Meeting of the BIO Advisory Committee
Summary Minutes
April 24-25, 2003

THURSDAY, APRIL 24TH

Welcome and Introduction of New Member: Dr. Mary E. Clutter, Assistant Director
Dr. Mary Clutter, Assistant Director for the Biological Sciences (BIO), introduced BIOAC members attending the meeting for the first time – Dr. Mary Lou Guerinot, Dartmouth College; Dr. Lynn Jelinski, Sunshine Consultants, International; and Dr. Cassandra Manuelito-Kerkvliet, Dine College (Navajo Nation). Dr. Clutter reviewed the BIO organization chart including Emerging Frontiers, a new virtual division of the Biological Sciences.

Remarks, Approval of Minutes: Dr. James Collins, Chair
The minutes for the November 2002 meeting were unanimously approved by the BIOAC.

LONG RANGE PLANNING - 21st Century Biology - Next Phase

FY 2003 Appropriation, FY 2004 Request, Dr. Mary E. Clutter
Dr. Clutter reviewed the FY 2003 Appropriation and the FY 2004 Request, noting that Congress has authorized a plan to double the NSF budget over the next five years. The Final FY 2003 Appropriation resulted in a 12.3% increase for BIO, despite an earlier Senate Recommendation of 3.5%. She noted that, due to timing, the FY 2004 BIO Request was less than the FY 2003 BIO Appropriation but was optimistic that Congress would resolve the dilemma. Lastly, Dr. Clutter reviewed the virtual division, Emerging Frontiers, and how it will be an incubator for 21st Century Biology.

The BIOAC discussed:

- The challenges NSF faces in educating Congress that NIH does not fund all areas of biology.
- The importance of interagency partnerships and the need for NSF/BIO to be ahead of the curve by funding research on the environmental and human health impacts of

nanotechnology.
- The management and staffing of Emerging Frontiers and the continuing downward pressure on Salaries and Expenses. (Dr. Clutter noted that Rita Colwell has made Administration and Management a priority.)

NEON Status: Dr. Joann Roskoski
Dr. Roskoski updated the committee on the status of the National Ecological Observatory Network (NEON), noting the overall budget structure planned for each observatory and a brief overview of the budget history. Dr. Roskoski reviewed FY 2003 activities in the community, including the establishment of a NEON Steering Group and the publication of a white paper, Rationale, Blueprint, and Expectations for the National Ecological Observatory Network. She also discussed a National Academy of Sciences study on NEON, community and NSF discussions with House and Senate staffers, and a planned interagency meeting.

The BIOAC discussed:

- Concerns that, with regards to NEON, Congress has been presented with a moving target thus far.
- The difficulties of presenting the NEON concept and exact budget numbers to Congress without losing flexibility and planning opportunities for the community.
- Lessons learned from Earthscope – a longer planning period, community involvement, and a specific, yet understandable, concept.
- The importance of the planned interagency meetings.
- The need to include minority-serving institutions in the NEON network.
- How BIO might structure discussions on the Hill and refine guidance to NAS for the NEON Study.

AC-ERE Decadal Report, Dr. James Collins
Dr. Collins briefed the committee on the activities and reports of the Environmental Research and Education Advisory Committee. He discussed the follow-on activities including a workshop held at NSF on The Academy of the 21st Century: Institutionalizing Interdisciplinary Research and Education (see later minutes for details), and the evolution of Biocomplexity in the Environment.

NSB Infrastructure Task Force, Dr. Mary E. Clutter
Dr. Clutter discussed the National Science Board Infrastructure Task Force Report, Science and Engineering Infrastructure for the 21st Century: The Role of the National Science Foundation, noting the reason for the study, the charge to the Task Force, and the principal recommendations resulting from the study:

- Increase the share of NSF's budget devoted to S&E Infrastructure towards the upper end of the historical range of 22-27%.
- Give special emphasis to: advancement of instrument technology, increased need for midsize infrastructure, increase support for large facilities, develop/deploy an advanced cyberinfrastructure.
- Expand education and training opportunities at new and existing research facilities.
- Strengthen the infrastructure budget and planning process.
- Develop interagency plans and strategies.

Sonya Mallinoff, Planning and Budget Officer for the Biological Sciences, presented FY 2002 dollars spent on Infrastructure. The percentage varies from 10-23% depending on the definition used for Infrastructure.

The BIOAC discussed:

- How the percentage spent on Infrastructure might be affected by the changing scientific and budget environments as the NSF budget doubles over the next five years.
- How BIO might respond to the recommendations in the report.

Cyberinfrastructure, Dr. Deborah Crawford, Deputy Assistant Director, CISE
Dr. Crawford presented to the AC the promise that cyberinfrastructure holds for science and engineering, noting early adopters (NEON, BIRN, NEES, ETF). She reviewed the integrated layers of cyberinfrastructure, the long-term investments needed, the challenging context in which the work will be done, and the plan of action for the future of cyberinfrastructure at NSF.

The BIOAC discussed:

- Lessons learned from the Internet.
- The challenges and natural tensions created when technological change is more rapid than institutional change.
- Concerns regarding sustained support in a multi-agency context.
- The need to involve the larger cyberinfrastructure community (academic, government, international).
- The need for accessibility for all institutions.

Priority Setting, Dr. Mary E. Clutter
Dr. Clutter briefed the AC on the inputs, processes and criteria for developing and setting priorities in the Biological Sciences.

BIO Leading Edge Presentations:

Division of Integrative Biology and Neuroscience, Dr. William Zamer
Dr. Zamer briefed the AC on new technologies used to investigate the evolution of animal movement including videos of wing-assisted incline running, forces affecting swimming speed of fishes, and transducers recording movement of fluid around robotic insect wings. He noted that these new technologies promote 21st Century Biology collaborations and provide training grounds for cross-disciplinary studies.

Division of Environmental Biology, Dr. Michael Bowers
Dr. Bowers briefed the AC on the importance and timeliness of research on Exotic Invasive Species (EIS), noting the practical, economic, and ethical reasons to research EIS. He suggested that NSF/BIO/DEB can bring an evolutionary perspective to the problem of EIS and that EIS research is an excellent example of leading edge science as well as 21st Century Biology.

Division of Molecular and Cellular Biosciences, Dr. Clare O'Connor
Dr. O'Connor briefed the AC on the leading edge field of single molecule biochemistry. She discussed the advantages and components of single molecule experiments, and the chemical

and physical challenges involved in single molecule biochemistry. She described new technologies – quantum dots and atomic force microscopy (ATM) – and how these are being used to address the chemical and physical challenges of this leading edge field of science.

Division of Biological Infrastructure, Dr. Anne Sylvester
Dr. Sylvester briefed the AC on evolving tools in plant genome research using examples of NSF funded research in the Plant Genome Research Program. She discussed the "plant genome toolkit" and the need for a transformation of this toolkit to fit the enormous amount of information being generated. Dr. Sylvester concluded by giving an overview of evolutionary genomics, noting the importance of finding the right organism to answer the right question.

BIO Education Plan, Drs. Penelope Firth and Judith Skog
Dr. Firth reviewed the strategic plan, Nurturing Discovery: Biology Education for the 21st Century, noting the purpose, vision, and the goals of Biology Education – broad career horizons, experiential learning, and biosphere literacy. She discussed the framework for integration of research and education and the context for the recommendations made in this report. Dr. Judy Skog briefed the Committee on the present BIO education portfolio, the balance of its investments, and its relationship to the goals of this strategic plan.

The BIOAC discussed:

- The importance of including an analysis of EHR education programs in the context section of the plan and presenting BIO's investment relative to that of NSF/EHR.
- The fact that the largest allocation of BIO Education resources is to upper level activities and that some funding could be (cautiously) moved from graduate and postdoctoral activities to those for K-12. The Committee noted that this would be an immense undertaking but suggested working with EHR to leverage their K-12 funds and programs.
- Concerns regarding the lack of RAMHSS awards being made and possible underlying problems.
- The effort and difficulties involved in reaching out to minority high school students, suggesting possible resources – leveraging existing relationships (e.g. using the Louis Stokes AMP program as a conduit) or tapping into Women in Science and Engineering or Native American organizations, in particular the American Indian Science & Engineering Society (AISES), the Society for Advancement of Chicanos and Native Americans in Science (SACNAS), the National Indian Education Association (NIEA), or the National Action Council for Minorities in Engineering (NACME).
- How BIO should continue to address barriers that keep students from going on in science and engineering – stipend levels, length of time to PhD degree, lack of jobs after PhD – and to investigate how the current portfolio impacts teachers.
- The idea of combining RET sites with RAMHSS so that teachers and students would have a research experience together, possibly facilitating increased participation from both groups.

FRIDAY, APRIL 25TH

LONG RANGE PLANNING – 21st Century Biology – Next Phase (continued)

Transforming Universities and Colleges, Drs. James Collins and Larry Vanderhoef
Dr. Collins summarized a meeting held to discuss The Academy of the 21st Century: Institutionalizing Interdisciplinary Research & Education, including points on timeliness of the effort, possible barriers and costs, suggested innovations for universities, and differences in marginal or large-scale change at institutions ("Fitness Landscapes"). Dr. Vanderhoef reviewed the report (and subsequent meeting on), Preparing for the Revolution: Information Technology and the Future of the Research University, which aimed to address broadly defined problems facing senior level administrators, including changes needed in individual evaluations, IT concerns on campuses, and the influence of widely-accessible large data collections (NEON was noted as an example). He also noted the six conclusions of the report: (1) the extraordinary pace of the technology evolution will continue; (2) the uncertainty of the impact on universities; (3) digital technology will change how universities are organized, financed, and governed, (4) inaction and procrastination on part of universities is dangerous, (5) it is very difficult to predict the changes information technology will bring, and (6) it is very important to have a larger contingency in the universities overseeing this revolution.

The BIOAC discussed:

- How to possibly expand IGERTs by capitalizing on the idea of students bringing faculty together and defining new interdisciplinary "disciplines" (i.e. collaborative PhD's).
- The difficulties of maintaining Centers over long periods of time.
- How funding agencies might drive this process, noting that universities would have to be flexible. However, several members were skeptical of total reliance on federal agencies and advised not to forget about industry funding, despite any strings attached.
- The recommendation to push the Tenure and Promotion process to a higher level and possibly "turn it upside down" with maximum flexibility early on in careers and later tenure based on performance.

Transforming the Core – Preparing for FY 2005
Dr. Roskoski reviewed the BIO themes for FY 2003, 2004, and 2005 budgets, noting that the FY 2005 Budget theme is Transforming the Core: Research, Education, and Infrastructure Across Scales. Dr. Judy Verbeke, Acting Division Director of IBN, discussed how BIO themes map onto Budget Priority Areas and the need for synergy between the core and priority areas. Dr. Quentin Wheeler, Division Director of DEB, reviewed two current, obvious signs of 21st Century Biology and this transformation of the core – the large-scale international collaborations, Assembling the Tree of Life and Planetary Biodiversity Inventories. Dr. Maryanna Henkart, Division Director of MCB, reviewed the challenges of the complexity of microbial biology, noting interagency efforts and the practical applications of "Metagenomics" for studying microbial impacts on the environment. She also gave an overview of experimental projects in MCB aiming to address the comprehensive review process. Dr. Machi Dilworth, Division Director of DBI, reviewed the history of the Plant Genome Research Program, noting how it encourages collaborations and the positive transformation seen in the young investigators. She reviewed the elements contributing to this transformation: a significant level

of resources, a ready community, the NSF merit review process, the ability to give supplements and take risks when given the opportunity, the management of the awards, and the oversight and long range planning by the National Plant Genome Initiative (OSTP/NSTC). Dr. Judy Skog presented the goals of Frontiers in Integrative Biological Research (FIBR), discussing the high number of proposals received, the scope of current FIBR proposals, and early insights gained from the FIBR proposals.

The BIOAC discussed:

- How the peculiarities of the FY 2004 budget will affect transforming the core.
- Single awards versus collaborations.
- The complexity of management plans and funding large (especially international) collaborations.
- The "external forces" moving the community to engage in more interdisciplinary activities.
- The transformation of the field of plant genomics since 1998.
- The need to monitor progress of FIBR awards over the full five years.
- The potential for cross directorate and interagency interactions.
- Genome sequencing and the discovery that information from multiple genome sequence projects can complicate the definition of a microbial species.
- The synergy between the Core and Priority Areas.
- Whether "transformation of the core" could result in increased funding.

Discussion with Rita Colwell, Director, NSF
Based on questions from AC members, Dr. Colwell discussed the following:

- The importance of interagency cooperation when dealing with the continuing NIH/NSF confusion, noting the recent NIH/NSF Math-Bio Symposium and other joint NIH/NSF programs.
- The A&M budget as a top priority – in particular, the need for more FTE's; the importance of Program Directors having adequate travel money; and the need for continued support from Advisory Committees and the community.
- Revisiting PhD programs, including the combination of social, economic, and academic factors contributing to the increased length of time to PhD – "indentured" students, low salaries for scientists, a lack of business and management courses in the curriculum, a lack of mentors, and the impact of foreign students (>50%). She discussed her support of The Math Initiative and the importance of quantitative sciences in the future, suggesting remedial education at the postdoctoral level in mathematics/statistics and business/ management as well
- 21st Century Biology: the importance of interactions with computers, the use of biology and its interface with every other science, ethical issues (food and vaccines), public awareness, improving the condition of high school labs, and attracting American citizens, including women and minorities to science careers.
- NEON – in particular, the importance of educating fellow scientists, partnering with industry, and highlighting the practical outcomes from NEON. Dr. Colwell reminded the AC members that MREFC funding is a very long process, noting the length of time to funding for ALMA and Earthscope, and urged them to continue to spread the word in the

community.
- Women and minorities, including the importance of targeting NSF efforts; Science of Learning Centers, with higher education and industry as partners, as resources for teachers; and using workshops and summer institutes to increase percentage of women and minorities in S&E.

BIOAC Activities

Information Item - Data Release Policy, Dr. Claire Fraser and Dr. John Wooley
The BIOAC discussed the complexities of the NIH NHGRI data release policy, noting the difficulties in defining a community resource project and the problems caused by inconsistent penalties for not publishing your data versus illegally mining that of others. A motion was unanimously approved to submit a "Statement Concerning the NIH NHGRI Rapid Data Release Policy" from the BIOAC to NIH signed by the Chair, Dr. James Collins.

Subcommittees
21st Century Biology – Collins (Chair), Vanderhoef, Wooley, Fraser
Education – Brady (Chair), Chandler, Guerinot, Manuelito-Kerkvliet, Liggins
Environment – Krishtalka, Stafford (Co-Chairs), Melillo, Ensley

Future Meeting Dates
Fall 2003 - November 13-14, 2003 (confirmed)
Spring 2004 - April 22-23 or 29-30, 2004 (tentative)

APPROVED

/S/ James Collins *11/13/03*

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James Collins, Chair Date

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