

**National Science Foundation  
Directorate for Biological Sciences**

**BIO ADVISORY COMMITTEE  
Room 375 Stafford I  
October 18-19, 2007**

**Summary Minutes**

**Welcome and Approval of Minutes**

Dr. Michael Mares, Chair of the Advisory Committee for Biological Sciences (BIO AC), convened the Fall 2007 meeting at 8:00 am with a welcome to the members and guests. Dr. Mares noted that all of the members were in attendance, with the exception of Dr. Robert Robbins who was available via phone. Dr. James P. Collins, Assistant Director for the Biological Sciences (BIO) greeted the BIO AC and asked the AC members to introduce themselves. The minutes for the April 2007 meeting were unanimously approved by the Committee.

**Presentation – “Advancing Innovation and Competitiveness at the Convergence of the Life and Physical Sciences and Engineering”** *Dr. James P. Collins, Assistant Director, BIO*

Dr. Collins presented an overview of the BIO directorate’s continuing mission as it aligns with the National Science Foundation’s (NSF) strategic goals and the American Competitiveness Initiative (ACI). He emphasized three main strategic areas of focus within BIO: origins, looking at how, where and when life begins; energy, examining how systems gain the fuel to sustain life; and adaptation, studying how life changes to adjust to environmental impacts. Dr. Collins noted the current continuing resolution in regards to the NSF budget, but expressed optimism for the 6.8% increase over last year’s fiscal request. If passed, the \$6.43 billion budget will fund 7.7% more research-related activities. As Biology moves ahead through the 21<sup>st</sup> century, the NSF faces challenges to managing the scientific community infrastructure in the context of long-term priorities. The BIO directorate is working to create avenues of communication to aid the scientific community through novel centers and networks.

*The BIO AC discussed:*

- How the second criterion in the NSF merit review process, broader impacts, is being evaluated and whether or not there is a quantitative and/or qualitative assessment either in BIO or throughout the Foundation
- The nature of transformative research and how to evaluate it

**Update on Undergraduate Education in the Biological Sciences,** *Dr. Penny Firth, Program Officer BIO/DEB*

Dr. Firth noted that there have been two special working groups established to help focus on the issues that surround transforming biological science education. One of the working groups, in cooperation with the Howard Hughes Medical Institute (HHMI), is concentrating on evaluating the effectiveness of textbooks and possible teaching alternatives. The other working group has

been formed to maintain and manage the Research and Teaching Coordination Networks. Dr. Firth also remarked on the upcoming Vision and Change meeting, taking place in the summer of 2008.

### **Presentations on Biology Education**

*Dr. Carol Brewer, University of Montana, Missoula - "Training the Next Generation of Biologists and Biologically Literate Citizens"*

Dr. Brewer discussed the need to foster scientific literacy in the American public. The growing gap between what scientists and the general population understand about biology and basic science is becoming a chasm. In order to increase fundamental scientific knowledge, Dr. Brewer argued for change in both the pedagogical and curricular strategies that the current education system employs. She highlights several different strategies: 1) identifying the audience and targeting on a "need to know" basis; 2) linking thinking skills and conceptual understanding through effective curriculum and pedagogical approaches; 3) training K-20 educators and giving them the tools necessary to keep up with the leading edge of science; 4) creating opportunities at cross-discipline interactions with peers; and 5) evaluating the influence of new training models through assessment. Dr. Brewer's ending remarks centered around creating tools to evaluate the real-world application of the broader impacts criterion.

*Dr. Vincent Cassone, Texas A&M University - "The Schizoid Aspects of Biological Education: History Dependence, Disciplinary Intransigence, and Just Plain Laziness"*

Dr. Cassone spoke about the reasons for the stagnation of biological science education and offered suggestions for improvement. These ideas included: 1) teaching a limited number of basic principles each semester; 2) removing canned laboratory lessons from curricula and creating a lab experience to inspire experimental science; 3) Adhering to a central dogma in terms of teaching concepts; and 4) tailoring other disciplines (e.g.: chemistry, physics, math, and statistics) to biology majors. By implementing these strategies, Dr. Cassone contended that institutes of higher education can begin to alleviate the current problems associated with education in the biological sciences.

*Dr. Jo Handelsman, University of Wisconsin, Madison – "Scientific Teaching"*

Dr. Handelsman's presentation began with a short film highlighting the lack of science literacy in the American public. Following the video, Dr. Handelsman emphasized the need for a reform in science education, so that all citizens will understand basic scientific principles and the process and necessity for scientific advancement. She pointed out the touchstones of the Wisconsin Program for Scientific Teaching, supported by the Howard Hughes Medical Institute, which is working to foster a new generation of undergraduate biology teachers. The program focuses on teaching graduate students and faculty to effectively mentor students and monitor classroom and laboratory learning.

*The BIO AC discussed:*

- Reforming the structure of typical lectures, specifically through team teaching, discussion, and problem-based learning
- How to support students from community colleges, who may not have the same level of scientific understanding

- Creating a reward system for good teaching, not just for successful research
  - o By more thoroughly integrating teaching aspects into grants
  - o Or by evaluating criterion 2 and making sure that the broader impacts get disseminated and rewarded
- The need to standardize incremental changes and scale-up new teaching methods
- How to utilize online tools to compliment teaching effectively, not to replace it
- Incentives for post-docs and grad students to teach, getting them out of the lab and incorporating teaching into their schedules

## **Presentation on Science and the Media**

*Dr. Matthew Nisbet, American University – “Presenting Science to the Public”*

Cheryl Dybas, Public Affairs Specialist in the Office of Legislative and Public Affairs (OLPA), commented on the importance of science in the media and introduced Dr. Matthew Nisbet, a well-known expert in the field of framing science. Dr. Nisbet spoke about how political strategists, scientists, and the news media selectively define science in ways that shape policy decisions, public opinion, and political culture. Nisbet argued that the lack of general public knowledge of basic science creates a disconnect between fact and opinion. Framing science in the right way helps to alleviate this disconnect. By targeting frames to specific social identities, opinions become reinforced. Likewise, by targeting an audience with heuristic images that provide a broader understanding of a very specific topic, scientists can reach those that might not otherwise understand the technical aspects of an issue.

*The BIO AC discussed:*

- Examples of graduate programs that effectively teach communication tools
  - o Pilot programs at Cornell and U. Wisconsin
- Strategies for creating a clear message about specific research
  - o Interacting with local media outlets
  - o Institution-sponsored media training workshops
- Changes in framing strategies
  - o Example: the recent history of the debate on climate change

## **Committee Reports**

*Long Term Ecological Research Network (LTER)*

Phil Robertson discussed the progress of LTER. Its five core areas focus on primary production, biodiversity, organic matter change, nutrient movement and availability, and disturbance across a variety of ecologically diverse climates. There are currently twenty-six worldwide sites where this fundamental science takes place. Spread across both urban and agricultural environments, studies examine long term processes, episodic or infrequent events, trends, and multifactor processes. The *Decadal Plan for LTER* comes in response to the twenty-year review of 2001-2002. The Plan reflects a community consensus that was established through three years of workshops and discussions. It establishes an integrated research framework as well as an integrated research plan. Dr. Robertson highlighted points from the Plan and responded to the Committee’s questions about site review; research sites get reviewed every six years, and several have been dropped over the course of LTER.

### *Broadening Participation Working Group*

Celeste Rolfing spoke about the progress of the Broadening Participation Working Group. The group was established in April, 2007, to evaluate the effectiveness of NSF's goal to incorporate underrepresented groups in the science community and throughout the Foundation. A draft report of the findings has been created and will be available for comment within the next few months. The report indicates six recommendations for enhancing broadening participation goals: 1) diversify the reviewer pool; 2) increase training on NSF priorities and the mechanisms for broadening participation; 3) clearly disseminate information; 4) promote accountability; 5) enhance coordination; and 6) expand the knowledge base. Next steps for the working group will be to incorporate comments to the draft report, finalize the report, and create a timeline for implementation of the recommendations.

### **Discussion with Dr. Arden Bement, Director of NSF**

Dr. Bement opened the discussion by noting that the NSF is currently in a continuing resolution with regards to budget. He opened up the floor for discussion.

#### *The BIO AC and Dr. Bement discussed:*

- The tension between research and education
  - o Establishing a reward system to recognize successful teaching, or to augment the research reward system
  - o Creating and/or supporting workshops to educate on effective teaching techniques
  - o Enforcing vertical continuity when it comes to the importance of science education reform
  - o Reaching out to children at an earlier age to establish a strong foundation for science learning and creating opportunities for individual research
- Reaching out to the general public to foster scientific literacy
  - o Engaging people through the NSF website
  - o Utilizing popular tools like YouTube to capitalize on public outreach opportunities
- Eliminating the drive to perform research for the sake of research – generating a relevance to real-life impact

### **Report on the Impact of Proposal and Award Management Mechanisms (IPAMM),**

*Dr. Joanne Tornow*

The IPAMM review was initiated to analyze impact of the increase in proposal submissions across the Foundation, coupled with the decline in funding rates. Several factors were found to be responsible for these trends, including but not limited to: the restriction and elimination of funding opportunities at other national sources, the Foundation-wide movement towards larger awards, and NSF congressional funding barely keeping pace with inflation. The impact of these trends was found to have several deleterious effects. These included, among others: a stressed reviewer pool, frustrated Principle Investigators (PI), and an overworked Foundation staff. After analysis of the results, NSF is currently looking for ways to effectively alleviate some of the issues that have arisen. Some recommendations consist of: running a pilot program within several divisions across the Foundation to try new proposal processing strategies;

triaging proposals that have no merit; and/or modifying the money distribution across some areas to alleviate tension in under funded programs. The Foundation welcomes input and suggestions for further solution suggestions.

*The BIO AC discussed:*

- The proposal ratio per PI and the success rates associated with multiple proposals per investigator
- The impact of reduced funding on other things such as education and materials
- Proposal resubmissions, currently no way to track this
- Initiating a task force of Program Officers and other interagency officials to look at current methods of proposal review and come up with some best-practices
- Broadening the reviewer community

**NRC Report: The Role of Theory in Advancing 21<sup>st</sup> Century Biology, Dr. Dr. James P. Collins, Assistant Director, BIO**

Dr. Collins spoke about the importance of theory in biology, especially in its role to catalyze transformative research. Theory helps the scientific community to understand biological phenomena through all scales of life. He spoke about the challenges of linking structure and function within interacting networks as well as incorporating adaptive dynamics and feedback into research. He also pointed out highlights from the National Academies handout. In addition, he noted that the recently developed program, Advancing Theory in Biology, just held its first panel and new awards were made prior to the fiscal year closeout. The BIO Directorate is enthusiastic about the possible developments of this new research.

**Plant Genome Research Program Committee of Visitor Report, Recommendations, and the BIO Response Susan Bryant**

In June, 2007, a Committee of Visitors met to review the practices and procedures of the Plant Genome Research Program (PGRP). The PGRP began in 1998 as part of national plant genome initiative, and an interagency working group was established by the Office of Science and Technology Policy. The Committee was very enthusiastic about this program and the report reflects this positive response, with a few recommendations for improvement. Some of the topics highlighted were: the need to include research of the impact of global climate change on plant systems; the call for a greater emphasis on genomics research; the burden of work on the program staff; and the importance of fostering communication and collaboration within the scientific community. The BIO Directorate was very receptive to the COV's report and took many of their recommendations into consideration in their response. The motion to accept the COV Report and the BIO Directorate's response was unanimously approved.

**Division of Biological Infrastructure Committee of Visitor Report, Recommendations, and the BIO Response Barbara Wakimoto**

In June, 2007, a Committee of Visitors met to review the practices and procedures of the Division of Biological Infrastructure. The Committee was happy with the division's efforts and the report shows this. Some of the topics touched on were: the need to encourage mechanisms for sustainability once the award expires; an emphasis on elucidating and evaluating broader impacts; balancing program staff workload; and recognizing the importance for maintaining already-established infrastructure within the scientific community. The BIO Directorate was

responsive to the COV's report and addressed their recommendations in the reply. The motion to accept the COV Report and the BIO Directorate's response was unanimously approved.

## **Follow-up Reports**

### *Division of Environmental Biology Committee of Visitors*

In June, 2006, a Committee of Visitors met to review the practices and procedures of the Division of Environmental Biology (DEB). Of the thirty recommendations made by the COV, DEB took action on twenty-five of them. Most significantly, more funding was allocated for small grants and supplements across the division. Additionally, a cross-cluster panel was established to review integrative proposals. DEB is also happy to announce that they are fully staffed.

### *Office of Emerging Frontiers Committee of Visitors*

In September, 2006, a Committee of Visitors met to review the practices and procedures of the Office of Emerging Frontiers (EF). This office was originally a virtual division, with programs shared among the other divisions in BIO, but with a centralized budget. However, increasing demand on division staff mandated a need for EF to become a more established entity. Staff were added, and programmatic responsibilities continue to be shared across the Directorate. Working groups for EF programs include both rotating and permanent staff. Transformative research and broadening participation remain the cornerstone of EF activities. Additionally, all of the Science and Technology Centers within BIO are housed in EF and several new ones are on the way.

### **Around the Table Comments:**

- Possibilities for key-note speaker to address BIO AC and other Directorates
  - o Suggestions included Newt Gingrich and Jeff Nisbet
- Suggestion to have lectures on synthetic biology at the next Advisory Committee
- Recommendation for talks on long-term infrastructure at the next meeting
  - o Looking into database management and funding
  - o Movement towards free access might mandate for libraries to house these
- Dr. Collins solicited help for finding candidates for new positions across BIO
- Date for the Spring Advisory Committee Meeting set for April 17-18, 2008

**The Fall Advisory Committee meeting was adjourned at 12:00 pm.**

APPROVED:

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Michael Mares, Chair

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Date