National Science Foundation

Directorate for Biological Sciences

BIO ADVISORY COMMITTEE

Room 1235, Stafford I

March 17 and 18, 2010

Summary Minutes

**Wednesday, March 17, 2010**

**Welcome and Approval of Minutes**

Note: Drs. Michael Mares and Daniel Wubah joined via teleconference

Dr. Barbara Schaal, Chair of the Advisory Committee for Biological Sciences (BIO AC), convened the spring 2010 meeting at 8:30 AM with a request for introductions. Dr. Joann Roskoski, Acting Assistant Director (AD) for the Biological Sciences (BIO) Directorate, greeted the guests, welcomed the BIO AC members, and discussed logistics for the meeting. The minutes from the fall 2009 BIO AC meeting were unanimously approved by the Committee.

**Request for BIO AC Liaisons for BIO Reviews**

BIO AC liaisons were requested for the Division of Biological Infrastructure (DBI) Committee of Visitors (COV) review July 12-14, 2010, the Plant Genome Research Program (PGRP) COV review August 31-September 2, 2010, and the Long-Term Ecological Research (LTER) 30 Year Review. Dr. Roskoski provided a brief background to the decadal reviews of LTER and noted that the LTER review committee will be chaired by Allison (Sonny) Powers and Anthony Michaels. The BIO AC members who volunteered to serve as liaisons are Dr. Robert Robbins – DBI COV, Dr. David Stern – PGRP COV, and Dr. Robert Robbins (interested) – LTER 30 Year Review.

NOTE: Subsequent to the BIO AC meeting, Dr. Robbins was unable to serve as liaison the DBI COV and was replaced with Dr. Jonas Almeida, a new member of the BIO AC.

**2011 Budget Report** – Dr. Joann Roskoski, Acting AD, BIO

Dr. Roskoski reported on senior personnel vacancies at NSF (Director) and in BIO (Assistant Director and IOS Division Director), NSF’s 60th anniversary, BIO’s ARRA awards, BIO’s FY 2010 budget, BIO’s FY 2011 budget request, and BIO priorities. BIO’s ARRA award portfolio included 555 awards totaling $260M and in 47 states. BIO’s activities for FY2010 included: Climate Research Investments (part of the focus of BIO’s efforts for the US Global Change Research Program), the National Ecological Observatory Network (NEON), Transforming Undergraduate Biology Education (TUBE), Digitization of Collections, and Experiments in Innovation. The FY2011 request increased the BIO budget by 7.5 % ($53.27M). BIO priorities for FY2011 include continuation of FY 2010 activities plus the additional areas of bio-economy, the intersection of biological and physical sciences, and Science, Engineering, and Education for Sustainability (SEES).

The BIO AC discussed ARRA funding and reporting, as well as the proposal submission, review, and recommendation process. Concern was expressed regarding questions to awardees about the impact of ARRA awards on jobs. It was suggested that NSF send guidelines to advise Principal Investigators (PIs) of the criteria used for making ARRA awards. The discussion then moved to the proposal submission and merit review processes. Most of the BIO AC favored evaluation of potential alternatives such as the use of pre-proposals or limiting number of times a PI can submit a proposal. The BIO AC also thought it could be useful to determine how the award profile maps to the PIs/institutions who are submitting proposals.

**Undergraduate Biology Education (UBE) Update** – Dr. Bill Zamer, Acting Deputy Division Director (DDD), IOS

Dr. Zamer posed the question of what kinds of institutional changes will be needed effect changes in undergraduate biology education in the 21st century and how will they be accomplished. He reviewed the recent timeline of activities and programs leading to a set of FY2010 activities aimed at undergraduate biology education and announced an external review of existing UBE activities in FY 2010. The review will analyze current investments and point to the development of metrics for future assessment and evaluation of activities.

In its discussion of the need for institutional change, the BIO AC agreed that metrics for assessment are very important, but acknowledged that adequate assessment tools may not exist. The BIO AC also discussed the use assessment “experts” who potentially could aid BIO in the development of metrics for evaluating potential “best practices” in undergraduate biology education and the subsequent “franchising” thereof. They agreed that currently there is insufficient data to evaluate different education styles; e.g., is there convincing evidence that inquiry based learning is better than other forms of learning. The BIO AC decided to revisit the topic at a future meeting.

**Scientific Collections Update** – Dr. Judy Skog, OAD

Dr. Skog reported on the progress towards the digitization of US scientific collections, including a focus group meeting held in February 2010, and continued funding efforts by BIO (FY 2009 ARRA funds and inclusion in the FY 2011 budget request), and the establishment of a interagency working group with USDA. International interest in promoting linked data resources has developed and models from other countries are being evaluated. A BIO working group has engaged the collections community by creating a “blog” to solicit community input, and a workshop is being scheduled later this year to focus on the development of a 10 year strategic plan.

Drs. Donoghue and Mares, who participated in the focus group, added that digitization of collections was considered critical. Dr. Donoghue felt the size and cost of the job may have been initially underestimated. They noted that the focus group acknowledged that some collections will be easier and faster to digitize than others and identified a number of issues that remain to be worked out including scope (what gets digitized) and prioritization.

**Dimensions of Biodiversity** **Update** - Dr. Penny Firth, DDD, Division of Environmental Biology (DEB)

Dr. Firth reported that the first Dimensions of Biodiversity solicitation was released the second week of March 2010 and included NSF-China as a partner in the formation of international RCN. She discussed a 10 year campaign to characterize the dimensions of biodiversity on Earth. The campaign’s strategic plan has 5 goals: research, analyses and syntheses, workforce, collections, and cyber infrastructure. Each goal has a working group and planning activities associated with it. In addition there are planning activities for international, interagency, and private partnerships, base-lining the characterization, and assessment of the progress.

The BIO AC discussion began with a question concerning the overarching goal of the program. Dr. Firth stated the goal is to understand and characterize the unknowns about biodiversity on Earth. Dr. McCombie expressed concern that an apparent lack of focus that would make it impossible to define biodiversity in 10 years unless clear boundaries are established at the beginning. The BIO AC suggested that development of a research agenda could add defined parameters to the program, and that staying within the intersection of the three target areas (genomic, taxonomic, and functional) would add value (although other areas may be added in the future). There also was some discussion of the working relationship with NSF-China and the possibility of involving other organizations.

**Working Lunch**

Action Item: Should a BIO AC Research Resources sub-committee be charged with developing a report for the next BIO AC meeting and what should be the scope of its charge?

Dr. Roskoski suggested that the group brainstorm on what current resources require more attention or should be approached in a different way. The subcommittee would produce a short report to be used for the BIO strategic plan for budget development.

Participating BIO AC members:

Dr. Juliette Bell Dr. Susan Bryant Dr. Christopher Comer

Dr. Michael Donoghue Dr. W. Richard McCombie Dr. Eva Pell

Dr. Robert Robbins Dr. Barbara Schaal Dr. Joseph Travis

Dr. Muriel Poston

NSF Staff Participants:

Dr. Charles Liarakos Dr.Joann Roskoski Dr. Peter Arzberger

Dr. Stephen Howell Dr. Mari Kimura, AAAS Fellow

**Afternoon General Discussion: The Future of Biology**

2 NRC Reports: A New Biology for the 21st Century (2009) and Research at the

Intersection of the Physical and Life Sciences (2010)

Dr. Liarakos introduced the discussion with a brief summary of the two NRC reports. The 21st Century Biology report identified four strategic areas of science with societal impacts: food, environment, energy, and health. The report on Research at the Intersection of the Physical and Life Sciences identified 5 grand challenge areas at the intersection of the physical and life sciences: synthetic biology, neurobiology, genotype to phenotype, environment, and biodiversity.

In their discussion of the 21st Century Biology report, the BIO AC noted the following:

* The absence of the social sciences or recognition of the emergence of regenerative medicine and stem cell research.
* The report’s apparent incisiveness about how science worked, but naiveté about how funding works, the amount of money needed, and the amount of new money that will be available.
* Concern regarding the placement and limited attention to biology education.

The 21st Century Biology report was praised as a welcome call to invest more in biology. The BIO AC felt that that almost every biologist could identify with at least one of the four strategic areas. In a brief discussion of the Research at the Intersection of the Physical and Life Sciences report, the BIO AC discussed the need for “grand challenges” and whether agencies would invest money in them. The BIO AC also discussed whether tractable grand challenges were preferable to open ended biological questions. The group was concerned that an articulated list of grand challenges could become unofficial criteria.

In response to a question about how BIO used these reports, Dr. Roskoski explained that BIO held brown bag discussions of both reports, which included all BIO Program Directors and Senior Managers, to identify ongoing and new areas of opportunity for research investments. She noted that a BIO-MPS working group had been established to discuss research opportunities at the intersection for FY2011, and that she had recently attended an interagency meeting with DOE and USDA that discussed potential responses to the 21st Century Biology report, and how to support activities in FY2012.

In response to a question about NSF’s efforts to break down boundaries between programs, divisions, and directorates, Dr. Roskoski commented that BIO participates in several cross directorate and cross program activities, and that NSF is exploring the use of panels that cross programs to deal with proposals in interface areas. She also noted that budget timelines and legal aspects often present difficult challenges at the level is interagency activities.

The discussion then turned to mechanisms of peer review (cited in both reports) and whether pre-proposals would be useful in dealing with proposal workload issues without sacrificing sufficient information to achieve a rigorous review. The BIO AC decided that more time was needed for a full discussion of peer review and the proposal submission process and suggested that the topic be revisited at a future meeting. Discussion then turned to whether core disciplines were at risk due to a growing focus on inter- and transdisciplinary research. While the group agreed that core disciplines probably would not disappear, still there is a danger that the scientific community may be inadvertently moving towards fewer researchers wanting to be in certain core areas. The BIO AC also noted that tenure requirements and decisions in the time of interdisciplinary research require different criteria than those used historically. New tenure opportunities also may necessitate new kinds of training for researchers in some areas.

Dr. Roskoski raised the question of whether multidisciplinary science and science at the interface are reflected at academic institutions. The general opinion of the group was that the organization and structure of universities make it very difficult. It takes money, a different organizational approach, and buy-in from the people at these institutions to make it work. The Carnegie Institute, the National Cancer Institute, and, to some extent, Penn State were cited as examples of institution that have been successful. The discussion then moved to the challenges of interdisciplinary undergraduate education. The BIO AC noted that tension exists between preparing undergraduates both in the basics and in interdisciplinary areas so they can do more advanced work. However, the “basics” are different for the 95% of students who will not go to graduate school compared to the 5% who will. Flexibility in curriculum, training programs and faculty time will be necessary for students to cross disciplines.

**Advances in Sequencing Technology** – Dr. Richard McCombie, Cold Spring Harbor Laboratory

Dr. McCombie presented the challenges, opportunities and implications of disruptive sequencing technologies, primarily with the Solexa/Illumina platform. He reported that CSHL is approaching a trillion bases sequenced per month by 15 people. And that the cost of sequencing a genome is changing (decreasing) almost monthly. . Dr. McCombie discussed the evolution of sequencing technology and equipment, which continues to get faster and more reliable. The latest sequencer being produced by Pacific Biosciences employs 3rd generation sequencing technology (PacBio RS).

**DEB COV Report** – Dr. Joe Travis, BIO AC Liaison to DEB COV

Dr. Travis reported his observations of the DEB COV review, which occurred in June 2009. The purpose of the review was to assess the quality and integrity of DEB operations. The committee felt there was excellent science being supported, including some potentially transformative projects. Dr. Travis stated the committee was impressed with DEB’s management, wise judgment in assessing proposals, and leadership in fostering multidisciplinary projects. The program officers are responsive to changes and needs of DEB’s scientific community. Two-thirds of the new investigators were successful in obtaining funding.

The BIO AC discussed the DEB COV report and DEB response, and expressed the following comments:

* Microbial ecology research should be better represented in the DEB award portfolio
* The advisability of revising a BIO-wide independent postdoctoral fellowship program should be considered.
* Some aspects of the proposal review and assessment processes should be reviewed including the disparity between some panel summaries and reviewer comments, the Conflict of Interest (COI) policy, and how to evaluate the effectiveness of broader impacts.

The BIO AC unanimously accepted the DEB COV report.

**Emerging Frontiers (EF) COV Report** – Dr. Jacquelyn Fetrow, BIO AC Liaison to EF COV

Dr. Fetrow reported that the EF COV was impressed with the quality of the projects funded in EF and support for the cross-disciplinary and multidisciplinary projects that bring scientific communities together. The new EF mission statement better captures what EF should be doing, but does not address all aspects. The COV commented that EF needs to be careful to not become a “catchall”.

Dr. Fetrow described three EF programs reviewed by the COV: Advancing Theory in Biology (ATB), Ecology of Infectious Disease (EID), and Microbial Genome Sequencing (MGS).

The COV felt that ATB has a good balance between innovative and potentially transformative projects, but needed to more clearly define the meaning of “theory.” To date ATB has had only two cycles of panel review. The COV felt that the first round of reviews was of somewhat questionable quality, but the second round had excellent reviews indicating improvement with experience.

The COV described EID as a strong ongoing program, which demonstrated strong leadership, and should be considered a model for interagency cooperation. Given its success, the COV expressed concern for the fate of the program as it transitioned out of EF and into DEB.

The COV observed that the Microbial Genome Sequencing program had filled a unique niche in sequencing microbial genomes, but identified problems with program leadership, sufficient appreciation for the impact and value of the resources provided, and the limited multidisciplinary nature of the projects funded. Noting that MGS has ended and that MGS projects would move into core BIO programs, the COV expressed concern about the lack of clear transition plan to ensure that the program’s key successes would survive. The EF COV made three major recommendations:

* EF should serve as an incubator of new ideas; it is crucial to identify the frontiers of science.
* BIO should develop a plan for transitioning programs from EF to core programs including what should be done when programs are “sun setting” and metrics to measure program success.
* BIO should increase staff to give PDs more time to think about the programmatic science

The BIO AC used this opportunity to discuss “broader impacts” identified in both COV reports as an area of concern (especially with respect to evaluation of effectiveness). They noted that there is wide variation in the interpretation of the meaning of broader impacts and that PIs are consequently branding broader impacts differently.

The BIO AC unanimously accepted the EF COV report.

Dr. Schaal adjourned the meeting for the day.

**Thursday, March 18, 2010**

**Convening of Meeting**

Dr. Schaal convened the meeting at 8:30 am. Possible dates and venues for the fall 2010 BIO AC meeting were discussed. It was decided BIO (Dr. Liarakos) would email the AC members possible dates to compare to their schedules after the meeting.

**Follow-up Report and recommendation of BIO AC “Resources and Facilities subcommittee”** (from Wednesday’s lunch time discussion) – Dr. Michael Donoghue

Dr. Donoghue presented the questions the group had used to frame their discussion:

* What is looming for the next decade to enable biological research?
* Should there be a BIO-AC subcommittee that focuses on the issues and develops a report by the next meeting?
* What would the charge and scope be for such a subcommittee? How many groups would be needed? What are the products to be developed by the subcommittee?

The discussion group identified at least three areas in need of attention including: sustainable storage of biological samples, management of genomics data, and imaging technology data storage and analysis. The group also identified “cultural” changes that may affect the discussion such as indirect costs, different communities of stakeholders (e.g., the education community, and smaller vs. larger institutions)) and partnerships. Overall, there was a strong interest in the formation of a working group.

Dr. Roskoski stated BIO is always in a strategic planning mode and depending on what is needed, the planning horizon may be long. BIO wants to take a hard strategic look at what biologists will be using 10 years from now and what is needed to enable that research. It was decided to engage the AC in getting a sense of what the future holds for biological research and what resources may be needed.

The BIO Ac formed two working groups: one for a cyber resources and a second for physical resources.

* Cyber Resources WG: Richard McCombie, Robert Robbins, and James Siedow.
* Physical Resources WG: Barbara Schaal and Susan Bryant. (Dr. Donoghue offered to supply BIO with other names for this WG.)

Dr. Roskoski agreed that BIO would develop a draft charge and pull together information requested by each working group to aid in the development of a report. Dr. Mari Kimura, a BIO AAAS Fellow, agreed to serve as executive secretary for the BIO AC working groups.

**Innovation Experiments Update** – Dr. Joanne Tornow, Director EF & Acting BIO Executive Officer

Dr. Tornow reported on the synthetic biology “sandpit” held in FY 2009 in collaboration with the UK Engineering and Physical Science Research Council (EPSRC) with participation by several Directorates in addition to BIO: Mathematical and Physical Sciences (MPS), Social, Behavioral, and Economic Sciences (SBE), Engineering (ENG) and (subsequently) Computer and Information Science and Engineering (CISE). The EPSRC developed the “sandpit” as a way to review, and support, high risk, potentially transformative research. Dr Tornow also reported that in FY 2010 BIO committed $16M for experiments in innovation in the areas of proposal development, merit review, and community input. The innovation experiments include:

* A second “sandpit” (renamed “Ideas Lab”) in Innovations in Biological Imaging and Visualization (IBIV) by DBI, DEB and MCB to be held May 24-28, 2010.
* A “Craig’s List” Wiki by IOS to facilitate and increase the number of collaborations between end-users and investigators who develop tools and resources by submission of EAGERs/RAPIDs.
* An Experiment in Merit Review by MCB and IOS that will compare the outcomes of standard review of full proposals versus blind review of two page proposal summaries of ideas
* An Experiment in Community Input by DEB and DBI that will use of a “design charrette” to develop a fully integrated research agenda in a collaborative way.

The BIO AC began its discussion with a question about the progress in establishing the shared BIO and GEO space on the 6th floor. They were informed that the relocation of BIO and GEO Program Directors and support staff has been approved and is in progress; however, the role as a virtual unit has yet to be determined.

The discussion then turned to the selection of topics for the ideas lab, which is a key to the success of the activity. Dr. Tornow indicated that BIO developed topics based on perceived gaps in the BIO research portfolios well as in response to cutting edge areas and/or intractable problems in biology.

In response to questions regarding the Experiment in Merit Review, Dr. Tornow explained that the participating PIs are volunteers who agreed provide two page concept summaries derived from the full proposals they submit. Separate panels will review the full proposals and the 2-page concept summaries and the results compared. The BIO AC expressed enthusiasm for BIO’s experiments in innovation and for the evaluation of the merit review process.

**White Paper Discussion: A Dialogue among Biological Sciences, the Arts, and the Humanities** – Drs. Christopher Comer and Ellen McCulloch-Lovell, authors and discussion leads

Drs Comer and Lovell expressed their view that exciting things are happening in the arts and humanities, which are turning to the sciences for models. Therefore, this is a fertile time for discussions about potential activities the interface, especially as they affect the communication of science to the public. Drs. Comers and Lovell proposed a symposium to explore the arts/humanities/sciences interface, with NEA as co-sponsor and possible involvement by other agencies in order to reach more people. Several BIO AC members who were enthusiastic about the symposium offered suggestions and volunteered to be involved with the process. It was hoped that such a symposium would serve as a mapping exercise to get “the lay of the land” that eventually would reduce the cultural gap between the sciences and the arts and humanities.

A working group was established with Drs. Comers and McCulloch-Lovell as co-chairs and participation by Drs. Richard McCombie, Jacquelyn Fetrow, Juliette Bell, Warren Burggren, and Michael Donoghue.

**Meeting with Drs. Arden Bement and Cora Marrett**

At the request of the BIO AC, Dr. Bement reflected on his time at NSF. He enumerated several achievements in interdisciplinary research, inter-agency leadership and increased partnerships, and science education of which he was the most proud. He was especially gratified with the management within NSF, its great leadership, sense of camaraderie, and focus on the community.

Finally, Dr. Bement emphasized the importance of NSF staying at the frontier, looking beyond current research, and identifying transformative research in which to invest. If this is not done, NSF will do a disservice to the nation. He suggested there are levels of complexity that have not been surmounted. The scientific community is entering a period of “data tsunami” as data collection grows exponentially, and transformative research is the key to dealing with it. He also commended his three Deputy Directors: Joseph Bordogna, Kathie Olsen, and Cora Marrett.

Dr. Schaal expressed gratitude on behalf of the BIO AC for Dr. Bement’s leadership of NSF and role as a national leader in support of science, after which Dr. Bement responded to questions from the AC. Among the areas discussed were:

* Advice to the next NSF Director about areas of focus: *Interagency and international collaborations; CI investment; K-12 education*
* Private sector opportunities: *Metagenomics, synthetic biology, metobolomics, information processing by the brain (analog, digital, holistic?)*
* NSF’s position with respect to underrepresented minorities: *Underinvested; should serve all minorities; program consolidation; more opportunities to leverage funding with other agencies*

**Lunch Discussion with Dr. Shere Abbott, Associate Director for Environment, Office of Science and Technology Policy** joined by the NSF Advisory Committee on Environmental Research and Education (AC-ERE)

After general introductions, Dr. Abbott described OSTP as a conduit for science and technology advice to the administration and a science think tank within the administration. She explained that OSTP has 5 Senate confirmed positions and is divided into four divisions: Science, Technology, Energy and Environment, National Security and International Affairs. OSTP also works closely with the President’s Council of Advisors on Science and Technology (PCAST). Dr. Abbott went on to discuss difficulties in dealing with a complicated world, where issues such as energy, climate, and sustainability are intertwined both as problems and as government agency R&D activities. She reported OSTP is developing a national ocean policy that will recommend a new national ocean council. She also suggested the Office of Energy and Climate Change Policy as another venue for developing policy across whole domain of energy and climate change. Dr. Abbott identified some additional challenges including:

* The interface of science and policy
* Identifying new technologies
* Basic research needed to understand the impact and adapt to climate change

After her statement Dr. Abbott responded to questions from AC members. Among the areas discussed were:

* OSTP’s efforts in STEM and climate education: *These are administration priorities and OSTP is constantly working on “messaging” to promote greater understanding*.
* Management of overlapping areas of operational observatories: *OSTP is working towards a national strategy for earth observations; however, previous attempts at shared observation systems among NASA, NOAA, and DoD have not worked.*
* Public understanding of climate change (In a survey of meteorologists in the Tampa Bay region and only 1 of 16 thought positively about climate change.): *Meteorologists are at the interface between climate change and the public. A series of efforts that add up to education program is required, but how do we go about this? Execution across the government is a challenge. The public’s general view of science is a bigger concern than the public’s view on climate change.*
* The Administration’s view on SEES: *No real answer and no visible metrics to determine long term impacts. It’s time to talk about how the programs add up.*
* Biodiversity: *Biodiversity does not appear on the administration’s priority list because it has not been considered a “problem.” OSTP is working toward a better interagency strategy to develop an effort similar to and consistent with the international effort.*
* The intersection of science and federal budget: *The open government initiative is causing agencies to release some data; OSTP has released all of the data related to USGCRP budget for the last ten years, but more should be released.*
* Data sharing with other countries: *Data sharing and openness is a policy of the Obama Administration but open access is still a challenge in some countries.*

**Wrap Up and Adjournment**

The next BIO AC meeting (October 2010) is tentatively planned to take place in Boulder, CO with one day devoted to visiting NEON. The meeting also will take up reports from the DBI and PGRP COVs and from the research resources working groups.

The BIO AC expressed a general interest in looking more closely at biology education including metrics for effective teaching and the body of knowledge on how people learn. They also thought it important to more fully discuss ways to streamline the proposal submission and review process and related issues concerning merit review. Finally, they wished to further discuss the problems of public acceptance of science and the accurate communication of scientific information.

A motion was made and seconded to adjourn and Dr. Schaal adjourned the meeting at 2 PM.