

**Directorate for Mathematical and Physical Sciences
Advisory Committee Meeting Minutes
April 6-7, 2006**

Thursday, April 6, 2006
Morning Session

Welcome and Introductions

Dr. W. Carl Lineberger, Chair, called the meeting of the Directorate for Mathematics and Physical Sciences Advisory Committee (MPSAC) to order at 8:00am. He highlighted one recent event as forming a central topic for this meeting, the announcement of the American Competitiveness Initiative in the President's State of the Union address and the opportunities that it presented to the NSF program.

State of NSF/MPS and MPSAC Discussion

Dr. Judith Sunley, Acting Assistant Director of the Directorate for Mathematics and Physical Sciences (MPS) reported on the NSF and MPS budget and on staffing changes.

Sunley noted that the FY 2006 budget saw increases for the National Science Foundation (NSF) as a whole of 1-2% over the FY 2005 appropriation. She noted that the overarching priorities in developing the FY 2007 plan and budget were Advancing the Frontier (including grant support), Facility Stewardship, Instrumentation and Cyberinfrastructure, Broadening Participation, and Education and Workforce Development. In addition, international activities had shown large increases and continue to receive emphasis within the Directorate.

With respect to "Advancing the Frontier," Sunley stated that the primary areas of activity were in understanding the nature of energy, space and time, and physics of the universe. Also included within this theme were strengthening core mathematical and statistical sciences, nanoscale technologies, cyberinfrastructure and cyberscience, connecting the complexity of life to underlying molecular processes, and sustainability of the environment and energy supply. She highlighted the request for increased support for grants programs across the MPS divisions. The request included increased support for facility operations of the Large Hadron Collider (LHC), the Gemini Observatories, and the Laser Interferometric Gravitational-wave Observatory (LIGO) in preparation for the Advanced LIGO project. Instrumentation in general, including public-private partnerships in astronomy, saw an increase, as did design and development of potential future projects.

Sunley noted that the current Major Research Equipment and Facilities Construction (MREFC) projects were the Atacama Large Millimeter Array (ALMA), under construction and recently subject to a complete rebaselining exercise, and Advanced LIGO, slated for an FY 2008 budget request. The additional funds needed for ALMA were expected to be the subject of discussion at the National Science Board at its May 2006 meeting. The Advanced Technology Solar Telescope (ATST) had moved into the readiness phase, but was not yet in the budget.

Other projects on the horizon were a Deep Underground Science and Engineering Laboratory (DUSEL) presently undergoing site selection, the Energy Recovery LINAC (ERL) in a design and development phase, and the Large Synoptic Survey Telescope (LSST) and Giant Segmented Mirror Telescope, both of which had received some design and development funding.

Dr. Coppersmith asked about the scale of the various projects. Sunley replied that the budgets estimated for these projects were \$344 million for ALMA, \$180 million for Advanced LIGO, and \$170 million for ATST (with an NSF share of \$140 million). The costs of DUSEL had yet to be determined, but were likely to be in the range of \$300 million to \$500 million. The cost of LSST was estimated to be \$110 million to NSF and it was hoped it would be jointly funded with the Department of Energy. The Giant Segmented Mirror Telescope (GSMT) was in the range of \$500 million to \$800 million and was to be jointly funded as a public-private partnership. It was too early to estimate the costs of an ERL.

Sunley concluded her discussion of the FY 2007 budget request by highlighting the increased funding across the NSF in the broadening participation and education activities, with an emphasis on increasing diversity in the workforce.

Sunley then described the FY 2008 planning activities. These activities were taking place in the context of the ongoing development of a new NSF Strategic Plan, the National Science Board's "2020 Vision" document, the President's American Competitiveness Initiative (ACI), the National Academies "Rising Above the Gathering Storm" report and other community and staff input. The priorities contained in the FY 2007 request were well-aligned with those articulated in the 2020 Vision, in particular the importance of being at the global research frontier, of developing a world-class science and engineering workforce, and of investing in basic research infrastructure.

Sunley then turned to the theme of Transformative Research, noting the questions posed by the NSB's taskforce on this topic and for which input was being sought from MPSAC: What do we mean by Transformative Research? How do we identify it? How do we plan for it? Do investigators submit proposals of this nature to NSF? Within the current NSF program, Small Grants for Exploratory Research (SGERs) were aimed specifically at speculative research and had a budgetary allowance of 5%, although only about 0.5% of the available budget was used.

In the wide-ranging discussion that followed, Dr. Coppersmith stated that Transformative Research (TR) was difficult to identify in advance but one knew it when one saw it! Dr. Fortson wondered whether there might be few applicants for speculative projects because of perceived conservatism within the peer-review process. Dr. Morris Aizenman responded that the SGER awards were created to combat that perception although there had been little incentive to expand upon those awards under the general budget pressure. Dr. Kohn remarked that his experience had been that the NSF funds activities earlier in their development cycle than do many other agencies. Fortson asked what role the CAREER program played in this respect. Sunley replied that in earlier incarnations the 5-year CAREER awards had allowed principal investigators (PIs) to move into new areas of research. Dr. Oxtoby added that one historically successful approach was to move to a new university and take advantage of large seed-funding to develop new activities. Dr. Onuchic suggested that an important factor in improving the success rate of TR proposals under existing programs was in educating the panelists and reviewers who tended to get increasingly conservative when funding was tight. Dr. Huchra suggested that a portion of the budget, say 5%, could be fenced to be allocated separately. Drs. Kettenring and Hughes asked how much research that is deemed to be TR was missed by the existing system and that an analysis of breakthroughs over the last 20 years and how they fared might provide useful data. Regarding the ACI, Dr. Burrows suggested that a doubling of the budget over 10 years was not a particular bold increase, especially considering the effect of inflation. Sunley replied it was a notable step that the OMB guidance for FY07 contained a significant increase for the first time in recent memory.

Sunley concluded her presentation by summarizing changes in staffing within MPS. Dr. Michael S. Turner had returned to the University of Chicago after his term as Assistant Director of MPS. The search for a new Assistant Director was underway. Dr. Tom Weber, the Division Director for the Division of Materials Research (DMR) was now the Director of the Office of International Science and Engineering (OISE). Drs. Lance Howarth and Ulrich Strom were now, respectively, the Acting Division Director (DD) and Acting Executive Officer of the Division of Materials Research; Dr. Peter March, present at the meeting, had just agreed to become the Director of the Division of Mathematical Sciences (DMS), replacing Dr. William Rundell who would be leaving at the end of August 2006. Dr. Luis Echegoyen of Clemson would become Director of the Division of Chemistry (CHE), replacing Dr. Art Ellis who would be leaving at the end of June 2006.

Division of Physics Committee of Visitors Report and Discussion

Dr. Luis Orozco of the University of Maryland gave a report on the Division of Physics (PHY) Committee of Visitors review that he had chaired in January 2006. Dr. Michael Turner, Assistant Director of MPS, had charged the COV to examine the Division's review, recommendations, and processing of proposals over the last three years, to assess the balance of the Division's priorities are balanced, and to address other issues as appropriate. The COV conclusions were that the Division of Physics is functioning extremely well and that staff and management is very good and should receive high marks. The COV was happy with the MPS response. He

noted that the Division has started a program in Biological Physics and Physics at the Frontier. Each of these new programs is developing well and the COV is highly supportive of these programs. He noted that the Physics Frontier Centers (PFCs) are very successful but do not have enough funding to keep pace with growth. The COV is happy with how the program is being administered and competed. PHY has done a marvelous job educating “both sides of the equation” to tell what is meant by NSF Merit Review Criteria 2.

He noted that within PHY the number of women who are Principal Investigators (PIs) and Co-PIs has increased over the last 10 years and has reached the 15% mark. With respect to representation of underrepresented groups, the COV notes that this problem extends throughout the science community. This issue needs to be addressed jointly as a community.

With respect to the Physics Frontier Centers, the COV recommends that these activities do not grow to more than 10% of the budget. It is a little under that now. The COV feels that higher-risk projects should be undertaken at these centers. At present approximately 55% of funds go toward base research support.

With respect to staffing he commented that the COV felt that PHY staff is overloaded with work and that while it is important to have a good balance between rotators and permanent staff it is important to maintain institutional memory.

Dr. Orozco discussed the Rare Symmetry Violating Program (RSVP). A series of complications kept the costs rising, and eventually the project was terminated. The COV recommended that in the future planning for facilities there should be more engineering support in order to obtain realistic project estimates.

In the discussion that followed, Dr. Joseph Dehmer noted, in response to a question, that midsize instrumentation is a critical need for physics. The Major Research Instrumentation (MRI) program provides support for projects costing up to \$2 million and the MRSEC projects start at \$100 million. The Accelerator Physics and Physics Instrumentation (APPI) program was developed as a new program in order to have proposals falling between these limits covered. However, the program has not been started because of flat budgets. Dr. Onuchic asked Dr. Orozco about the current cap on physics centers. Did the COV believe that a cap on centers support be maintained if the PHY budget grows? Dr. Orozco replied that the base program in PHY should be maintained under all circumstances. Dr. Coppersmith noted that the true costs of a facility are more than what is slated for construction, and these costs cannot be allowed to “eat” up what is slated for investigator awards. Dr. Hughes asked if the number of female principal investigators (15%) was the same as the number of women getting doctorates in Physics. Dr. Orozco replied in the affirmative. With respect to underrepresented minorities, they represented less than 4% of the total population and showed to trend to increasing.

The MPSAC unanimously accepted to Committee of Visitors Report for the Division of Physics.

Workshop Report and Discussion: Building Strong Academic Chemistry Departments

Dr. Cynthia Friend of Harvard University and Dr. Kenneth Houk of the University of California, Los Angeles, co-Chairs of the Workshop on Building Strong Academic Chemistry Departments, joined the meeting via teleconference.

Dr. Lineberger introduced the topic by noting that there had been brief presentations on the topic of gender equity a few meetings ago and this had led to the workshop that was being reported today. The development of the workshop was due to the staff work of Dr. Celeste Rohlfsing and others in the Division of Chemistry. While each of the MPS divisions has unique issues in this area, the workshop the Division of Chemistry conducted is a model that might possibly be followed by other MPS disciplines.

Dr. Friend began her report by stating that the workshop had exceeded expectations. A large number of chemistry department chairs had attended and there was a high level of enthusiasm. At the end of the meeting a plan had been developed for follow-up activities, and, while there were many issues specific to chemistry, there were also many issues at the institution level and funding level could be applied broadly to other disciplines.

Dr. Friend described the planning for the workshop and she noted that having important key note speakers attracted people to the workshop. A play by a group from the University of Michigan Center for Research in Learning and Teaching was extremely well received. She noted that 30% of PhDs in chemistry are awarded to women and it is essential to keep them in the field. In conducting education and outreach for the physical sciences MPS should be sure to include activities related to chemistry. The excitement, vitality, and opportunities in chemistry need to be highlighted. In particular, by increasing diversity and promoting change we will attract the best minds to chemistry and allied fields and she noted the importance of this since science and technology are key to national security, it is essential to the U.S. capability to compete in the global marketplace since that competitive edge depends on innovation in science and engineering. Strong leaders at every level are essential – within academia and government.

Action Items that resulted from the workshop:

At the Departmental level, each department is to select two action items for implementation within the next two months. Specifically, goals were to double the percentage of women applicants in the applicant pool in the next year (AY 2005-2006 vs. AY 2006-2007); and establish effective mechanisms for assisting career development of young faculty, especially women. Chairs were to consider personal obligations in academic scheduling and planning such as organizing teaching schedules with family obligations in mind; and develop and implement programs that educate *all* faculty members and students in a department such as organizing and supporting workshops that educate on issues of gender bias and decision-making, gender schemas, *etc.*

At the university institutional level, departmental chairs were to propose gender equity action items to institutional administration. Examples include making diversity an academic priority and developing programs that enhance recruitment and retention of faculty and revising promotion and appointment processes. Institutions should develop policies to facilitate the hiring of women, including facilitating spousal hiring. Universities should assure that mid- and senior-level faculty, especially women, are participating in leadership roles by involving women in key decision-making regarding academic priorities. Institutions should recognize the importance of and advocate for institutional support of child care such as mandating that a specific percentage of building costs be allocated for child care in capitol projects, building child care considerations into hiring packages, and institutionalizing and funding policies for family leave for graduate students and postdoctoral fellows.

With respect to actions at Federal agencies, the workshop proposed that there be mandatory training of reviewers and grantees on diversity issues, that there be modifications of peer review processes, and that agencies ensure there is Title IX compliance. Agencies should create highly visible federal programs at national labs and at large research centers promote gender equity in highly visible programs at national labs and research centers. There should be prestigious awards associated with such activities.

As further follow-up to the workshop, an interactive website was to be created by the Committee on the Advancement of Women Chemists (COACH) to provide on-line resources, there would be follow-up surveys and reports, with a survey in approximately 6 months to evaluate progress, and a follow-up workshop in a year to evaluate progress and chart the next steps to achieve gender equity in chemistry departments.

Dr. Houk presented further details on the workshop – the workshop included 65 chairs out of the top 50 Chemistry departments (note that definition of top chemistry departments varied). It was very important that the three agencies [NSF, Department of Energy (DOE), and the National Institutes of Health (NIH)] were actively involved in the workshop. There was a spirit of consensus at the workshop and a realization that there are structural issues and cultural issues that will be difficult to get around.

In the discussion that followed this report, it was noted that activities occurring within the NSF towards increasing the participation and advancement of women in academic science and engineering careers programs (ADVANCE) came up several times during the workshop and all were complimentary of its activities. Dr. Dalton commented that coordination with institutions is critical. Dr. Witherell thought that it was an excellent idea to have a workshop with department chairs involved; this should be also be done in physics. Dr. Onuchic felt that the report had too many big solutions. He believed it would be better if solutions can be tailored more to

individual universities; by being more flexible he felt that individual universities could implement ideal more quickly. Dr. Hughes commented that a focus on the top 65 schools would not be enough. One had to consider the schools with large departments in middle America and these departments had to become involved. Dr. Friend responded that she agreed that such departments need to be reached and the hopes of the workshop organizers was that by targeting the large, top 65 schools it would have a trickle-down effect that would reach other schools. Reaching out to these other universities is important and should be part of the follow-on activities of the workshop. Dr. Lineberger commented that the workshop committee needs to look seriously at the follow-ons. He thanked Drs. Friend and Houk on behalf of the MPSAC, and commented that they might be called upon in the future for another report. [Note: Information and the report on the workshop is available at <http://www.chem.harvard.edu/groups/friend/GenderEquityWorkshop/index.html>]. The report is also available in Appendix V.

The Division of Astronomical Sciences Senior Review and Discussion

Dr. Roger Blandford of Stanford University, Chair of the Senior Review committee, provided an interim report via telcom. He stated that the Senior Review (SR) committee was providing an interim report as the SR committee was behind schedule and had not finished writing full report. Dr. Blandford summarized the Division of Astronomical Sciences (AST) charge to the committee: The Senior Review committee had been charged to:

- 1) Look at the AST program as the stewards of ground-based astronomy in the US and to comment on the impact and benefit of redistributing funds on the order of \$30M; and
- 2) Look at the funding current AST-supported facilities and examine the possibility of closing down or divesting some facilities in order to invest in other new telescopes and technology.

The SR was examining five facilities: the National Astronomy and Ionosphere Center (NAIC), the Atacama Large Millimeter Array (ALMA), the National Optical Observatories (NOAO), the National Solar Observatory (NSO), the National Radio Astronomy Observatory (NRAO), and the GEMINI Observatories. The SR had held seven town meetings across the country and had received a great deal of feedback from the community. The SR committee had also received advice and feedback by collecting documents and comments via a website. In addition it had received documents from the facilities as to what they have done, what they are doing, and their future plans.

The committee has received much advice and input from the community and was still grappling with the decisions that had to be made. The full report had not yet been completed because there were still several areas that the committee has not yet found a consensus on – the committee would need to meet at least one more time to resolve these issues.

Dr. John Huchra commented that the SR wants to maximize the science impact for the investment AST makes and wants to maintain public access to the observatories. He stated that the SR feels the future AST program should be managed to emphasize their common scientific goals and that the committee realizes the increased international character of AST research and the need for the rebalanced NSF program to reflect this. Approximately 70% of the Division's budget is spent on existing facilities, and many major new facilities have been proposed, with operating costs estimated at about 10% of the construction costs.

Dr. Blandford added that it *not* part of the SR committee's charge to recommend an implementation plan for new facilities, but it was part of the committee's charge to *not* shrink the individual investigator budget and all members of the SR committee were in agreement about this.

Charge to Breakout Sessions

Dr. Sunley stated that the MPSAC members would have lunch with the MPS Divisions in the divisional breakout sessions. There were potential MPS initiatives that were scheduled for discussion during the breakout sessions and the groups may also want to discuss the gender equity report and how to implement this among the other divisions.

12:35pm- Adjourned to Lunch and Breakout Sessions

The MPSAC adjourned for lunch and met with the individual divisional breakout groups.

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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.

Division of Astronomical Sciences (AST): Dr. John Huchra presented the AST report. He commented on the discussion that had taken place with respect to Transformative Research. On the question of definition of 'transformative research', AST could not come up with a clear answer. The AST breakout group also discussed initiatives, and how AST could contribute to such initiatives. On Cyberscience, AST provides tools for young people and for the workforce. On mid-scale instrumentation, there are a plethora of projects that are of importance to AST. On partnerships, AST has much to offer. On massive data sets, AST feels support is critical, and AST is at vanguard producing large data sets. With respect to physics/biology frontiers, AST has little to contribute except in astrobiology or astrochemistry. In summary, AST would like to see support for mid-scale instrumentation, cyber, massive data sets, and education. Issues of diversity and childcare are high on the AST list and one would like to see how the agency can help this issue as people spend a fair bit of time away from home.

Division of Chemistry (CHE): Dr. David Oxtoby presented the CHE report. He described the way programs could support transformative research. There were three ways this could be done – via traditional grants, via Centers, with large groups, working on major subjects, and small grants for exploratory research (SGERs). The emphasis on cyber discovery/cyber science is critical. With respect to mid-scale instrumentation it was noted that a number of important instruments, particularly associated with national facilities are exactly in this program's range. CHE was especially involved in the area of energy and sustainability. Quantum Science is deeply relevant to developing competitiveness and will also advance new materials.

Division of Materials Research (DMR): Dr. Sol Gruner presented the DMR report. He noted that transformative research can be defined as research that changes the world for the better. It is difficult to predict - but use of classical support of grants, and investment in the development of instruments and new technology was likely to lead to such discovery. Other aspects of transformative research can include supporting new people from different disciplines working on common problems could facilitate transformative research. He noted that transformative research is associated with "risk." And Small Grants for Exploratory Research (SGERs) are also another mode to promote transformative research. Dr. Susan Coppersmith noted that cyber discovery is critical to DMR but DMR does is critical to cyber discovery since DMR supports research in areas essential to cyber, such as spintronics, quantum computing, etc. Dr. Venkatesh Narayanamurti noted that there is a real need to invest in instrumentation because industry no longer supported this area. Stochastic research is critical to the area of materials by design. Dr. Coppersmith noted that instruments are viewed as a critical need.

Division of Mathematical Sciences (DMS): Dr. Robert Kohn presented the DMS report. A gender diversity workshop similar to CHE is in advanced planning stages for 2007. An important internal review will happen to evaluate student/postdoc training programs. On transformative research DMS does not have a definition. Besides transformative research/transformative issues, there are transformative programs. Example: A DMS/NIH program is helping create new interdisciplinary partnerships. A DMS/DARPA program is another example. The central concept in these examples was to do transformative work. On initiative: With respect to massive data sets, large data sets are being created. The area of emergent phenomena is one of vast opportunity that integrates all sciences. With respect to cyber, DMS has large role to play.

Division of Physics (PHY): Speaker: Dr. Jose Onuchic presented the PHY report. He noted that there is a good balance between centers, individual investigators. The Physics Frontiers program is an excellent way to integrate large research areas. He noted that MPS can impact biology. The group had a difficult time with the question of transformative research. A major question is how to emphasize the need to take "risk."

Discussion of Innovative/Risky/Transformative Research

Dr. Arthur Ellis, Director of the Division of Chemistry, gave a brief presentation on NSF activities with respect to transformative research. The National Science Board had created a task force to examine the issue of transformative research. He was a liaison to this group. He described MPS viewpoints on support of transformative research. It can be supported through regular grants, and one can make use of creativity-based awards. SGERs are underutilized and most researchers are unaware of SGERs. One cannot really target where transformative research takes place, but in many instances it is a cross-disciplinary activity. The concept of transformative programs might be considered.

Adjournment

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

Friday April 7, 2006

Morning Session

The MPSAC convened at 7:45 A.M.

NSF Strategic Planning

Dr. Sunley noted that NSF has been developing a new strategic plan and introduced Dr. Craig Robinson, who was leading the strategic planning effort. Dr. Robinson noted that the latest draft of the plan was on the NSF web site and that the plan would be available to the MPSAC later in the month. He noted that there was a need to develop a new plan for FY 2006 – 2011 by September 2006 and that this plan required an agency mission and vision, one or more strategic goals, means and strategies for achieving strategic goals, relationships between annual performance goals and strategic goal framework, identification of key factors that could affect achievement of the strategic goals, a description of program evaluations and the process for communicating goals and strategies throughout the agency, and for assigning accountability to managers and staff for goal achievement.

Dr. Robinson presented a history of NSF Goals from 1950 onward and the strategic plan update process. Community input on the draft strategic plan had been sought, more than 200 responses (some from organizations) had been received. The general themes from these responses were the following:

- The nation has a critical need to improve math and science education;
- The nation needs to continue to attract the best and brightest to study and perform research;
- NSF needs to balance support for investigators with the development of world-class research infrastructure;
- NSF needs to continue to coordinate research efforts with other organizations; and
- NSF needs to further enhance consistency and transparency of the merit review process.

He then presented the different aspects of the plan to the MPSAC, and asked the MPSAC Chair to collect any comments that MPSAC might have with respect to the plan and transmit them to him.

Planning for the Physical Sciences and Engineering in Europe

Dr. Patrick Bressler of the European Science Foundation (ESF) described planning for physics and engineering from a European perspective. He noted that Europe has 78 funding agencies in 30 countries and coordination among the various agencies is very complex. He described structure of ESF. It consists of 5 Units & Standing Committees: Physical and Engineering Sciences (PESC), Life, Earth and Environmental Sciences (LESC), Medical sciences (EMRC), Humanities (SCH), and Social Sciences (SCSS). The disciplines within PESC are mathematics, physics, chemistry, information sciences and technology, engineering sciences, and materials sciences and engineering. The budget of the ESF has grown from 350 thousand euros in 1974 to approximately

48 million euros in 2006, with a staff increases of 9 (1974) to approximately 134 (2006). ESF offices are located in Strasbourg and Brussels. He then described various aspects and activities of the ESF and noted that a transition is taking place to a single European-wide funding agency (the European Research Council).

MPS Perspective on Planning Needs for FY 2008 and Beyond; Charge for Breakouts

Dr. Sunley introduced the series of breakout sessions that were to follow concerning planning needs for FY 2008 and beyond. The breakout sessions were to discuss possible MPS initiatives in future budget years and to discuss opportunities for MPS to cooperate in areas important to other directorates. These would be presented to the Director and other Assistant Directors during a retreat aimed at discussing NSF-wide FY 2008 budget initiatives.

Breakouts on Planning Topics/Investment Opportunities

The breakout sessions on possible MPS investment opportunities were organized into four areas: Advancing the Frontier (lead – Dr. Larry Dalton), CyberDiscovery (lead – Dr. Douglas Arnold), Discovery of Partnerships/Education for Innovation (lead – Dr. Lucy Fortson), and Instrumentation (lead – Dr. Mike Witherell). Membership of the breakout groups can be found in Appendix III.

Key Issues from Breakouts

Dr. Dalton reported on the breakout session on “Advancing the Frontier.” In this area, the topic of sustainability and energy security was an area that is a societal crisis and that transformational science is essential. He noted that this topic should also connect to the other areas concerning cyber, education, and instrumentation.

Dr. Arnold reported on the breakout session on cyber discovery. He noted that MPS is a driver for the development and use of cyberinfrastructure and that MPS is an enabler of cyber science and cyber discovery. In the future, important things to watch were advanced materials, higher density materials with photonic bandgaps, quantum computers, and pattern recognition.

Dr. Fortson reported on the breakout session of education for innovation. There are issues associated with need for a literate public, the needs of women and minorities, involving teachers with implementation and making teachers aware of resource, the issues associated with the pipeline and the need to leverage MPS activities into the K-12 arena, and the need to encourage researchers to be teachers as well as researchers.

Dr. Witherell reported on the breakout session on instrumentation. It was especially import to address the need for instrumentation in the \$100K to \$100M gap between the Major Research Instrumentation (MRI) and the Major Research Equipment and Facilities Construction (MREFC) programs. This is important because instrumentation in this range is critical for progress on some of the most compelling questions in the MPS core programs. It was emphasized by this breakout group that addressing this need can only be done within the context of new funding in the MPS divisions, because the needs are very different and can only be addressed by tailoring the mid-scale program to the types of instrumentation that meet those needs. This group advised maintaining a flexible lower limit to awards for mid-scale, again because needs vary so much from community to community.

Meeting with NSF Director Dr. Arden Bement, Jr.

The discussion began with introductions around the table. The Director then reviewed the recent budget related activities, *e.g.*, hearings and ACI. He pointed out that the ACI was a vote of confidence by the President in the role research and education has to play in fostering competitiveness. The NSF addresses 5 of the 9 goals of the ACI, including, among others, tools, K-12, workforce, higher education, and cutting edge research. Dr. Bement then made several comments about future budgets: NSF has to be competitive to take advantage of the ACI, since only a doubling of the sum of three agencies was specified. He noted that the older initiatives have been baselined and NSF is considering new initiatives tied to innovation. He then reviewed the stages in preparation of the budget for FY 2008, beginning with discussing plans with the NSB in May to the publication of the FY 2008 President’s request in February 2007. He then discussed the management of the MREFC process.

Dr. Oxtoby asked about the search for an Assistant Director for MPS. The Director indicated that NSF expected to make an offer in the next few weeks.

Dr. Marcia Rieke asked how can scientists help deliver the potential of the ACI. Dr. Bement said that a broad support of basic research is the best approach; and that the ACI is well accepted but achieving a budget increase is difficult, especially in these times. Scientists can help by communicating the importance of research to competitiveness and by supporting a broad advance, rather than their own interest areas.

Dr. Lineberger mentioned the work that was taking place at this meeting on ideas for the FY 2008 budget request. Dr. Bement said he had received the initial input, but was interested in hearing of the committee's discussions. The key points of the four areas discussed by the AC earlier in the day were described to him.

The Director discussed the AD retreat in April and the strategic planning process that was underway and is due to be completed in time for the OMB budget submission in September. He strongly supported the idea of enhancing support for young faculty. He discussed several aspects of instrumentation and large facilities.

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MPS Planning for FY 2008 and Beyond (continued)

Discussion of the four areas discussed earlier in the morning and with Dr. Bement continued. With respect to the instrumentation area, discussion focused on the origin of the present apparent cap of 28% on instrumentation and facilities within the NSF budget. It was noted that the cap of 28% can be changed by the National Science Board. With respect to cyber, it was noted that massive data sets must be included. Other areas that could be proposed included sustainability and green technologies, sensor technologies, quantum science and engineering, and the interface between life science and MPS.

Dr. Lineberger reminded the AC that the reports from the four breakout groups were due to MPS by April 21.

Response to Theory Workshop Report

The committee discussed the MPS response to the report and recommendations from the Theory workshop. MPS had been strongly supportive of the workshop conclusions. However, it was noted that it is difficult to collect statistical data on students as recommended. Issues raised by this recommendation were better addressed by Division of Science Resource Studies (SRS) within NSF. With regard to the recommendations concerning broadening participation, childcare support is not an allowable cost on grants, but MPS will bring this recommendation to the attention of senior NSF management. Other suggestions made in the report will be supported. Several AC members noted the weak language in the MPS response with respect to diversity and urged strongly enforcing the requirement that there be demonstration of participation by women at all MPS supported workshops. Others noted that insisting on such participation would, in some fields, place a burden on the few women active in research in that area. In any case, the representation of women should reflect the percentage of women in the field.

The discussion turned to the lack of representation of diversity in the Laser Interferometer Gravitational-Wave Observatory (LIGO) movie being prepared by the Office of Legislative Affairs (OLPA) with discussion of whether the film should just have portrayed the history of the development of LIGO, or present the project in the current context, with, for example, the introduction featuring physicists from under-represented minorities. Sunley stated that MPS would take this advice and work to make sure this kind of representation does not happen again.

Summary, Follow-up Activities, Other Business

The Chair noted that MPS AC needs to provide a liaison to the Environmental Research and Education Advisory Committee. Their first meeting is coming up in several weeks, but most important is to provide coverage over the next year. Jon Kettenring volunteered to serve in this capacity.

Elizabeth Simmons reported that a group from the MPS AC had talked to OGC about how to collect data on participation in NSF sponsored programs. General Counsel Larry Rudolph reviewed the allowed legal aspects, practice, and challenges of collecting data noting, for example, that if you rely on self-reporting, it may be more accurate, but is likely to be more incomplete. If you look through names, the results are not as accurate, but one may get full lists. There was some discussion about how to persuade people to self-report. AC members noted that these activities are dependent on state laws and institutional policies and recounted their experiences within their institutional situations.

Concluding Remarks

Dr. Carl Lineberger, Chair of the MPSAC, called attention to the gender equity workshop organized by the Division of Chemistry and its follow through by the Division of Mathematical Sciences. The MPSAC will want to continue to be apprised of this kind of activity in other disciplines.

Dr. Lineberger noted that this was the last meeting for some members, although terms run until October 1, 2006. He thanked the departing members of the MPSAC and noted that his chairmanship ends with this meeting. He noted that it had been a privilege to work with the group. Dr. Sunley expressed her thanks to the departing members, and particularly to Dr. Lineberger.

Members inquired about the process for selecting the next Chair of the MPSAC. Sunley stated that this would wait until the new MPS Assistant Director is in place.

Members were reminded of the meeting schedule, which calls for semi-annual meetings during the 1st Wednesday (for new members), Thursday and Friday in November and the first Thursday and Friday in April. The next meeting will be held November 1-3, 2006.

Adjournment

The meeting adjourned at 2:45 P.M.

Appendices

APPENDIX I

ATTENDEES

MPSAC Members

Douglas Arnold, University of Minnesota
Cynthia Burrows, University of Utah
Claude Canizares, Massachusetts Institute of Technology (absent Friday, April 7)
Susan Coppersmith, University of Wisconsin
Larry Dalton, University of Washington
Luis Echegoyen, Clemson University
Mostafa El-Sayed, Georgia Institute of Technology
Lucy Fortson, Adler Planetarium and University of Chicago
Sol Gruner, Cornell University
John Huchra, Harvard-Smithsonian Center for Astrophysics
Rhonda Hughes, Bryn Mawr College
Jon R. Kettenring, Drew University
Robert Kohn, New York University
W. Carl Lineberger, University of Colorado
Venkatesh Narayanamurti, Harvard University (absent Friday, April 7)
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
Elizabeth Simmons, Michigan State University
Michael Witherell, University of California, Santa Barbara

MPSAC Members Absent

Lars Bildsten, University of California, Santa Barbara
Janet Conrad, Columbia University
Frances Hellman, University of California, Berkeley
Raymond Johnson, University of Maryland
Steve Koonin, British Petroleum, Inc.

MPS Staff

Morris Aizenman, Senior Science Associate, MPS
Adriaan de Graaf, Senior Advisor, MPS
Laura Bautz, Acting Executive Officer, Division of Physics
Henry Blount III, Head, Office of Multidisciplinary Activities
Joseph Dehmer, Director Division of Physics
Arthur Ellis, 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
Lee Magid, Senior Advisor, Division of Chemistry
William Rundell, Director, Division of Mathematical Sciences
Judith Sunley, Executive Officer, MPS
Ulrich Strom, Acting Executive Office, DMR

Visitors

Arden Bement Jr., Director, NSF
Mitchell Waldrop, Office of Legislative Affairs, NSF

APPENDIX II

**MPS Advisory Committee Meeting
April 6, 2006
Divisional Breakout Group Assignments**

Term Ends 09/30/06		AST	PHY	CHE	DMR	DMS	
ABSENT	CONRAD		X				
	ECHEGOYEN			X			
	EL-SAYED			X			
	FORTSON	X					
ABSENT	HELLMAN				X		
	HUCHRA	R					
ABSENT	JOHNSON					X	
	KETTENRING					X	
	LINEBERGER			X			
	NARAYANAMURTI				X		
Term Ends 09/30/07							
ABSENT	BILDSTEN		X				
	COPPERSMITH				X		
	GRUNER				R		
	KOHN					R	
ABSENT	KOONIN		X				
	OSTRIKER	X					
	OXTOBY			R			
	RIEKE	X					
	SIMMONS		X				
Term Ends 09/30/08							
	ARNOLD					X	
	BURROWS			X			
	CANIZARES	X					
	DALTON				X		
	HUGHES					X	
	OLVERA				X		
	ONUCHIC		R				
	WITHERELL		X				

X Absent

X, R MPSAC members attending Divisional Meeting on 04/06/2006

R Breakout CHAIR, MPSAC member who will summarize Divisional meetings activities to MPSAC

APPENDIX III
MPS Advisory Committee Meeting
April 7, 2006
MPS Planning Breakout Group Assignments

		PLANNING GROUPS			
		Frontiers	Instrumentation	CYBER	BP/WF/O
		Room	Room	Room	Room
		1020	1060	1235	1005
Term Ends					
09/30/06					
ABSENT	CONRAD				
	ECHEGOYEN	X			
	EL-SAYED				X
	FORTSON				L
ABSENT	HELLMAN				
	HUCHRA	X			
ABSENT	JOHNSON				
	KETTENRING		X		
	LINEBERGER		X		
	NARAYANAMURT I		X		
Term Ends					
09/30/07					
ABSENT	BILDSTEN				
	COPPERSMITH	X			
	GRUNER			X	
	KOHN	X			
ABSENT	KOONIN				
	OSTRIKER			X	
	OXTOBY			X	
	RIEKE		X		
	SIMMONS				X
Term Ends					
09/30/08					
	ARNOLD			L	
	BURROWS	X			
ABSENT	CANIZARES				
	DALTON	L			
	HUGHES				X
	OLVERA				X
	ONUCHIC			X	

	WITHERELL		L		
L = Lead					

**APPENDIX IV
Gender Equity Workshop Report**



Adobe Acrobat
Document

**APPENDIX V
MPSAC Working Groups**

CyberScience and CyberInfrastructure Working Group

Lucy Fortson
Jon Kettenring (Lead)
Jose Onuchic
Eve Ostriker

Data on Gender and Diversity Working Group

Douglas Arnold
Elizabeth Simmons
Michael Witherell

Diversity Working Group

Dr. Luis Echegoyen (Lead)
Monica Olvera de la Cruz
Larry Dalton
Venkatesh Narayanmurti

Education and Human Resources MPSAC Working Group

Larry Dalton
Lucy Fortson
Rhonda Hughes
John Kettenring
David Oxtoby

Strategic Plan Working Group

Sol Gruner
Mostafa El-Sayed
John Huchra
Carl Lineberger
Jose Onuchic

APPENDIX VI



University of Colorado at Boulder

W. Carl Lineberger
Department of Chemistry and Biochemistry
JILA

440 UCB

September 18, 2006

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email:WCL@JILA.Colorado.edu

Dr. Judith S. Sunley, Acting Assistant Director
Directorate for Mathematical and Physical Sciences
National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230

Dear Dr. Sunley:

I have reviewed the final version of the minutes of the Directorate for Mathematical and Physical Sciences Advisory Committee meeting that was held on April 6-7, 2006 (attached), and am pleased to certify the accuracy of these minutes. I especially appreciate the efforts of Morris Aizenman, both in preparing this record, and in incorporating those changes suggested after my review of the draft minutes.

With best wishes,

A handwritten signature in cursive script that reads "W. Carl Lineberger". The signature is written in black ink and is positioned above a thin vertical red line.

W. Carl Lineberger
Chair, MPS Advisory Committee