

National Science Foundation
Directorate for Biological Sciences

BIO Advisory Committee Meeting
December 15 and 16, 2011
Stafford I Room 1235
Summary Minutes

Thursday, December 15, 2011

BIO AC Members in Attendance:

Dr. Jose Nelson Onuchic, Chair	Dr. Jonas S. Almeida	Dr. David J. Asai	Dr. Juliette B. Bell
Dr. Carol Brewer	Dr. David Burgess	Dr. Warren Burggren	Dr. Sean Decatur
Dr. Michael J. Donoghue	Dr. Jacquelyn S. Fetrow	Dr. Katherine L. Gross	Dr. Robert M. Hazen
Dr. Hopi Hoekstra	Dr. Peter Wyse Jackson	Dr. Nalini N. Nadkarni	Dr. James N. Siedow
Dr. David Stern			

Welcome and Approval of Minutes

Dr. Jose Onuchic, Chair of the Advisory Committee for the Directorate for Biological Sciences (BIO AC) welcomed everyone and asked the participants of the meeting to introduce themselves. (Dr. Onuchic began his term as BIO AC Chair at this meeting after Dr. Barbara Schaal notified BIO that she was unable to attend the meeting.)

Dr. Onuchic asked for approval of the minutes from March 2011 Bio AC meeting. Dr. Almeida requested that HEPA be changed to HIPAA. Dr. Burgess requested the addition of attendees to the minutes. The minutes were unanimously approved with the changes.

Welcoming Remarks – Dr. John Wingfield, Assistant Director, Directorate for Biological Sciences

Dr. Wingfield thanked Dr. Joann Roskoski for serving as acting AD and for mentoring him during his time at NSF. Dr. Wingfield provided an update of the NSF and BIO budgets for FY 2012. He noted the NSF budget had exceeded \$7 billion for the first time, suggesting that basic research and science education continue to be national priorities. He then described the NSF and BIO responses challenges and priorities for the coming year including: BioMaPS, Comparative Neural Systems, Science Engineering and Education Sustainability, CIF21 and the Bio-economy.

The BIO AC briefly discussed the budget decision date, how the challenges/priorities were chosen and communication between programs and divisions was accomplished.

Approval of MCB Committee of Visitors (COV) report – Dr. James Siedow

Dr. James Siedow summarized the MCB COV report for years 2008-2010. He felt the Division deserved an “A” overall for its diverse portfolio and support for outstanding research. The portfolio indicated a movement towards larger grants. He noted that the award rate for single investigator grants was “good” and that signature projects were well represented. He reported that MCB did a good job trying novel innovative ways of reviewing projects and there was good evidence of MCB reaching out to other directorates and divisions. Other areas of praise noted were:

- the number of EAGERs increased;
- the funding of underrepresented groups has increased
- the geographic distribution of those awards has increased/shifted;
- the workload issues seem to be resolving;
- the morale of the division seems good and division working well together.

The challenges noted by the COV included: decreasing budgets, increasing numbers of grant applications, maintaining the core portfolio while identifying new research areas to support. The COV thought the NSF’s response to societal needs should be incorporated when considering the division portfolio. The COV suggested that the Review Analysis (RA) go to the investigators and that more than one PO should review EAGERs. Dr. Roskoski stated the RA is considered an internal document. Dr. Siedow noted the “lumpiness” of the *ad hoc* reviews’ still exists while the committee expressed concern about the confidentiality of panels and proposals.

The committee discussed the dynamic nature of the division, the integration of MCB and other divisions, the number of proposals in BIO crossing divisional lines and the marginal increase in the quality of the analysis of BI in reviews. ***The MCB COV report was approved unanimously by the BIO AC.***

Approval of IOS Committee of Visitors (COV) report – Dr. David Stern

Dr. Stern reported that the Committee of Visitors appreciated the continuity provided by IOS from the last COV. The COV found both the proposal review and quality broad and balanced. They noted the number of applicants to IOS from members of underrepresented groups was less than expected and that there had been a decrease in the number of submissions from 4-year institutions. The COV also examined the virtual panels and identifies those thought to be transformative. Major recommendations by the COV included:

- Provide more guidance to the PIs regarding BI.
- Do a better job of explaining what IOS supports to the public and the larger scientific community.
- Institute some quality controls by PDs regarding what goes into FastLane.
- Make sure PIs who are declined but whose proposals nevertheless reviewed well understand why they did not get funded.

Dr. Stern noted that IOS had been responsive to the recommendations in the last COV report, most notably beginning to develop internet and television programming to explain externally what is being awarded and the development of a mentoring initiative.

The BIO AC discussed publicizing the efforts and value of the division. They also discussed an apparent discrepancy in balance of funding among programs in IOS, whether bias underrepresented groups might contribute to low funding rates and proposal submissions, and how to increase the appeal of STEM fields to underrepresented groups and the number of applicants from PUI. ***The IOS COV report was approved unanimously by the BIO AC.***

The BIO AC requested a future discussion about REU, how the program helps support increased research at PUI and RUI, and whether REU could be used to address the capacity issue?

NEON (status report)

Drs. Elizabeth Blood and Roskoski were available to answer questions. Dr. Roskoski provided a brief overview and status. The discussion that followed focused on BIO's role in and planning for the operations and maintenance of NEON, data issues, NEON's Science, Technology, and Education Advisory Committee's (STEAC) responsibilities, the function of scientists at a facility as observational scientists, and allocation of the Airborne Observation Platform as NEON is constructed.

NOTE: A more extensive discussion by the BIO AC of the potential areas of overlap between NEON and LTER and funding plans for NEON occurred on later in the day and is described in the minutes below.

DEB/IOS to annual pre-proposal/full proposal submission

Dr. Roskoski summarized BIO's efforts and NSF exchanges to date and briefly described NIH efforts to manage the proposal review process. Some AC members expressed their personal concerns and those of their colleagues about the new pre-proposal processes. Those concerns included the timing of the overall process and the affects of limitations on the number of pre-proposals on which an applicant can serve as a PI or co-PI, the possible negative effect of this change on workload in BIO, and the assessment of the affects and success of this change. AC members also were very concerned about the lack of clarity regarding why MCB was using a different process from DEB and IOS and how the different deadlines would affect NSF workload. The acting DDs and DDDs (Drs. Firth, Silverthorne, Gilchrist, and Deshler) from IOS and DEB responded to these concerns by providing the DEB/IOS rationale and assessment plans to the committee. Types of panels being considered, activities in other directorates, sustainability of young investigators getting awards and consultation with the community were also discussed. The BIO AC expressed an interest in monitoring these changes over the next few years.

AIBS Update – Robert Gropp, Director, Public Policy Office, AIBS

Dr. Gropp began his presentation with an overview of AIBS and its programs and services. He focused on the science policy program in which AIBS was an advocate for NSF investments, defended NSF investments, helped reverse Senate proposed cuts, and ensured that museums were eligible to receive stimulus funding. A new focus of the policy group is helping to cultivate communication skills in young scientists. Policy Issues identified by Dr. Gropp were:

- federal support in science research and education,
- science for 21st century (working to increase the exchange b/n fed and non-fed collections),
- science integrity policy;

The AIBS Education program is working with diverse stakeholders to determine how to best leverage AIBS resources to move STEM education forward. Dr. Gropp also described an upcoming effort by AIBS to survey the biology and related communities (findings will appear in *BioScience*). He then reported AIBS bylaw and constitution changes that will enable AIBS to better serve the biological community with a more stable and strategic board. Dr. Gropp concluded his presentation by stating that AIBS is more than willing to continue to serve as a conduit to the biology community and to bring together those who would like to collaborate.

Comments from the BIO AC reflected a positive impression of AIBS as more aggressive advocates for biological research. BIO AC members also wanted to know where assistance is needed from the scientific community in communicating with Congress and if there was any support at AIBS for scientists writing BI beyond the local community.

Vision for the Biology Directorate – Dr. John Wingfield

Dr. Wingfield began his presentation by stating that PIs are the source of innovation of science. He presented the 5 Grand Challenges at the intersection of the life and physical sciences and examples of research that BIO is funding in the grand challenge areas. He then detailed Directorate funding activities that are responsive to the challenges and priorities described earlier. Dr. Wingfield highlighted ongoing initiatives, some of which have the potential to impact other sciences and other countries. These include PGRP; iPlant; Dimensions of Biodiversity; NEON; Advancing Digitization of Biological Collections (ADBC); BIO Data Management Priorities; and the Bio-economy (including examples of bio-economy projects). Dr. Wingfield concluded his presentation with I-Corps, a new program introduced by Dr. Suresh. One BIO team was funded in the first round of I-Corps awards.

The discussion that followed centered on the challenge of exploring the linkage between scales, collaborations and approaches to further research investigating interactions between organisms and environments and genome to phenome interactions. It was stated that molecular efforts alone would not be enough.

Prepare for meeting with Dr. Suresh: Discussion – Role of the BIO AC; NSF Communications

In preparation for the discussion with Drs. Subra Suresh and Cora Marrett, the committee developed questions and comments. Dr. Roskoski noted some topics of discussion such as how to model the complex system, how the BIO AC will be a part of the decision process, NSF communications – survival skill in order to get funding for science and One NSF.

The committee began an extensive discussion about making the BIO AC more active, including the creation of subcommittees to discuss specific issues - a topic they plan to discuss in more detail at in the next meeting. Possible discussion topics include the rationale for making decisions and the possible overlap between what the multiple COVs do and the BIO AC. Dr. Onuchic stated his intention to communicate more between meetings and to address the need for continuity in thinking about the role of the BIO AC. Council members will be probed for what issues they believe should be discussed and sub-panels assigned where appropriate.

Discussion with Dr. Subra Suresh, Director, National Science Foundation

Dr. Suresh welcomed the committee, thanked the members for finding time to participate, and requested advice and feedback on what NSF does or does not do well. He asserted that 2011 had been an interesting year in terms of the budget and funding. The agency spent a lot of time communicating externally to reinforce the need to support science and is developing the FY13 budget and thinking about FY14. BIO increasingly does a variety of activities that cut across NSF. Dr. Suresh said that we are entering an era of observation that includes data management and computational and data enabled research. He talked about refocusing the NSF vision on what NSF can and will do as well as what NSF will not do. The discussion turned to One-NSF and how to foster more and better interactions among communities within and beyond disciplinary boundaries. The question is how best to leverage NSF’s reach, stature, and scope to provide greater opportunity for scientific engagement. The NSF vision document states that NSF is an innovation agency and Dr. Suresh would further argue that basic research and efforts to foster education are essential requirements for innovation. NSF has the opportunity and responsibility to begin conversations about how to leverage and create a national infrastructure that will move the Foundation in the right directions.

Dr. Onuchic thanked Dr. Suresh and Dr. Cora Marrett, NSF Deputy Director, for meeting with the committee and expressed his happiness in having Dr. Wingfield on board as the new BIO AD. He opened the floor to questions including how to make the BIO AC more active in the priorities of the NSF leadership. Dr. Suresh listed several issues/priorities:

- Issues faced as an agency are similar to what universities face
- Disciplinary silos cannot be the be all end all
- NSF must move nimbly to keep up with the world and scientific community
- Identify mechanisms that work across all initiatives
- Reduce both internal and external barriers – the focus of One NSF;
- Topics for advice: workload pressure, setting realistic community expectations, supporting the best research

Questions from the BIO AC included:

- Is there Broader Impacts criteria accountability?
 - Questions to be answered: Is the money invested giving the intended results? Are we investing the right amount of money? What are the metrics that should be assessed?
- Can NSF open portals similar to I-Corps to other communities in ways that will be mutually beneficial?
 - I-Corps is set at \$5M intentionally to not take money away from basic science
 - Must try to not overlap with other activities
 - Must not depart from fundamental NSF mission
- What types of Public-Private partnerships can create “billable science”?
 - Examples are BREAD and I-Corps (two non-profit organizations contributed financial support)
 - Cautionary notes: universities are struggling; foundations do not support full overhead, managing combined public-private funding can be tricky due to different rules, goals, limitations etc.
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- How should the BIO AC and BIO manage the balance between Core and non-Core supported research?
 - Senior Management does not decide; it comes from the community
 - There is a strong misconception that interdisciplinary research does not have a Core component or value
 - Would it be helpful to convene sub-groups to identify and explore issues in more detail?
- Is there a continued commitment to be involved in the preparation of K-12 students?
 - PCAST about to release a white paper

- Dr. Suresh is a co-chair of the NSTC Committee on Science, Technology, Engineering, and Math Education (CoSTEM)
 - NSF does primarily innovation of education models but does not implement the models
 - Given all of the concerns, what is the best way for NSF to support K-12 education?
 - NSF has expanded the interaction and communication with Department of Education and other agencies
 - It is easy to begin programs but not so easy to sunset programs
- What are the Director's thoughts on graduate student education?
 - Graduate Student Fellowship program began in 1952
 - NSF doubled the number of fellowships between FY09 and FY10 to 2000
 - GSF is a key component to research and workforce

Science Presentations: *Fundamental Research for the Bio-economy*

Dr. Jacob Schmidt, UCLA Dept. of Bioengineering – recipient of BIO's first I-Corps award - (Artificial membrane technology for ion channel screening)

Dr. Schmidt described the background to the development of an ion channel screening technology. The new technology, an automated lipid bilayer and ion channel measurement platform, is able to screen a wide range of ion channels accurately and at a lower cost than current technology. Dr. Schmidt completed the I-CORPS program, which he described as an intense experience with a first-class teaching team. In the course he learned how to test all aspects of a business model and identify cost/data point and throughput metrics. Dr. Schmidt's team was able to define their minimum viable product, a 32-channel system instrument with a consumable player and targeted user groups. Although a small system, it will be extremely cost competitive, offer a superior cost/ data point, and approach industry best throughput. He also detailed the development process, which included a partnership with Librede, a business co-founded with a former graduate student and residing as an incubator on UCLA campus.

Dr. Barry Bruce, Dept. of Biochemistry, Cellular and Molecular Biology, University of Tennessee, Knoxville – Applied Photosynthesis (Direct Solar to Fuel Production using PSI)

Dr. Bruce presented his lab's attempts to exploit the process of solar energy capture and conversion of natural photosynthesis into devices that will allow the utilization of the energy or energy storage as some form of fuel such as molecular hydrogen. He discussed the limited number of alternative and renewable systems and the role of the sun as a singular solution to our future energy needs. The goal of his team's activities is to "take what makes a leaf green and make it a sustainable energy solution." He further described the use of hydrogen as a preferred energy carrier, the direct production of hydrogen by green bacteria and oxygenic organisms via Photosystem (PS) I.

The BIO AC discussed the feasibility of using platinum in the process, the effectiveness of the process, bleaching, and why PSI works well for an extended period of time.

Dr. Lou Burnett, Dept. of Biology, College of Charleston; Director, Grice Marine Laboratory - "Shrimp on a Treadmill" (Performance in Crustaceans in Stressful Environmental Conditions)

Dr. Burnett described the marine laboratories and partnerships that have come together at the Hollings Marine Laboratory, which is funded through NOAA. He explained the focus of one area applied research is the disease processes that affect shrimp aquaculture in this country. Dr. Burnett showed videos of shrimp on treadmills and explained the use of treadmills in research by biologists. He detailed the decline of shrimp and blue crab harvests in the US, changes to coastal waters conditions and the findings of his research: low oxygen inhibits innate immunity, low oxygen and elevated CO₂ make things worse, and bacterial infections are common. His group was able to create a bacterial infection model. He also presented other research questions answered through the use of treadmills and talked about the Coburn report and his response. Dr. Burnett expressed the importance of receiving training to deal with media scrutiny.

The BIO AC asked about the impact of the research on the industry, the origin of the low oxygen levels and new microbial strains, and the inability of shrimp to maintain oxygen levels.

Dr. Margaret Palmer, Dept. of Entomology, Univ. of Maryland; Director, National Socio-Environmental Synthesis Center (SESYNC) – Sustainability of Socio-environmental Systems

Dr. Palmer described the mission of SESYNC as supporting synthetic, actionable science related to the structure, functioning, and sustainability of socio-environmental systems. She detailed the importance of linking the economy and environmental science as environmental problems cannot be solved without exploring social issues. SESYNC is working to develop metrics of effectiveness of working across boundaries and encouraging a shift from a "provenance" scientific culture. Dr. Palmer stated SESYNC hopes to promote synthesis within and across portfolios using thematic approaches and the identification of "common currency" (something both groups of scientists can identify with) to stimulate relationship development and collaborations. The plan for SESYNC includes

bringing in facilitators that can assist in the transcending, developing new teaching tools and pedagogy and development of modules that will be tested over the next few years within multiple institutions with different types of students.

The BIO AC and Dr. Palmer discussed actionable science and the ability of scientists to remain objective.

Presentation of certificates of appreciation – Dr. John Wingfield

Dr. Burggren was recognized for 6 years of service. Two other BIO AC members recognized in absentia—Drs. Barbara Schaal and Joseph Travis.

General discussion – *the Bio-economy*

Regarding Bio-economy and the science presentations, the committee discussed:

- Interdisciplinarity and its effect on tenure
- Data maintenance, usage, quality, and documentation
- Common endpoints and issues for two groups regarding Bio-economy
- Importance to researchers of on-campus incubators
- Media interactions
- Communication training
- Types of dissemination
- Science journalism

Dr. Onuchic opened the floor to other discussion topics. The BIO AC began an extensive discussion about the relationship between NEON and the LTER program. Drs. Blood, Firth, Gilchrist, Kane, and Twombly joined the discussion to provide information and answer questions. The BIO AC's primary concerns were about clarification of the differences and linkages between LTER and NEON and about how BIO plans to manage the long-term financial support for NEON as well as any potential negative effects this may have on the divisions. The need to resolve the apparent confusion surrounding NEON and LTER was strongly expressed.

The BIO AC requested NEON briefing and discussion (if possible with Chris Fields and the Project Scientist) as well as a thorough discussion of its aforementioned concerns, if possible at the next meeting.

Dr. Liarakos requested volunteers for the 2012 COVs.

Dr. Onuchic adjourned the meeting for the day.

Friday, December 16, 2011

Dr. Onuchic convened the meeting.

NSF Merit Review Process Working Group – Drs. Steve Meacham and Candice Major, Co-Chairs

Dr. Candice Major described the reexamination of the Merit Review Process at NSF and provided the background of the establishment of the WG. In response to increasing pressure/strain on the process, the WG was tasked to

- enhance the process
- think boldly
- keep in mind the workload issues internally and externally
- ensure broad participation
- develop pilot activities and evaluate these activities, and
- engage the stakeholders.

The WG is **focused entirely on the process and NOT the merit review criteria**. It was important to note the process is not seen as broken. Dr. Major presented some of the relevant trends and identified examples of potential process enhancements some of which have been developed by the community. She stated BIO has been at the forefront of experimenting with the merit review process. Dr. Major listed questions and pilot activities on which the WG would like input from the AC members.

The BIO AC and the presenters discussed the merits and feasibility of the potential process enhancements in conjunction with the effects on NSF staff workload. The use of virtual meetings as a method to broaden participation was discussed.

National Science Board Task Force: Revised NSF Merit Review Criteria – Dr. Joanne Tornow

Dr. Tornow began by stating the focus of the Task Force (TF) is the merit review *criteria*. She reminded the AC of the rationale for the establishment of the Task Force and its history. Dr. Tornow described the issues identified by the TF and the types of data collected and the methods of collection. Survey observations included: intellectual merit is given more weight in the review process; current methods for assessing intellectual merit are adequate; more needs to be done to assess if Broader Impacts goals are being met; institutions could do more to help the PIs meet the Broader Impact criteria. The TF recommended keeping the two review criteria, IM and BI, and using five review elements for each criterion. The NSF is charged with developing an implementation plan of the

revisions and TF has identified issues that should be discussed and included. The report has been approved and was published in December 2011. Revised criteria and principles should be included in the next iteration of PAM and PPAG.

The BIO AC members agreed that the recommended guidance is clearer. They also discussed different aspects of the recommendations and asked for clarity on certain issues. It was stated that communication is key to the implementation of the revised guidance and assisting PIs in proposal development. Dr. Tornow stated the implementation process would take several months.

The Biology Education Pipeline

Undergraduate Science Pipeline - Dr. David Asai, HHMI

Dr. Asai described the precollege and undergraduate science education activities at the Howard Hughes Medical Institute including a relatively new initiative called PULSE – Partners in Undergraduate Life Science Education. This initiative has a goal of sustained implementation of the Vision and Change conference recommendations and involves partnerships between NSF (BIO and EHR), NIGMS, and HHMI. Dr. Asai explained the approach, the questions to be answered for different institutional types (community colleges, PUI, masters granting universities, and doctorate granting research universities) and the steps identified to develop implementation mechanisms.

The BIO AC discussed the involvement at the department level versus other levels of institutions, the structure of the responses and perspectives, and the outcome of the exercise were discussed.

A Brief Perspective on US Graduate Education in Biology – Drs. Mike Donoghue and David Stern

Dr. Stern presented the points to be addressed regarding graduate education, recent literature on the subject, 2010 US trends seen in doctoral training, and international trends. He stated graduate student training has not changed much in 50 years and reviewed the results of satisfaction surveys given to graduate students and PhD holding individuals. The graduate education programs and initiatives at NSF and important aspects of a successful training were explained. Dr. Stern ended his presentation with a suggested path forward.

Dr. Donoghue expanded on the ideas presented by Dr. Stern. He expressed the thought that NSF does not have enough training grants and is falling behind. Training grants at NIH are seen as easier to apply for and less disruptive. He suggested that BIO to take a leadership role in bringing together a group of stakeholders to initiate a proposal to do develop a new training grant program.

Topics discussed by the committee included:

- Teaching Assistant compensation
- Faculty members facing salary reductions to cover the costs of graduate training
- The cost of Post-Docs being equal to that of graduate students
- The complication and involvement of the IGERT Process and lower payoff to PI for IGERT versus a training grant
- Concerns that graduate training has not changed
- Other models for training grants in NLM
- Transition points for graduate students
- The charge to the EHR DD to look at all of the graduate training opportunities in the Foundation and develop recommendations to revamp the process.

Dr. Onuchic adjourned the meeting at noon.