MINUTES

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

DATE: April 25-26, 2002

LOCATION: American Geophysical Union, Washington, D.C. The meeting was announced in the Federal Register.

PARTICIPANTS: Approximately 85 people were in attendance during the meeting. Fifteen BERAC members were present:

S. James Adelstein
Eugene Bierly
Michelle Broido
David Burgess
Ray Gesteland
Richard Hallgren
Willard Harrison
Steven Larson
Jill Mesirov
Louis Pitelka
Janet Smith
Lisa Stubbs
James Tiedje
Warren Washington
Barbara Wold

Thursday, April 25, 2002

Keith Hodgson (BERAC chair) was unable to attend the meeting due to a program review commitment. Ray Gesteland chaired the meeting.

Attention was called to a World Trade Center ground zero exhibit in the foyer and Terrace Room of the American Geophysical Union. This is a public exhibit of images before September 11, 2001, after September 11, and on December 11, 2001.

Dr. Jim Decker – Principal Deputy Director, Office of Science (SC), DOE
FY 2003 Office of Science budget request overview

- 5% increase in the FY 2003 request overall for Science
- Nanoscience +$48 million
- Genomes to Life +$20 million ($15 million in of Office of Biological and Environmental Research, and $5 million in the Office of Advanced Scientific Computing Research)
- Scientific Discovery for Advanced Computing $5 million
- User facilities time & instrumentation +$40 million
- Improved infrastructure +$6 million – SC has responsibility for 10 DOE labs
- 3 nano science centers to be built at Oak Ridge, Lawrence Berkeley, and Sandia National Labs – project engineering & design funding in place with construction of Oak Ridge center underway

- Infrastructure
  - Line item construction +$10 million
  - Oak Ridge landlord +$1 million
  - Congress had added $10 million in FY02 for facilities disposal

Questions/Discussion -

- Are there any budget protections for people? Generally increases in budgets are for specific initiatives. Decreases in personnel have become common across government.
- Government Performance and Results Act – DOE hasn't done a great job so far according to Congress.
- Earmarks – BER continues to be the home for the majority of SC earmarks. In the past few years Congress has always added funds for projects so they haven't eaten into BER's core budget. In FY03 there are concerns about whether there will be enough money to fund earmarks outside of our request.

Rod Brown - Deputy Undersecretary; Research, Education, and Economics (REE); USDA

- Mission area divisions at USDA, REE covers almost all research, most education, and cooperative extension service
- REE Research: Food safety, Human nutrition, Biosecurity, Environment, Animal health, Plant disease
- Genomics: Animal, Plant, Microbe – animal/plant pathogens, fermentation, Insect

Opportunities
- Sequencing needs, leverage genome projects funded by other agencies
- Strong technology R&D partners – sequencing centers, government labs, universities
- Would love to have every USDA-related organism sequenced – how to prioritize? NIH process to identify priorities. Interest in working with DOE as well – sequencing, informatics, etc.
- Very appreciative of microbial sequencing DOE has done so far to benefit USDA needs

- OSTP committee on domestic animals – Joe Jen (USDA) chair, Francis Collins (NIH), Ari Patrinos (DOE), Mary Clutter (NSF)
- Farm bill being debated that may include opportunity for joint research with other departments to co-mingle funds, reviews, etc.

Questions/Discussion -
- Plant genomics progress? – National plant genome initiative. December 2001 report available. Progress greater than expected. Hope for similar success in animal genomics.
- How international are USDA interests/activities? – Very substantial interactions, e.g., public perception of genetically modified foods. Meeting on Agriculture research in Europe about 18 months ago – in spite of what is going on publicly in Europe there is

still an expectation at some levels that genetically modified foods will dominate even the European market at some time in the future.

Ray Gesteland

BERAC – USDA working group has been formed and has met once by phone. Planning to meet at the DOE Joint Genome Institute Production Genomics Facility in July to see/understand sequencing possibilities. Membership of this joint working group attached to these minutes in Appendix.

Francis Collins - Director, National Human Genome Research Institute (NHGRI), NIH
So We've Sequenced the Human Genome: Now What?

- Few parts of future genome research will be as clearly defined as sequencing 3 billion bases of DNA.
- Most things from the last 5 year plan for the Human Genome Program (1998-2003) are actually almost done already. The last few are being done.
- Current plans call for an April 25, 2003 completion/celebration/publication of the complete human DNA sequence. This will be the 50th anniversary of the Watson & Crick Nature publication on DNA.
- Medical genomics, functional genomics, comparative genomics, proteomics - all examples of where things are going in genomics today.
- There is a new environment for research – Centers of excellence in genomic science, multi investigator, multi disciplinary. Each with a common theme and core facilities. Planning grants are available. These are modeled after NSF Science and Technology centers. These are intended to have long term, stable funding and a review after 5 years. These may to increase to 25-33% of the Human Genome Research Institute budget over time.
- Proteomics is more complex and challenging than genomics – Broader in scope. Protein modification adds an order of magnitude in complexity. Multiple technologies are needed and not yet available. Proteins are more difficult to work with experimentally than DNA. A huge dynamic range is involved – 7 to 8 orders of magnitude. There is a need for more sophisticated tools for data integration and analysis. Intellectual property issues are more complex.
- Comparative genomics – the most straight forward? Lots of additional sequencing and sequence comparison will be required. We have made much more progress in model organism sequencing than seemed possible only four years ago. We are already seeing lots of similarity between human and mouse genomes with only half of this similarity found in protein coding regions.
- How should we use current sequencing capacity? We will continue for at least the next 5 years. The NHGRI prioritization process - 10 page white papers accepted 3 times per year. Not currently accepting white papers for plants or microbes since these are not in NHGRI's purview. As capacity becomes available the sequencing Center Director and NHGRI staff will choose the next target from the high priority list (white papers are rates as high, moderate, or low priority) after the list goes to

Council. There is currently about 6 giga bases of DNA sequence on the high priority list. Twelve white papers were received from the first call.

- Technology development will be needed to reduce the cost and time of sequencing – still 5 or more years off.
- NHGRI's next plan will have more of a medical focus. Currently a haplotype map of human variation is being developed to provide insights into the major genetic contributions for complex diseases.
- Current planning for the future of genome research is intended to enable, not forsee, the future.
- NHGRI is planning a series of workshops for 2002. The December 2001 workshop lead to 11 workshops through October 2002. There will be an Airlie House workshop in November 2002 to discuss the new research plan which will be published in April 2003.
- Key questions for future research – Will it result in public benefit? Does it fit within our mission? Is it technologically feasible? Do the benefits justify the cost? Are there other entities better suited to pursue the goal?
- "Skate where the puck is going to be" – Wayne Gretzky.

Ray Gesteland – New Business

We owe a great debt of gratitude to Elbert Branscomb and Trevor Hawkins. The JGI is at a critical juncture in leadership and with regard to its future direction. Eddy Rubin is currently the acting director. He has considerable expertise in comparative genomics. Running a high throughput facility is a considerable task. BERAC hopes that DOE and the JGI raise its search for a new director to the level of a high profile international search. The JGI has many options depending on its scientific and technical direction. There is a sense of urgency to get this done but it shouldn't be done hastily. This is a crucial juncture in determining what the JGI is, what it means to DOE's programs and to broader interactions and collaborations. It is reasonable to separate the scientific leadership and sequencing production leadership. For example, the Whitehead sequencing leader has experience in high throughput production activities but not in DNA sequencing but has still resulted in big improvements. It is the JGI policy committee view that the JGI should have a strong scientific leader and a deputy (or the like) as its sequencing leader. Many other agencies and parts of DOE could benefit from a partnership with the JGI. The appetite for sequencing will always be greater than our sequencing capacity. We need to rethink the model of the link between DNA sequencing and the ensuing science.

Janos Hajdu – Uppsala University - Science talk
The Challenge of X-Ray Free Lasers in Biology

Working to develop the next generation of x-ray sources for structure determination in biology. There is a possibility of using smaller samples, even single molecules. Of using shorter pulses of higher energy radiation that reduce sample damage during imaging. At this time we can only do theoretical calculation/modeling since the radiation capability is only now being developed.

Experimental possibilities

- Single viral particles
- Nanoclusters and nanocrystals
- Kinetics on nanometer sized samples
- Coherent reaction dynamics and mode-selective chemistry
- Two-dimensional crystalline arrays
- X-ray diffraction tomography of whole cells
- X-ray scattering of whole cells

Paul Gilman - Assistant Administrator for the Office of Research and Development, EPA

- ~$627 million in FY 2003 request
- Air ($93M), water ($94M), food ($11M), communities ($25M), waste ($120M), global ($22M), information ($6M), science ($257M)
- Intramural research is organized around the risk paradigm - hazards, exposures, mechanisms, biological outcomes. Research is funded at 13 institutions in a number of states. There is ~$100M in extramural research (since 1995) using individual PI's and centers. The program is constantly under pressure to justify this portion of the program.
- Initiatives proposed in FY 2003
    - Central basin integrated assessment – From costal to inland monitoring & assessment of risks
    - Science to support regulatory decisions ($1M and 5 FTE's in addition to 8 FTE's in FY 2002)
    - Homeland Security ($75M)
    - National Environmental Technology Competition – rewarding innovative ways to attack environmental problems ($9.8M – begun this year)
    - Computational Toxicology ($3.2M) – trying to go a step further than NIEHS program. The initial focus is on endocrine-like substances. The goal is to develop more diagnostic and less costly tools for EPA risk assessments. The program is linking molecular level events with effects/outcomes. There is a focus on biological pathways and the use of computation (structure/activity analysis) to make predictions about potential outcomes from related substances. There are opportunities for collaboration with the Genomes to Life program and with DOE's computational capabilities to develop screening tools for endocrine disrupters.
    - Computational Ecotoxicology – the same model with applications in ecological settings and, hopefully, BER collaboration.
    - Biotechnology Research ($4.9M) – Serves the EPA regulatory role in biotechnology, allergenicity in genetically altered food, ecological risks associated with genetically modified foods, and management of gene transfer and resistance.

Ari Patrinos – U.S. climate change research

- Administration plans for its climate change research are in flux. The final implementation of the new program has been delayed. The President made a speech in February 2002 announcing plans for a shifting/rearranging of agency responsibilities. A new organization is being developed to handle climate issues.
- Committees have been formed for Climate Change Science and Technology Integration that will be co-chaired by Commerce and DOE in alternate years. Interagency working groups have been formed for the same also with shared/alternating co-chairs.
- Commerce has the lead for the Climate Change Science Program Office. DOE has the lead for the Climate Change Technology Program.
- The U.S. Global Change Research Program (USGCRP) is in transition to something different that depends on current Congress/Administration negotiations. Margaret Leinen (NSF) has stepped down as head of the USGCRP. Jim Mahoney (the new Deputy at Commerce) is taking the reins for research activities related to global change. The Administration is currently taking inventory of its global change research programs and contributing programs. There is a possibility of reconstituting program in a different form with a different focus and with different leaders. There are currently two initiatives in the FY 2003 budget:
    - The Climate Change Research Initiative – Commerce has the lead ($3M of a $40M increase across the US program came to BER for research related to the North American carbon sink, especially the AmeriFlux network, and for facilities increases for ARM and FACE.
    - The National Climate Change Technology Initiative – DOE has the lead. There are new/exciting investments that could be made. Document have been prepared and are under review. $40M has been proposed in FY 2003. These funds are in DOE/EERE for coordination across all DOE technology programs and with other agencies.

Ari Patrinos – Resource needs for the Genomes to Life program

- Genomes to Life is a BER/ASCR partnership. It had its origins within BERAC.
- Initial funding underway in FY 2002 with proposals/applications currently under review.
- The future of Genomes to Life has many dimensions including facilities needed for the program and beyond. BERAC has been asked if Genomes to Life requires such facilities and if it is an appropriate launching point for these types of community facilities. We hope that BERAC can quickly feedback on the best path forward.

David Galas - Chief Academic Officer, Keck Graduate Institute
Report of BERAC working group on Genomes to Life facilities needs.

- The working group has a simple message. It outlined a basic rationale for the future of biological sciences with regard to BER's role, DOE's mission, and what we need to get from here to there.

- Can we do science the same way we did before genomics and in the same kinds of laboratories?
- There is a lot of history and capability in BER. Understanding complex biology systems is a next transforming phase in biology. Genomes to Life is the nucleus and motivation for the next phase within DOE. But more is needed. How do we get there?
- High data densities are needed to interrogate complex systems. High throughput technologies are essential to current biological research. New research instrumentation and methods are emerging, e.g., protein and nucleic acid arrays, proteomics, high resolution and high information imaging. Each scientific goal of Genomes to Life serves as a basis for new resource needs.
- A few examples of scientific opportunity
  - Calcium carbonate and silicate structures formed in microbes by genetically encoded functions. Examples where genomic/proteomic analyses can elucidate mechanisms leading to reengineering – precise automatic control at the sub-micron level.
  - Early development of the sea urchin. Genetic networks for cell determination, interaction, and function. Regulatory network of >40 transcription factor genes and regulatory sequences. An example of building a complex predictive model by experimentation and how 10 -15 years of work led to the beginnings of a complex model for development and the need for computation.
- Need to compile a comprehensive, prioritized list of the capabilities that are needed and that are matched to the goals of Genomes to Life. The working group has identified a list of existing resources and proposed capabilities.
- Examples of existing resources that need to be incorporated – databases, sequencing, NMR, mass spectroscopy, electron microscopy, x-ray stations at synchrotrons, mouse facilities, ribosomal database, National Center for High Performance Computing.
- Examples of new resources, facilities with a functional focus – analysis of multiprotein complexes, mapping and modeling gene regulatory networks, microbial growth and interaction, combinatorial chemistry for functional probes, molecular imaging, production proteomics, integration of computing resources in biology, large scale protein production, mouse capabilities – new technologies, production transgenics, ENU mutagenesis, and more.
- New resources that could be established as pilot facilities – protein production, high throughput proteomics, new approaches to intermediate scale imaging, analysis of nano-scale structures, large scale DNA sequencing of targeted regions.
- Suggested management and implementation principles – Importance of BERAC, ASCAC and community involvement. Use of an open, peer-reviewed competitive process. Need for a strong integration of diverse research sites, laboratories, and users across disciplines and national lab/university/industry boundaries. Process should be proactive and evaluative. Pilot projects should be considered to try new approaches.
- BERAC and ASCAC should move to recommend action on a bold new program incorporating new facilities and resources.

Question/Discussion

- How does this expand beyond Genomes to Life and DOE without jeopardizing mission relevance? DOE didn't worry too much when we launched genome projects and climate change research program. There are times to take risks and to go beyond normal expectations. What is being proposed will not surprise our interagency partners. Would doing this discourage individual PI activities? It may be best not to call these user facilities since it may scare away biologists even though they embrace the capabilities being proposed. These need to be 'user' friendly since difficulty of use may have been a source of past skepticism. DOE's role has been to catalyze new technologies even with a small budget
- There is value in having multiple agencies taking different approaches to common problems. A little bit of competition, even in the public sector, is a good thing. DOE contributions in the human genome project, e.g., BACs and capillary electrophoresis, were key in spite of NIH investments at the time.
- We need to have flexibility and clarity in user interactions and to be helpful yet not prescriptive.
- Exciting science is the driver for cutting edge technology development. DNA sequencing centers may have been an anomaly or an exception since they were so production oriented.
- Scientist's behavior changed for synchrotron use because of the new technology. Once synchrotrons started being used for structure determination, the process went from a 1 in 10 to a 9 in 10 likelihood that a structure would be obtained from a crystal. This is/was a very strong motivator.
- If, for example, we could go from being able to study/image the interactions of 3 proteins at a time to 20 or more at a time there would be no question of choosing to use an external facility. Its easy to develop many different colored probes in one's home lab but not to be able to image them. This is where an imaging facility could be important.
- To achieve success in Genomes to Life we need new technologies and streamlining of existing technologies. We should develop these for Genomes to Life and make them broadly available but we don't want to reinvent capabilities that others already have or fund.
- One approach will not work for every technology. Each case may be different. It will be important to use diverse approaches rather than preassuming what size and shape an effort should be. There will be many example where we think we have it right only to find something else that passes it by. We don't want to over commit to big things that can't be moved or have flexibility.
- Technology transfer is a DOE hallmark, e.g., synchrotrons didn't start out as a resource for biologists. We should assume that similar types of technology transfer will be critical and important here. We also need to consider the value of co-location of resources, technology, and basic research. We also need to encourage cultural transfer in how scientists and technologist interact. A critical balance will need to be maintained between mindless crank turning at a facility versus a dominance of local users that would likely discourage other users. We can't be at either end of the spectrum and have this succeed.
- The draft document describes needs that seem to be far beyond the funds that seem likely to be available. The hope is that the document will results in new money,

prioritization for use of existing funds, and reallocation of resources? This is part of a long term and large strategic planning process. We have been encouraged to think about the future of Genomes to Life and what it would involve in terms of funding and opportunities. The issue of facilities adds an additional dimension to planning for Genomes to Life. This is so important that it needs to be bold.

- There is still a need for a lot more homework. There are facilities that may take small investments whereas others that may take very large ones.
- There is value in presenting this in the historical context that underpinned successful investments made for the genome project.
- We need to include "sun setting" mechanisms for most or all of these facilities. These facilities will change over time and should not be expected to go on "forever." They will be part of a dynamic process. It is also important to recognize the value of failure in achieving success.

Other business – none
Public comment – none
Meeting adjourned 5:10 PM

Wednesday, April 26, 2002

Ari Patrinos

- Ray Orbach was sorry not to be able to attend this meeting. He is part of a delegation in China with Jack Marburger, the President's science advisor, this week.
- The potential for earmarks in our budget are worrying us this year due to ongoing disagreements between the Administration and our Congressional budget committees. This is our greatest current concern because if we got the number of earmarks we got this year ($70M) without the additional funds it would be very damaging to our research programs. Special acknowledgement is due to Prem Srivastava and Larry James for handling the current earmarks projects so effectively.
- Our FY03 budget request is essentially flat though there have been some rearrangements and a roll over of construction money. As a result, there is some growth in Genomes to Life and climate change research.
- Government Performance and Results Act – The administration is looking for increased accountability. Taking risks can payoff if they are well documented. Thanks to Gene Bierly as a member of the BES Advisory Committee Working group on this topic. How do you set performance indicators and standards? We are not too far down the line on this effort yet. Mike Riches has taken the lead on this within BER. This will not be going away. Some of our performance targets include:
    - Amount of DNA sequencing at the Production Genomics Facility?
    - How many microbial genomes will we sequence?
    - How many intensive operating period studies will be done at ARM sites?
    - What kind of spatial resolution will we achieve in our climate modeling?
    - How well are our facilities operating? Being upgraded? How many users?

- Life Sciences (Marv Frazier) – The only significant growth is in Genomes to Life. We anticipate another round of solicitations next year to fill in the gaps from our current solicitation. Total request for next year should be $44.6 million together with funds requested by ASCR.
- Structural biology – new station for small angle neutron scattering at ORNL to be completed and the beam line at the Advanced Light Source at LBNL should become operational.
- We are asking for a small increase in the Human Genome Program. This highlights our commitment to finish to a high quality the DNA sequence of our 3 human chromosomes by April 2003. We should schedule next spring's BERAC meeting to coincide with the April 25, 2003 human genome completion/celebration. We are currently discussing where the DOE papers on our three chromosomes should be published – in Nature with the rest or not?
- We are in the midst of a major transition at the JGI with Trevor Hawkins' departure and Eddy Rubin serving as interim director. This will be an important decision for the JGI and for our program.
- We are continuing our DNA sequencing projects at the JGI – Xenopus, parts of the chicken genome, Poplar, diatom, many microbes.
- JASON will be doing a study this summer on nano/bio technology. Perhaps they can make a presentation at the next BERAC meeting on this study.
- Our strategy for soliciting the next sequencing targets needs to be further developed and clarified. We have been ahead in this process for a number of years but now we need to communicate details of this process to the scientific community and to other agencies. It is important to extend this open process to our facilities needs as well.
- The low dose program continues to be extremely popular on the Hill. It is currently being led by Noelle Metting and continues to get a disproportionate share of attention on the Hill. We continue to link Genomes to Life outcomes to this program as well.
- Climate change research (Jerry Elwood) – We did get some growth in this program mostly focused on facilities. This is part of the recognition that facilities of some kind are needed. BER is one of the programs in the government to receive the "nod" for facilities increases - $4M for ARM, $3M for the Climate Change Research Initiative for AmeriFlux and FACE. This is the first growth in the program for quite some time.
- JASON did a review of the ARM program last summer. Nate Lewis (JASON) recently presented the results of this study to Bob Card and Ray Orbach. This was an opportunity for a presentation on basic research in this area and for links to climate modeling. A questions raised was whether climate modelers are using (or clamoring for) ARM data like biologists are for genome sequence data?
- A review of our UAV program was recently completed and a report should be available soon.
- It also may be time to take another look at the majority of the climate change program.
- It is important to develop links/ties between climate science and climate technology programs across the government and within BER.
- Teresa Fryberger has recently joined BER from the Office of Environmental Management. She will be the director of BER's new division of environmental sciences. The FY03 budget request proposes the transfer of programs from EM but

this is obviously still up in the air. The new Division is intended to include – the Natural and Accelerated Bioremediation Research (NABIR) program, cleanup research, the Environmental Molecular Science Laboratory, the Environmental Management Science Program (proposed transfer from EM) (EMSP), and the Savannah River Ecology Laboratory (proposed transfer from EM).

- Kudos to Roland Hirsch for his role with the management of the EMSP these past few years, principally with the coordination of peer review.
- We will be looking to BERAC for advice on how to best spend and coordinate the $100+ million in this program being transferred to BER. Hoping that Michelle Broido will play a key role for BERAC. BER will continue to depend on staff in the Basic Energy Science program, especially for their expertise in chemistry and materials, to manage the EMSP. We are likely to inherit a few additional staff from EM along with EMSP to help manage the new BER funds. We also plan to continue our partnerships with NSF and EPA in this area. The budget requests show cuts for both EMSP and SREL compared to FY02 but there is not a lot to be done at this point. Previous cuts to the NABIR program have been restored. Additional EMSL funds have been included to match those added by Congress last year. Best wishes to Jean Futrelle (EMSL Director) for a speedy recovery from a recent illness.
- Medical sciences program (Mike Viola) – This program has seen many transitions to take advantage of emerging opportunities especially to partner with NIH. Many workshops have been held leading to the currently restructured program. As recommended by BERAC we are seeing the end of Boron Neutron Capture Therapy research and the subsequent growth of cell targeted cancer therapies. We are also emphasizing research to develop strategies and technologies to image gene expression. Radiophamaceutical design and synthesis continues to be a program that is unique to BER yet one that doesn't get enough credit. Research on multimodal imaging continues to be a priority. The artificial retina project, a large and successful multi institutional project, is one to watch in upcoming years.
- The Center for Comparative and Functional Genomics at ORNL will be completed this year. This is another opportunity for a user facility.
- We continue to develop partnerships within DOE and across the government. BER supports the National Nuclear Security Agency within DOE on bioterrorism. BER continues to have a long list of collaborations with other agencies.
- We need to become more competitive in our cost of doing business. Will rely on BERAC for help.

Questions/Discussion

ACTION - Notify BERAC when research solicitations are issued in the future.

When picking genomes for future sequencing at the JGI it is important to consider a broad view of the potential contribution to science versus a reliance on specific constituents who are working on specific organisms. This process shouldn't just be driven by the experimental community. Usefulness of the "1% solution" discussed by

Francis Collins, i.e., picking a small portion of a genome to solicit suggestions/strategies for intense investigation/mining.

GPRA standards - quality (peer review – the easiest), relevance, and performance (a lot of this is retrospective, management and science). Specific milestones are not assumed to be representative of entire programs which is a reasonable expectation. GPRA should also deal with work force issues. How DOE implements all of this is yet to be determined.

Dick Swaja - National Institute of Biomedical Imaging and Bioengineering (NIBIB), NIH

- Few NIH Institutes are focused on general issues and not diseases, body parts, or social issues.
- NIBIB was mandated December 29, 2000 by Congress and approved by HHS April 2001. Its first budget was approved January 2002.
- NIBIB currently has $45 million in new money and $67 million of ongoing grants related to the mission of NIBIB transferred from other Institutes. NIBIB plans to have 30 employees by the end of the current fiscal year.
- Yesterday the candidate for the new, permanent director of NIBIB accepted the position and will be announced by HHS soon.
- NIBIB's focus is on enabling technologies with broad applications, multi-disciplinary and collaborative research, technology and design driven applications in addition to hypothesis driven research, and interagency and intra-NIH coordination. The face page for NIH grants now has a new statement inviting applications for hypothesis and technology and design driven research. NIBIB is looking for research with broad applications. Applications with a very specific research focus will still go to the other institutes. NIBIB will not be funding technology for technology sake. It must be linked to a medical application.
- The Institute has five areas of emphasis – sensors, nanotechnology & microtechnology, biomaterials, computer applications, and imaging.
- Molecular level imaging and sensor technology development were the basis of the first Requests for Applications. There have been good responses in both cases with about 3-times more applications received than expected.

John Houghton (BER) / Gary Johnson (ASCR)
Genomes to Life – A Partnership Between Biology and Computing

- There is value in having a mechanism for both office's advisory committees work together on common documents, plans, etc.
- ASCR overview –
    - Mathematics, Information, and Computer Science (MICS) – basic research to computer networks to high performance computing to SciDAC (Scientific Discovery through Advanced Computing). Basic research, SciDAC, and facilities are each about one third of $166 million total. Computational biology (Genomes to Life) is about 5%.

- Advance Scientific Computing Advisory Committee – Margaret Wright, NYU, is the chair. The biology working group is headed by Juan Meza, LBNL. Warren Washington of BERAC is on ASCAC. It would be a good idea to have an additional member(s) in the computational biology area shared between BERAC and ASCAC.
- The precursor activity for ASCR's Genomes to Life investment was an announcement in FY01 (01-21), Advanced Modeling and Simulation of Biological Systems. Nine awards totaling $3 million were made.
- Program planning activities for ASCR Genomes to Life – 5 workshops have been held to identify Genomes to Life needs/opportunities and to further develop a Genomes to Life Goal 4 roadmap. Since last August the following activities have been held -
    - Computing workshop
    - Systems Biology workshop
    - Computing Infrastructure workshop
    - Computer Science workshop
    - Mathematics workshop
- A draft of a roadmap for Genomes to Life Goal 4 has been prepared and will be present to ASCAC next week. BERAC will be asked to review this document soon. The current draft is not quite ready for distribution.
- Three research areas have been identified that map onto the overall goals of Genomes to Life -
    - Bioinformatics - Data intensive applications involving large, heterogeneous data sets, legacy systems that don't interoperate and scale.
    - Biophysics – Compute intensive applications. We are already bumping up against computation resources, algorithms, and new theory.
    - Biosystems – Complex systems modeling. We already have too much data not to have models yet at the same time we are data poor and biology poor. The "parts list" for biological systems are relatively short but the systems are very complex.

Next BERAC meeting – December 3-4, 2002

Other business – none
Public comment – none
Meeting adjourned 11:30 AM.