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# Meeting of the BIO Advisory Committee Summary Minutes December 2-3, 1999

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## THURSDAY, DECEMBER 2 - MORNING SESSION

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

Dr. Mary Clutter, Assistant Director for the Biological Sciences (BIO), welcomed the new members in attendance, Lynn Jelinsky, John Wooley, and Larry Vanderhoef. She noted that Gwen Jacobs, Chair of the BIOAC, was not able to attend the meeting; past Chair, W. Franklin Harris, agreed to assume the position for the two-day session. Dr. Peter Preuss from the EPA is sitting in for Norine Noonan for the first day. Dr. Clutter announced staff changes within the Directorate (Program Officers temporarily serving as Acting DDs or DDDs); she noted that former Division Director for Integrative Biology and Neuroscience (IBN), Bruce Umminger, has moved to the Office of Integrative Activities (OIA) and that Grace Wyngaard has assumed the position of IBN Division Director.

### **Remarks, Approval of the Minutes, and Report on Advisory Committee Chairs Meeting, Dr. Frank Harris**

The minutes of the Spring 1999 meeting were unanimously approved by the BIOAC. Dr. Frank Harris gave an overview of the Advisory Committee Chairs Meeting and reported on their discussion about the changing directions of science. Dr. Rita Colwell, Director of the National Science Foundation (NSF), discussed the agency's need to 'think bigger' and to focus on a larger budget by moving beyond the scope of individual investigators. New initiatives such as Biocomplexity and Information Technology Research (ITR) emphasize the importance of large projects and collaborations that encourage crossfertilization between scientific disciplines. The recently established NSB Task Force on the Environment exemplifies these themes by examining the environment in a larger context through the incorporation of several scientific and engineering fields. Dr. Colwell hopes to reflect the mix of disciplines by establishing an advisory committee on the environment composed of members from other various committees.

Dr. Frank Harris expressed the need for NSF to link its new directions in scientific research with the budget plan directly. The strategic and budget plan for the agency need to be parallel

in order to emphasize both the benefits and monetary costs of these programs.

### **BIO GPRA Performance Evaluation, Dr. Burt Ensley**

Dr. Burt Ensley reviewed several sections of the Draft AC Assessment of Directorate Performance for GPRA FY 1999. Sources of information for the report included Program and Division Annual Reports, FY99 Committee of Visitor (COV) reports, and periodic announcements, such as press releases, made by the BIO Directorate to the public. The report evaluated the effectiveness of the Directorate in reaching NSF's four outcome goals for the fiscal year.

**GPRA GOAL 1:** Discoveries at and across the frontiers of science and engineering that result from NSF investments. The Directorate successfully achieved this goal by supporting a balance of innovative, risky and interdisciplinary research.

**GPRA GOAL 2:** Connections between discoveries and their use in service to society. Successful. NSF leads multiagency programs in areas such as plant genomics, plant disease resistance, and genomic structure. The Directorate also participates in the U.S. Global Change Program, which contributes directly to the creation of policy options. The COVs cited several other examples and noted the effectiveness of NSF press releases and public announcements in quickly educating the public about recent scientific advances.

**GPRA GOAL 3:** A diverse, globally oriented workforce of scientists and engineers resulting from NSF investment. In general, Dr. Ensley found the Directorate to be successful in its efforts to diversify the workforce, especially in areas where it has the most influence (i.e. the gender and ethnic composition of ad hoc reviewers, panelists, agency staff, etc.). Programs such as the BIO Minority Postdoctoral Research Fellowships and Undergraduate Mentoring in Environmental Biology also serve to engage a wider diversity of people in science. Internet resources provide an example of general outreach to the scientific community.

**GPRA GOAL 4:** Improved achievement in mathematics and science skills needed by all Americans. The Directorate successfully reached this goal through its support of projects that link innovative research activities with K-12 education and those that use the Internet to disseminate information to the scientific community and general public.

The Directorate's use of merit review criteria was considered to be successful despite the apparent reluctance of the research community to address criterion 2. COVs repeatedly praised the efforts of Program Officers in upholding the importance of criterion 2 and in assessing it during funding decisions. A suggestion was made to modify FastLane so that reviewer comments may not be submitted until both criteria are addressed.

### **BIO FY99 Committee of Visitors**

***Division of Biological Infrastructure, Training and Research Resources Clusters, Dr. Burt Ensley.***

Dr. Ensley reviewed the 11 recommendations made by the COV to the Division; most of the discussion focused on the following two areas:

- The need to establish a standard guideline as to when a Materials Transfer Agreement (MTA) may be appropriate, how it might be used, and what format it might take. The COV recognized that this issue extends beyond DBI programs but placed high importance on creating a model that could be used by researchers and their institutions.
- The need to provide long-term support for community databases in all areas of biology including genomics as well as biodiversity/biocomplexity data. This is especially important as science moves from individual investigator research to large-scale collaborations where sharing and having access to data is imperative.

***Division of Environmental Biology, Dr. James Collins.***

Overall, the COV stressed the positive performance of the Division through its continued funding of leading science, efforts to increase minority participation, and emphasis on training graduate students. They made 14 recommendations, two of which were discussed in greater detail.

- The need for increased funding in DEB. This stems from DEB's leadership in activities at the forefront of highly complex and interdisciplinary research. Funding levels have remained flat and in order to fund grand research, the Division needs a grand budget.
- The COV encourages NSF and the Division to continue its efforts in supporting special competitions such as IGERT and NEON. They also noted that in order to reach the level of science addressed in special competitions it is essential to continue substantial levels of funding in the core programs.

***Division of Integrative Biology and Neuroscience, Neuroscience Cluster, Dr. Gwen Jacobs.***

Due to Dr. Jacobs' absence, the COV report was not discussed.

***Division of Molecular and Cellular Biosciences, Genetics Cluster and Biochemistry of Gene Expression (BGE), Dr. Claire Fraser.***

In general, the COV was impressed with the staff and the science funded by the programs. Dr. Fraser discussed 2 of the 5 recommendations in more detail.

- In comparison to the Microbial and Eukaryotic Genetics programs, the COV found the level of science funded in BGE to be a bit lower. They questioned the overlap of this program with areas supported by NIH, suggesting that BGE may provide seed money for pilot projects that later move to NIH for higher levels of support. They also suggested that the lack of a permanent home (BGE started in the Genetics Cluster and now resides in Biomolecular Processes) could contribute to the lower number of proposals in the program. Dr. Fraser acknowledged the Division's response that movement between clusters allows for flexibility in such a rapidly advancing field.
- The COV recommended that future COVs assist in strategic planning for the Division and look towards future directions of NSF.

The committee approved all COV reports as submitted.

**NSF Strategic Plan, FY 2000-2005, Dr. James Edwards**

NSF's new strategic plan focuses on three outcome goals: 1) investing in ideas that broaden the fundamental science and engineering knowledge base, 2) investing in people who contribute to a diverse and internationally competitive scientific workforce, and 3) investing in tools that provide widely accessible, state-of-the-art infrastructure to scientific disciplines. Dr. Edwards outlined the four elements of NSF's investment strategy that will be used to reach these goals. They incorporate enabling competitive investigator-initiated research, identifying unmet opportunities (e.g., nanoscale science and the integration of disciplines with mathematics), identifying transcendent areas of research across broad frontiers (e.g., biocomplexity, ITR), and enhancing the diversity of participation within NSF programs. Members of the BIOAC approved the goals but encouraged NSF to link its strategic plan directly with the budget. It would not only be helpful to attach a cost to each goal but to discuss the consequences of NOT investing in these important areas.

#### **BIO/NSF FY 2000 Budget, Dr. Mary Clutter**

Dr. Clutter gave an overview of the budget process and highlighted NSF's increase of 6.6% for the FY 2000 budget (approximately \$240 million). She applauded Rita Colwell's dedicated efforts to achieve this increase. The majority of the new funds are dedicated to the special initiatives: \$90 million for Information Technology Research (ITR), \$50 million for Biocomplexity (phase 2), \$10 million for the Plant Genome program, and \$36 million for Terascale Computing systems. The Education and Human Resources (EHR) Division also received an increase of \$34.6 million. Dr. Clutter noted that the Educating for the Future initiative will receive H-1B money from visas to support international students and scientists. Universities may apply for the money through training fellowships (for technicians, engineers, mathematicians, etc.).

Dr. Clutter also appointed Dr. John Wooley to chair a genomics subcommittee that will work with Dr. Henkart, Division Director for Molecular and Cellular Biosciences, to address NSF's long-term involvement in genomics.

#### **THURSDAY, DECEMBER 2 - AFTERNOON SESSION**

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##### **Discussion with Dr. Rita Colwell, Director of NSF**

The discussion focused on the need for broader communication and education regarding issues of scientific research. Historically, scientists and engineers have not made adequate efforts to explain their work or its purpose to others. The current public outcry regarding biotechnology and genetic engineering reflects on this lack of understanding. Not only do scientists need greater communication with the general public but also with their congressional representatives. A stronger voice from the scientific community will come when fields and disciplines combine to express the importance of investing in basic research.

##### **BIO Update/Current Issues**

###### ***Biocomplexity, Dr. Joann Roskoski.***

Dr. Roskoski gave an overview of the Biocomplexity phase I competition (FY 1999), which focused on the functional interrelationships between microorganisms and their environment. Phase II is open to research on all organisms and aims to understand and model complexity among biological, physical, and social systems. The program plans to fund two types of

activities, research projects (\$45 million) and incubation activities (\$5 million). The incubation activities will allow researchers to develop collaborations that could lead to larger projects in the future.

***Information Technology Research, Dr. Michael Lesk***

Dr. Lesk gave an overview of the ITR initiative, which incorporates research from many disciplines such as molecular biology, ecology, informatics, database management, computer science, and engineering. The program received 1400 letters of intent and expects to fund about 30 projects. He discussed the difficulty faced by universities in retaining both students and faculty who receive competitive offers from industry. Dr. Lesk also mentioned the need to diversify the field and to continue active recruitment of minorities and women.

***Plant Genome Research Program, Dr. Jane Silverthorne***

Dr. Silverthorne discussed the Second Annual Awardee meeting that involved close to 90 PIs and bioinformaticists. During a focus group session, the attendees identified three key areas that need to be addressed: 1) the formation of a Plant Genome web site to facilitate discussion and access to data, 2) the development of microarray and data standards so that experiments may be compared, 3) the incorporation of training components and a diverse workforce into these large projects. The third year of the plant genome competition focuses on functional genomics with an emphasis on the utilization of tools developed as a result of prior funding. A total of 87 letters of intent have been received. BIOAC members stressed the importance of requiring PIs to develop strong management plans for these large-scale projects.

***Task Force on the Environment Status Report, Dr. Mary Clutter***

The National Science Board (NSB) established the task force last year with the charge to review the scope of NSF activities in the environment and to develop guidelines for NSF policy that is consistent with the National Science and Technology Council's (NSTC) strategy and the activities of other agencies. The task force surveyed over 250 reports issued within the past 10 years and identified 4 major needs: 1) to increase cross-disciplinary/interdisciplinary research, 2) to recognize the inherent complexity of environmental systems, 3) to consider questions at the appropriate scales, and 4) to improve our predictive capabilities. They made two keystone recommendations: 1) NSF should invest \$1 billion in the environment over the next 5 years and 2) NSF should rethink its organization within the Foundation for coordinating these activities. Dr. Colwell has appointed Margaret Leinen (Assistant Director of GEO) to oversee NSF's activities related to the environment.

***Report on Postdoctoral Fellowships, Dr. Carter Kimsey***

- **Minority:** The BIO Minority Postdoctoral program began in FY 1990 and has since supported 115 fellows. The program seeks to increase the number of underrepresented minorities in faculty positions who are eligible for NSF grants. BIOAC members commented on the need to increase the pool of minority applicants as well as the award size for start-up grants.
- **Biological Informatics:** Seeks to support people interested in problems that bring the tools of computer science and mathematics together to solve biological questions. Last year the program funded 18 projects; it expects to fund about 20/year.
- **Microbial Biology:** The Microbial Biology Postdoctoral program started in FY 2000. It

received 42 applications and expects to fund about 20 projects. The small number of applicants reflects the need to stimulate research in this area.

BIOAC members also discussed the need to encourage U.S. scientists to spend some time studying abroad. Few postdoctoral fellows take the opportunity to work in another country; perhaps it would be better to encourage graduate students or young faculty members to study/work in a foreign lab.

### **BIOAC Education Working Group, Dr. Marvalee Wake and Dr. Laura Hoopes**

Dr. Wake and Dr. Hoopes reviewed the goals of the working group and its efforts to track education-related activities within standard grants and special programs. Discussion included the following topics:

- To what extent should NSF be involved in curriculum development or the promotion of educational diversity? NSF has a strong role to play in education but also recognizes the inherent tension faced by scientists between research and education. In what ways could NSF promote and reward the teaching activities of scientists?
- BIOAC members identified the need to reexamine and define the CAREER program. Emphasis should be placed on demonstrating a clear integration of research and education instead of requiring exceptionally innovative educational components.
- NSF and the community must address the changing needs in education as scientific research moves from single-investigator projects to large-scale collaborative endeavors.

Prior to adjournment for the day, the committee reviewed and approved the AC GPRA Report for FY 1999.

## **FRIDAY, DECEMBER 3 - MORNING SESSION**

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Dr. George Jones from Emory University and Norine Noonan from the EPA joined the meeting today.

### **Unmet Opportunities**

#### ***NEON - National Ecological Observatory Network, Dr. Scott Collins***

Dr. Collins from the Division of Environmental Biology (DEB) introduced the NEON program, which BIO is developing for possible inclusion in the FY 2001 budget request. NEON seeks to establish a national network of observatories that provide state-of-the-art infrastructure to support interdisciplinary and integrated research (from ecological fieldwork to genomics).

Topics of discussion included:

- The necessity for interagency cooperation in this endeavor to avoid duplication of efforts and to maximize the use of available resources.
- NSF must clarify how NEON differs from the existing Long-Term Ecological Research (LTER) Program (much broader, seeks cross-disciplinary activity with engineering, geology/earth science, computer science, etc.).

- The NEON program should require proposals to include extensive and carefully organized personnel, scientific, and data management plans for the observatories.

### ***Genomics, Dr. Maryanna Henkart***

Dr. Henkart, Division Director for Molecular and Cellular Biosciences (MCB), discussed the need to develop a long-range plan for NSF's role in genomics research. Several workshops, an Interagency Report on Microbial Genomics, and an Interagency Genomics working group have identified gaps in areas of genomics. Some of the gaps and/or needs include developing techniques for culturing novel microbes, establishing NSF's role in selecting or prioritizing potential non-model organisms for sequencing, encouraging the vertical integration of genomics into biology through the training of students, and providing support for infrastructure and database development.

### ***Human Resources: Report on BIOAC Workshop, "Access by Minority Investigators to NSF Extramural Support," November 6, 1999, Atlanta, Georgia, Dr. George Jones***

Dr. Jones gave an overview of the suggestions and recommendations made by the participants during the workshop. Discussion focused on the following topics:

- The need to facilitate connections between junior and senior investigators. A suggestion was made to establish a website (with NSF support) containing a list of investigators willing to take on the role of a mentor.
- Several participants expressed concern about pedigree discrimination. Dr. Jones emphasized the PI's responsibility to convince reviewers of her/his ability to conduct quality science but said that assumptions on productivity based on an individual's home institution or alma mater thwart these efforts. Including more minorities in the panel and ad hoc review processes may help to alleviate some of the discriminatory problems.
- Participants discussed the need for minorities to work together and suggested establishing a national organization for African American biologists. Eventually the activities and outcomes of a focused effort could be extended to include other ethnic groups.

### ***2010 Project, Dr. Machi Dilworth***

Dr. Dilworth, Division Director for the Division of Biological Infrastructure (DBI), discussed the goals of the proposed 2010 Project, which developed as a logical extension of the coordinated Arabidopsis projects. By the end of 2000, the Arabidopsis genome will be sequenced completely. Currently, only 10% of the sequenced genes have been assigned (and verified experimentally) to particular functions. This project seeks to assign functions to the 20-25,000 genes of Arabidopsis by the year 2010. Dr. Krishtalka mentioned the need to vertically integrate the growing information on genomics with the ecological and evolutionary aspects of plant biology.

### ***Collaboratories/Networking Activities, Dr. Mark Courtney***

Dr. Courtney discussed the increasing trend for science to be conducted through multi-investigator efforts that address broad conceptual questions. BIO has become interested in facilitating collaborations and networks of exchange by providing a mechanism to bring researchers together across scientific disciplines. In FY99, the Population Biology program tested the idea of a collaboratory by inviting a group of individuals to examine the population aspects of invasive species. Collaboratories differ from workshops in that they are more

targeted and directed towards the future outcomes of their activities.

### ***Nanotechnology, Dr. Tom Quarles***

Dr. Quarles from the Division of Biological Infrastructure (DBI) reported on BIO's involvement in the area of nanotechnology. Overall, the Directorate's investment has been small (~ \$1 million/yr) relative to the amount spent by the Foundation. In FY99, NSF spent about \$85 million and it plans to spend close to \$97 million in 2000. The BIOAC members viewed nanotechnology as an area with high potential that encourages collaborativ

### ***Portfolio Balance, Dr. James Edwards***

The majority of the discussion focused on the balance between funding special competitions and core programs within NSF. As the number and size of special competitions/initiatives increase, NSF will need to reexamine its staffing situation and workload distribution. One possibility would be to switch the core programs to single, annual competitions and to run the core programs and special competitions at different times during the year. Other options include hiring more staff or contractors to compensate for the rise in proposals, but this would require additional financial resources. The implementation of electronic proposal receipt and processing (through FastLane) may lessen the overall increase in work.

## **Working Group Reports**

### ***GPRA***

Dr. Ensley reported on the GPRA Working Group's suggestions for future GPRA assessments. Overall the group thought that preparing the AC GPRA Assessment Report was a worthwhile experience but one that required serious commitment of time and attention. The following suggestions were offered: (1) following the COV model, maintain as much independence as possible, (2) add a not-for-profit representative to the BIOAC, (3) start the process earlier, and (4) use/review program annual reports of a comparable timeframe to the COV reports (rather than just the most recent program annual reports). The group believed the exercise could be designed to provide more useful information to the Directorate and Foundation.

### ***Education***

Drs. Marvalee Wake and Laura Hoopes reported on the group discussion. There was much work on refining the Working Group's charge and identifying the BIO program activities to be included in their review. Also a lot of discussion revolved around the kinds of data needed and available. The group expects to receive statistical data from BIO in about 6 weeks to start their review and will report at the next AC meeting.

### ***Genomics, Dr. John Wooley and Dr. Claire Fraser, co-Chairs***

Dr. Wooley and Dr. Fraser summarized the working group's discussion regarding long-range plans for NSF's role in genomics. Three areas of interest involved developing a list of higher organisms to be sequenced, actively facilitating the establishment of infrastructure and databases that the entire scientific community may access, and providing training opportunities for students as well as faculty. The group noted that ideas related to genomic complexity tie in with NSF's 5-year strategic plan and with several Foundation-wide initiatives such as Nanotechnology and Information Technology Research (ITR).

### ***Biocomplexity in the Environment, Dr. Leonard Krishtalka and Dr. James Collins,***



### ***co-Chairs***

The working group developed a charge that involves advising BIO on the evolution/trends of biocomplexity research, identifying leading areas of research, and encouraging a focus on information management and data compatibility.

### **Future Business**

#### ***FY 2000 BIO Committee of Visitors Reports***

- Division of Biological Infrastructure, March 28-30, 2000: Dr. Ralph Quatrano
- Division of Environmental Biology, Systematic & Population Biology Cluster, Week of August 14 or August 21, 2000: Dr. Leonard Krishtalka
- Division of Integrative Biology, Developmental Mechanisms Cluster, July 17-19, 2000: Dr. James Collins
- Division of Molecular and Cellular Biosciences, Biomolecular Structure and Function Cluster and Biomolecular Processes Cluster, July 10-12, 2000: Dr. Lynn Jelinski

#### ***Meeting Dates for the BIOAC***

Spring - April 6-7, 2000

Fall - undecided

The meeting adjourned at 1:45 p.m.

Hardcopy minutes approved by Gwen A. Jacobs, Chair

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