



Meeting of the BIO Advisory Committee Summary Minutes April 6-7, 2000

THURSDAY, APRIL 6 - MORNING SESSION

Welcome & Introduction of New Members, Dr. Mary Clutter

Dr. Mary Clutter, Assistant Director for the Biological Sciences (BIO), welcomed the committee members and introduced Dr. Terry Yates from the University of New Mexico at Albuquerque, the new Division Director for Environmental Biology as well as Dr. Forest Baskett, the chair of the Computer and Information Science and Engineering (CISE) Advisory Committee. Dr. Baskett joined the meeting to discuss initiative areas.

Remarks, Approval of the Minutes, Dr. Gwen Jacobs, Chair

The minutes for the December 1999 meeting were unanimously approved by the BIOAC. Dr. Jacobs thanked Dr. Harris for chairing the previous meeting and welcomed Dr. Baskett to participate and offer insights to the discussion from the perspective of the CISE Advisory Committee.

Discussion with Dr. Rita Colwell, Director of NSF

Dr. Colwell provided an update on the budget process for Fall 2001, noting NSF's request for a 17.3% budgetary increase. The rest of the discussion focused on NSF's current activity and future role in education. As an agency, the NSF spends close to \$1 billion per year for fellowship programs; high school outreach; centers for science, math, learning, and teaching; and research supplements. With NSF's strategic outcome goals centering on ideas, tools, and people, the FY2001 budget places an emphasis on people through funding education initiatives. An example discussed was the Graduate Teaching Fellows in K-12 (GK-12), which fosters a community effort between universities and K-12 schools. This serves to increase the scientific literacy of the elementary through secondary school students and teachers while training fellows to instruct in a team-oriented environment..

Dr. Colwell also discussed a potential program designed to provide financial incentives and rewards for excellent teaching of introductory science and science for non-majors courses.

Such a program would encourage recognition for creative and effective teaching so that both quality education and research are viewed as meritorious activities at the university level.

FY 2001 Budget and Status of Current Initiatives, Dr. Mary Clutter

Dr. Clutter discussed the requested budget for FY2001, which involves a 17.3% increase in funding for the Foundation. The BIO Directorate would receive a 23.3% increase; half of the money would go towards strengthening the core programs and the other half would support areas of emerging importance. Dr. Ruzena Bajcsy, the Assistant Director for CISE, spoke to the committee about the growing interest of the CISE community in biological problems such as protein folding and algorithm development. Collaboration on such issues requires mutual respect for the science and research motives at both ends of the spectrum. The committee also discussed the National Ecological Observatory Network (NEON) program, which would benefit from more cross-Directorate activity. A network of research platforms that focuses on high-tech infrastructure and the integration of several data sources, NEON provides an opportunity for the CISE community to explore new database systems such as XML (Extendable Mark-up Language).

Dr. Clutter briefly discussed the trade-offs faced in the core programs as NSF tries to increase its standard award size, duration, and success rates. The Directorate must enhance selected areas that in turn stimulate the broader community.

GPRA Updates, Ms. Sonya Malinoff

- **FY 1999 GPRA Performance Report:** The Directorate used the results from annual reports and Committee of Visitor (COV) reports to draft a self assessment of its performance in relation to the three categories of goals: results, investment process (portfolio), and management. The results for outcome goals were mostly successful with a few issues regarding the support of high risk projects, adequate representation of diverse groups, and the use of the new merit review criteria. The Directorate achieved nearly all of its investment process and management goals.
- **GPRA 2000 Performance Plan:** Ms. Malinoff highlighted the changes from the FY1999 plan. The Advisory Committee will be asked to address BIO's performance in areas of global change and plant genome research as well as to review its progress in urban communities. A continued goal is to increase the diversity of the scientific workforce.
- **NSF Strategic Plan, FY 2001-2005:** The National Science Board adopted a new strategic plan that more closely aligns the GPRA strategic goals with the agency's budget.

Report and Discussion on Advisory Committee Chairs Meeting, Dr. Gwen Jacobs

Discussion at the Chairs Meeting focused on two issues:

1. The appropriate roles and activities of the Advisory Committee (AC) chairs
2. How the Foundation should evaluate cross-directorate programs.

People agreed that the AC chairs serve as a conduit for communication between the Directorate and a focused scientific community. An additional role could be to serve as a COV for the review of cross-directorate activities and initiatives. The Chairs could offer valuable perspectives on how initiatives fit within both the Foundation's strategic plan and the broader

goals of the scientific community.

THURSDAY, APRIL 6 - AFTERNOON SESSION

New Activities at the National Institute of General Medical Sciences (NIGMS), Dr. Norka Ruiz Bravo

Dr. Bravo gave an overview of the four new areas of activity for NIGMS:

1. Complex Systems: The Complex System initiative arose out of a need to support interdisciplinary research and training in computational biology as well as an effort to attract quantitative scientists to the issues in biomedical science.
2. Pharmacogenetics: Pharmacogenetics program seeks to understand the mechanisms underlying individual variation in responses to drugs.
3. Glue (collaborative projects): The Glue initiative promotes both small- and large-scale collaborative projects that will stimulate the development of interdisciplinary research on biological processes. This initiative focuses on scientists currently funded by NIGMS.
4. Structural Genomics: Activities in Structural Genomics encourage research and method development in the areas of protein structure and function as well as protein family identity.

BIO Science Retreat, Introduction to Possible Thrusts for FY 2002, Dr. James Edwards

Dr. Edwards discussed the process used to set the priorities and the focus for future budget plans. The Directorate identified three areas of opportunity for FY2002 that are compatible with the four initiative areas and overall goals of NSF.

Systems Biology, Dr. Machi Dilworth, Dr. Christopher Greer, Dr. Joann Roskoski

Systems biology seeks to promote a dynamic, integrated linkage between theory, model, observation, and experiment in biological research and to enhance opportunities for converting data/information into knowledge.

The proposed activities fall within 5 categories, each of which enhances one or more of NSF's initiative areas:

1. Knowledge-based bioinformatics
2. integration of theory, modeling, observation, and experimentation in research
3. tools and resource development
4. cross-disciplinary training
5. collaborative centers for biologists, mathematicians, and information scientists.

These activities build onto the core programs by supporting investigator-initiated research that combines theoretical and quantitative methods and, in doing so, catalyze a change in the community's approach to scientific research.

Genome-enabled Science, Dr. Maryanna Henkart, Dr. Grace Wyngaard, Dr. Terry Yates

Genome-enabled science seeks to study fundamental questions in the life (and other) sciences using the tools, resources, and concepts of genomics.

This encompasses three levels of activity: Sequencing and the assembly of sequence databases, functional analyses (including derived databases and research tools), Fundamental research.

Discussion with the BIOAC centered on developing a plan based within a phylogenetic framework to guide research decisions in genomic sequencing and/or functional analyses.

In this way, the community can move forward in a coordinated effort that allows them to sequence organisms based on their evolutionary and developmental significance as well as their position on the tree of life. As a non mission-oriented agency, NSF has an integral role to play in determining sequencing priorities based on scientific merit and interest.

Science of Learning, Dr. Christopher Platt

Science of Learning seeks to bring together several disciplines by encompassing the biology of the brain, psychology of the mind, and education. Here, NSF's role serves to bridge the cultural gap between these communities of scientists and educators, to foster cross talk between disciplines, and to foster the incorporation of information and computational sciences into the area of cognitive studies.

The BIOAC discussed the need to encourage people in CISE and their communities who study artificial learning to examine systems of biological learning as well. They also stressed the importance of NSF to define areas of cognitive neuroscience and learning where the Foundation can play a unique and catalytic role in promoting the field's development.

BIOAC Working Groups, Status Reports

Genomics, Dr. Claire Fraser, Dr. John Wooley

Dr. Wooley and Dr. Fraser were enthusiastic about the report on genome-enabled science and encouraged to hear of BIO's proposed support for increased sequencing efforts on phylogenetically important species. Their discussion focused on three areas in genomics that could benefit from organized workshops: marine microbes (to define infrastructure necessary for genomic work), new models, and quantitative biology (to develop new tools for genome-scale biology).

Education, Dr. Laura Hoopes, Dr. Marvalee Wake

Dr. Hoopes and Dr. Wake discussed thirteen recommendations that involve issues such as tracking more data on programmatic efforts and award recipient activities, increasing funds for DDIG (Doctoral Dissertation Improvement Grants), and increasing the involvement of K-12 teachers in NSF programs. Conversation focused on the recommendation to decrease the nation's dependence on international scientists and engineers in certain areas of science by limiting the eligibility of applicants to US citizens. Some BIOAC members felt that this would encourage the participation of underrepresented groups in the US while others cautioned against an isolationist approach since much of the country's strength in science comes from the diversity of its players. The committee praised the IGERT program for incorporating teaching, teamwork, and professional development into the activities of the award recipients. The discussion closed with Drs. Hoopes and Wake emphasizing that the two main recommendations of the report were (1) BIO develop a philosophy/mission statement about its role in education and (2) interaction with other directorates, especially EHR, be strengthened.

FRIDAY, APRIL 7 - MORNING SESSION

Dr. Ellen Goldberg and Dr. Larry Vanderhoef volunteered to serve on the GPRA working group.

Biocomplexity FY 2000 Update, Dr. Joann Roskoski

This year's competition required the integration of computational sciences (through modeling, statistical analyses, etc.) with more traditional forms of biology by having a model serve as the basis for the project and by including a quantitative expert on the research team. The Foundation received 160 incubation proposals and over 300 research proposals that broke down into the following six categories or levels: theory/math/computation, humans and the environment/ecosystem, ecosystem - terrestrial, ecosystem - aquatic, organism/population /community, and organ/cellular/molecular. Proposal review will take place in 6 panels, roughly separated according to the system of study. Committee members discussed the need to ensure multidisciplinary review of proposals, especially for those projects that integrate studies both horizontally and vertically across scales.

BIOAC Working Group, Status Reports continued

Biocomplexity in the Environment, Dr. James Collins, Dr. Leonard Krishtalka

The BIOAC encouraged NSF to determine the goals or desired outcomes of Biocomplexity and to establish a plan for evaluating its effectiveness in the future. The outcome goals for Biocomplexity listed within the NSF GPRA Strategic Plan FY2000-2005 provide a starting point for evaluating the initiative.

Biocomplexity in the Environment, Dr. Margaret Leinen

Dr. Margaret Leinen addressed the Foundation's efforts to establish priorities and enhance its activities in the area of environmental science and education. The NSF plans to increase its entire environmental portfolio through greater funding in the core programs and large-scale initiatives such as NEON.

The BIOAC discussed the need to collaborate with other federal agencies when developing programs and to establish a MOU for biocomplexity research across the government. They also addressed the need to promote multidisciplinary education (through programs such as IGERT) in an effort to prepare the community for the more integrated science of the future.

General Discussion - BIO Thrusts FY 2002

Discussion focused on genome-enabled science, systems biology, and the NEON program.

Genome-enabled science - The committee agreed with the urgency with which the Foundation should establish priorities and a phylogenetically relevant framework for sequencing organisms. Some suggested holding workshops in which various communities could discuss and defend their organisms of choice. Dr. Krishtalka recommended taking a portfolio manager approach by sequencing a mixture of high risk/high payoff, blue chip, high growth, etc. species while also considering the species' position in the tree of life. Tool development that would

enable the translation of sequence differences between similar organisms would allow the community to work on a broader group of organisms.

Systems biology - The activity area of knowledge-based bioinformatics fits well within the Foundation's Information Technology initiative and provides an excellent opportunity for interaction between biologists and information/computer scientists. The committee stressed the importance of increased communication between these groups in an effort to stimulate cross-disciplinary research. Dr. Jacobs recognized the difficulty of retaining and capturing the interests of computer scientists in issues of biological importance since industry offers more lucrative incentives and rewards.

NEON - Both the CISE and BIO communities need to be involved in planning the breadth of scientific issues, management strategies, and the technology/infrastructural needs of the NEON sites. In this way, each community will meet its research priorities while benefiting a range of other disciplines. The committee agreed that criteria for choosing the ten proposed sites should involve distinctive features of the location, the range of questions that could be asked, and consideration as to how the site (with its infrastructure) could drive the field forward. Some members expressed concern about potential overlap between the NEON and LTER (Long-term Ecological Research) programs. Dr. Edwards explained that LTER sites are funded by research grants that address specific questions; they are evaluated according to their productivity, not on how they serve the community. NEON sites, in contrast, will provide the infrastructure and tools needed by the scientific community regardless of an investigator's specific research objectives.

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DOE Microbial Cell Project, Dr. Marvin Frazier

The long-term goals of the Microbial Cell Project are to understand how the parts of a cell work together; to identify and characterize genes, their interactions, and protein-protein interactions; and to develop computer models for predicting these interactions as well as the responses of microbes to environmental conditions. DOE has placed a large amount of resources into microbial research (~\$70-77 million) by funding national labs, large sequencing facilities, instrumentation programs, fellowships for training computational scientists, and projects that focus on mission-oriented microbes.

Dr. Frazier expressed DOE's interest in expanding their microbial activities by partnering with NSF. This would provide a greater pool of money and build on the strengths of each agency for the benefit of the microbial community. Future directions include comparative genomics, diversity surveys, and functional biology.

BIOAC Working Group Follow-on Activities for FY 2002

Discussion focused on future activities related to the 21st Century Workforce through the avenue of education. BIOAC members recognized the need to centralize efforts for Biology education and suggested NSF's involvement in coordinating such a movement. The Education Subcommittee plans to meet with EHR (Education and Human Resources Directorate) to

discuss ways of promoting more multidisciplinary education as well as involving K-12 and community college teachers and students in education programs. The committee also discussed the type of role BIO should play in both formal and informal science education.

Future Business

Plans for Fall Meeting

- The education subcommittee would like to talk with EHR to facilitate the drafting policies or guiding principals regarding the Directorate's role in education.
- A representative from the Biocomplexity in the Environment Subcommittee will participate on the Environment Advisory Committee for the Foundation.
- Dr. Clutter invited those members who are scheduled to rotate off the committee this spring to volunteer for another year.

Meeting Dates for the BIOAC

Fall 2000 - November 16-17, 2000

Spring 2001 - April 5-6 or April 26-27, 2001

The BIOAC engaged in a dynamic discussion regarding the public's fear of biotechnology and genetically modified organisms (GMO) while emphasizing the importance of NSF's role in increasing people's overall scientific literacy. Dr. Vanderhoef noted that ultimately the public will decide the outcome of the GMO debate and that the best way to win their favor is by supplying honest information and demonstrating the extent to which they already use and rely upon products from GMOs. Issues such as these point to the strong need for both formal and informal science education that reaches the public as well as across the scientific disciplines.

Hardcopy minutes approved by Gwen A. Jacobs, Chair

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