

**Directorate for Mathematical and Physical Sciences
Advisory Committee Meeting Minutes
November 2-3, 2006**

Thursday, November 2, 2006
Morning Session

Welcome and Introductions

Dr. Michael Witherell, Chair, called the meeting of the Directorate for Mathematics and Physical Sciences Advisory Committee (MPSAC) to order at 8:00am. He congratulated an MPSAC member, Dr. Jose Onuchic, on his election to the National Academy of Sciences, and noted that another MPSAC member, Dr. Larry Dalton, along with his colleagues Harold Fetterman and William Steier, had been awarded the 2006 IEEE LEOS Will Streifer Scientific Achievement Award for his seminal work with polymer photonic devices and materials. Over the past decade this group revolutionized the field of polymer photonics. Awarded annually, the Streifer award is the highest award to be given by the Lasers and Electro-optics Society of IEEE. Witherell then introduced Dr. Tony Chan, the Assistant Director of MPS.

Assistant Director Remarks

Dr. Chan began his presentation with an overview of his professional background. He noted that the vision he has for the Institute of Pure and Applied Mathematics (IPAM) at the University of California, Los Angeles, which promotes the engagement of the mathematical sciences in different communities and cultures, may be useful for exploring the connection and relationship between MPS and other NSF directorates.

With respect to his vision for MPS, he noted that MPS has a more diverse community compared to other NSF directorates. NSF must maintain adequate support for the university science and engineering community and ensure that talented students in the sciences MPS supports are encouraged and provided with support to pursue a graduate career in the sciences. He noted that there is an ongoing experiment in California to encourage university science majors to consider teaching at the K-12 level.

Chan stated that his immediate goals were to develop a strong MPS response to the American Competitiveness Initiative (ACI), foster stronger collaboration among MPS divisions, other NSF directorates, and other Federal agencies. The MPS investment portfolio had to be broad, robust, at the cutting edge, responsible to its science community, and help maintain global leadership of US science. He commented that countries like India and China are making impressive investments in the sciences. International partnerships are of vital importance, particularly for large projects such as telescopes. The educational aspects of globalization are also important. NSF has to ensure that the next generation of scientists was internationally and globally aware. In this regard, NSF is making progress and has initiatives such as the NSF office in China and Taiwan involvement in the Atacama Large Millimeter Array (ALMA) project.

With respect to the MPSAC, he looked to them for advice, and felt that not only should they be disciplinary community representatives, they should also provide a broader perspective to issues that arose during the meetings. They should serve as ambassadors for MPS.

Dr. Chan discussed the MPS response to the ACI. He felt that the MPS Directorate is central to ACI but there is tension between basic science and its economic impact. He felt that what was needed was a dual strategy: supporting basic research where the connection to innovation is identifiable and transparent, and, at the same time, advancing the intellectual frontier, where there were the seeds for future impact. He stated that there would be increased interaction between the Engineering (ENG) Directorate and MPS.

In his discussion of transformative research, Chan noted that the National Science Board (NSB) was issuing a report on this. There was a perception that research considered transformative did not review well, but there was and there was the question of the definition of transformative research. Was it only paradigm-shifting, and did it involve high payoff or risk? He discussed possible new MPS programs such as creativity extensions.

The balance in programs remains an issue. For example, what should the balance be between curiosity-driven versus targeted areas, support for individual principal investigators versus support for groups/centers/institutes, support of major facilities, and support of the core disciplines versus emerging areas of research. In all of these areas there is the question of balance, and Committee of Visitors (COV) reports indicate that there is an appropriate balance in these areas.

In the international context, there was always the question of competition and collaboration. Chan noted that there was a strong trend for large projects to require international partnerships, and in many instances US leadership was at stake. In such an environment the US had to rely on its abilities with respect to innovation.

In the discussion that followed, Onuchic asked how one made sure that a COV was properly critical of the existing portfolio. Sunley responded that NSF requires that a certain fraction of the members of the COV did not have awards and have not applied for support from the program under review by the COV.

Dr. David Oxtoby commented that it was critical for MPS to have strong connections with the Office of Cyber Infrastructure (OCI) and talking with David Atkins at the next meeting would be valuable to MPS.

Dr. Lars Bildstein asked about the response from MPS to the ACI. Chan responded that the NSF FY 2008 budget request was with OMB. While there may still be opportunity for some changes with request to the request it was the FY 2009 budget request where an impact could be made. Witherell commented that ACI is an administration initiative deriving from a National Research Council (NRC) report about the physical sciences and engineering. It was therefore of interest to discuss ACI with the NSF Director.

NSF and MPS Budgets

Sunley reported on the NSF and MPS budget and on staffing changes. She noted that MPS had a new Assistant Director (Chan) as well as two new Division Directors: Dr. Luis Echegoyen was now heading the Division of Chemistry (Dr. Arthur Ellis had left NSF), and Dr. Peter March was heading the Division of Mathematical Sciences (Dr. William Rundell had left NSF). There were approximately 20 new program officers in MPS as well as 10 other new staff members. On the Advisory Committee there were now 8 new members (10 members had rotated off the Committee).

With respect to activities within MPS since the April 2006 meeting, a revised baseline for the ALMA project has been approved by the NSB and NSF was still awaiting congressional action on FY2007 Budget Request. She reviewed the MPS aspect of the FY 2007 budget request and noted the priorities within that request of Advancing the Frontier, Facility Stewardship, Instrumentation and CyberInfrastructure, Broadening Participation, and Education and Workforce Development.

With respect to MPS activities within the area of Advancing the Frontier, increased support with respect to FY 2006 was planned for the grants programs across MPS: [Astronomical Sciences (AST) 13%; Physics (PHY) 6.4%; Chemistry (CHE) 5.5%; Materials Research (DMR) 5%; and Mathematical Sciences (DMS) 3%]. There would be new investment in elementary-particle physics frontier activities, increasing from \$5 million in FY 2006 to \$15 million in FY 2007 and beyond. Nanoscale science would receive increased support, as would cyber activities. She noted that an investment of \$50 million was planned within the Office of Cyber Infrastructure for development of a petascale computing capability. There would be increased support for Physics of the Universe activities as well as increased support for Molecular Basis of Life activities.

With respect to broadening participation and the workforce, the FY 2007 request had increases in NSF-wide programs, expansion of existing MPS education and workforce activities, increased support for broadening participation, and increases throughout MPS programs and projects that enhance education and workforce development and broaden participation.

Turning to the future, Sunley felt that key documents included the ACI, the *NSF Strategic Plan: 2006 – 2011*, and the *NSB 2020 Vision*. Important community input came from the MPSAC and other advisory committees,

workshops, and National Academy of Sciences (NAS) reports. She reviewed the key features of the ACI, the NSF and the NSB 2020 documents.

Sunley noted that several years ago MPS had developed a Mission Statement:

“To make discoveries about the Universe and the laws that govern it; to create new knowledge, materials, and instruments which promote progress across science and engineering; to prepare the next generation of scientists through research, and to share the excitement of exploring the unknown with the nation.”

MPS had also developed a set of scientific themes:

- Charting the evolution of the Universe from the Big Bang to habitable planets and beyond
- Understanding the fundamental nature of space, time, matter, and energy
- Creating the molecules and materials that will transform the 21st century
- Developing tools for discovery and innovation throughout science and engineering
- Understanding how microscopic processes enable and shape the complex behavior of the living world
- Discovering mathematical structures and promoting new connections between mathematics and the sciences
- Conducting basic research that provides the foundation for our national health, prosperity, and security.

In conclusion, Sunley noted that at the April 2006 meeting of the MPSAC, the MPSAC had developed white paper on four long range planning areas: Advancing the Frontier of the Physical Sciences, Cyber Discovery, Education for Innovation, and Midscale Instrumentation.

Dr. Robert Kohn commented that the ACI document did not deal with pre-college issues. Witherell said this raised the question of what belonged within the Department of Education and what belonged within NSF. Chan commented that NSF’s main communities were universities.

Witherell noted that the University of California, Santa Barbara had developed a number of programs in K-12 over the past 15 years thanks to the NSF and that all Centers should had an education component. This has resulted in a transformation in connecting science and education. The Augustine committee was very frank in stating that the NSF should have a larger role in K-12 education but this was not reflected in the ACI document. Dr. Monica Olvera de la Cruz commented that DMR has an Research Experiences for Teachers (RET) program but it had slow growth because it is difficult to get researchers to work with teachers. Onuchic commented that his experience in this was positive but one had to be careful not to overburden postdocs and graduate students. One problem is that faculty uses them as a buffer so there is little interaction of REU students with faculty.

Session on Underrepresented Minorities

Dr. Luis Echegoyen- introduced the session and described his part in bringing the discussions of diversity to the MPSAC meeting. He stated he wanted to do something different to highlight the issues in the hopes of creating a better understanding of the issues and to inspire action. He made three main points:

- We all have prejudices whether we realize it or not;
- Statistics for underrepresented minorities have not and are not improving despite actions that have been taken; and
- There is a great need to go back to ground zero to reexamine the efforts taken to improve diversity.

He then introduced Dr. Larry Dalton, a member of the MPSAC, who gave a personal account of his background and history. Based on his personal experiences, he noted that economic background has a major impact and makes a major difference. NSF programs can help and do make an impact. We live in a meritocracy where standards are set high and tend to drive out those people who are not willing to make sacrifices in their personal lives, and we need to have diverse faculties so that students have mentors or someone they can turn to who will understand their issues from the same perspective as the student.

Dr. Robert Williams asked Dalton of his opinion of quotas. Dalton responded that quotas are an explosive issue and we live in a world where you will get a strong push-back on this issue. He felt that programs that teach ethics and diversity sensitivity should be implemented and given to individuals before they enter into a faculty position and this may lead to a change in how open positions are filled

The discussions that followed may be summarized as follows:

- We must first admit there is an issue that needs to be addressed, understand what is causing the issue, and then we have to be committed to solving it. We must go back to ground zero and start from scratch and we have to keep trying different methods until we find what works.
- People have to understand and confront their own biases before they can address the problems and try to understand others.

The University of Michigan's Center for Research on Learning and Teaching Theater Program then presented a skit entitled "The Faculty Meeting" designed to highlight some of the situations that arise when decisions are made with respect to hiring new faculty. Following the skit, the actors continued to maintain their roles as they responded to questions from the MPSAC.

The MPSAC applauded the performance.

Lunch Adjournment Followed by Divisional Breakout Sessions

MPSAC members had lunch with the MPS Divisions in the divisional breakout sessions. Topics discussed during these sessions: included the under-representation of minorities in MPS-discipline departments in colleges and universities, key long-range planning issues and FY 2009 budget ideas, and other matters.

Thursday, November 2, 2006

Afternoon Session

The MPSAC reconvened in plenary session at 4:00 PM.

Reports from Divisional Breakout Groups

Membership within each breakout group can be found in Appendix II.

The reports back from the divisional breakout sessions are divided into three topical areas:

1. Increasing Participation of Under-Represented Minorities

Echegoyen stated that improvement over the last 40 years had been marginal. Dr. Winston Soboyejo stated that there is a sense that a lot is being done, but a significant increase in numbers has not been observed. Dr. Sol Gruner commented that other fields such as business, law, *etc.* have more success with minorities; the attraction of science is not apparent to them. Sunley posed some questions: Are we biased in favour of some things (which in effect biases one against other things)? Do we have a bias for the top institutions and for people who have degrees from these institutions? Do we have a bias for full-time students? Do we prefer not to have students transferring in from community colleges?

Dalton stated that the MPSAC not try to solve the problem alone. NSF needs to reach out to Minority Serving Institutions (MSIs), professional societies, minority networks, *etc.* to dispel myths and find the best paths. Dr. Elizabeth Simmons asked if we are getting feedback from the community of teachers in urban areas. Dalton noted that partnerships could move us forward and this is timely since universities are poised for change.

Witherell spoke about barriers for the first person in a family to attend college. They may not know a scientist or an engineer. Are we setting the best role models? Young adults do not realize that professors are their own bosses – how do we communicate this to them? Traditionally science has only been well presented on public television watched by 3% of the population. Dr. Rhonda Hughes noted that Oprah would be a good forum, but

that it was not an easy route. *Numbers*, a popular TV show in its third season and a spin-off from CSI, has generated interest in mathematics. Chan commented that he was one of several math consultants for *Numbers*.

Dr. Eve Ostriker, commenting on discussions within the AST breakout group said that the number of minorities submitting proposals is small, but is consistent with the community representation. Accordingly, however, there are few awards, but the funding rate for minority PI's is consistent with remainder of division. Recruitment of minorities into the field could be improved by spreading information about Research Experiences for Undergraduates (REU) supplements. Could there also be outreach-oriented supplements to undergraduates? Dr. Marcia Rieke stated that one must factor economics into minority recruitment in the sense that minorities do not see a practical future in the field in terms of employment.

Simmons, commenting on discussions within the PHY breakout group, reported that the Division of Physics has funds to make awards to or increase the size of borderline under-represented minority principal investigator (PI) proposals; they consider this a best practice and intend to increase their effort in this area. These awards look like any other, so that there is no stigma attached to them. She also suggested that MPS should track, in a systematic way, women and minorities coming into the PI pool and also get grant awardees involved in the review process. Possible targets are the four-year community colleges where support at critical points (*e.g.* at the freshman level) can make a difference. Reaching out to under-represented groups is a strength of facilities and centers. However, they could still improve by forming committees of outside knowledgeable persons to get input on best practices, *e.g.*, regarding childcare. Onuchic noted that the magnitude of problem with Hispanics is large and is relatively new and that participation in science and engineering (S&E) is low. Minority students tend to go to less expensive places to study where they can also live at home. They do not know about REU sites and that you would receive a stipend while participating in such a program. The same applies with respect to their perception of graduate school. It is critical to make these mechanisms more accessible.

Dr. David Oxtoby, commenting on discussions within the CHE breakout group, held up model examples from chemistry: the gender equity workshop that would now be implemented in other fields, two chemists spoke at today's earlier underrepresented minority session; and two NSF program directors and the only minority division director are found in CHE. CHE has good minority representation in panels and committees at NSF and is getting close to representing America [COV with 20% under-represented minorities; panelists 15%, *ad hoc* mail reviewers 11% (self identified), PI's 5-6%]. The REU program addresses pipeline issues where 30% of the participants are minority (including 12% Hispanic). Doubling of the REU program and expansion of RET program was discussed. Steps are being taken to make further improvements, *e.g.*, larger facilities grants will require a diversity plan. A bridge to the doctorate level was discussed and MPS involvement was encouraged. NSF has a program for Minority Postdoctoral Research Fellowships and Supporting Activities (http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf06586) where other NSF directorates participate and MPS was encouraged to partake. NSF needs a central person to address diversity, respond to questions, and disseminate information both within and outside the foundation. Dalton stated that the Discovery Corp Fellowships are a wonderful mechanism for broad and creative approaches. Undergraduate students are very good with mathematics mentoring, but are often unpaid. Criteria II – societal impact – makes a difference.

Gruner, commenting on discussions within the DMR breakout group, said that practices to fund minorities are in place (division reserve, *etc.*) and to educate minorities as to how to be effective principal investigators. Single investigator and small group awards to minority principal investigators have increased from 4 to 9% over the past 10 years. Diversity plans for centers and facilities are in place. DMR sends back superficial plans and asks for more. Representation is good: Panelists 7-18%, PD's 11% and COV 17%. DMR has many societies to interact with. Soboyejo discussed making use of self-assembled minority groups. Can we engage them, as PI's, to serve as mentors, role models, *etc.*? There are many activities underway from people surviving on soft-money. Can we make these activities more broadly accessible within the university environment? We need to proceed with caution, so that minorities are not over-subscribed and their intellectual growth is fostered. Olevra de la Cruz commented upon the DMR Partnerships for Research and Education in Materials (PREM) as a model and the effectiveness of centers with vertical integration including Research Experiences for Teachers (RET). Dr. Ian Robertson stated that special or remedial programs turn off students. Gruner spoke about the use of teaching assistants to improve poor mathematics preparation.

Dr. Susan Coppersmith stated that it is mentoring that is critical, not money. She also noted that we are not good at providing advice for alternate career paths to faculty positions.

Dr. Robert Kohn, commenting on the DMS breakout group, asked first if there are practices/programs that are not spread as widely as they should be. Grants for the Vertical Integration of Research and Education (VIGRE), is good at workforce development. One sub-program (mentoring through critical transitions) is used to help smaller universities become engaged in research, and it seems to have become the perfect tool for increasing diversity. The program is rather new so it is difficult to fully assess its success. Research Opportunity Awards (ROA) are successful in individual cases. The professional organization SIAM has a diversity day at every annual meeting – students and post-docs interact and it is well integrated into the meeting. Visibility of mathematics is low as a career path and it is not uniform within the field. Young people preferentially choose newer areas. Dr. Rhonda Hughes said they had made a bridge program through an intense summer program followed by a mentorship program funded in part by NSF. Diversity at all levels was maintained. A supportive environment was a key factor to success, not preparation. When there are problems, feedback to the universities has been effective in teaching them what they are doing wrong.

2. American Competitive Initiative

Ostriker stated that it remains to be seen how ACI plays out. AST members are excited by the opportunities. They want to see constructive engagement with the Office of Science and Technology Policy (OSTP) with respect to implementation and to monitor dialogue as it develops. Williams said AST sees ACI as a great thing and encourages NSF, and in particular MPS, to compete aggressively for their piece of the action, even though AST does not have a major role. Of course, AST can contribute to science literacy and as Sunley pointed out AST can also contribute since they are instrument builders.

Dalton pointed out that CHE and DMR should partner on ACI.

Oxtoby noted that CHE is naturally part of the initiative. CHE is cosponsoring a workshop with industry and is also involved with several workshops on (i) moving beyond Moore's law, (ii) imitations of biology, and (iii) sustainability and energy/environment.

Gruner said it is critical that we relate the activities that DMR undertakes to ACI. The role of DMR in large facilities is important since these are flexible tools. He felt MPS needed a subcommittee to fully address ACI and Soboyejo agreed. He felt a subcommittee should consist not only of MPSAC members, but should also include scientists who were not MPSAC members. The interface with biology and medicine was also mentioned.

3. Other Issues

Ostriker reported briefly on the AST Senior Review. This entire process might serve as a model for other programs. AST is ready to move onto implementation of its recommendations. Dr. Robert Williams commended that the funding of one area means not funding another. We must encourage this type of re-programming.

Simmons discussed budgetary issues within PHY. At present no less than 50% of the PHY budget is reserved for individual investigator awards. She suggested that there be a lower threshold to award size, but was hesitant to set a dollar amount. The 10% allocated for Physics Frontiers Centers is working well. The remaining 35% of the PHY budget goes to facilities and operations funding. Oxtoby raised concern about the place of CHE within MPS – it has one of the smallest increases and lowest funding levels. He asked how CHE could achieve more visibility? CHE does not have centers (apart from the Chemical Bonding Centers which are rather new); it was felt that critical areas are under-supported.

Adjournment

The meeting was adjourned at 6:00 P.M.

Friday, November 3, 2006
Morning Session

The MPSAC convened at 8:00 A.M.

Introduction to Facilities, Balance Questions, Other Issues

Dr. Adriaan de Graaf briefed the MPSAC on MPS facilities. This included a review of the MPS Science Themes; the distribution of funding for different MPS categories of funding (facilities and instrumentation represent 21% of the MPS budget); facilities under construction or approved for construction [the Atacama Large Millimeter Array (ALMA), IceCube (a project at the South Pole to detect high energy neutrinos from galactic and extragalactic sources, and joint with NSF's Office of Polar Programs (OPP)), and Advanced LIGO; a listing of the current 7 projects on the MREFC horizons list [the Advanced Technology Solar Telescope (ATST), the Deep Underground Science and Engineering Laboratory (DUSEL), the Energy Recovery LINAC (ERL), the Gian Segmented Mirror Telescope (GSMT), the Large Synoptic Survey Telescope (LSST), the Extended VLA (EVLA), and the Square Kilometer Array (SKA). He presented a chart showing the MPS budget at the division level and provided information on the FY 2005 – 2007 facilities' budgets. He provided a discussion of the international dimensions of the MPS facility portfolio.

Sunley provided an overview of the Major Research Equipment and Facilities Construction (MREFC) process, including the stages and ranking criteria by which a proposed project is considered for funding. This process consists of four stages: the conceptual design stage, the readiness stage, the NSB approved stage, and the construction stage. She then detailed the ranking criteria by which the highly diverse set of proposed projects are judged:

- Scientific and Technical Criteria Assessed by Researchers in a Field or Interdisciplinary Area (First Ranking Criterion);
- Agency Strategic Criteria Assessed Across Related Fields (Second Ranking Criterion); and
- National Criteria Assessed Across All Fields (Third Ranking Criterion).

In response to a question by Witherell about where the central oversight for NSF facilities lay Sunley introduced Dr. Mark Coles, the Deputy for Large Facilities in NSF's Office of Budget, Finance and Awards Management.

Sunley described some of the characteristics of the stages of the MREFC process: All of the MREFC candidates are projects that come from the community. In the Conceptual Design Stage one reaches the point where a complete, although not highly accurate, conceptual design report is prepared. The Readiness Stage begins with the conceptual design, where the costs are only known to within a factor of 2; and the project team from the community proceeds to develop a preliminary design. This stage is typically multiyear; and the costs tend to grow, as more and more details emerge. Based on the preliminary design report, the project is considered by the NSF's MREFC Panel for recommendation to the Director. If the Director decides that the project satisfies all the ranking factors and is sufficiently developed and documented, the Director takes the project to the NSB for their consideration. NSB approval moves the project into the Board Approved Stage; and the planning continues in earnest. After inclusion in the NSF budget request and funds are appropriated, the project enters the Construction Stage.

Sunley proceeded to discuss some of the main issues about facilities, *e.g.*, continuing improvement in the process, the challenge of providing operations costs from the Research and Related Activities (R&RA) account, application of ranking criteria by appropriate bodies, persistent budget growth after approval, impact of budget instability, management of technical and management risk with planning, oversight, and contingency, political dimensions of high profile projects, and the role of the MPSAC.

The important role of the MPSAC in advising MPS on projects that span the directorate and can involve other organizations and on process improvement was emphasized; and, by the end of the meeting, it was decided to form a sub panel for focused attention on MPS facilities and infrastructure.

Senior Review – Division of Astronomical Sciences

This session was devoted to presentation of the AST Senior Review Report by the chair of the Senior Review, Dr. Roger Blanford.

Dr. Wayne van Citters set the context for the major review undertaken by the Senior Review panel. Issues revolved around the inability to fund new facilities identified in the NRC Decadal Survey of Astronomy and Astrophysics. The Survey provides a prioritized list of projects for NSF and NASA for the coming decade, given the budget history and existing commitments to existing facilities. The goal of the Senior Review was to look at the entire AST portfolio in order to identify ways of producing a \$30 million investment potential in five years. This was an enormous challenge, because it would mean termination of some activities that are still doing scientifically significant research.

Blanford described the results of the committee's work. He described the many steps of the review process. Thirteen senior members of the astronomical community, all of whom made a major commitment of time and effort, conducted the Senior Review. The charge included many aspects, including balancing existing facilities with proposed facilities; assuming flat budgets; protecting the grants program; targeting \$30 million savings; casting everything in the international context; and producing a report by April 2006. Input was requested and received from the community, from the existing astronomical facilities, from seven town meetings, from over 200 emails, and from NSF staff. A review of the guiding principles was presented, including optimizing the workforce, public benefit, bridging artificial divisions, engaging university community and accounting for the international context. The issue of federal and private observatories was considered, and means to achieve mutually advantageous partnerships were articulated. An overview of the AST program and observatories was reviewed; and the international standing was addressed. The realities of operating the facilities of the future were addressed to achieve a basis of realistic expectations, and the need for selectivity and life-cycle management was made clear. The most promising future facilities were reviewed with their estimated costs. Recommendations on the future actions on the portfolio of facilities were provided, including a set of priorities for existing facilities, phase out plans for some, and other management considerations. General findings were listed, including high praise for the AST program of research, the need for more resources, the strategic challenge of live-cycle planning, need for coherent national and international partnerships, and anticipation of the next decadal survey.

At the conclusion of Blanford's presentation, there was an animated discussion of the significant challenges and implications of the Senior Review, including discussion of the need for detailed cost reviews of recommended actions, steps to be taken in the immediate future by AST, continued interaction with the community on the steps taken, and discussion of the importance of the integrity and high level of the Senior Review for acceptance of a course of action that involved actions adverse to excellent activities.

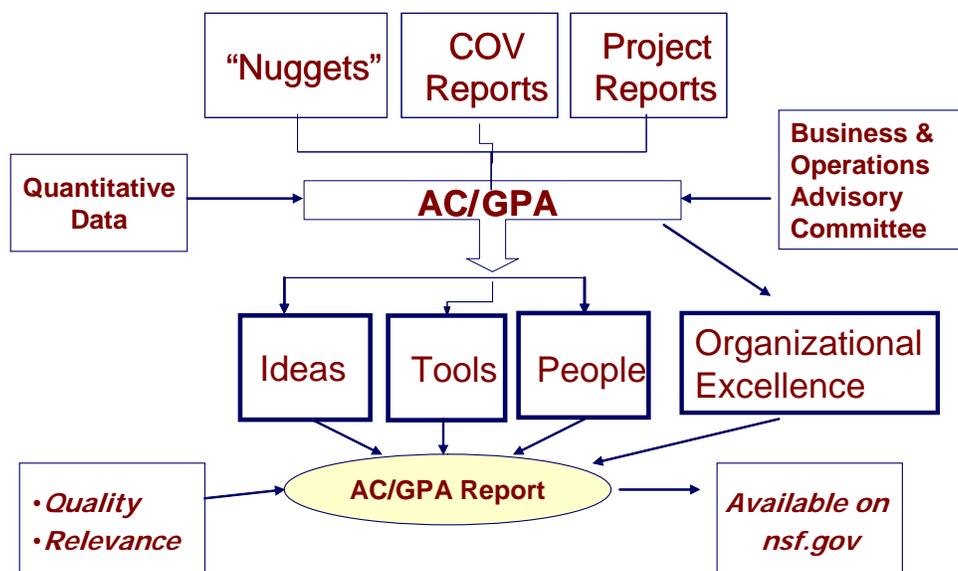
There was a sense of the MPSAC, expressed by many members, that they had great respect for and confidence in the results of the Senior Review, even in cases where there were direct negative impacts. The MPSAC noted the outstanding job of AST staff in working with the community and the Senior Review to ensure the best possible outcome and wide acceptance by the community and MPS. MPSAC expressed their debt of gratitude to the Senior Review panel and the truly outstanding leadership provided by Roger Blanford.

The MPSAC was unanimous in its acceptance of the Senior Review Report.

Report on Advisory Committee for GPRA Performance Assessment

Dalton, a member of the NSF-wide Advisory Committee for Government Performance and Accountability (AC/GPA) gave a 10-minute summary of the AC/GPA Process. In determining whether the NSF has accomplished its annual performance goals with respect to its strategic goals, the AC/GPA makes use of highlights reported by the various NSF programs, COV reports, and project reports. Input into their deliberations is outlined in the diagram below.

AC/GPA Process



The AC/GPA concluded that NSF had demonstrated significant achievement in all performance indicators related to its strategic outcome goals in FY 2006.

The following recommendations were made by the AC/GPA to NSF:

- NSF was encouraged to give thought as to how best to use the 2006-2011 Strategic Plan objectives as evaluation tools.
- Highlights should include indicators of success when available.
- NSF should develop analysis on research and education trends with baselines indicating how NSF efforts are contributing to change.
- NSF is encouraged to do more to stimulate new and more in-depth research in teaching and learning.
- The AC/GPA would like to see data on all aspects of "broadening participation."
- NSF should establish supplemental guidelines and factors to consider in evaluating the "Broader Impacts" criterion for proposals.
- The AC/GPA would like to see information that links goals, objectives and priorities to budgets and outcomes across NSF.
- NSF should provide a report on the most important innovations across the NSF directorates and embrace innovation as a fundamental element of its mission.
- NSF needs to improve the management of large projects.
- NSF should find ways to reduce the workload that program officers continue to face.

Neuroscience at NSF: Status and Prospective

Dr. Rae Silver, the Senior Advisor in the Office of Integrative Activities gave a presentation on how the brain works, current research efforts in this area, and noted that this research is an opportunity for data analysis, mathematical & statistical modeling, and informatics. The availability of immense quantities of high-resolution data demands new statistical tools and models, and new informatics capabilities. New approaches for inferring association, linkage, and causality will be required. The 2006 OMB-OSTP memorandum calls for more research in complex biological systems – systems that are non-linear, multi-scale, and difficult to predict. NSF is the one agency that can bring to bear the necessary scientific, mathematical and engineering disciplines.

Impact of Proposal and Award Management Mechanisms (IPAMM) Working Group

Dr. Deborah Lockhart, Executive Officer of the Division of Mathematical Sciences described the activities of this working group. Their charge is to identify the best practices within NSF to achieve an appropriate balance between proposal success rates, award sizes, and award duration. The emphasis is on individual investigator grants and has membership from across NSF.

The issue the working group is addressing concerns that fact that the success rate for research proposals was 20% in FY 2005, down from 30% in FY 2000. This has potential impact on merit review, with increased workload on the reviewer community and on NSF staff. The working group will be examining case studies of various practices related to proposal submission, do additional data analyses, obtain external input, conduct focus groups with new rotators, and conduct an applicant survey to assess external drivers.

Meeting with NSF Director Dr. Arden Bement, Jr.

Dr. Arden Bement, Jr., Director of NSF and Dr. Kathie Olsen, Deputy Director of NSF, joined the MPSAC for lunch. In his opening comments Bement stated that the NSF FY 2007 budget request had been passed by the full House Appropriations Committee but still awaited Senate action. NSF was on a continuing resolution until November 17, 2006 and a renewal of the continuing resolution was expected until sometime in December.

Bildsten commented on the AST Senior Review. He said that the MPSAC felt the Senior Review team, led by Dr. Roger Blandford of Stanford University, had done a remarkable job and the MPSAC was looking for an encouraging response from NSF. Bement replied that he was very grateful to Dr. Blandford and to his committee. He hoped that this review would serve as a template for the future and similar reviews would be implemented in all of the NSF directorates. He stated that on the Hill there had been broad appreciation of what had been done. Witherell commended NSF for implementing the Senior Review. Bement added that NSF needed better configuration control for costs, schedules, and the scientific objectives of the project and that it was in the preliminary design review where all of this came together.

Coppersmith said that the MPSAC considered MPS as quite central to the ACI goals. Bement responded that MPS and ENG had the same percentage increase request within the Research and Related Activities (R&RA) area of the NSF request. NSF had to continue to invest in transformative research, but, at the same time, it had to ensure that the nation had an adequately trained workforce. He noted that NSF must stay connected to the frontier and commented on the importance of maintaining a dialogue with industry. It was also important that scientists and engineers engage in discussions with the public as to why science and engineering are important. Chan noted that MPS and ENG were now working together. Bement felt that MPS should be seeking ideas from the community with respect to ACI and perhaps the MPSAC could help in this area. Members of the MPSAC commented on areas within their disciplines that were applicable to ACI.

Dalton commented on NSF efforts with respect to underrepresented minorities and congratulated the staff for leading by example. He described the impact of subtle bias within universities, and congratulated the Chemistry Division for the gender equity workshop it had conducted in January 2006. CHE had engaged university administration in this activity, and he noted the CHE was planning to require diversity plans from departments when they submit requests for instrumentation. He said that there was a need to address the transition of students from community colleges into four year colleges. Minority serving institutions were also very important in generating new degrees among underrepresented minorities.

In response to a comment on neuroscience, Dr. Bement said there had been an NSF-sponsored workshop on this topic and a question was of how neuroscience can inform other areas of science.

Friday, November 3, 2006

Afternoon Session

Follow-up on Meeting with Director

Oxtoby asked how the MPSAC could provide any real input into the budget formation process. The timelines for the creation of budgets was not conducive to the receipt or use of such input. Specifically, at its meetings, the MPSAC is typically confronted with one budget that is embargoed and another that is “far away.” Witherell restated this problem, offering the suggestion that effective feedback mechanisms could be created for updating the MPSAC on the budget process at important junctures in its development and soliciting advice that would then be more timely.

Coppersmith asked how MPS actually allocated resources to the divisions during its budget formation process. Her question was motivated by the perception that, in recent years, MPS has shortchanged CHE and DMR in favor of other MPS divisions. She cited the example of the Nano Initiative that was supposed to bring \$100 million of new money to CHE/DMR, an event that never came to pass. Her point was that the AC might be given a more active role in setting MPS budget priorities. Chan’s response was that MPS must seize opportunities when they arise (*e.g.*, ACI) and that in some instances doing so favors some divisions over others. Sunley added that MPS must be in step in its budgetary decisions with agency-wide priorities. Coppersmith’s reaction was that the AC is not asked for advice on “things that really matter,” and the mission of the MPSAC should be rethought.

The discussion then turned to facility-related issues. Witherell indicated that there are two major aspects of the MPS investment in facilities that deserve MPSAC attention: (1) projects in their early stages and (2) the operation and maintenance of facilities. He suggested that the MPSAC would be best served if it had a “facilities subcommittee” that enlisted the help of expert consultants from outside the AC. Sol Gruner agreed in principle, adding that such a subcommittee should report to the full AC only at critical junctures in the life of a facility.

Witherell noted that there were other areas in which issue-specific subcommittees could provide useful sounding-boards for the directorate without occupying the attention of the full AC until the appropriate time. He identified ACI and MPS centers as key cases in point. Onuchic was supportive of Witherell’s suggestion, but Kohn wondered whether this would be any more productive than the activity of preparing white papers. Chan felt that having input from such subcommittees would provide greater continuity to the AC’s operation. Witherell then announced that he would put together subcommittees addressing three areas: facilities, ACI, and centers.

Sunley asked that a fourth subcommittee be assembled to help identify possible candidates to fill the Division Director vacancy in DMR. Kohn stated that the existence of such a group had been quite useful in the process that led to the selection of Peter March as Division Director of the Mathematical Science Division.

International Cooperation and Coordination

It was noted that the European Science Foundation (ESF) traditionally sends a representative to the AC meetings, but for this meeting it was not possible. Dr. Morris Aizenman commented that a few years ago the Physical Sciences area invited an NSF representative to their meetings. It was felt appropriate to reciprocate, so an invitation was sent. The ESF was very responsive and have sent representatives to AC meeting ever since. This year there was no representative due to meeting conflicts. Chan asked whether MPS should limit these exchanges to just the ESF. NSF has opened an office in China and he has returned from an extensive trip to India. Witherell noted that the ESF is very organized in Asia. It is very complex to interact with the equivalent body in India. Onuchic pointed out that the ESF is only part of the science funding in Europe. Chan then asked how MPS should respond if another country wanted to participate. Bildsten replied it would be good to have as much contact as soon as possible. Witherell suggested that MPS should provide support for this to happen. Chan followed up by pointing out that Japan is a part of ALMA, as is Taiwan. Bildsten commented that at an earlier meeting of the MPSAC the ESF representative pointed out how different the NSF operates from the EST. It was very educational to see the different approach to the matter.

Witherell reported that the particle physics community had various Asian and European agencies communicating on a collider project. It was amazing to see how complex this process was in just getting people together. Getting the agencies together is the biggest issue. De Graaf pointed out that the topic of international cooperation was discussed at the MPS retreat and is of major importance to the NSF. Much of it at the moment is international collaboration which is *ad hoc*. Should we make this topic a more fleshed out agenda item in the future? Witherell replied that NSF has increased interest in international programs. Chan suggested that we could explore this and perhaps have the Japanese come here to make a presentation. Witherell agreed that there is generally a positive response to this, as long as there is not too much of an extra time burden. Onuchic asked if there was a mechanism in place for people with NSF funding to ask for a supplement to do international collaboration. How much of this is available for students and postdocs to travel? Chan responded that several programs do exist for this. Burrows then pointed out that it would be timely to make an effort of outreach to Chinese students. Many Chinese students that are being trained in the U.S. are thinking about going back to China.

US-France Symposium

Dr. Adriaan de Graaf showed the MPSAC an overhead slide containing the contents of an e-mail about a possible collaboration with the French. During the summer, the French science counselor approached Dr. Bement about sponsoring a U.S./France symposium similar to the Frontiers of Science meetings http://www.nasonline.org/site/PageServer?pagename=FRONTIERS_main held by the National Academies. The French proposed a meeting with about 100 top junior researchers, half from the U.S. and half from France, to convene for 2-3 days to build research collaborations. They envisioned approximately 25 scientists in each of four fields, with the hope that connections would be built not only within each field but also across fields.

When the French asked what fields NSF would be most interested in supporting, Dr. Bement suggested that the Advisory Committees be asked for their feedback. De Graaf asked the MPSAC what topics would be of interest. He suggested that the timeline would involve working with the French to identify an institution, a principal investigator, and a plan for submission of a proposal in 2007 for funding of a symposium in 2008. Perhaps the ACI subcommittee, as its first task, could come up with ideas for this symposium. Kohn wondered whether the MPSAC should be involved in the task of organizing meetings. Witherell and de Graaf noted that the MPSAC was not being asked to organize a meeting, but instead to just suggest topics. Burrows suggested that neuroscience be considered. Maldonado suggested that a partnership with the National Academies might work well. Other suggested topics were biophysics, nanotechnology, cyberinfrastructure, probabilistic and statistical physics, and optical interferometry.

Witherell suggested that at the next meeting there could be some discussion on what are the NSF resources for funding international collaborations.

Adjournment

The meeting adjourned at 3:00 P.M.

Appendices

APPENDIX I

ATTENDEES

MPSAC Members

Douglas Arnold, University of Minnesota
Cynthia Burrows, University of Utah
Susan Coppersmith, University of Wisconsin
Larry Dalton, University of Washington
Sol Gruner, Cornell University
John Huchra, Harvard-Smithsonian Center for Astrophysics
Rhonda Hughes, Bryn Mawr College
Iain M. Johnstone, Stanford University
William L. Jorgensen, Yale University
Robert Kohn, New York University
Theresa A. Maldonado, Texas A&M University
Dusa M. McDuff,, SUNY-Stony Brook
Monica Olvera de la Cruz, Northwestern University
Jose Onuchic, University of California, San Diego
Eve Ostriker, University of Maryland
David Oxtoby, Pomona College
Marcia Rieke, University of Arizona
Ian M. Robertson, University of Illinois at Urbana-Champaign
Elizabeth Simmons, Michigan State University
Winston O. Soboyejo, Princeton University
Robert Williams, Space Telescope Science Institute
Michael Witherell, University of California, Santa Barbara

MPSAC Members Absent

Claude Canizares, Massachusetts Institute of Technology
David Keyes, Columbia University
Steve Koonin, British Petroleum, Inc.

MPS Staff

Morris Aizenman, Senior Science Associate, MPS
Denise Caldwell, Acting Executive Officer, Division of Physics
Adriaan de Graaf, Senior Advisor, MPS
Henry Blount III, Head, Office of Multidisciplinary Activities
Joseph Dehmer, Director Division of Physics
Luis Echegoyen, Director, Division of Chemistry
Eileen Friel, Executive Officer, Division of Astronomical Sciences
Lance Haworth, Acting Division Director, Division of Materials Research
Janice Hicks, Executive Officer, Division of Chemistry
Deborah Lockhart, Executive Officer, Division of Mathematical Sciences
Peter March, Director, Division of Mathematical Sciences
Judith Sunley, Executive Officer, MPS
Ulrich Strom, Acting Executive Office, DMR

Visitors

Arden Bement Jr., Director, NSF
Kathie Olsen, Deputy Director, NSF
The University of Michigan Center for Learning and Teaching Theater Program

APPENDIX II
MPS Advisory Committee Meeting
November 2, 2006

		DIVISIONAL ASSIGNMENTS FOR MPSAC MEMBERS						
		AST	PHY	CHE	DMR	DMS		
		Room	Room	Room	Room	Room		
		320	330	1020	1060	SII-525		
Term Ends 09/30/07								
	BILDSTEN	X						
	COPPERSMITH				X			
	GRUNER				R			
	KOHN					R		
ABSENT	KOONIN							
	OSTRIKER	R						
	OXTOBY			R				
	RIEKE	X						
	SIMMONS		R					
Term Ends 09/30/08								
	ARNOLD					X		
	BURROWS			X				
ABSENT	CANIZARES							
	DALTON			X				
	HUGHES					X		
	OLVERA				X			
	ONUCHIC		X					
	WITHERELL		X					
Term Ends 09/30/09								
	JOHNSTONE					X		
	JORGENSEN			X				
ABSENT	KEYES							
	MALDONADO		X					
	MCDUFF					X		
	ROBERTSON				X			
	SOBOYEJO				X			
	WILLIAMS	X						
X	Absent							
X, R	MPSAC members attending Divisional Meeting on 11/02/2006							
R	Breakout CHAIR, MPSAC member who will summarize Divisional meetings activities to MPSAC							

APPENDIX III MPSAC Breakout Session Reports

AST Breakout Session Report

At the AST breakout session, MPSAC members Bildsten, Ostriker, Rieke, and Williams met with AST staff, as well as with visitor R. Blandford.

1. NSF Astronomy "Senior Review"

Much of the breakout discussion centered on the Senior Review report, "From the Ground Up: Balancing the NSF Astronomy Program," which Blandford chaired, and which he presented to the full MPSAC on Friday morning. This report was commissioned by the MPSAC in response to a request from the AST Division. The overall goal of the review was to examine the AST portfolio and identify potential means of recovering approximately \$30M of annual spending from existing programs, which could be redistributed to other activities within AST. In the short term some form of reallocation was understood to be needed in order to cover ALMA operating expenses, but more generally and over a longer term AST was seeking the means -- under the assumption of a limited budget -- to shift resources from some of its existing activities to new ones, according to the greatest promise and opportunity.

The Senior Review was requested by the AST Division itself, in order to address one of the serious challenges of long-range planning within the NSF environment: construction for new facilities is approved and budgeted through the MREFC process, while other lifecycle costs of these same facilities must be dealt with separately. Since facilities make up a large proportion of the AST budget, and lifecycle costs (operations, instrumentation, maintenance, and decommissioning) can be very large, forward-thinking planning is essential for continued success of the overall AST program. The AST Division sought the advice of the scientific community in order to maintain an optimized and balanced portfolio moving forward into an era of increasingly large facilities (and, potentially, increasingly complex management structures that include international and other non-NSF partners).

Overall, the AST staff were very satisfied with the report that the Senior Review produced. The MPSAC Astronomy members were also extremely impressed by what some termed the "heroic" efforts of Blandford and the other members of the committee, and felt that the committee had executed its charge in a thoughtful, deliberate, and well-informed manner, while maintaining the necessary confidentiality throughout. The report itself sends a strong message regarding the overall prioritization within the existing AST portfolio, with a high level of specificity in its recommendations but nevertheless sufficiently clear enunciation of principles to allow adaptation to changing budgetary conditions. AST staff expressed a readiness to move ahead with implementation immediately, bringing the report's recommendations into realization in the FY09 budget and beyond. Among the recommendations of the Report is cost reviews of the five national observatory facilities that AST manages (Gemini, NOAO, NRAO, NSO, and NAIC); the MPSAC committee members strongly supports these detailed cost reviews, which would include study of potential decommissioning costs (and options) for some facilities.

The tremendous coming opportunities for the astrophysics community (as documented in the recent Decadal Survey) were in large part what made the Senior Review so urgent for AST. The MPSAC AST breakout committee members hope that the MPS Directorate and the NSF Director respond positively to the Senior Review recommendations. We hope that the difficult task of prioritizing among existing successful ventures in the AST Division, now that it has been completed, will be rewarded by support for striking out in new directions. With the support and encouragement of MPS and NSF leadership, AST will be able to take advantage of many new opportunities offered by the vibrant astrophysics community in the nation.

2. American Competitiveness Initiative

The AST breakout also discussed the ACI. Both the committee members and AST staff agreed that there are many ways that the Astronomy community and NSF AST can contribute to this initiative. Astronomy could, for

example, be involved in some very competitive technology proposals, e.g., in image restoration and parallel signal processing. In addition, Astronomy is very much a "public face" for the kind of research that is done within MPS, and this allows a natural connection to the educational aims cited in the ACI. In general terms, the Astronomy community has already developed a package of new initiatives -- identified through extensive community input -- that matches well to the concept of technology development and federal investment in facilities and instrumentation, as described in the ACI report.

Overall, the ACI clearly represents a great opportunity. The MPSAC Astronomy members hope that the NSF leadership -- and the MPS leadership to the extent possible -- will engage in dialogue with OSTP regarding the development of the program broadly outlined in the February 2006 release.

The AST group felt that the MPS Directorate has much to offer the ACI program, and that the MPS should be aggressive in putting forward proposed projects for inclusion in the NSF response to the ACI. Competition for ACI funding will be keen, and the MPS and NSF must be very proactive in pursuing funding in order to ensure strong participation.

3. Participation of under-represented minorities

The AST breakout group also discussed the issue of under-representation of minorities within our discipline overall as well as within NSF-sponsored activities and institutions.

Based on the description and statistics provided by NSF AST staff, the division has been proactive in broadening participation in PI funding within the individual investigator program (AARG). AST makes appropriate use of the "divisional reserve" in funding proposal submitted by members of under-represented groups. Funding rates for these PIs are at least as high as those for AST PIs overall. Under-represented minorities are also present in the pool of funded PIs, reviewers, panelists, etc., in numbers proportional to their presence in the AAS membership -- which is nevertheless very low compared to the U.S. population overall.

A main focus of the discussion was in increasing the numbers of undergraduate students entering Astronomy or related fields, and in using Astronomy-related activities to raise awareness of MPS and STEM fields in the population of young people who are beginning to explore career options.

One suggestion was made to increase awareness of REU supplement opportunities for individual investigators by notifying AAS members in the regular newsletter. Another suggestion was made to introduce outreach-oriented supplements that could be made to individual-investigator grants; these could in particular be valuable to support undergraduates for training as enthusiastic and approachable emissaries in outreach efforts.

CHE Breakout Session Report

Report to MPSAC on the Chemistry Division

Personnel change

New Division Director, Luis Echegoyen, moving from the MPSAC

Underrepresented minority participation in the Chemistry Division

Leadership of CHE at NSF in broadening participation

Gender equity presentation to MPSAC last year (including gender equity workshop for department chairs, being used by other Divisions as well)

Underrepresented minorities presentation at the present meeting led by Luis and Larry Dalton

CHE staff: 3/23 minority in program officer/division director level staff at CHE

Review functions

Last Committee of Visitors was 40% women, 20% underrepresented minorities

Panelists: 15% URM, reviewers 11% (but most of the last category are unknown)

Grant recipients

5-6% of active CHE grants have URM PI's; funding rate comparable to overall

REU (Research Experience for Undergraduates) program is 60% women, 30% URM (including 12% Hispanic)

Ideas

- Increase REU by a factor of 2
- Increase RET program (Research experience for high school teachers)
- Continue and strengthen Bridge to Doctorate program
- Institute a Minority Postdoc program along the lines used by BIO and SBE
- MPS should have a staff member focused on broadening participation

Key Long-Range and Budget Issues

Budget issues for CHE are not internal (distribution of funds within Division) but external (place of CHE within MPS funding)

Why has CHE dropped to the lowest funding level of all division in MPS?

Why has CHE (together with DMR) had the lowest increases over the last 10 years in view of nano initiatives and now the ACI initiative?

Lack of visibility of CHE in MPSAC: without senior reviews or \$100M pieces of equipment, our work is lost at the Advisory Committee level

Chemistry as the central science, connected to other divisions and directorates: is the center being ignored?

Chemistry is not just curiosity driven but also creativity driven: we make the things that we study

Critical relationship to the ACI highlighted by upcoming conference (cosponsored by NSF, organized by Mark Wrighton, Chancellor of Washington University) for academic leaders in chemistry with Chief Technical Officers of chemical industry

Important areas for future emphasis of CHE

Beyond Moore's Law: molecular electronics

Complexity and Emergence: how does matter become complex?

DMR Breakout Session Report

Diversity: Various practices are in place in DMR to fund minorities (e.g., division reserve, PREM, etc.) and also to educate them to be effective PI's (e.g., using them as reviewers). Single investigator and small group awards to minority PI's have increased from 4 to 9% over the past 10 years. DMR has worked with centers and facilities to install diversity plans that are substantive. DMR is also working to involve under-represented groups in panels (7-18%), program officers (11%) and Committee of Visitors (17%).

Since DMR serves a very diverse community it has lots of societies to interact with, running from the American Chemical Society, the American Physical Society and the Materials Research Society to specialized societies, such as the American Crystallographic Association. Some of these, notably the larger, better known groups, have activities that are targeted at URG's; others do not.

With respect to mechanisms to improve URG participation in universities, it was suggested to engage self-assembled minority groups as a vehicle for progress. Perhaps we can engage these groups to increase URG PI's and to serve as mentors and role models. It was also observed that there are lots of diversity-enhancing activities underway in universities, but typically by people surviving on soft-money. Can we make these activities more broadly accessible within the university environment?

It is important to proceed with caution, so that minority faculty are not overcommitted to the point that professional growth within their specific fields are hampered. Some viable mechanisms include the PREM and RET programs. Another idea, given that URG undergraduate students may be technically less prepared, is to fund graduate teaching assistants who are chosen for their skills in tutoring.

A range of mechanisms were suggested as ways of improving the number of minority faculty that are engaged actively in research. One idea involved the formation of minority science institutes, similar to the international materials institutes. Such virtual institutes could provide a framework for minority and non-minority faculty to collaborate in ways that could help to catalyze the engagement of professional groups such as the National Societies of Minority Scientists/Engineers in scientific research and education. A minority science network could also be organized to promote interdisciplinary collaborations between scientists and engineers. The

institutes and networks could also be used to provide greater outreach and mentorship to diverse groups in ways that could lead ultimately to a critical mass of minority scientists and engineers.

The barriers to entry were found largely to be partly economic. For example, many of the people doing outreach at majority institutions are often employed on “soft” money. More grant vehicles for this purpose would be helpful. It would also be important to have more permanent personnel, e.g., by encouraging NSF grantee institutions to have permanent diversity staff within diversity plans to show commitment to diversity issues. The institutions should also be encouraged to use such structures for the institutional management of education and outreach programs in ways that will facilitate faculty efforts of education and outreach at all levels.

Other Divisional Matters: There was considerable discussion on the role DMR can play in the American Competitiveness Initiative (ACI). The scope of DMR science is very well tailored for the ACI. Potential transformative new technologies include carbon-based systems, molecular electronics, spintronics, single electron transistors, and biomaterials that could create a new generation of electronic and biomedical systems.

Furthermore, with the decline of the industrial labs that created the optoelectronic and telecommunications revolution of the last three decades, it is important to invest in a portfolio of new materials that will enable the US to remain as the leader in information technology, telecommunications and biomedical science and technology.

Beyond these, there is a need for a sustained effort in materials for transportation and energy science that could lead to new discoveries that will maintain the US lead in these critical industries. The potential areas for future investment include high temperature coatings for aeroengines, nuclear materials and sustainable materials.

The above are all areas that could be facilitated by ACI investment in science and education initiatives that link to US industries and diverse communities. Such activities are natural ones for DMR to engage in. Furthermore, DMR large facilities (vs. observatories) are exactly the kind of broad-based, flexible tools that could catalyze the engagement of a critical mass of US scientists in leading edge research and development that will enable us to achieve the goals of the ACI.

This is clearly a case for the many DMR connections to engineering. What is needed is a sub-committee to articulate the best way in which DMR can help with the ACI. This subcommittee might include MPSAC members, as well as other leaders within the larger scientific and engineering community.

DMS Breakout Session Report

Report on the MPSAC Breakout Session with the Division of Mathematical Sciences (DMS), November 2, 2006

MPSAC Participants: Rhonda Hughes, Robert Kohn (reporter), Dusa McDuff

DISCUSSION OF ISSUES RELATED TO UNDER-REPRESENTATION OF MINORITIES

The DMS leadership and program managers are keenly aware of the importance of diversity, and they expend great effort (with good effect) in furtherance of this goal. In particular:

a) The new Mentoring Through Critical Transition Points (MTCP) component of DMS's EMS21 workforce program has funded many creative projects to attract and retain minority talent in the mathematical sciences pipeline at the undergraduate and graduate levels.

b) DMS funds many events aimed at increasing the involvement of under-represented minorities. Some are at national meetings (for example, the Diversity Day component of SIAM's annual meetings); others are stand-alone meetings (for example the Blackwell-Tapia Workshop hosted by the Institute for Mathematics and its Applications in November 2006).

c) DMS emphasizes the importance of diversity in all its programs. In particular, recipients of workforce grants must provide information about the diversity of the funded student and postdoc populations. Similarly, the Mathematical Sciences Institutes must report on the participation of under-represented minorities in their meetings and other activities.

d) DMS monitors the participation of under-represented minorities as PI's on research grants. The data are incomplete due to the large number of PI's who decline to provide information, but all evidence indicates that minorities participate in NSF's programs roughly in proportion to their presence in the mathematical sciences community.

e) DMS pays proper attention to diversity internally, for example in the selection of program managers and review panels.

In our view, the only way to improve minority participation is to enlarge the pipeline. We need to increase the number of minority students who leave high school with an interest in mathematics and science; and we must increase the number of minority undergraduates who choose to major in these areas.

It could be useful to focus on urban populations, since many cities have large minority populations that are barely being tapped. The new MTCP program at DMS (created in 2004) provides one potential mechanism for reaching such populations.

We found two areas where NSF could do more:

i) The Research Experiences for Undergraduates program is a great pipeline-enhancer. The current practice in DMS is not to fund faculty salary through REU grants. Salary support for the faculty most involved in such programs would, we think, enhance their attractiveness -- increasing the number of good proposals, and therefore the number of students served.

ii) NSF used to fund summer enrichment programs for talented high school students (such as those listed at <http://www.ams.org/employment/mathcamps.html>). It no longer does. Renewed support for such programs would surely help the pipeline. We think this should be a priority for EHR, since the target population consists of high school students.

DISCUSSION OF LONG RANGE PLANS

The present context for DMS includes:

- a) Peter March's 9/06 start as Division Director, replacing Bill Rundell;
- b) the end of the Mathematical Sciences Priority Area (MSPA) initiative, now in its final year;
- c) concern about the sustainability of DMS's many Mathematical Sciences Institutes;
- d) fresh attention to workforce issues; and
- e) plans for a Committee of Visitors meeting in February 2007.

A major component of MSPA was the support of interdisciplinary activity. The partnerships formed as a result (between researchers, and between NSF divisions) are among this initiative's most important long-lasting impacts.

DMS presently supports 9 Mathematical Sciences Institutes. Three were recently renewed (IMA, IPAM, and MSRI); renewal decisions on several others will be made in the coming year. These Institutes are valued highly by the mathematical sciences community and DMS; among other benefits, they provide valuable platforms for scientific leadership, and cost-effective mechanisms for broadening participation. A new website <http://mathinstitutes.org/> encompasses all their activities, making it easy for prospective participants to find the events most relevant to their interests. In the current flat-budget environment, it is natural to ask whether the total funding devoted to all Institutes is at the proper level. Another natural question is whether the Institute portfolio is appropriately distributed across mathematical subdisciplines. The DMS staff is well aware of these

issues, and it expects input from the Feb 2007 Committee of Visitors in this area.

DMS is proud of its leadership in workforce programs. Its first traineeship program, Vertically Integrated Graduate Research and Education (VIGRE) was established in 1999; a review of this program's impact will soon be undertaken by the National Academy of Science's Board on Mathematical Sciences and its Applications. Meanwhile there is ample evidence that VIGRE has had dramatic impact on the quality of undergraduate and graduate mathematics education. It also dramatically increased the number of postdoctoral positions available in our discipline. A few years ago DMS increased the breadth of its workforce activities by creating two new programs, Mentoring through Critical Transition Points (MCTP) and Research Training Groups (RTG), wrapping them along with VIGRE into a single program called Enhancing the Mathematical Sciences Workforce in the 21st Century (EMSW21). The new components involve targeted grants, focusing either on a particular population (MCTP) or on a particular area of research (RTG). Thus they extend the reach of the workforce program. In the current flat-budget environment, questions naturally arise concerning the balance between workforce and research programs, and concerning the size of each component of EMSW21. The DMS staff has a realistic understanding of these issues, and anticipates input from the Feb 2007 Committee of Visitors. Overall, we are very pleased with DMS's workforce activities. As the American Competitiveness Initiative takes shape, they provide a valuable model – which could be replicated across MPS or even all of NSF.

Looking to the future: we discussed the role of DMS in selecting and shaping new NSF-wide initiatives. The recent report on Simulation-Based Engineering Science is replete with opportunities for the mathematical sciences. We hope the nascent Cyberinfrastructure initiative will recognize the importance of algorithms; if so then it too should have a strong mathematical component. The DMS staff have been very effective in promoting the interests of the mathematical sciences community in these and similar discussions.

PHY Breakout Session Report

Report from the MPSAC PHY breakout group of November 2, 2006.

What MPS should do to increase STEM participation by under-represented groups: continue to be creative!

1. **Continue to enhance the reserved funds set aside (e.g. in PHY) to support meritorious proposals by PIs from under-represented groups.** Receiving an NSF grant makes a huge difference in the career of an individual PI.
2. **Maintain representation of women and under-represented minorities among the committees, panels, reviewers, etc. of MPS.** Broaden the pool from which all reviewers and committee/panel members are drawn. This may require a combination of home-grown methods used by some program officers (keep a personal database of individuals from under-represented groups in a given field) and more systematic methods (put all MPS grant awardees into the official reviewer database).
3. **Include Asians:** While Asian-Americans are not under-represented within science, they are significantly under-represented on advisory boards, review panels, and so forth, throughout science. MPS is no exception... but it should work to become the exemplary exception! Since there is no pipeline issue here, MPS should be able to correct this oversight immediately for its own committees and panels by simply paying attention when recruiting.
4. **Encourage institutions to pilot transitional programs for Community College STEM students moving into 4-year Colleges/Universities in order to establish and disseminate best practices.** Many of these students are from under-represented groups, e.g. by race/ethnicity or by income. Their rate of retention in STEM is low due to a mismatch between their preparation and the background a junior-year STEM course assumes. Such a transitional program could build on what many institutions now do for freshmen from under-represented groups. The AAPT SPIN-UP report may have some useful ideas <http://www.aapt.org/Projects/ntfup.cfm>
5. **Encourage Facilities/Institutes/Centers to bring in committees of visitors** to help address climate issues (similar to those run by the APS Committee on Status of Women in Physics <http://aps.org/educ/cswp/visits/index.cfm>).
6. **Press NSF to make special childcare expenses associated with research travel or conferences an allowable grant expense.** This would help relieve some of the stress associated with work-life conflicts for

both women and men scientists, especially during months when a researcher is caring for an infant. It could also help reduce the temporary dip in productivity associated with birth or adoption of a child.

7. **Continue encouragement of Education/Outreach efforts.** Outreach programs at facilities/institutes/centers are crucial because they have sufficient infrastructure and staff to ensure continuity and to reach a large community. Significant ad hoc efforts to reach underserved groups (e.g. CHEPRIO) are also worthy of support.
8. **Consult directly with those MPS hopes to affect.** Speak with teachers who work in school districts with primarily disadvantaged or minority students. Speak with people from under-represented groups who are in the “pipeline” but have not yet reached the advanced career levels characteristic of MPSAC members. Or consult studies that have done so. This may lead to some new ideas that will be more effective.

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March 21, 2007

Dr. Tony F. Chan,
Assistant Director
Directorate for Mathematical and Physical Sciences
National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230

Dear Dr. Chan:

I have reviewed the final version of the minutes of the Directorate for Mathematical and Physical Sciences Advisory Committee meeting that was held on November 2-3, 2006 (attached), and am pleased to certify the accuracy of these minutes. Morris Aizenman has done an excellent job in recording the most significant parts of the discussion.

Sincerely,

A handwritten signature in cursive script that reads "Michael Witherell".

Michael Witherell
Chair, Mathematical and Physical Sciences Advisory Committee