ppt>)

BER is changing how it funds research at the national laboratories from single principal-investigator (PI) grants to broader laboratory programs. During the past 10 years, BER has issued targeted solicitations to individual PIs at both universities and national laboratories. In terms of the science, the national laboratory and university solicitations were identical. Funding for the two solicitations largely came from the same pot of funds and was allocated based on the merits of proposed projects as determined by peer review. This approach has worked well for BER programs in the past, but is quite different than the overall approach used by other major funding offices within SC. DOE has a responsibility to maintain the national laboratories as entities that are distinct from universities.

The current funding format within BER has resulted in a collection of single-PI projects, sometimes widely disparate projects, at the national laboratories. For the national laboratories this system is problematic. They are geared to run as programs, not individual projects. The current system does not make the most effective use of the unique capabilities, strategic focus, flexibility and administrative resources of the national laboratory system and its ability to conduct coordinated interdisciplinary and multi-disciplinary research.

SC is emphasizing to BER that the national laboratories should be funded as programs while University Notices will continue as they have been.

BER has looked at the entire research portfolio and binned the research into SFAs that mirror the research elements outlined in the BER budget. BER will ask the national laboratories to re-evaluate current projects and budgets that were competitively awarded

under each SFA category and craft integrated programs that are coherent and cohesive. User facilities are not included in this process.

To develop policies and procedures, BER assembled an SFA Working Group that received helpful input from many others, including colleagues in BES, to develop a best-practices document for those managing this change. The SFA Working Group has been developing a series of documents for the national laboratories to help them deal with this shift in funding format. “Managing BER Scientific Focus Area Programs at the DOE National Laboratories” (<http://www.sc.doe.gov/ober/sfareview.pdf>) describes the procedures for initiating, reviewing, and managing laboratory SFA programs. The startup of these programs is envisioned as a two-step process: the development of a program plan followed by the preparation of a larger science plan.

A program plan is a short outline of the proposed research program that will be reviewed within BER. It should provide an outline of the SFA program being developed, the overall goals, hypotheses and personnel involved. A science plan should provide a vision of the strategic direction of the research program over a 3-year period. A specific science plan format has been adopted. All science plans will be subject to peer review by an external panel that will use a four-level rating scale.

Program plans are due on December 9 of this year and science plans on May 5, 2009. These science plans are to be reviewed between May and September of 2009. The SFA programs will begin in FY10 with annual reporting and BER review and triennial program review using external reviewers.

The SFA management and review process is intended to challenge the national laboratories to develop, sustain, and advance integrative science programs of the highest caliber in support of BER strategic goals, producing

- A structured and fair external SFA review process that is science-focused,
- A more uniform set of procedures within BER to document scientific progress, review outcomes, and track overall Lab program management, and
- Improved communication and coordination of BER science programs.

Discussion

Broido noted that until the mid-1990s, the national laboratories were given bulk money to “do with as they saw fit.” (Wildung noted that as an employee of a national laboratory during that period, his research was certainly subject to extensive and regular merit review that impacted his research funding.) Another part of SC reviewed the science that was funded by BER and conducted at the national laboratories. BER was sensitive to the appearance that the funding provided was not used to support projects that were critically reviewed, either prospectively or retrospectively. As a result, a process was put in place that equilibrated laboratory-led and university-led research funding.

Riley stated that the type of documentation that the national laboratories would provide would be very welcome.

Washington noted that, at some national laboratories, the overhead costs are substantial and asked if that were factored in. Anderson replied, yes. They have to be conscious that they are in competition with the universities.

Petsko asked what the real price of this was. Some creativity from entrepreneurial fronts may be lost. Anderson replied that there are two parts to BER programs. The university/industry part is bottom-up, which provides the creativity that is sought.

Karin Remington asked what kind of planning had been done for program turnover. Anderson replied that there is a wide interpretation of the DOE mission. All planning is done on a flat-budget scenario. New money would be divided up between the laboratory and university programs. Broido noted that the national laboratories also have Laboratory Directed Research and Development (LDRD) funds that are used to seed new ideas. When successful, those ideas would be integrated into the laboratory's programs. Palmisano did not see it as a top-down issue but as new opportunities for teaming. Anderson pointed out that when additional money was available it would be split, as appropriate between laboratories and universities and that competitions would be held in both sectors for the new funds.

Robert Dickinson noted that there was nothing said about external collaboration. Anderson responded that the Office should be open to university–national-laboratory collaboration. Thomassen pointed out that the guidance that was being given out recognizes such collaboration and directs the national laboratories to seek expertise that they do not have from universities.

Broido commented that the scientific dialogue found at PI meetings should not be lost. Palmisano said that all programs have and will continue to have PI meetings.

Jim Tiedje suggested that a certain portion of the budget should be reserved for new opportunities that arise.

Stacey noted that Dehmer had mentioned new funding coming to BER and suggested that this might be a good time to initiate a 10-year strategic planning project. Broido replied that this topic is in process and will be discussed at the February meeting.

A break for lunch was declared at 11:32 a.m. The meeting was reconvened at 1:00 p.m.

Robert Dickinson was asked to review the changes made to the report on identifying outstanding grand challenges in climate-change research.

(<http://www.science.doe.gov/ober/berac/Dickinson09-08.ppt>)

The report was discussed at the May BERAC meeting. Further editing was done on the basis of inputs from a closed interactive website used to distribute the report to all the workshop participants for comment. Ice issues were added to report.

Climate has become a big issue. A chorus of voices is asking for more detailed local information on what has and will change. Also, the National Oceanic and Atmospheric Administration (NOAA) are planning on providing a “Climate Service” to meet this need, but little research is being done for such a service to be built upon.

The grand challenges identified by the workshop are:

1. Improve the characterization of Earth's climate and its evolution through the last century to its present state,
2. Predict regional climate change for the next several decades, and
3. Simulate Earth-system change over centuries (most of DOE's focus to now).

The first is limited by both lack of understanding and data. Re-analyses are needed to provide global system research data sets for many important system components. Models need to be tested, and initial conditions need to be provided for future projections. Regional-scale observational field programs are needed.

For the second, much more climate detail can be provided by the use of the latest high-performance computational tools and by limiting the time frame to decadal and processes to those that are important on that time frame. Additional information may be available if the initial state is adequately constrained by observations. Decision support would be provided for adaptation at state and local level.

For the third, century time scales, many feedbacks affect the climate system that are not yet modeled or adequately modeled (e.g., involving biogeochemical cycling, dynamic vegetation, and atmospheric chemistry). Carbon-cycle feedbacks have large control on how much atmospheric CO₂ increases over this time. Decision support would be provided for mitigation policies.

Research needed to address these grand challenges includes characterizing the impacts of radiatively active constituents, especially aerosols and clouds on climate and air quality; determining the interactions between ecosystem processes and changes and the climate system; determining the interactions between changing climate and hydrological systems; developing multiple generations of Earth-system models; and probing the climate-change implications for energy systems.

Highlighted directions call for including integration and communication; human-dimension components; computational, observational, and experimental research initiatives; enhanced computing capabilities; and the education of new scientists and the public.

A table was inserted that related the grand challenges to decision issues and needed decisions.

Discussion

Sayler asked about the definition of GCIP. Dickinson replied that it was an acronym within an acronym: GEWEX Continental-scale International Project.

Remington noted that Ocean Research by Integrated Observation Networks (ORION), National Ecological Observatory Network (NEON), and other activities need to be recognized.

Mavrik Zavarin asked what the third grand-challenge question was focused on. The subtopics are related to climate change, adaptation, and mitigation. Dickinson answered that those were put in to incorporate human-dimension issues.

Wildung noted that the report talks about persistent modeling and at the same time recommends incorporating a carbon budget under the Atmospheric Radiation Measurement (ARM) Program and asked how that would occur. Dickinson replied that one of the breakout sessions suggested doing that, but it is only an introduction. Another workshop would have to fill out the details.

Broido asked for a motion to accept the report. Bierly moved to accept the report, and Larson seconded the motion. The motion passed with one abstention.

Michael Kuperberg was asked to report on the Climate Change Sciences Program's strategic planning retreat. (<http://www.science.doe.gov/ober/berac/Kuperberg09-08.ppt>) The retreat was held September 3–4 in Germantown. Prior to this, there had been many efforts to develop a strategic plan for the Climate Program; indeed, this had been a multiyear effort, informed by many sources. However, the different steps had not coalesced.

At the retreat, logic models were incorporated into the planning. In essence, these logic models asked the following questions:

1. What is the objective?
2. What are the long-term goals?
3. What are the mid-term goals?
4. What other near-term goals?
5. What are the inputs and resources?
6. What is the current situation?

The climate-change group developed a draft logic model for each program. The programs are now charged to integrate these existing reports and develop a plan for the future.

Broido noted that it is important that logic models be periodically visited and updated. They should be living documents. Kuperberg said that that was understood by the group.

Margaret Leinen asked what highlights came from the retreat on how DOE is going to move forward on climate change. Kuperberg said that the final outcome and the group's agreement about DOE's role in addressing climate change were exciting highlights.

Anjali Bamzai was asked to describe DOE's role in the production of the Synthesis and Assessment Product (SAP) reports. In 2002, a workshop drew up the Climate Change Science Program (CCSP) strategic plan goals and identified the SAPs.

(<http://www.science.doe.gov/ober/berac/Bamzai09-08.ppt>) The goals were to

- Improve knowledge of the Earth's past and present climate and environment, including its natural variability, and improve understanding of the causes of observed variability and change.
- Improve quantification of the forces bringing about changes in the Earth's climate and related systems.
- Reduce uncertainty in projections of how the Earth's climate and environmental systems may change in the future
- Understand the sensitivity and adaptability of different natural and managed ecosystems and human systems to climate and related global changes
- Explore the uses and identify the limits of evolving knowledge to manage risks and opportunities related to climate variability and change

For each goal, a series of SAPs was published. Of the 21 SAPs, DOE was the lead agency on three: SAP 2.1 a: Scenarios of Greenhouse Gas Emissions and Atmospheric Concentrations, b: Review of Integrated Scenario Development and Application; SAP 3.1 Climate Models: An Assessment of Strengths and Limitations; and SAP 4.5 Effects of Climate Change on Energy Production and Use in the United States.

SAP 4.5 was commissioned from the national laboratories and addressed three questions: How might climate change affect energy consumption in the United States? How might climate change affect energy production and supply in the United States? How might climate change have other effects that indirectly shape energy production and consumption in the United States?

SAPs 2.1 and 3.1 were developed by a DOE Advisory Committee, U.S. Climate Change Product Development Advisory Committee (CPDAC). It had 29 members and was chaired by Soroosh Sorooshian. CPDAC was active from August 2006 to July 2008.

SAP 2.1, Part A, developed scenarios to evaluate four alternative stabilization levels of greenhouse gases in the atmosphere (450, 550, 650, and 750 ppm) and the implications to energy and the economy for achieving each level. SAP 2.1, Part B, examined how scenarios have been developed and used in global climate change applications; evaluated effectiveness of current scenarios; and recommended ways to make future scenarios more useful. SAP 3.1 focussed on climate models, particularly the three leading U.S. models: Community Climate System (CCS), Goddard Institute for Space Studies (GISS), and NOAA's Geophysical Fluid Dynamics Laboratory (GFDL).

SAP 3.1 assumes a technical reader, but not necessarily a climate researcher. It is written at a level that enables intelligent use of climate model results. It covers comprehensive global coupled atmosphere-ocean-land surface-sea ice models and downscaling approaches. It does not include Earth system models of intermediate complexity. The report does not present projections; that was the responsibility of another SAP. It had a vigorous peer review. It focused on the following questions:

- What are the major components and processes of the climate system that are included in present state-of-the-science climate models, and how do climate models represent these aspects of the climate system?
- How are changes in the Earth's energy balance incorporated into climate models? How sensitive is the Earth's (modeled) climate to changes in the factors that affect the energy balance?
- How uncertain are climate model results? In what ways has uncertainty in model-based simulation and prediction changed with increased knowledge about the climate system?
- How well do climate models simulate natural variability and how does variability change over time?
- How well do climate models simulate regional climate variability and change?
- What are the tradeoffs to be made in further climate model development (e.g., between increasing spatial/temporal resolution and representing additional physical/biological processes)?

All three SAPs have been completed. DOE coordinated a press release of each SAP with the CCSP. SAP 2.1 hard copies have been submitted to Congress. SAP 4.5 and SAP 3.1 hard copies are being printed; these will also be submitted to Congress. Steps are being taken to terminate the CPDAC because it has successfully completed its charge.

Sayler noted that SAP 4.5 is not a FACA (Federal Advisory Committee Act) product and asked if that will be a factor in its acceptance by the scientific community. Bamzai replied that it went through the same types of rigorous review that the other SAPs did, so its usefulness should not be detracted from.

Leinen congratulated CPDAC and DOE. DOE was the only agency to complete all of its original SAPs. Bamzai and the advisory committee had done a great service to the science and policy communities Broido echoed the congratulations to Bamzai and her colleagues.

A break was declared at 1:50 p.m. The meeting was called back into session at 2:05 p.m.

Anna Palmisano was asked to report on the state of BER. She thanked the BER staff, BERAC, and Peg Riley's COV for their service and support and reiterated some of her priorities for BER. (<http://www.science.doe.gov/ober/berac/Palmisano09-08.ppt>)

- Rebuilding the leadership team after a number of retirements;
- Building even stronger programs through strategic planning and scientific peer review processes;
- Encouraging linkages among programs and having cross-cutting themes;
- Delivering on investments post-award;
- Strengthening partnerships within SC, DOE, and other agencies of the Federal Government;
- Empowering program managers to develop and sustain national programs that provide world leadership; and
- Clearly articulating BER science and increasing the visibility of BER's successes.

BER has been reorganized to improve communication among employees, reduce "stove-piping," allow full participation of all employees in programs, better reflect mission priorities and approach, and position BER for the future. The Office used to have three divisions that did not have a common culture. There are now two: Biological Systems Science Division (BSSD) and Climate and Environmental Sciences Division (CESD). A permanent division director is currently being recruited for BSSD. The directorship for CESD will continue to rotate for 120 periods until BER is able to recruit a permanent division director sometime after the new Administration begins.

BER held a scientific retreat in June. The goals for the retreat were to define the BER mission, approach, and cross-cutting themes; share information across program boundaries; team and establish linkages among programs; introduce logic models as a consistent approach to strategic planning, and discuss managing risk, strategic partnerships, outreach and communication, and human capital.

BER advances world-class biological and environmental research programs and scientific user facilities to support DOE's energy, environment, and basic research missions. Four overarching priorities were identified:

- Developing biofuels as a major secure national energy resource
- Understanding relationships between climate change and Earth's ecosystems, and assess options for carbon sequestration
- Predicting the fate and transport of subsurface contaminants
- Developing new tools to explore the interface of biological and physical sciences

BER has a distinctive approach to science: understanding complex biological and environmental systems across many spatial and temporal scales from the submicron to the global, from individual molecules to ecosystems, from nanoseconds to millennia. Also, part of the BER approach is integrating science with tight coupling between theory, observations, experiments, and models; supporting interdisciplinary research to address critical national needs; and engaging national laboratories, universities, and the private sector to produce the best possible science.

The logic model approach to strategic planning starts with the desired outcomes. The intermediate steps are very dynamic although the desired outcome will probably stay the same. The desired outcome for BER science is to achieve a predictive understanding of complex biological, climate and environmental systems in support of DOE's energy and environmental missions.

A support staff retreat was also held to analyze process flow, improve efficiency of operations, re-balance the workload, and encourage staff-development activities.

BER is already preparing for, and will be implementing, the transition to a new administration. In FY 2009, it is planning for one or more Continuing Resolutions that may last the entire year, effectively freezing budgets at the FY08 level. Expectations for a final FY09 congressionally appropriated budget are unknown.

BER is implementing a new management approach for the national laboratories: SFAs. SFAs encourage integrative, collaborative research programs, in support of the DOE mission. SFAs take advantage of unique national laboratory strengths in interdisciplinary, team-oriented, mission-relevant research. The SFAs will enhance dialogue between national laboratory science managers and BER program managers. Best management practices are being developed and shared with the national laboratories; follow up conference calls are scheduled.

In the Biological Systems Science Division, a workshop is being held on National Synchrotron Light Source II (NSLS-II) Imaging and Spectroscopy to explore NSLS-II imaging and spectroscopy applications for microbiology, cellular and organismal biology, plant science, and diagnostic medicine. Life science applications for macromolecular crystallography and X-ray scattering are well defined. However, applications of planned imaging and spectroscopy are less clear and will be the focus of the workshop.

The Bioenergy Research Centers are being reviewed with year-end, on-site reviews of science and management by a team of experts.

A workshop will be held on Sustainability of Biofuels: State of the Science and Future Directions to assess the current state of the science and identify future research, opportunities for partnering. It will be jointly sponsored by DOE (SC/BER) and USDA (Research, Education and Economics, and U.S. Forest Service).

Another workshop will be held on New Frontiers of Science in Radiochemistry and Instrumentation for Radionuclide Imaging to discuss reconfiguration of the BER Radiochemistry and Instrumentation program to incorporate research relevant to DOE's missions in biology and environmental sciences and to seek programmatic outcomes broadly useful and transferable to other agencies and industry, including nuclear medicine community. BER wants to participate in fundamental research in radiochemistry and imaging technology and contribute to BER biological sciences, BER environmental sciences, and NIH human health sciences.

The triennial onsite review of the JGI is being organized. A team of experts will evaluate science, operations, informatics, and management. Criteria include scientific productivity and impact, quality of user program, and value added from JGI informatics and data analysis activities.

A workshop on Low-Dose Epidemiology – What Can It Tell Us? will be held to develop an understanding of the value of current human low dose/low dose-rate epidemiological data, the potential to improve and expand low dose epidemiologic data, and approaches for integrating new molecular/biological knowledge and technologies into epidemiologic studies.

The Genomics: GTL PI Meeting will be held February 8-11, 2009, in North Bethesda, MD. Plenary sessions will include presentations by the DOE Bioenergy Research Centers. Breakout sessions will include topics on biohydrogen, annotation, multiscale

computing, ELSI and sustainability, and proteomics. It will include the USDA-DOE Plant Feedstock Genomics for Bioenergy Awardee Workshop 2009.

In the Climate and Environmental Sciences Division, the Environmental Molecular Sciences Laboratory (EMSL) Triennial Review will be held September 8-10, in Richland, Wash. An expert review panel will evaluate scientific impact and operational efficiency. Criteria include scientific productivity, strategic planning, and scientific leadership.

The ARM Airborne Measurements Workshop will be held to advance instrument development for and airborne measurements of atmospheric, climate-related processes.

The ARM Climate Research Facility (ACRF) Workshop will be held to ensure that ACRF has the strategy and tools to meet the science needs for the next 10 years.

The Workshop on Extreme-Scale Computing for Climate Change Science is being held to explore the potential applications of extreme-scale computing research to enable discovery in climate change science.

Upcoming plans and activities for BERAC: The JGI is working on a Strategic Plan and anticipates briefing BERAC at the February 2009 meeting and inviting a subsequent review of that plan. Palmisano has asked Tim Killeen, new Assistant Director of Geosciences for NSF, to attend the next BERAC meeting to give a briefing. It is hoped that BERAC will contribute strategic thinking that identifies areas of opportunity, science leadership, forward-looking advice, program reviews and COVs to keep the Office on the cutting edge of science, and visibility.

Discussion

Broido commented that the planning and reconfiguration of radiochemistry and nuclear medicine has left some angst. Dehmer said that the nuclear medicine program will be an integral part of the portfolio, but BER will be looking at how the lessons learned can be integrated into the other BER programs. Palmisano said that she saw researchers working in different programs, including nuclear medicine. It will be on the basic side, not the application side (which belongs to NIH). DOE will engage a lot of researchers in nuclear medicine in working on its other missions because that is where the program is going to grow.

Larson noted that the nuclear-medicine community is worried about any change in funding because DOE has been a major funding source. It must be made clear that DOE is going to continue that support. The entire effort could be intensified, as suggested by the appropriations committee. The trouble is, many interpret the model in a negative way. The language from the appropriations committee did not mention nuclear medicine. Such specificity is needed to attract students and other interest.

Petsko noted that the BER systems science program covers 20 orders of magnitude in size and time. The intermediate scales are the ones that are the most challenging. No technology spans those scales.

BERAC ACTION ITEM: Broido pointed out that strategic planning is a *process*, and the results from the workshops should be considered before this Committee discusses the topic. That notwithstanding, volunteers are needed to frame the questions to be addressed by the workshops. Gary Saylor, Gary Stacey, and Steve Larson volunteered.

Roland Hirsch was asked to provide an update on the Climate and Environmental Science Division. (<http://www.science.doe.gov/ober/berac/Hirsch09-08.ppt>) The new name reflects the science that is done. The largest share of the research

is done by the GTL: Genomics Program, and many of its accomplishments are being made at the Bioenergy Research Centers.

BER has made substantial contributions to a major federal interagency effort on biofuels spearheaded by the Biomass Research and Development Board, a high-level interagency group created by Congress in 2000, chaired by the Secretaries of Agriculture and Energy.

BER is making a significant contribution to Plant Feedstock Genomics for Bioenergy, a DOE-USDA joint research program. Other joint work is being done with BES, ASCR, and EERE. Another activity is information sharing within the GTL program; a workshop on the GTL Knowledge Base was held in May, which will lead to other activities to make information sharing effective.

Joint Genome Institute Strategic Planning is coming out early next year. The JGI has been extraordinarily successful. It is a complicated organization with a lot of work being done away from the central facility, which is jointly operated by JGI's six partners.

Recent BSSD Research highlights include:

- The use of the soft X-rays at the Advanced Light Source enables imaging of cellular components without having to expose the cells to potentially damaging staining reagents.
- The development of experimental approaches that will track single molecule movement in cells, correlating the location of a molecule with its biological and chemical actions, and producing insights about how specific systems function in cells.
- A Genomics Review Paper describes the enormous promise for development of new routes to cellulosic biofuels from genomic sequencing of plants and microbes.

A review of the Human Subjects Protection Program was held at Sandia National Laboratories and found the appropriate infrastructure and excellent procedures, a dedicated and a knowledgeable Human Subjects Administrator, significant management support, and a committed Institutional Review Board (IRB).

BSSD scientists receiving recognition include (1) Fred Hawthorne, who received the Priestley Medal, the highest honor bestowed by the American Chemical Society, and (2) George Church, who was featured in the August 2008 issue of *Wired* magazine, which noted his key role at the 1984 Alta Meeting and the beginning of the Human Genome Project.

Michael Kuperberg was asked to provide an update on the Climate and Environmental Science Division. (<http://www.science.doe.gov/ober/berac/CESD09-08.ppt>)

University solicitations from ARM garnered 16 proposals. The Environmental Remediation Science Program got 208 proposals in its 2008 annual call. The results from the transuranics SFA solicitation will be released in the near future.

Research highlights include

- The Japan Meteorological Agency has adopted DOE-funded cloud science to improve global precipitation forecasts.
- Accelerated Arctic land warming and permafrost degradation has been observed during rapid sea-ice loss.

- Changing atmosphere has been found to possibly drive forests to use more water.
- A special session at the American Geophysical Union (AGU) meeting highlights Climate Change Program field experiments.
- The Pacific Northwest National Laboratory (PNNL) aircraft facility received “Gold Standard” recognition.
- Lawrence Berkeley National Laboratory (LBNL) researchers won an R&D 100 Award for phylochip development.

Focusing on facilities, the ARM Climate Research Facility had its data accepted for international modeling use. The 160-teraflop upgrade of supercomputers at the Environmental Molecular Sciences Laboratory (EMSL) is almost complete. Also, EMSL had an MIE [major item of equipment] approved for its new chemical transmission electron microscope.

Roger Dahlman is being detailed to the SC position on the Climate Change Science Program.

The floor was opened to new Committee business. There being none, the floor was opened to public comment. There being none, the meeting was adjourned at 3:22 p.m.

Respectfully submitted,
Frederick O’Hara, Jr.
Recording Secretary
Sept. 19, 2008