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# Meeting of the BIO Advisory Committee Summary Minutes October 22-23, 1998

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## THURSDAY, OCTOBER 22 - MORNING SESSION

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### **Welcome & Introduction of New Members, Dr. Mary Clutter**

Dr. Mary Clutter, Assistant Director for the Biological Sciences (BIO), gave an overview of BIOAC fall and spring meeting agendas. She then welcomed the new members in attendance, Dr. James Collins and Dr. Claire Fraser. She noted that Dr. Lynn Jelinski and Dr. Steward Pickett were also new members, but were unable to attend the meeting.

### **Remarks, Approval of Minutes, & Report on BIO Management Retreat, Dr. Frank Harris**

The minutes of the Spring 1998 meeting were unanimously approved by the BIOAC. Dr. Frank Harris gave an overview of the Fall 1998 BIO Management Retreat. He noted that the Government Performance and Results Act (GPRA) Performance Plan and the directorate response were the main topics of discussion at retreat. BIO proposed that the GPRA process would require continued heavy participation of the BIOAC in COVs. BIO will provide the BIOAC with a draft performance report for their approval before the Fall 1999 meeting. Another topic of discussion was the effects of new initiatives and limited staff on program management.

### **BioUpdate, Dr. Mary Clutter**

Dr. Mary Clutter reviewed the status of the FY 1999 Budget, including highlights of the Appropriation, activities planned for FY 1999, and the results of the FY 1998 Knowledge and Distributed Intelligence (KDI) competition. She noted the importance of the BIOAC role in determining BIO priorities and gave an overview of NSF's budget development timetable and process. Dr. Clutter also reviewed BIOAC action items from FY 1998, including those related to GPRA, microbial biology, environmental research, the Plant Genome Research program, graduate education and human resource development, and research resources.

*The BIOAC discussed:*

- The status of programs for underrepresented minorities

### **GPRA Discussion, Dr. Judy Sunley & Ms. Sonya Mallinoff**

Dr. Judy Sunley, Assistant to the NSF Director, gave a brief overview of GPRA and its requirements, NSF's FY 1999 Performance Plan, the schedule for completing the FY 1999 Performance Report, and the roles of the Directorates and Advisory Committees in this process. She also discussed the FY 1998 Mock Report, which will be available for Advisory Committee review at the Spring 1999 meeting. She noted that the Advisory Committees have been very helpful in the NSF GPRA planning process.

Ms. Sonya Mallinoff, Budget and Operations Officer for BIO, reviewed BIO's FY 1997 Mock Report. She discussed the process the Working Group used to develop the Mock Reports. BIO's report drew heavily from Committee of Visitors (COV) reports, especially the Integrative Biology and Neuroscience (IBN) Division-wide COV, and the annual reports that BIO requires from each program. She stated that the FY 98 Mock Report would be presented to the BIOAC at the Spring 1999 meeting. She noted that BIO and NSF are strengthening the information sources available to evaluate performance for FY 1999.

#### *The BIOAC discussed:*

- The challenges NSF will face in using a more qualitative format for the performance plan and report, particularly in striving to develop a credible report and one that is meaningful to the Foundation
- How the National Institutes of Health (NIH) and the Department of Energy (DOE) dealt with the performance plan development process

#### *BIOAC recommendations:*

- Do not use the "exceptional" rating category, as it can be very problematic for the agency to rate itself at that level unless it is required to do so
- The draft COV guidelines were considered reasonable

### **Working Lunch - Plant Genome Research Plans**

#### ***The Information Age: Advanced Computing in Biology, Dr. Gwen Jacobs & Dr. Maryanna Henkart***

Dr. Gwen Jacobs reviewed recommendations from the President's Information Technology Advisory Committee (PITAC) Interim Report, the NSF-DOE Joint Workshop on Next Generation Biology: The Role of Next Generation Computing, and the DOE-NSF National Workshop on Advanced Scientific Computation. In particular, she noted that the PITAC report states that information technology will be one of the key factors driving progress in all areas of life in the coming century. The four research priorities identified in this report are software, scalable information infrastructure, high-end computing, and socio-economic and workforce impacts. Dr. Jacobs then presented the charge to the breakout group:

- Biology must not only take full advantage of information technology but must play a leading role in the development of information technologies for the future. How can we accomplish this, beginning now?

### **The Workforce: Education (Undergraduate through Postdocs), Dr. Marvalee Wake & Dr. Bruce Hayden**

Dr. Marvalee Wake reviewed the recommendations in the National Research Council report

Trends in the Early Careers of Life Scientists. In particular she focused on the report's recommendation that the life science community constrain the rate of growth in the number of graduate students and only develop new programs that serve an emerging field or encourage the education of members of underrepresented minority groups. Other recommendations included dissemination of accurate information on the career prospects of young life scientists, improvement of the educational experience for graduate students, enhancement of opportunities for independence of postdoctoral fellows, and alternative paths to careers in the life sciences.

Dr. Wake then reviewed the preliminary report of the NSF Working Group on Undergraduate Education (WGUE). This report notes that NSF should make investments to achieve the following outcomes: High quality SMET education for all undergraduate students

- Effectiveness in teaching and scholarship for SMET faculty in all types of institutions
- A robust research base that strengthens education in SMET disciplines
- Measures and studies that accurately assess quality in undergraduate SMET education
- Organizations that exert collective responsibility and leadership for improving undergraduate SMET education

The WGUE is developing recommendations to meet these outcomes.

Dr. Wake then presented the following charge to the breakout group:

- Assess whether BIO's investment in undergraduate education to postdoctoral education is situated effectively and efficiently

### **The Environment, Dr. Frank Harris & Dr. Bruce Umminger**

Dr. Frank Harris discussed NSF's leadership in environmental research, particularly in the biological sciences. He noted that the Committee on Environment and Natural Resources (CENR) Integrated Science for Ecosystem Challenges and the President's Committee of Advisors on Science and Technology (PCAST) Teaming with Life: Investing in Science to Understand and Use America's Living Capital reports highlighted the critical need for basic environmental research. Dr. Harris also stated that the boundaries between disciplines are disappearing and that this will help further develop research relevant to the environment.

- Dr. Harris then presented the charge to the breakout group:  
In its first 50 years, NSF has had a rich history in support of environmental research and education. Given a new appreciation and heightened awareness of the importance of environmental understanding to society, how does NSF position itself for continuing its tradition of leadership in environmental science and education into the 21st Century?

## **THURSDAY, OCTOBER 22 - AFTERNOON SESSION**

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### **Dr. Rita R. Colwell, Director, NSF**

Dr. Rita Colwell, NSF Director, noted NSF's 7% budget increase, particularly the increase in the Research and Related Activities account (8.8%). Dr. Colwell discussed future emphases at NSF, including information technology and biocomplexity. She stated that it is time to address

seriously biological problems on a grand scale and that the Life and Earth's Environment (LEE) theme provides the basis for the biocomplexity initiative currently being planned. Dr. Colwell noted that partnerships will become increasingly important in order to support such research. She also noted the importance of investments in K-12 education and discussed plans to weave the capability for graduate students to work with K-12 students, particularly in large cities, into existing Education and Human Resources Directorate (EHR) programs. Dr. Colwell also noted the need to provide funding to support laboratory technicians and undergraduates, as well as graduate students. Educating the next generation of scientists to take on a variety of careers, not just academic ones, is imperative.

*The BIOAC discussed:*

- The continuum between applied and basic research and how the boundaries between them will become less distinct
- The need for large scale experimental facilities for research in environmental biology, particularly when looking across scales and levels of organization
- The need to ensure that all researchers have equal access to technology and information. This is especially critical in genomics research.

### **Preliminary Reports from Breakout Groups**

Dr. Gwen Jacobs gave a preliminary report for the Information Age: Advanced Computing in Biology breakout group.

Dr. Marvalee Wake gave a preliminary report for the Workforce: Education (Undergraduates through Postdocs) breakout group.

Dr. Frank Harris gave a preliminary report for the Environment breakout group.

## **FRIDAY, OCTOBER 23 - MORNING SESSION**

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### **Committee of Visitors Report and Approval**

The following Committee of Visitors Reports were discussed by the BIOAC:

- Division of Molecular and Cellular Biosciences COV, July 22-24, 1998 (reported by Dr. Laura Hoopes)
- Ecological Studies Cluster, Division of Environmental Biology, May 13-15, 1998 (reported by Dr. Frank Harris)
- Instrument-Related Activities Cluster, Division of Biological Infrastructure, June 8-9, 1998 (reported by Dr. Gwen Jacobs)
- Physiology and Ethology Cluster, Division of Integrative Biology and Neuroscience, July 13-15, 1998 (reported by Dr. Benjamin Hart)

*The BIOAC approved the COV reports, with the following additions:*

- Improvements in Facilities, Communications, and Equipment for Research at Biological Field Stations and Marine Laboratories (FSML) program should use ad hoc reviews in addition to panel reviews when evaluating proposals
- NSF should pay particular attention to the possibility that animal behavior research is underfunded

*Other BIOAC suggestions included the following:*

- Run a NSF-wide COVs for certain topics, such as education or underrepresented groups
- Develop more partnerships with NIH, especially for funding multi-user instrumentation

*The BIOAC discussed:*

- If reviewers are addressing the revised merit review criteria. It was noted that some panels are paying more attention to how proposals are addressing Criterion 2 (addresses the broader impacts of the proposed activity) than others.
- NSF's mechanisms for providing feedback on the COV reports
- The COV's role in auditing the integrity of the review system and the need to bring this out more in the reports
- How special competitions are funded
- The increasing cost of doing animal behavior research, as researchers use more molecular techniques

## **Final Reports from Breakout Groups**

### ***The Information Age: Advanced Computing in Biology (reported by Dr. Gwen Jacobs)***

Noting that biology must be poised to take advantage of information technology and play a leading role in the development of the information technologies of the future, this breakout group provided the following recommendations:

- Modeling and simulation and biological databases will be increasingly important to biological research. To anticipate these needs, the breakout group endorsed the PITAC recommendation that there be an increased investment in computing resources for civilian scientists. They also noted that BIO should remain vigilant to the growing computational resource needs of the biological community.
- The lack of production quality software ("hardened software") for the biological community was identified as a critical problem. Existing programs are not robust enough to meet the demands of the research community. NSF should explore mechanisms to support the development of these resources.
- Good economic models should be developed for database development and long-term maintenance. Some possibilities that should be explored include an endowment model for the preservation of data collections, user fees, contributions from industry in the form of an "information tax", or contributions from scientific societies.
- Most database architectures in use by the scientific community were developed for commercial business applications and may not be ideally suited to the needs of biological research. NSF should explore ways to support the development of new database architectures appropriate for biological research, as well as address the need

to establish standards for database design and interoperability.

- NSF should foster communication between domain scientists and computer and information scientists in order to encourage collaboration for database development. This could be achieved by hosting annual meetings of groups funded through the Database Activities program.
- Individuals trained in biological informatics are a critical need. To meet this need, undergraduate biology curricula should include more quantitative and computer science training. Industry should be encouraged to participate in the training process, perhaps through activities such as the GOALI program. KDI proposals could also include a training component, since many of these are likely to have an IT focus and a multidisciplinary set of investigators who could provide these training opportunities. The IGERT program and biological informatics postdoc program are also excellent mechanisms to address this problem.

***The Workforce: Education (Undergraduate through Postdocs) (reported by Dr. Marvalee Wake)***

This breakout group assessed whether BIO's allocations for education are situated efficiently and effectively. In general, they noted that BIO's position is appropriate. The breakout group reviewed the recent National Research Council report on Early Careers of Life Scientists, which recommends that training of students in the life sciences be curtailed because supply exceeds demand. The breakout group did not agree with this assessment and noted that the concern about oversupply is one that requires calibration. There are areas of the life sciences where oversupply is not the issue, but level and nature of qualifications might be a problem. In light of this, the breakout group made the following recommendations:

- Graduate students should be supported by funds in PI-directed research grants only after they reach the equivalent of advancement to candidacy.
- PIs should explicitly delineate their responsibilities for mentoring and training and the roles of undergraduate and/or graduate students and/or postdocs in any proposal that requests support for those categories.
- Final reports on grants should include the results of training such students.
- BIO should consider the following targeted programs for postdocs: (1) one for retraining or emphasis shifting and (2) another that emphasizes the integration of research and teaching.
- A new emphasis on technology-based Master's programs should be encouraged.
- New data are needed regarding numbers of jobs available and numbers and qualifications of applicants in order to assess the presumed variation in the supply-demand ratio in different sectors of the biological sciences.
- Counter to the NRC report recommendations, mentored teaching should be a much larger part of the doctoral program.
- Fellowships and grants to graduate students should include a teaching component.
- The group strongly endorsed RUI, REU, Graduate and Minority Graduate Fellowships, Undergraduate Mentoring in Environmental Biology (UMEB), and the Schoolyard LTERs, but was concerned about the lack of data to assess the effectiveness of these programs.
- NSF should consider facilitating partnerships among industry, government and universities to provide students with information about alternative career paths.

- BIO should issue REU award announcements earlier so that undergraduates will not have accepted other positions before learning about REU opportunities.
- NSF should separate out all conflict of interest data now in the Biographical Sketch and put it in an appendix to facilitate database implementation. The Biographical Sketch should include more information about the research and mentoring qualifications of the PI.

***The Environment (reported by Dr. Frank Harris)***

This breakout group discussed NSF's role in environmental research, education and assessment. As a result of this discussion, they proposed a resolution that endorsed the overall approach set forth in the CENR report "Integrated Science for Ecosystem Challenges" and recommended that the CENR report be regarded as a good first step toward developing a comprehensive, long-term federal environmental research strategy (see attached resolution). This resolution was passed by the BIOAC. In addition, the breakout group offered the following recommendations:

- NSF's major role has been in supporting investigator initiated research and this role is appropriate for supporting environmental research.
- The group encouraged collaborations within NSF to support environmental research and education.
- NSF should continue to employ a multidisciplinary approach to environmental research, such as collaborations between molecular and ecological biology.

**Reports from Representatives of Other Agencies**

***Dr. David Thomassen, Department of Energy***

Dr. Thomassen gave an overview of research supported through the Biological and Environmental Research Program (BER) and budget outlook for FY 1999, noting that funding was flat. He also discussed the new 5 year plan for the Human Genome Program, structural biology research, and DOE programs in microbial genomes, low dose research, model organisms, natural and accelerated bioremediation, and climate change technology. He noted that the BER Advisory Committee meeting would be held November 1-2, 1998. Dr. Thomassen then briefly discussed the programs supported by DOE's Energy Biosciences Division. He concluded by reviewing FY 1998 and 1999 funding profiles for Environmental Remediation, Life Sciences, and BER overall.

***Dr. Marvin Cassman, National Institutes of Health***

Dr. Cassman noted that the National Institute of General Medical Sciences (NIGMS) would have a lot of opportunity to take advantage of NIH's 15% budget increase in FY 1999, including sequencing activities and model organisms. NIGMS is also seeking to lift constraints on award sizes and reduce limitations on instrumentation on grants. They are developing a new solicitation focusing on research on complex systems, which will require collaborations between biologists and mathematicians or engineers. They are developing a major thrust addresses the genetic architecture of complex genotypes. A related area of support is in pharmacogenetics, which addresses the issue of differential drug response. Other areas that NIGMS is addressing include structural genomics, improving access to synchrotrons, and evolution and infectious disease. NIGMS will also encourage joint teaching/research

postdoctoral fellowships to improve training in teaching.

*The BIOAC discussed:*

- If animal behavior research will be supported by NIH in the future
- Access to research resources, such as gene chips and scanners, and reliance on industry for technology

## **FRIDAY, OCTOBER 23 - AFTERNOON SESSION**

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### **Working Lunch - Interagency Plant Genome Initiative**

Dr. Machi Dilworth discussed the review process and outcomes of the FY 1998 Plant Genome Research program competitions in Collaborative Research and Infrastructure and Arabidopsis thaliana Genome Sequencing. 67 proposals were submitted in response to Collaborative Research and Infrastructure solicitation and 23 awards were made, 12 of which were for virtual centers. Two awards were made to accelerate Arabidopsis genome sequencing. In FY 1999, funding for the Plant Genome Research program is \$50 M. FY 1999 plans include continuing accelerated Arabidopsis genome sequencing and a new Collaborative Research and Infrastructure competition emphasizing functional genomics. The program announcement for this new competition is available. The deadline for letters of intent is December 4, 1998 and January 29, 1999 for full proposals. Dr. Dilworth noted that NSF will be participating in an interagency effort to sequence the rice genome as part of the larger international effort. Other participating agencies include the Department of Energy and the Department of Agriculture.

Dr. Mary Clutter noted that plant biology would change forever because of the National Plant Genome Initiative. She stated that Japan is the lead country in the effort to sequence the rice genome and that in the United States, USDA will be the major player. US investments in rice genome sequencing will be about \$4.5-\$5.0 M per year. Dr. Clutter then discussed USDA's Food Genome Initiative, noting that the program did not receive the funding requested for FY 1999.

### **Future Business**

The Spring 1999 BIOAC meeting will be held April 22-23.

The Fall 1999 meeting date has not yet been determined.

COVs to be held in 1999 include the Neuroscience Cluster (IBN), Genetics Cluster (MCB), and the Research Resources and Training clusters (DBI).

*The BIOAC briefly discussed the draft core COV questions and performance measures:*

- It may be useful to use a consulting firm to assist NSF in developing a performance review process
- Provide historical analyses to the COVs, rather than just data from the years that they are focusing on
- Could analyze support provided for the current group of Nobel Laureates
- Have Principle Investigators describe their key accomplishments



- Consider counting publications, but calibrate it to the disciplines. Not all disciplines demonstrate the same level of productivity in terms of numbers of papers published per year. Counting the number of people that publish per year was also suggested.

Dr. Clutter asked the BIOAC to suggest useful areas of collaboration between NSF and NIGMS. The following areas were suggested:

- Bioinformatics
- Postdoc training
- Evolution of disease/virulence

Please contact Dr. Clutter with any further suggestions.

The meeting was adjourned at 2:30 p.m.

Hardcopy minutes approved by W. Franklin Harris, Chair

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