MINUTES

Biological and Environmental Research Committee (BERAC) Meeting
Office of Biological and Environmental Research
Office of Science
U.S. Department of Energy

DATE: April 30 – May 1, 2003

LOCATION: American Geophysical Union, Washington, DC. The meeting was announced in the Federal Register on April 8, 2003.

PARTICIPANTS: Approximately 75 people were in attendance for part or all of the meeting. Fifteen BERAC members were present:

Keith Hodgson	Williard Harrison
James Adelstein	Steven Larson
Eugene Bierly	Louis Pitelka (by phone)
Michelle Broido	Janet Smith
Robert Fri	Lisa Stubbs
Ray Gesteland	James Tiedje
Jonathan Greer	Warren Washington
Richard Hallgren	

Ten BERAC members were not present:

John Ahearne	Roger McClellan
David Burgess	Jill Mesirov
Carlos Bustamante	James Mitchell
Charles DeLisi	Nora Volkow
Lee Hood	Barbara Wold

(Information on the BERAC membership can be found at: http://www.science.doe.gov/ober/berac/members.html)

Wednesday, April 30, 2003

Meeting opened at 9:00 a.m. Dr. Orbach was unable to attend due to last minute travel to Spain for the Secretary.

Introduction of members.

Keith Hodgson has given Ray Orbach recent briefings on the Structural Biology charge and on the GTL facilities letter report (though no commitments were made on future facilities plans or decisions).

Steven Larson – BERAC Member

Preliminary report on BERAC response to Orbach charge on future opportunities in radiopharmaceutical research. Preliminary report provided to BERAC members for discussion and evaluation. Vast majority of current advances in nuclear medicine and radiopharmaceutical development made with BER support.

How might BER optimize? Four questions in charge to BERAC -

- Assess future needs for radiopharmaceutical development in the era of molecular medicine
- Evaluate impact of the reported shortage of highly trained radiochemists
- Complementary role of agencies
- Impediments

Had participation of current thought leaders in this field.

Four summary recommendations -

- Tremendous opportunity and need for associated infrastructure. Establish 5-6 regional centers of excellence through open peer review to expand support for radiopharmacuetical development. About $100M per year additional needed to establish and support these centers. Need for close ties with academic centers of excellence.
- Expand training programs for radiopharmaceutical chemists and allied disciplines. $3-4M for training stipends with hope for matching funds from sister agencies. US academic institutions still have the lead in this area.
- DOE must take the lead in basic development and use of the physical sciences integrated with medicine by creating a master plan for a path forward.
- Need to work to create regulations that recognize the unique nature of radiotracers as "generally safe and effective."

Discussion/Questions

Shortage of radiochemists discussed. Most trained in radiochemistry have retired and not a lot of new training going on. What about mid-career changes for people trained in other disciplines? Good suggestion. Will try to incorporate into final report. Other kinds of chemists needed as well, e.g., organic chemists, all needed to enrich development of radiotracers. Value of an alliance with GTL program.

Same comment would have been made by the Environmental Remediation Sciences working group. The need for these types of chemists exist across disciplines.

When is a discipline pre doctoral or post doctoral? Argument for initial strength of training in chemistry with later specialization. Need funding agency support.

Radio/nuclear chemistry pitch within chemistry departments still a tough sell unlike new interest in chemical biology programs. Lots of excitement in development of and participation in interdisciplinary programs that span many different programs. These programs tend to be driven by teaching responsibilities. What about MD/PhD programs? Any opportunity there? Have tried to capture the interest of this group through the imaging side because of the growing interest and progress in this area.

Consensus that working group should finalize and flesh out report prior to posting on the web site.

Janet Smith – BERAC Member

Report on BERAC response to charge from Orbach - Current and future needs of large x-ray sources for biology and uses/opportunities of 4th generation light sources?

- X-ray crystallography – Growth and demand will continue to grow. Big changes coming with automation. This will result in more experiments that are faster, cheaper, and better. There will also be fewer on-site users. Not much done in the home laboratory anymore as reliance on synchrotrons grows. Recommend continued stewardship of biological crystallography and to continue coordination with NIH. See new opportunities for enhancing productivity of beamlines through development of automation. Also recommended continued coordination through interagency working group.
- X-ray spectroscopy – Require synchrotron radiation. Small diverse community. Detectors are the biggest technical challenge. May benefit from liaison with environmental science community. Maintain adequate resources for the critical field.
- Small angle scattering/diffraction – Very small US user community. Larger in Europe. A detector problem here too. Make good use of third generation sources since flux limited. May benefit from liaison with materials science and polymer communities. Need to maintain resources while exploring interdisciplinary opportunities.
- Next generation sources – energy recovery linac (ERL) – Very speculative. What, if anything can these sources do for biology? DOE leading development of these new sources which is good. High risk, high benefit science. Could be wonderful if it works for biology but still an unknown. This would be new science. ERL viewed as evolutionary while X-FEL is revolutionary. Be prepared to take advantage of ERL in future if stable, reliable sources become available. These would give shorter (1000x) and brighter (100x) pulses. High repetition rate could serve many experiments. May be well suited to use of microcrystals. Sources would need to be stable and reliable though they haven't been built yet.
- Next generation sources – x-ray free electron laser – These don't exist yet so speculative statistics. 10,000x shorter pulses and 100,000,000x brighter? Low

repetition rate so serve single experiment. Kinetic studies using a single pulse? Femtosecond reactions? This is doable. Would provide new information. Fundamental studies. Imaging non-periodic materials at nm resolution. Breakthrough importance but feasibility unknown. Possibility of imaging single molecules but a huge uncertainty at this point. Play a leading role in assessing the feasibility of imaging experiments. Solve substantial technical problems IF experiment is found to be feasible. Worth investigating but enormous technical challenges. Exciting if it works.

Discussion/Questions

Value or importance of this information in the context of GTL? Don't understand how anything works until you can see it. If this imaging methods works it will work best with larger complexes that are difficult or impossible to crystallize. Structural genomics as an aside on GTL. Improvements ongoing at light sources fits in very well with GTL needs.

Currently have a greater need for better utlization of beamlines rather than more beamlines. Improvements in utilization may be keeping up with or ahead of growing need. Ideas for use of these next generation sources are beginning to emerge – ideas that weren't there even 3-4 years ago.

Do we have a good fix on how to get from here to there or is this still really futuristic? Right now we need a source to even have a here. Radiation will destroy sample so need pulses so short that information obtained from diffraction of the sample and not its destruction. Initial machines will not have very good resolution. Most activities to date have been computational.

The reason that Ray, in part, pushed for this report was that it is important to have biological community input in ongoing discussions/planning for the next generation machines. Already seeing that early designs are for machines with shorter pulse lengths with goal of going even shorter. Needs to be lots of careful thought and computational modeling/planning. Ray was pleasantly surprised that biologists have been providing input.

Status of FEL facilities now? Stanford and Cornell have projects. Lots of international activity in the hard x-ray range with push to the visible. Germany investing – planned completion in 2011. LCLS DOE project at Stanford in preconstruction phase – planned completion in 2008.

Ari Patrinos – Associate Director of Science for Biological and the Environmental Research

Introduction to the rest of the day - EMSP moved from EM to SC in FY 2003. Teresa Fryberger joined BER from EM. Activities of great importance to DOE, SC, and BER. Strong links to GTL.

Michelle Broido – BERAC Member

Standing working group chair for Environmental Remediation Sciences Division. EM budget is more than 2X SC budget. Eight years ago idea for EMSP was presented to BERAC. EM needed science to support its mission. This actually happened over the past eight years. Will discuss future evolution. Also spoke of $200M construction project – EMSL – that would support DOE environmental needs. Will also hear update on EMSL. Also spoke of Natural and Accelerated Bioremediation Research (NABIR) program – an active and productive program within BER. Not as well integrated into broader DOE needs as well as it could have been. Now have opportunity for this integration with EMSP, NABIR and SREL all in one place now.

Teresa Fryberger – Director Environmental Remediation Sciences Research Division

- Environmental Remediation Sciences Division (ERSD). All missions related to cleanup of DOE legacy waste.
- Overview of cleanup challenges from Kevin Crowley at the last BERAC meeting (see minutes from December 2002 meeting).
- Office of Environmental Management (EM) has been in existence since 1989.
- High level waste (HLW) comes from reprocessing, transuranic waste (TUR) goes to WIPP in New Mexico, most low level waste (LLW) buried, nonradioactive hazardous and mixed wastes very poorly characterized.
- More contamination and waste will be identified as characterization continues. Decontamination-related wastes haven't even been considered yet to any extent. Secondary waste streams from clean-up operations will be an issue. Long-term stewardship of sites with residual contamination also needs to be considered.
- We haven't done this before. There is a need for a technical basis to make decisions as well as for new approaches to reduce costs or provide new (or any) approaches.
- Example – HLW in tanks at Hanford. Nitric acid dissolving to reprocess. Left with high radioactivity, large volume of acid, many metals. Attempt to neutralize resulted in pH 11-12 or higher. Single and double shell tanks. 50+ million gallons of waste.
- Science issues – Chemistry of high pH solutions to predict waste behavior. Tailored waste processed to cut cost, reduce volume, improve waste form performance. Designer materials for waste forms to improve performance and reduce volumes and costs though once decisions are made and agreement is achieved with the public this can be difficult to change. Remote characterization and online monitoring tools.
- What happens during retrieval? What does it mean to say that we are done? We don't really understand the risks. We don't understand how contaminants behave in the environment.
- Many science issues – modeling/prediction, complexity, scaling, characterization/monitoring, in situ remediation/immobilization, surficial transport, trophic transfer

- ERSD staff – Judy Nusbaum, Anna Palmisano, Paul Bayer, Roland Hirsch (in Medical Sciences), Brendlyn Faison, Henry Shaw, 3-4 new slots hopefully
- Four topical areas – EMSP, NABIR, EMSL, SREL
- NABIR - $24.7M, EMSP - $29.9M, EMSL - $38M (operations not research, budget up this year due to purchase of new computer), SREL - $6.8M, miscellaneous - $10.1 M – minus $12M for unfounded congressional earmarks in FY 03. This is the largest (only) program of its kind anywhere in the world.
- Strategic planning – Two workshops with broad scientific and federal participation. BERAC working group. Version 2 of strategic plan is under development following initial meeting with BERAC working group.
- Mission statement – Enable scientific advances that help solve currently intractable environmental problems or otherwise provide break-through opportunities for DOE environmental missions, while also contributing to the general advance of the scientific fields involved.
- Three goals – Science to inform decisions about environmental remediation and stewardship. Advance science that enables innovative remediation technologies and methodologies. Synthesize and integrate across disciplines to foster new approaches.
- Focus on DOE-EM relevant issues that are currently intractable and where science can have the greatest impact.
- Broad collaboration and coordination across agencies and within DOE and BER.
- Challenges – Integrating the science across BER. Fostering interdisciplinary research teams. Nurturing truly innovative ideas. Getting the science used.
- To get the science used we need to – Work with clean up site staff. Work on specific site problems. Sponsor frequent technical exchange workshops with sites. Develop strategy to "advertise" successes.

Anna Palmisano – BER Program Manager

- NABIR program overview. Goal to provide science underpinning development of bioremediation strategies for cost effective remediation of metals and radionuclides in the subsurface. Focus on immobilization as a long term strategy.
- Coordination across agencies and internationally.
- ~$20M per year spread across ~60 projects and a Field Research Center (FRC). Over 300 peer reviewed publications.
- What have we learned so far?
    - Naturally occurring microbes reduce U, Tc, Cr and other metals. Don't necessarily need to reengineer microbes since they can already do things that we need them to do.
    - Metal reducing microbes are common in subsurface environments. Have found metal reducers at all DOE sites examined so far. Use of community fingerprinting methods. Have been able to isolate a number of novel metal reducers.
    - Metal reduction can be enhanced by feeding microbes carbon sources. Provides electrons that fuel chemical reduction of metals. Nutrients can accelerate reduction rates.

    - We can stimulate the growth of metal reducing organisms in situ. Two examples. Push-pull study at ORNL FRC. Push substrates into monitoring well. Pull samples back out to interrogate in situ microbial activity. U and Tc were pulled out of test samples though need to test impact of co-contaminants. Uranium Mill Tailing Remedial Action (UMTRA) site. Following injection of organic carbon saw dramatic change in makeup of in situ population with big increase in Geobacter – the U-reducing microbe. With additional time, the Geobacter were replaced by another microbe. This illustrates the importance of doing field studies to test laboratory based hypotheses.
- Key questions remaining – What are the in situ rates of metal reduction in a range of subsurface environments? Can we model and predict what these rates might be? What is the long term stability of the reduced phase?
- How can NABIR help? Can serve as the basis for science-driven decision making and policy.

Discussion/Questions

- How large an area can be stimulated with a carbon injection? Depends on site hydrogeological properties. Some places will be very difficult. At many sites with great porosity this will be very doable (presumably).

- How specific are these microbes for the metals? Do need to drive the system anaerobically. Don't have answers yet. Is the reduction reversible? Looking at this very carefully in the program.

Roland Hirsch – BER Program Manager

- EMSP snapshot. What are the possibilities?
- Stated goals – Scientific knowledge! Understanding the properties of waste is needed.
- Jointly managed by EM and SC since its inception.
- EMSP covers many disciplines (FY 2002 snap shot) – chemistry (42%), geosciences (30%), materials sciences (9%), engineering and robotics (9%), biosciences (9%), other (1%). Similar breadth by EM topic area – HLW and subsurface contaminants represent 67%.
- Very collaborative program – most projects have PIs at more than one institution.
- Impacts to date
    - Personnel monitor for radon and thoron. Significant factor at Fernald site. Need to be able to detect Rn-222 from U decay chain (4 day half life and biological health risk) separately from Rn-220 from the thorium decay chain (very short half life and less of a biological risk)
    - Replacing a failed cesium separation process. 30 year half life compared to thousand for some of its co-contaminants. If separation possible, then could allow cesium to decay. Original precipitation process was dangerous and yielded an unstable precipitate. New process now in use.

- A scientific basis for predicting the migration of cesium-137 leaked from high level waste tanks. Research showed why initial predictions that cesium would move quickly at Hanford were wrong and showed that certain forms of cesium moved much more slowly than predicted. Thus, the cesium was not likely to reach the river before it decayed.

Tina Kaarsberg – comments. Staff for House Science Committee.

- HR 238 SC authorization bill passed out of committee on April 28 (?). SC increases recommended at ~15%. Some programs carved out – fusion, nanotechnology, GTL. Good news is that there is finally authorization for SC programs. Senate marked up their version yesterday. Very similar to HR 238 as originally introduced (lower numbers). Also recommends Undersecretary for Science.
- SC has not been authorized since the 1980's. Will see if there will be any impacts on subsequent appropriations.

Bill Rogers & Allison Campbell – EMSL Director & Associate Director

- EMSL update. Is it a user facility and is it providing value to EM needs?
- Just celebrated 5th anniversary.
- FY98-02 – 5500 users and 2000 user projects
- EMSL facilities: chemistry and physics of complex systems, environmental spectroscopy and biogeochemistry, high field magnetic resonance, high performance mass spectroscopy, interfacial and nanoscale science, molecular science computing
- Science thrusts – advanced computational methods, chemical physics, nanoscience, oxide chemistry, proteomics, structural biology, subsurface science
- Examples of research highlights – breast cancer tumor suppressor protein interactions, U of Washington scientists; proteomics accurate mass tag approach and mass spectrometry demonstrated on Deinococcus radiodurans for which 80% of proteome characterized in a single run, aiming for 60 runs per day; microbial electron transfer to oxide surfaces, SREL scientists; subsurface science demonstrating the soluble U-bicarbonates are precipitated as U-silicates that will help determine in-ground reaction sequences, support corrective action decision
- EMSL peer review November 2001 and May 2002 action plan – benchmarking needed, establish scientific challenge areas, attract high visibility users, maintain EMSL as state-of-the-art; scientific advisory committee being re-established separate from user advisory committee; collaborative access teams and team leads being used in the future help strengthen and build programs
- Building and engaging user communities to identify and solve scientific grand challenges and developing new capabilities to support these challenges.
- Two new grand challenges – The mineral-microbe interface and defining the molecular "hand shake" or transfer of electrons that occurs across that interface. Biology challenge. Advisory group meeting soon (Marv Cassman, Mina Bissell,

Dave Galas, Rudi Aebersold, Len Spicer) to help define a challenge. Molecular crowding as one possibility.
- Attracting leading scientists – Mario Molino – Nobel laureate as new user in air pollution; J. Mike White, UT Austin user and sabbatical visitor, origins of photo-induced hydrophilicity on TiO_2; Barbara Finlayson-Pitts and Jim Pitts, user and sabbatical visitors, atmospheric processing of sea salt.

Discussion/Questions

- Review of applications from users – All reviewed externally or by expert PNNL staff.
- How/why so many more users this year (2x increase?) – More computing capacity increases user base. Count people who use EMSL software at their site. Increase in PNNL users who can run experiments themselves.

Paul Bertsch – Director SREL

- Founded in 1951, with AEC funding, by Eugene Odum (father of modern ecology) of the University of Georgia; funding from "SC" 1951-1990, funding from the Savannah River Site 1995-2002. Transferred to BER in FY 2003.
- Located at the Savannah River Site in Aiken, SC. Sits on the Savannah River that divides Georgia and South Carolina. SREL Director reports to VP for research at U of Georgia. ~150 staff including ~25 faculty. Teaching, research, and service responsibilities.
- Integrated, multidisciplinary program of field and laboratory research.
- SREL received state funds to purchase vehicles, instrumentation, equipment, and student support (up to $1M per year).
- Current cooperative agreement established under EM model requiring greater responsiveness to DOE needs in areas of ecological processes understanding and ecological risk assessment
- Base ecological studies - Why/how ecosystems change with and without disturbance. Benchmark for assessing impacts of environmental disturbances and efficacy of remediation activities. Site specific information for ecological risk assessment.
- SREL products used by Savannah River Site – Improved remediation and lanad management. Interface with site personnel to influence management decisions, e.g., decision made not to drain and remediate a reservoir but instead to repair dam and maintain at full pool saving ~$1B in clean up costs.
- Education program – 300 theses and dissertations, >600 undergraduates from all 50 states have participated in SREL-sponsored research, NSF funding for undergraduate research since 1967.

Workshop report (Paul Bertsch continued)

- March 4-5, 2003. "Research Opportunities for Studies of Contaminant Transport in Fluvial Systems at the Tims Branch-Steed Pond System at the SRS."

Possibility of establishing a long-term field research site at the Savannah River Site. Value of expanding ongoing BER emphasis to surface or near surface sites compared to current subsurface emphasisi

- Key research needs – current drivers of contaminant fate and transport, effects of perturbations, coupled processes, scaling
- ERSD should expand its focus to include research on fate and transport of contaminants in fluvial riparian systems

Benjamin Hay – PNNL, Science talk

- Computer-aided design of metal ion hosts
- Broad and diverse needs and uses for metal ion hosts from water softeners to applications in medicine
- Structural effects are often difficult to predict. Seemingly small structural changes can dramatically change the binding affinities or specificities of various ligand molecules.
- Need to understand/predict the structures with and without ligand binding. Use of electronic structure calculations. Use of 6 cpu years for only 10 structures 5 years ago. Took 1 month of EMSL computer. Today would take a few days. Still too slow since many structures have many more potential conformations.
- Force field calculations are much, much quicker. However, these models often require parameterizations. Work well on simple systems but not initially on more complex systems.
- Structure design – actinide sequestering agent design as an example. Drug design programs not helpful since specific for proteins. Problem – You have to build structures before you can test them. Host designer software – sort of a computerized tinker toy program.
- Several specific applications in progress with various collaborators.

Michelle Broido – Discussion and recommendations of the Environmental Remediation Sciences Working Group

- Four BERAC members on the working group. Wanted to avoid members whose research is dependent on funding from the ERSD.
    - Michelle Broido, Chair, BERAC, U Pittsburgh
    - John Ahearne, BERAC, Sigma Xi
    - Jill Banfield, UC Berkeley
    - Margaret Cavanaugh, NSF
    - Wendy Cieslak, SNL
    - Sue Clark, Washington State U
    - Ken Eggert, LANL
    - Lou Pitelka, BERAC, Appalachian Laboratory
    - Mark Rivers, U Chicago
    - Jim Tiedje, BERAC, Michigan State
    - Sam Traina, U California, Merced
- Strategic Plan discussion

    - How do you maximize impacts and not dilute research efforts? Too much for ERSD to try to tackle "everything." What are the intractable problems at the five top DOE sites – Hanford, INEEL, Nevada Test Site, ORNL, Savannah River? Presumably EM will focus on the low hanging fruit. Is there broader applicability to any of the science being done beyond just these specific sites?
    - What is relationship between the four programs we heard about today – EMSP, NABIR, EMSL, SREL? Strategic Plan hasn't really addressed this yet but there is a real opportunity here. Tremendous potential to build a broad synergistic division.
- NABIR
    - Excellent example of successful, well managed, focused, well planned science program.
    - Raised issue of long-term immobilization. Is potential remobilization being adequately addressed since this is a central point related to long-term value of potential NABIR-based remediation strategies?
    - Excellent example of the absolute need for field research. ERSD is going to need more and diverse field sites. Critical and expensive. Current plans call for NABIR to issue a call for an additional field site. How can this be leveraged more broadly for the needs of the ERSD?
- EMSL
    - Many points discussed are broader than EMSL.
    - Many questions raised about the grand challenges. Be careful that these aren't based on "instruments looking for problems." Are these really grand challenges. They are certainly important but are they all grand. The subsurface one in particular didn't seem that grand – is the choir preaching to the choir in this case? Doesn't seem to be the case in the case of the biology challenge. How are these going to be paid for? If properly orchestrated these are a great opportunity to educate a broad scientific audience about scientific issues and research opportunities. Great strength in microbiology at PNNL. Important to tie challenges to this strength. Important linkages to other parts of the program. Opportunities to tie to physical sciences needs of GTL. Try to tie more broadly across BER needs.
- SREL
    - Opportunities for complementing other ERSD programs even though SREL strengths haven't been central to ERSD activities in the past.
    - SREL does have strong and useful connections to DOE/EM sites.
    - Broader focus on ecology has not been part of EM programs. Given budget realities, probably not possible to expand beyond SREL but important to continue this SREL work.
    - Potential opportunity to change some of the directions or at least some of the working rules. EMSP projects have addressed key EM problems in EM language. Projects have mostly been small, focused efforts. Science has been good. Some examples of concrete successes. With time try to focus, not on all EM problems, on a smaller number of really intractable

problems that fill in gaps. Look to complement SREL research and EMSL grand challenges.

- INEEL Environment lab and the Idaho site would like to expand their subsurface activities. Ray asked to review concept and asked BER for comments. Working group will be reviewing at INEEL in the fall of 2003.
- Aresenic in drinking water congressionally directed research. Directed by the American Water Works Association in conjuction with Native American tribes. Not likely to be a one time appropriation. There are some opportunities here. The surface water issue is much broader than arsenic so hopefully can leverage into something with broader value for ERSD.

Summary -

- ERSD can certainly be greater than the sum of its parts though much work will be required to get there.
- Field sites absolutely critical.
- Speculation for future opportunities: Nanoscience and nanotechnology. What role could it play in ERSD? What about nano particulates and their impacts on the environment?
- Inegration across scales from the microscopic to the mesoscale. Clearly not just limited to the environment. A GTL issue too. ERSD and GTL can help each other. Crossing scales found across disciplines, e.g., big issue for medicine. Many opportunities.

- How should this working group proceed? Charge from Ray? BERAC? Don't really want to self charge in the future.

- What should be done with draft report? Let BERAC review and transmit formally? Provide to ERSD informally? Use as the basis to formulate a future charge? Chair's view that the report should remain informal. Can certainly get charges before the next BERAC meeting. Much of these initial deliberations were based on less than complete information on different aspects of the program so probably don't want to formalize it at this point.

Discussion

- Need to continue to balance between real needs drivers and fundamental science drivers.

Public Comment –

- There are some major EM policy shifts. Need to consider land use after remediation and the associated risks. There are now opportunities to invest in even riskier remediation strategies. In some cases there is a view that bioremediation will be the method of choice. There is an open ear on the EM side more than ever before.

Meeting adjourned – 5:40 p.m.

Thursday, May 1, 2003

Congratulations to Jim Tiedje (BERAC Member) who was just elected to the National Academies

Ari Patrinos

- Seesaw of our FY 2004 budget travails. 10.5% reduction overall from President's request. Funds to Homeland Security, Congressional direction, general reduction and rescission, and proposed reprogramming for needs in Ohio (OVEC). Some additional funds appropriated and added at SC-1 discretion primarily to supplement grant at Dr. Venter's Institute for Biological Energy Alternatives.
- Optimistic that FY04 and FY05 will be much better. In the midst of dealing with FY05 now. This was one year where all three fiscal years got jammed together in time. In fact, FY04 was presented to Congress before we even had our FY03 budget.
- Joel Parriott (our OMB examiner) thinks that we have done a good job of setting and managing our priorities. Our highest priority in BER is GTL. We value all our programs but this is at the center of our future and the future of many of our national laboratories if they want to remain part of the biology revolution. Not all believe the DOE and biology are still a good match, including some in the Administration and in Congress.
- Some reference yesterday from Tina Kaarsberg about GTL. Have a lot of friends on the Senate side. The House Science Committee has been reasonably supportive as well. Both the House and Senate have passed bills authorizing the GTL program – like having a limit on your credit card established. The House Energy and Commerce Committee (the old Dingle committee) has had some issues with GTL. A jurisdictional issue between House committees. Claims were made that GTL should be an NIH program. Ray and Ari spent a Sunday on the Hill discussing and negotiating. Things have been worked out reasonably satisfactorily at this point. Confident that we will eventually emerge from the Conference Committee with a GTL and GTL facilities mandate. Congress only picks certain areas of science to authorize so those programs not specifically mentioned should not feel left out.
- GTL facilities – mostly what I can't tell you. Owe many a real debt of gratitude for their efforts. Know that it is frustrating that I can't tell you very much. Each SC office has proposed a set of new/next generation facilities. BER opted to only put forward the four GTL facilities. Ray had promised decisions in March after receiving Advisory Committee input but decisions/announcement have been delayed. Other parties need to be engaged first, both inside and outside the Department. Ray has made some decisions but has delayed making any announcements. Can't say anything more than this at this point.

- Keith – Didn't have an impression from Ray that he had a clear plan yet. Said that he would pay very close attention to BERAC recommendations and that he understood the advisory committee role.
- Preliminary good news about facilities. BERAC has pushed for SC/DOE recognition of unconventional facilities within BER. Until now it has been only light and neutron sources, EMSL, and the other very large facilities. User facilities have traditional been treated better by OMB when funds were available. For now have gained some traction here. PGF, ARM sites, FACE sites, AmeriFlux sites, new mouse facility at ORNL have been accepted, at least on a test basis, as user facilities. This brings with it new responsibilities for reporting, interactions with users, etc. Patience and persistence is urged since the eventual outcome is a benefit. Does this acceptance extend beyond the budget office to outside DOE yet? OMB buys into this – Parriott is on board.
- Human Genome celebrations a few weeks ago. Welcome to Mark Guyer from the National Human Genome Research Institute. Parties, science, good press coverage – even references to GTL in the Washington Post. The Secretary was unable to make any of the events but wanted to do something separate which occurred at The Institute for Genomic Research with Claire Fraser and Craig Venter and the announcement of additional funding for IBEA and kudos for DOE's role in the project. A great series of events.
- Are banking on the success of the high risk IBEA effort by Craig Venter and Ham Smith. Has caught the attention of some within DOE for its potential/predicted impacts on energy production.
- During recent Ray Orbach budget hearings Senator Domenici challenged Ray on when we would be able to come up with real and final answers to the thorny questions in low dose radiation. We are pushing back to emphasize that this is still basic research.
- Orbach was also challenged by Senator Hobson to identify a high risk, high payoff project that could yield results over the next 7 or so years. Orbach identified BER. We have proposed going forward with ideas and devices that could restore neurosensory function, e.g., paralysis, artificial sight, bladder control, etc.
- Grand challenge issue. Came from Undersecretary of Energy Bob Card. He is renegotiating national lab contracts and is asking some tough questions. Focus on competition and reward for good performance. From this came the grand challenge or the "over the top" concept. Goals that are unlikely to be reached in the normal course of business. Some variations on what would constitute a reward at each lab. What we put together for PNNL – Notion to make the EMSL resources available as an ensemble to an outside community that would compete for and use these resources over a period of time. How could these resources be used to drive science beyond what would normally occur. Valuable since it exposes the capabilities of PNNL to the outside scientific community. Transferability to other laboratories? These challenges do not imply that any additional resources will be provided. This is not intended to be an add on.
- Climate change. Getting a bit more organized though much remains to be done. Now have Climate Change Science and Climate Change Technology programs.

Overall plan for the Climate Change Science Program will be ready soon. We are committed for Ray Orbach to look at impacts of three levels of CO_2 – 450, 550, and 650 ppm. Controversial but going forward with this. Issues of the Earth Simulator in Japan that can deliver sustained Tflops of 40-45 which is much more than we can do in the US. We are working to run our models on the Earth Simulator with Warren Washington and others.

- JASON interactions this year. Joint summer study sponsored by us and NIBIB (National Institute of Biomedical Imaging and Bioengineering at NIH). Computational issues associated with medical imaging, e.g., PET of moving subjects.

Questions/Comments

- Grand challenge. How will users be chosen? This can be very difficult and challenging. This is a key part of the process. How do you measure success? What is the time constant applied to that metric? No question that this is high risk and will take uncertain amounts of time. Careful thought required. One of the challenges of defining these is that they may not look like grand challenges if you aren't in the field. Will not necessarily be easily recognized by everyone as such. These must be defined by scientists.
- GTL facilities. Have previously described concept for these. Have they changed substantially or remained the same? Information is available on the GTL web site at www.GenomestoLife.org. Hope that BERAC will get to have more input into this process. We should be thinking of these in new and imaginative ways and not just as buildings that tend to take on lives of their own. Need to think about creative ways to include both labs and universities in this process. Would like to engage Dr. Orbach on these topics. Additional charge in this area that could help? BERAC can/should play role as ambassadors with other agencies. May want/need to consider some of these facilities, especially the later ones, as virtual facilities. Opportunities for partnering with NIH? NSF is grappling with exactly these same questions, i.e., what is a facility. NSF will clearly be going to much more distributed facility. DOE can be a leader. Things change so quickly that you don't want to get locked into any one plan too early. Would be valuable to come up with a short statement for Ray of what BERAC thinks are the key issues going beyond the GTL facilities report provided to Ray in February/March. The facilities are a key enabling part of the program but they aren't the program itself. If done correctly they will enable and help grow the science program.
- Update on SC strategic planning? Delays in releasing the strategic plan. Essentially ready to go but some internal bureaucratic issues as it relates to budget and performance measures.
- What about SEAB process as it relates to the Strategic Plan? SEAB is focusing on SC research portfolio. This is encouraging. Chuck Vest has the lead for SEAB. Have heard from AD's. They were then supposed to go hear from the community and would only get back with AD's if additional information needed. Presumably they are working on this. Assumption that the Secretary would make science a

priority in FY05 and beyond so SEAB input will be critical. No contact with SC Advisory Committees as far as we know.

- What is the future of Homeland Security with respect to BER? Hopefully this is the last we will hear of this or least of budget impacts. We no longer discuss items related to Homeland Security in our budget or when discussing our programs. Homeland Security does have some of the same needs discussed yesterday in the Nuclear Medicine report. John Vitko (LLNL) is our contact at Homeland Security.

Lou Pitelka – BERAC Member

- Evaluation of the Biosphere 2 Center (B2C) as a potential National Scientific User Facility.
- Review team was charged to "provide its collective comments and perspective on the potential of B2C as a user facility." Four questions were asked.
- What are the potential values and uses of B2C as a user facility and what are its scientific and operational limitations? There is potential value to B2C for conduct of long-term experiments on large stature vegetation under controlled conditions. There is also great advantage to being able to close the mass budgets (e.g., carbon, nitrogen). However, in the end there is only a sample size of one and too many potential problems that could result from "memory effects" as environmental conditions are changed between experiments. There is also little or no evidence for sustained operation of B2C over long time periods and there is an absence of critical data and analyses. The review team concludes that B2C is a facility in search of questions.
- Would investing in B2C now be timely and appropriate for DOE/BER? If not, is there a need for further assessment of the potential uses, limitations and strengths of B2C compared to other existing or potential facilities? There is not now a compelling rationale for DOE/BER investment in the facility. A stronger case needs to be made. Recommendation #1 – BER should not fund the operation of B2C at this time. Recommendation #2 – BER should not conduct any further investigations or assessments at this time.
- How might BER seek independent input on the relevance, limitations, uses and value of B2C from members of the scientific community? Recommendation #3 – Any further consideration by BER of funding for B2C should be done through an open, competitive RFP process through which other proposals for ecosystem research facilities are solicited and the strengths and weaknesses of B2C can be compared with those of alternative types of facilities. (This is appropriate mechanism for seeking community input and evaluation)
- If DOE should consider providing core operating funds, what factors should DOE consider about timing, level, and sources of funding? Recommendation #4 – Any future funding for the operation and maintenance of B2C should not be taken from the current research budget of BER. Recommendation #5 – Any further consideration by BER to provide support…should be conditional on obtaining new funding specifically targeted for national user facilities for research on ecosystems and global change.

Questions/Comments

- Actual report (posted on BERAC web site) has list of participants at the review.
- Very well done and interesting report. This is a case designed for very different purposes that is trying to convert itself into something that it wasn't intended to do.
- Why was it built in the first place? To do the human sustainability experiment in terms of the atmosphere, food, and waste.
- This has also been reviewed by the Washington Advisory Group. Person hired by Columbia to direct the facility is now gone. Serious problems for Columbia. Did this initially come to us through congress? No. It came through our previous Undersecretary Ernie Moniz with no pressure to go forward.

Ari Patrinos – DOE Data Release Policy

- Especially DNA sequence data but likely the beginning of broader data release policies for all types of BER generated data.
- Early decision in the Human Genome Project to make all sequence data freely and rapidly available. Initially 6 months early on but eventually it became immediate release. Bermuda Principles adopted in 1997 called for release, within 24 hours, of any DNA sequence data >2,000 base pairs.
- Meeting in January 2003 to revisit data sharing issues - initiated by the Wellcome Trust. Sequencers, bioinformaticists, funding agencies including a number of NIH institutes, journal editors. So much additional sequencing of other organisms occurring now. Also cases of "abuse" (of scientific etiquette) by bioinformaticists scanning public data bases and rapidly publishing without even contacting sequence originator. Ended up reaffirming the original Bermuda Principles and beginning discussions about original types of data.
- NHGRI has draft guidelines that have gone through their council.
- NSTC Interagency Microbe Project Working Group has also developed a draft data release policy. Reaffirms Bermuda Principles but acknowledges that microbial data requires additional considerations.
- Draft DOE policy – Adherence to NHGRI Draft Policy for Community Resource Projects with the following exception – single project of <100 Mb total or consortia of single organisms of <300 Mb total have a 6 month grace period before unrestricted data release.
- Community projects are those for which sequencing centers receive public funding to do sequencing for scientists in the broader scientific community.

Questions/Comments

- Mark Guyer, NHGRI – More and more the funding agencies are providing funds for projects that are meant to generate public resources.
- Interesting if we can get journals to buy in to prevent publication of analyses of "stolen" data. Won't happen. Nature has been quite adamant about this if the

articles pass peer review. The journal editors may play some role but they don't want to be the initiators.

- Nothing gets out of genome study section now without a specific data release plan.
- Major sequencers are encouraged to make their sequencing plans publicly available.
- Where do these numbers come from and is NIH using a similar process for microbes? Our numbers are still part of an experiment. What about the 100 and 300? These seem like pretty substantial numbers. Could imagine that many "community projects" would fall under this cutoff.
- Perception that NIAID would call for immediate release of organisms sequenced to generate a resource whereas delayed (or no?) release for projects that were being done solely for research.
- Six months seems reasonable but the 100 and 300 seem too high.
- Propose that BERAC establish bounds based on the proposal and size of the community of interest rather than on project size.
- Most microbes would not be community resource projects because of the limited scientific community value.
- Path forward for recommendation from BERAC? Ray Gesteland to contact members of subcommittee and provide rapid feedback to BER for use in the current solicitation.
- Revisit soon as JGI/PGF develops into a user facility and defines what users are and how different types of projects will be categorized, e.g., who is paying for the project, etc.?

Public Comment

- Make sure that GTL facilities letter report to Ray Orbach is on the BERAC web site. [Post meeting note – This report was posted on the BERAC web site in March 2003.]

November 13-14, 2003 for next BERAC meeting