

National Science Foundation  
Directorate for Biological Sciences

**BIO Advisory Committee Meeting**

March 29 & 30, 2011

NSF Room 375

**Summary Minutes**

**Tuesday, March 29, 2011**

**Welcome and Approval of Minutes**

Dr. Barbara Schaal, Chair of the Advisory Committee for Biological Sciences (BIO AC), convened the Spring 2011 meeting at 8:30 am. Dr. Schaal welcomed Dr. Joann Roskoski, the BIO AC members, and guests and asked for introductions. The AC meeting logistics were discussed. The Committee unanimously approved the minutes of the October 2010 meeting. All BIO AC members were in attendance except Dr. Juliette Bell, who joined the meeting by teleconference.

**BIO Budget Request and Funding Opportunities - Dr. Joann Roskoski, Acting Assistant Director (AD), BIO**

Dr. Joann Roskoski reported NSF's budget request for fiscal year 2012 and an update on the budget status. She discussed the NSF strategy of "Building Blocks for Innovation" as part of the Administration priority to "out-innovate, out-educate, and out-build the rest of the world," and how BIO's FY 2012 budget request aligned with these priorities. Dr. Roskoski described BIO's participation in several cross-NSF activities (BioMaPS, SEES-Clean Energy, CIF21, NNI and STEM education) as well as details of ongoing BIO activities to enable innovation (supporting the disciplinary knowledge base, PGRP, BREAD, Dimensions of Biodiversity, Synthesis Centers, Digitization of Research Collections, NEON, and Innovations in Merit Review).

The discussion that followed focused on the innovations in merit review, outcomes of previous experiments, and the evaluation of the outcomes. Committee members were also interested in the effects of these activities on the proposal review process and changes that could result. *Dr. Charles Liarakos stated there would be more time allotted at the next meeting for further discussions of the Innovations in Merit Review activities.* Other questions dealt with a post-doctoral program in SEES and the current level of data mining capabilities with NSF's systems.

**NSF in the America Competes Act (ACA) - Dr. Joann Roskoski**

Dr. Roskoski summarized the ACA as a 3-year authorization plan that creates several new programs, expands/modifies current programs, and includes other provisions. She noted that the ACA limits the National Science Board (NSB) to matters within NSF authority and directs the NSB to evaluate mid-scale research needs at NSF. The ACA expanded the application of the Broader Impacts review criterion to include three new areas and requested BI review criterion policy changes that mandate the development of systems to evaluate BI activities.

**National Science Board committees**

Dr. Roskoski reported the establishment of three NSB Task Forces - Unsolicited Mid-scale Research (MS), Data Policies (DP), and Merit Review (MR) - and the charge for each task force. The MS Task Force will investigate if perception of "appropriate" award size by applicants for NSF research grants leads to loss of otherwise "great ideas." A preliminary report will be presented to the NSB in August 2011. The DP Task Force will define the issues and outline possible options to make more effective use of data in meeting NSF's mission. The MR Task Force will examine the two merit review criteria and their effectiveness in achieving NSF's goals. The members are focused on how the merit review criteria are being interpreted by the PIs, reviewers and NSF staff, strengths and weaknesses of

criteria, impact of criteria on project development, and the role of the institution. The task force is incorporating data and input from stakeholders, COV report analysis, and the topic modeling analysis of BI in submitted proposals. The MR task force is developing principles to guide the description and implementation of the merit review criteria. The America COMPETES Reauthorization Act requires the NSF to have a plan/policy related to the Broader Impacts Review Criterion by June 2011.

Committee members asked questions about the level of Congressional involvement, follow-up by congressional members, assessment of BI/BP programs, the MR task force report, and the inability to harvest all of NSF's data. The committee expressed concern regarding the assessment of BI and proper guidance of BI.

### **SymbIOTic ART & Science Conference – Dr. Nalini Nadkarni**

Dr. Nadkarni gave an overview of the logistics of SymbIOTic ART and Science Conference held Feb 28- Mar 1, 2011 and jointly funded by NSF/BIO and National Endowment of the Arts. The focus of the meeting was genetics, ecology, and the environment as perceived through the visual arts, dance, and literature. The participants were asked to examine the nature of the creative processes and practices of joint work and to identify joint benefits and challenges for research, education, and outreach. Dr. Nadkarni presented examples of joint art/science projects (e.g., The Ferocious Beauty Genome, The Emergent Improvisation Project, and the Long-Term Ecological Reflections 200-year Log Decomposition Study) and enumerated both the benefits and challenges of doing art-science work. Dr. Nadkarni also reported on the context of proposed interactions, the types of support needed, the questions that arose and the conclusions of the meeting. A report of this conference is being prepared by the co-PIs.

The committee expressed enthusiasm about the workshop, the ongoing collaborations and interactions and its perception that interaction makes both art and science more accessible to communities. The participation in the workshop and interest of the research based museum community was discussed. The discussion then moved on to the support needed (for the collaborations and education training), the next steps, other collaborations between NSF and NEA, the rigor needed to ensure effective collaborations and the potential impediments to collaborations. It was suggested the inclusion of sciences that are more disposed to work with the arts should be explored.

### **Deep Carbon Observatory – Dr. Robert Hazen**

Dr. Hazen briefed the Advisory Committee on the Deep Carbon Observatory (DCO), an international research initiative to achieve transformational understanding of Earth's deep carbon cycle, funded by the Sloan Foundation. DCO has an estimated 2000 co-investigators in 60 countries and is modeled after Census of Marine Life. Dr. Hazen identified four DCO research Directorates – Deep Carbon Reservoirs and Fluxes, Deep Life, Deep Energy, and Physics and Chemistry in Carbon – and the questions each is attempting to answer. Dr. Hazen focused on the research activities and objectives of the Deep Life Directorate. Some of the results of the research have shown:

- Active and robust microbial communities have been identified more than 1 km beneath the seafloor.
- There is microbial activity at giga-pascal pressure and surveys have demonstrated high-pressure viability of microbes.

These results have led questions of how deep in the Earth microbes can go and if deep microbes could provide clues to the origin of life.

The BIO AC discussed:

- The definition of “deep” (a meter down to the core)
- The connection between deep domain of life and astrobiology and how the Sloan Foundation is making sure exciting opportunities at the interfaces are supported
- The types of activities related to undergraduate education being encouraged by the project
- The search of unknown life forms, the methods used and position scientists need to be in to be able to recognize the unknowns
- The composition of a new domain and the design of experiments to look at a film that is only a few molecules thick

## **Lunch-time Presentation by Dr. Freeman H. Hrabowski, III, President, University of Maryland Baltimore County**

After being introduced by Dr. Roskoski, Dr. Hrabowski began by discussing a recent (2010) National Research Council report, "Rising Above the Gathering Storm Revisited". This report was a follow-up to the original "Rising Above the Gathering Storm" report that cited the need to develop a strong and diverse science and engineering workforce. He observed that broadening participation is important because under-represented minorities make up 28.5% of the population but only 9.1 % are educated in STEM areas. However, STEM education problems are not confined just to minorities since 2/3 of all US students who begin in science and engineering do not complete a degree (compared for example to 70% of Korean BS degrees that are in STEM). Dr. Hrabowski explained that undergraduate students need both financial and academic support and that their skills associated with academic access and motivation must be strengthened. The retention problem must be understood clearly in order to solve it; therefore, it is important to be able to disaggregate the data. College affordability and academic support and integration were cited as major components of the problem. Principles to frame national policy, the institutional roles of different types of higher education institutions (predominantly-white, minority-serving, and community college), leadership roles, and successful program development were identified and discussed by the committee in order to develop recommendations and priorities. Dr. Hrabowski ended his presentation with the thought that this is a transformative moment for the nation to seize so that we do not fail future generations.

The discussion that followed focused on the impact of and alleviating the financial burden, mentoring by professors, innovation in science teaching and learning, relevancy of HBCUs, and focused initiatives.

### **Scientific workforce development – Dr. David Burgess**

Dr. Burgess began his talk in Cherokee. He explained the importance of culture and its role in his career as a scientist. He explained that in the top 100 US Academic Institutions, the percentage of Assistant Professors is 1.8% for African Americans, 4% for Hispanic Americans, and 0.1% for Native Americans. Moreover, there exists significantly higher expectations/workload placed on the minority professor because of the additional campus responsibilities requested of the professor. There is also an expectation that because you are a mentor you will be a good mentor. Minorities publish less and go to professional meetings less and the issue of faculty burden is only touched upon in reports.

Dr. Burgess opened the floor to questions and other discussion. Topic discussed were:

- resources are needed to reward what we value;
- funding and awarding of tenure;
- transition strategy from community college to 4 year institutions (the impact of credit of classes under the articulation agreements between community colleges and 4 year institutions)
- how to measure the other kinds of success in science; e.g., for PhDs who decide not to continue in STEM fields and/or work in non-STEM fields;
- the difference between individual success and program success; program success has to look at the PhD level and beyond;
- evaluation of the 4 year graduation rate versus the 6 year graduation rate;
- the role medical schools have in determining that future students do not have to major in sciences; getting the pre-meds out of biology

### **Vision and Change in Undergraduate Biology Education – Dr. Carol Brewer**

Dr. Brewer summarized the *Vision and Change in Undergraduate Biology Education - A Call to Action* report. She described the meetings that led to the Vision and Change Conference July 2009 and what students who participated said they wanted. The Vision and Change Conference also focused on core concepts, core competencies, and how they are linked in a curriculum. The five core concepts identified were:

- evolution,
- structure and function,
- information flow, exchange, and storage,
- pathways and transformations of energy and matter, and

- systems.

The six core competencies are the abilities to

- apply the scientific process,
- use quantitative reasoning,
- use modeling and simulation,
- tap into the interdisciplinary nature of science,
- communicate and collaborate with other disciplines, and
- understand the relationship between science and society.

Dr. Brewer expressed the need of the community to get over the depth versus the breadth fight because a professor cannot teach everything there is to know about biology in an introductory biology course. Seven points were detailed that help connect teaching with learning. The key messages of Vision and Change were listed and the next challenges were identified as the implementation of the recommended changes and building and sustaining the community.

The discussion that followed centered on technology as resource to share best practices, where the Vision and Change participants felt the changes should begin (with the curriculum), the division between concept and competencies and the use of few words to describe them, and the identifications of topics that need to be better developed. Topics such as the mesh of digitization and new teaching methods and the use of Boogle/Course Source were suggestions for further conversations within the community. Dr. Brewer ended the discussion by stating the decisions to change courses have to be context specific and specific to an institution's curriculum.

### **General discussion**

Innovations in Merit Review – Dr. Parag Chitnis, DDD, MCB

Dr. Chitnis reviewed the most recent innovation activities in the proposal review process. He provided an overview of the processes for the Ideas Labs and the Big Pitch panels. He noted that while individual reviewers were more favorably inclined towards the high risk, innovative, and inter-disciplinary Ideas Lab proposals, while regular panels reviewing the same topic area were more risk averse in their treatment of Ideas Lab proposals. Dr. Chitnis also reviewed the details of the latest Big Pitch experiment: 50 proposals relevant to Climate Change were reviewed in 1 core disciplinary panel and 2 experimental panels. Dr. Chitnis concluded his presentation by commenting on the correlations seen, the panel discussions and panel outcomes.

The committee discussed the composition of the Ideas Lab participants, the role of on-site mentor panel, as well as risky proposals, risk adverse review panels and the value of innovation. Recognition of novel projects and prize mechanism were also topics of discussion.

Dr. Schaal adjourned the meeting for the day at 4:30 PM.

### **Wednesday, March 30, 2011**

Dr. Schaal convened the meeting at 8:30 AM. Drs. Juliette Bell and Jose Onuchic were not in attendance.

Drs. Daniel Wubah, Eva Pell, and Sue Bryant were thanked for their years of service and received certificates of appreciation from Dr. Roskoski.

The AC prepared for the visit with Dr. Cora Marrett, Acting Deputy Director of NSF by listing questions and areas of concern/interest and discussing these with Dr. Roskoski. These included:

- Future directions w/in NSF
- Discussions with Congress
- The external community as partners
- Ensuring that fundamental research continues to be reviewed as a high priority
- NSF physical move to new HQs
- Prizes

- FY2011 budget: How is NSF preparing for a shutdown? What happens? Is NSF experiencing a level of scrutiny about what if anything would be cut from the budget?
- Impacts of salary and time restrictions (new restriction- 10%) for PI involvement on projects in proposals
- FY2012 budget request: what is NSF's doomsday plan?
- Finding ways to partner with NIH
- NSF's view on science in society
- More foundation connectivity
- What is leadership's perspective on BI?
- GK-12: engage K-12 with a scientist in the classroom and teachers; this program is being cut but no idea why it will be cut; alert the community, there is a loss of trust for NSF;
- Role of the AC and more interaction by the AC: what does NSF need advice on? What upcoming issue is advice needed on? What specific things can be accomplished here? Crystallization of a plan to lay out input that is wanted by NSF would be helpful.
- Is there a program to fund science fairs?

### **Discussion with Dr. Cora Marrett**

Dr. Marrett expressed apologies from the Director for not attending the meeting. She then spoke about NSF's response to the budget situation and potential hiatus. She also identified areas in which the AC members could provide help:

- Low funding rates
- Reducing the work load pressure on NSF staff

The panel proceeded to ask the questions that they had previously discussed (listed above). The committee also thought this is a good opportunity to engage the public and generate public interest. Dr. Marrett suggested this is area in which the AC could help. NSF's way of thinking about partnerships was discussed. Dr. Marrett encouraged the Advisory Committee members to provide advice to address some of the questions raised during the discussion.

### **LTER 30-year Review – Dr. Anthony Michaels and Dr. Alison “Sunny” Power**

Drs. Michaels and Power presented the key questions from the charge for the LTER 30-year review, and reported that the review panel struggled with the leadership question. The review process included two meetings (Jun 2010 and Oct 2010), site visits to 8 LTER sites and the LTER Network Office, and meeting with the entire network at the network meeting in May 2010. The key strengths included the transformative role of the LTER program in ecology, leveraged funding by PIs, empowered short term research, and the beginnings of a network that could address larger research questions. The challenges include tension between the LTER Network Office and the LTER sites and leadership needed to move forward. Social science research not a central value-added part of the network, and data management and data issues loom huge for the projects. The recommendations of the LTER 30-year review committee were divided into four categories: science, networks, outreach and education, and administration.

The committee asked for clarification on some of the points. The differences between NEON and LTER network were discussed. An AC member suggested the broadening participation aspects of the program should be covered more with highlights of the more successful programs. It was also stated that the report should clearly articulate what the benefit is to the community as a whole. The data problem was seen as crucial and suggestions should be made for empowering the leadership. Dr. Brewer stated that most of what was presented aligns with what the LTER National Advisory Board recommended.

### **Information Exchange Environments – Dr. Jonas Almeida**

Dr. Almeida described information exchange environments as products of a generation and how everyone is embedded in an information exchange environment. He explained that RDF-BUS is the data backbone on which everything reads/write and which exhibits the key feature of being symbolically unified and physically distributed. He noted that a society of machines and people working together exists and code is starting to travel instead of data. Because of this, there should only be one set of data and traceability. Data is increasingly provided in the correct format but it is not always accessible. He referenced linkeddata.org which is a website that is looking at communities of data and software. Dr. Almeida showed how easy it is to perform “social hacking”. HEPA does not protect against

this sort of hacking and the law is on the side of code migration and not on the side of data migration. A prevailing question is how can you manipulate data without changing the data. There is a paradigm shift toward full availability of code and transparency. Scientists can begin to address the issue of only getting back what you need.

The Committee's discussion centered on the traceability of using a third party server, the next set of problems moving forward, data analysis, management, and visualization, and data.gov. A committee member expressed the need to add the ability to ask a question on the bioinformatics web pages. Dr. Nadkarni said that data management and visualization are holding forest canopy scientists back. Scientists are having a problems sharing data and with informatics management and maintenance. Dr. Almeida responded that scientists cannot be asked to maintain data forever and machines cannot be trusted to keep it forever. He also stated that cheap or free storage is available, such as google.com and amazon.com. The question "at what point will NSB decide that all data funded by NSF will be available" was raised.

*The committee would like to have more data on and discuss the funding of graduate students at a future meeting.*

*An email regarding a date for the next meeting and the possibility of an off-site meeting will follow this meeting.*

**Dr. Schaal adjourned the meeting at 12 noon.**