

Minutes
MPS Advisory Committee Meeting
November 5-6, 2009
National Science Foundation

Thursday, November 5, 2009

Morning Session

Welcome and Introductions

Dr. Iain Johnstone (Stanford University), Chair of the Mathematical and Physical Sciences Advisory Committee (MPSAC) opened the meeting at 8:40. He welcomed new and returning members (Dr. David Keyes participated in the meeting via teleconference and Dr. Tinsley Oden of the University of Texas was present as a guest) and commented that the purpose of this meeting of the MPSAC was to provide advice to the MPS Directorate on possible future research directions it might consider. The agenda had been developed by Ed Seidel, Iain himself, and Morris Aizenman. He complimented Dr. H. Edward (Ed) Seidel, the Acting Assistant Director, on coming up to speed so rapidly in the new position he had assumed. He reviewed the meeting agenda and noted specifically that a significant amount of time was to be devoted to how the MPSAC and NSF could work together.

Remarks by MPS Assistant Director

Seidel began his presentation with several slides showing photographs of members who had just left the MPSAC, continuing members, and members who had just joined the committee. As this was his first meeting with the MPSAC in his role as Acting Assistant Director, he provided some background on himself. His scientific activities have involved computational studies of colliding black holes and colliding neutron stars.

He provided a retrospective on the FY 2009 budget. The total NSF budget was \$9.5B in FY 2009, and this consisted of \$6.5B in FY 2009 Omnibus Appropriations and \$3.02B in FY 2009 American Recovery and Reinvestment Act (ARRA). Within this budget, MPS had \$1.75B, with \$1.26B in FY 2009 Omnibus Appropriations and \$0.49B in FY 2009 ARRA funding. The \$3.02B in ARRA funding provided by Congress consisted of \$2.5B for Research and Related Activities, \$100M for Education and Human Resources (including Professional Science Masters Program), \$400M for the MREFC account. The focus of the ARRA funding was aimed at restoring the funding rate for NSF awards to 32%. The remaining \$0.5B in ARRA support consisted of \$300M for MRI of which \$200M was to be awarded in FY 2010 and \$200M was for Academic Research Infrastructure awards, which were also to be awarded in FY 2010

MPS received \$490M in ARRA funding. The MPS priorities were to increase the funding rate for proposals; support high-risk/high reward proposals, new PIs (including both CAREER and GRF programs), energy and climate research; and support ongoing operations at MPS facilities. The effect on the funding rate was to change the funding rate from 39% in FY 2000 to 40% in FY 2009. CAREER awards increased from 90 in FY 2000 to 196 in FY 2009, while SGER/EAGER awards went from 15 in FY 2000 to 55 in FY 2009.

Seidel then described the distribution of FY 2009 funds within MPS and showed a number of charts showing the distribution of funds over the past several years with respect to the different Directorates within NSF.

He then turned to the status of the FY 2011 budget. He could not comment on what was within the FY 2011 budget request as this was embargoed. NSF had submitted its budget request to the Office of Management and Budget (OMB) in mid-September, and a passback from OMB was expected at the end of November. The budget was expected to be submitted to the Congress in February 2010 at which time details would become public. He noted that as the FY 2011 budget request was already in the pipeline, the work of the MPSAC at its current meeting and the meeting in April would have real impact in 2012 and beyond. Detailed impacts of the FY 2009 budget on the MPS Divisions would be covered within the afternoon breakout sessions.

Seidel then described the current situation with respect to recruitment of senior personnel within MPS. These included the Status of Search for MPS Assistant Director, the status of the search for the Division of Astronomical Sciences Division Director, the status of recruitment for the Division of Chemistry, Division of Mathematical Sciences, and Division of Materials Research Division Directors, and the status of search for the Division of Astronomical Sciences and Division of Materials Research Deputy Division Directors.

Seidel then provided an update to the status of facilities within MPS. The Advanced Technology Solar Telescope (ATST) had been approved by the NSB for construction. However, a NEPA/NHPA Record of Decision was still pending. \$146M had been provided through ARRA funding. DUSEL has been approved to the stage of a preliminary design review, and the NSB has called for an NRC study to inform NSF on a post-PDR decision. Active coordination with DOE is underway. A DMR strategic plan for coherent light source development is being formulated and discussions on this with the Department of Energy (DOE) are beginning. The MPS facilities and the Office of Cyberinfrastructure have begun discussions and there is also an NSB portfolio review that will begin in May 2010. It is likely that MPS will need to involve MPS AC Facilities Subcommittee over next six months

Major facilities challenges include the fact that costs are approaching O(\$1B) for new projects and there is a need for accurate costs estimates and control. There is also the question of balance between the core programs and the management and operation costs of facilities.

Seidel concluded his presentation with comments on the challenges and opportunities facing MPS. These include supporting the breadth of MPS's portfolio, growing MPS activities in face of rapidly changing science culture, methodology, funding climate, broadening participation, promoting science highlights effectively, interagency roles and collaboration, and international competition/collaboration.

At the conclusion of the presentation Dr. Ramesh Narayan (Harvard University) inquired about the status of the search for the new Assistant Director. Seidel said that a committee had been formed, headed by Mike Witherell of the University of California, Santa Cruz and that names were being collected. This set of names would be sent to the Director, who would choose people to bring in for an interview. The Director would then make a selection. To date names have been collected, but no interviews had taken place. Iain Johnstone noted that this would be a good question for the meeting with the Director.

New Concepts for the MPSAC

Johnstone presented the following potential new concepts for the MPSAC that he wished the MPSAC to discuss during the meeting. These included that the general goal is for MPSAC to be more engaged in helping MPS plan strategically, to discuss emerging trends in science, to provide observations on opportunities, to have subgroups of the MPSAC connect to MPS working groups, and to plan for future meetings.

Seidel then commented on what he saw as emerging trends in science. While fundamental science remained the primary core value and the top priority for MPS, there were also other trends, opportunities for collaboration, and grand challenges. He noted several trends that were taking place. Science is becoming more compute and data intensive and this is taking place on exponential growth curves. Science is changing and so should MPS. He expected the budget to grow, and that within five or six years the funding climate for science will be different. A number of reports were appearing on particular topics such as energy and sustainability. He felt that MPS is well aligned with respect to economic recovery, energy and climate, the life sciences interface, and security. He felt that MPS is also relevant to four cross-cutting themes: the efficiency of Research and Development system, strengthening STEM education, improvement of information technology (IT) infrastructure important to science, and capabilities in space. NSF and science will look different in a few years. The Directorate for Geophysical Sciences (GEO) had just produced a strategic plan, and he thought that MPS should consider producing white papers on areas where it should consider investing in the future.

Johnstone noted that the Advisory Committee for GEO had created a subcommittee that produced their strategic plan.. Keyes pointed out how science already looks different from past 10 years, in that experimental facilities costs are causing simulation to become more important in generating results. NSF has done well in the area of cyber for engineering design. Glotzer commented that NSF can make a difference in computational science and

engineering. She led a WTEC study on preparedness of the next generation and found it inadequate. Narayan expressed a concern that the MPSAC was acting like a rubber stamp, even though they are asked to contribute. He also asked if the AC should wait until a new AD is appointed. DeSimone commented that the roles of companies and universities are changing, so that a research and development (R&D) vision is critical. R&D dovetails with innovation and diverse teams are key. Both Seidel and Echegoyen pointed out that the Division of Chemistry (CHE) has had workshops on shortening the pipeline from basic research to innovation. She asked if NSF has thought about mechanisms for improving this situation rather than leaving it as an *ad hoc* process. Seidel commented out that there is an opportunity for MPSAC to meet with other advisory committees, and that NSF Assistant Directors meet weekly as a horizontal communication channel. Coupling this with vertical working groups could be such a mechanism. Bortoletto commented that there is more unity in subject disciplines in other NSF directorates, *e.g.* GEO, whereas there is more diversity in MPS. There are many common aspects such as cyber, but there are also many challenges that are unique to the many fields represented. Seidel noted that this was a challenge for MPS. He gave climate as an example where the MPS divisions provide support for fundamental research important to this area.

Roberts commented that the Office of International Science and Engineering Advisory Committee (OISEAC) always had at least one Assistant Director from other another areas of NSF attend their meetings to exchange information. Leszczynski wondered if we should partner with the European Union. Interchanges with other countries could be beneficial. Is NSF doing anything? Seidel commented that the Office of Cyber Infrastructure (OCI) was looking for ways to collaborate in cyber to coordinate and facilitate these activities. He felt that the MPSAC could be very influential in suggesting future areas for MPS, and he would welcome efforts by the MPSAC and recommendations from this committee. Abruna commented that NSF should have a bigger footprint on energy and better relationship with the Department of Energy (DOE) and that joint solicitations would have a strong effect. DeSimone added that the same applies to the National Institutes of Health (NIH) in areas such as nano, centers, *etc.* and that NIH looks attractive physical scientists. Orozco added that looking to the future is important, but that we must consider what NSF does best. NSF must build on its strengths. Seidel said discovery was NSF's and MPS's great strength and one needs to energize the core strengths, targeted initiatives, and the development of facilities needed to revolutionize basic sciences. Johnstone noted that at its last meeting the MPSAC had heard from Jean Cottam of the Office of Science and Technology Policy (OSTP), who emphasized that basic science needed to define its unique role in areas such as energy.

The discussion turned to other topics. Tohline commented on the major facilities and wanted to understand what the activity the National Science Board (NSB) was undertaking involved. He felt that NSF was not in a leadership role in this area because it was not nimble and because of the scale of costs. Seidel commented that projects have indeed become much larger than in the past and the NSB is trying to go beyond first-in-first-out practice, but was grappling with how to handle this. He mentioned a recent Branscomb article on the Jeffersonian Approach to Innovation, which promotes casting a broad net, but this also needs balance. Johnstone pointed out the need for fleshing out the relationship between basic research and needs of society.

Seidel then posed the question of how MPS can move forward in addressing these issues. He noted that there are working groups within MPS in areas where MPS would like input from the MPSAC. Also, should a working group on fundamental science across MPS be considered? These working groups would be used for the next six months and then their effectiveness would be assessed. At the April MPSAC meeting, MPS would ask for preliminary recommendations from these working grounds. These groups could also look at activities from other agencies. Radical ideas are encouraged. The white papers that would be generated will be used in planning for the MPS FY2012 budget strategy.

During the discussion that followed there was a suggestion to forming a working group on 'applying science and technology to the economic recovery.' Another suggestion was that the working groups on energy and climate should be considered.

The discussion turned to efforts at broadening participation. Kathleen McCloud commented that broadening participation speaks to development of people and increasing diversity. The MPS Broadening Participation Working Group plans to serve as a clearinghouse for ideas and formulates suggestions to push Foundation goals on broadening participation. It will be important to make meaningful connections to the social sciences. Diversity is more than consideration of race, gender and disability. Talking to other disciplines outside MPS

will be important. It was suggested that Foundation-wide information be gathered and examined for best practices. The Director of the Division of Materials Research, Zakya Kafafi, said that at a recent Materials Research Science & Engineering Center director's meeting focused on diversity, that NSF should explore K-12 success stories, and that broadening participation should include non-research universities and 2- year colleges. Concern was expressed that little implementation or effort is often put behind recommendations for broadening participation. Recommendations should be made concrete.

The Director of the Division of Chemistry (CHE), Luis Echegoyen stated that CHE had conducted 3 workshops on broadening participation and was currently working on implementation.

Suzanne Hawley commented that the University of Washington has found that early exposure to research and the formation of a cohort is a key to broadening participation at the undergraduate level. However, the challenge has been to find extramural funding for non-research activities. It was suggested that NSF consider funding more of these activities. Concern was raised that the science community will object if NSF begins to fund activities without intellectual merit.

Life Sciences Working Group

Mary Ann Horn presented the findings from the MPS-Life Sciences Working Group. The focus of this working group was on the interface of these disciplines. NSF has begun to see proposals at this interface and they often review poorly. There are training issues at the interface of these disciplines. She noted that truly collaborative work requires researchers to understand the language of the other discipline. Transitioning from disciplinary research to interdisciplinary collaborations typically requires a significant time commitment for faculty. Also, interdisciplinary training at the student and postdoctoral levels requires support and commitment from all disciplines involved

There are also organizational challenges at the interface of the disciplines. Innovative and transformative research at the interface is often difficult to recognize at an early stage, and there is a clear need for collaborative research to address scientific questions ranging from scales of environment and ecology down to genetic level. She commented that NSF is currently behind the curve compared to the research community. Proposal pressure and the increasing need for co-review demonstrate this problem.

Horn concluded her presentation by pointing out the need for a coherent effort between MPS and BIO. It is critical to find ways to provide opportunities for researchers to learn each other's language, to understand the key questions and challenges in each other's field, and to transform the way research is done at the interface. In addition, it is vital to adapt as we seek to fund the most innovative research that advances synergistic developments which will ultimately open new avenues of exploration in the disciplinary fields. She emphasized that disciplinary review panels struggle with review of proposals tackling challenges at the interface

Scientific 'silos' often hinder collaboration. Moreover, it is difficult to recognize transformative science at the interface. A more coordinated effort is needed between the Division of Molecular & Cellular Biology in the BIO Directorate and MPS. At present co-review is essentially *ad hoc*.

Presentation by Dr. Tinsley Oden, University of Texas

Dr. Tinsley Oden of the University of Texas spoke about the place of computational science and engineering (CS&E) in the contemporary scientific and technological environment. In his view the science and engineering community is now at a "historical moment" at which CS&E will play a profound and catalytic role in the breaking down of boundaries between the traditional scientific and engineering communities and lead to much more effective interdisciplinary research. He was careful to make a clear distinction between interdisciplinary research, in which all players possess, or are willing to learn, the tools of many traditional disciplines, and multidisciplinary research, in which each participant brings to bear on a problem only the skills and knowledge peculiar to his/her own nominal field. He argued that CS&E complements observational science through its capacity to control complicated experiments, to dissect and analyze massive data sets, and, through modeling and simulation, to extend investigations well beyond the range accessible to direct observation. Applications of CS&E extend over the full range of scientific endeavor from the behavior of biological systems, to the design of

new materials and pharmaceuticals, and to larger scale problems in geologic, atmospheric, and interstellar science.

Citing the inherent conservatism of the academy that resists erasing the distinctions between the traditional disciplines, he urged the NSF to lead the way to removing these distinctions through its support of CS&E as a foundation-wide activity that would span all the existing Directorates. Indeed, he said that the universities were incapable of such change on their own but would readily follow the lead of the NSF. He endorsed plans described to the MPSAC for discussions at the workgroup/taskforce level to plan for the implementation of a broadly based CS&E home at NSF. He argued explicitly against the creation of an academic discipline called CS&E for fear that it would become as parochial as its traditional academic siblings. The proposed NSF CS&E structure was described as providing for continuity of support for CS&E activities in contrast to many prior NSF initiatives that burned out quickly for lack of follow through after an initial round of solicitations.

Following the presentation, several members of the MPSAC noted the importance of verification and validation of computational results and the general failure of university science programs to teach these precepts to their students; engineering programs were cited as doing a better job here. Another issue raised was the current absence of an appropriate medium for publication and archiving of computational results. MPSAC members urged attention to these matters in academic departments other than Computer Science and Engineering Departments, where the focus is on different issues. Commonality of interests in CS&E between NSF and other federal funding agencies was also described.

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 long-range planning issues and FY 2012 budget ideas.

Thursday, April 5, 2009

Afternoon Session

Reports from Divisional Breakout Groups

The MPSAC reconvened in plenary session at 3:30 PM.

Division of Astronomical Sciences (AST)

Dr. Joel Tohline reported on the breakout session for AST. The MPSAC members wished to express their appreciation to the AST division staff for their great service to the community, especially given the shortage of four staff members in FY 2009. He also expressed appreciation to Seidel for engaging with the division, especially in trying to resolve some leadership/staffing needs. He pointed out the additional funds from ARRA have been used to make more awards, to fund more young people, and to make more CAREER awards. He commented that the community has indeed benefited from the ARRA funding that was awarded through the MREFC to cover a major fraction of the construction costs for ATST. He also expressed support considering the concept of transferring ATST project responsibilities out of MPS into GEO.

Tohline discussed the state of AST's investment in various major multi-user research facilities. A number of special remarks were made. The Atacama Large Millimeter Array (ALMA) has been progressing very well, and the first call for scientific proposals is likely to be issued in early 2011 in preparation for the first acquisition of scientific data in 2012. This was felt to be very exciting.

Tohline pointed out that there have been a variety of cooperative agreements recently, and that the AST staff has been investing a great deal of time negotiating these agreements. MPS leadership should pay attention to the additional costs (in staff time as well as dollars) that attends such negotiations. He pointed out that the National Science Board (NSB) is now expecting all cooperative agreements to be renegotiated more frequently, and this will impact MPS as a whole.

He then discussed the upcoming Astro2010 decadal review, and indicated that the timing of the review could be awkward. The committee recommendation is not expected to be ready until the summer of 2010, and this means that the Astro2010 report will not be available to guide decisions that influence the structure of NSF's FY2012 proposed budget. He urged the MPS Directorate leadership to be aware of the considerations that are being discussed by the decadal review team so that the NSF can be poised to take advantage of the Astro2010 recommendations in a timely manner.

Tohline summarized the discussion on AST's contribution on "New Concepts for the MPSAC." Three areas within which AST is felt to fit well have been identified. They are: computational science and computational infrastructure, climate change, and broadening diversity.

In addition, Tohline suggested the formation of a focus-area subgroup that addresses "Applying Science & Technology to Further Economic Recovery." This was felt to be an area that the AST could make a particularly significant contribution, given its connection with *Management of the Electromagnetic Spectrum*.

Division of Physics (PHY)

Eric Cornell, who was unable to attend the meeting, reported on the breakout session for PHY by telephone. He stressed the importance of support for basic research by NSF. His presentation started with some hypothetical stories: an advisory committee at NIH decides not to talk about curing diseases because it will not fly with the Office of Management and Budget (OMB); The Department of Energy (DOE) does not discuss clean sources of energy because the Office of Science and Technology Policy (OSTP) does not want to hear that; and NSF does not want to talk about individual grants to university professors on basic research because it is not fashionable. Cornell argued the importance of investigator-driven research, and pointed out the opportunity to promote basic research with the new president who really understands its value. Cornell called for fewer initiatives, less focused working groups, and more emphasis on discoveries, uncharted territories and the like. He pointed out the importance of being radical, and acknowledged that university professors and NSF panels can be conservative. Therefore, the tasks of picking and funding such basic research can fall onto the shoulders of NSF program directors who override the panel once a while. This requires time and money. Cornell suggested that the time could be found by reducing the time spent writing solicitations for new initiatives, and the money can come from those initiative programs.

Seidel expressed appreciation for sharing those thoughts. He agreed with the importance of promoting fundamental research, but added that this does not mean that we do not support other research, many of those demonstrating the reason why fundamental research enables these other areas of research.

Johnstone asked Cornell if the following analogous question could be the summary of his speech: Suppose one has 100 eggs, would you advise him to put them all in one basket, or would you advise him to put 90 eggs in one basket and 10 in another? Cornell responded that he is not arguing about 100 and 0, but he wanted to make sure that, if NSF doubles its funding, it should not be done by doubling the number of working groups and leave behind the fundamental research which is really the strength and mark of NSF.

Division of Chemistry (CHE)

Dr. Héctor D. Abruña reported on the breakout session for CHE. The breakout started with the usual statistics on numbers of proposals, awards, *etc.* Abruña then discussed the division realignment that was done to match the way the disciplines are described to what people actually do.

He reported on the need for additional staff for CHE, pointing out that the 25% increase in proposals in recent years (from 1300 to 1700), has not been matched by an increase in staff members in CHE.

The breakout group discussed how proposals should be reviewed. Abruña described two models: the *ad hoc* model where you try to identify the best people who can review in a particular subject area and then get their opinions, and the NIH model of going into panels. The pros and cons of each of these models were discussed.

Abruña then turned to discussing how to increase the budget. It is useful to come up with topics such as water, energy and health that make sense to the general public. Questions were raised as how to make such topics more closely associated with CHE, and what can CHE can bring to these areas. As an example, even if DOE has its name in energy, CHM can provide things that DOE is unable to do, such as bringing people from different areas to address a particular question.

Finally, Abruña raised an idea of creating a new directorate within NSF that addresses topics in “molecular science.” This would create an umbrella that would encompass contributions from numerous fields including chemistry, condensed matter physics, polymer science, chemical engineering, biological sciences and others. Seidel responded that this idea came up before and it is beginning to percolate. He asked if it has been discussed with units outside MPS. Echegoyen indicated that it has been discussed with a division within BIO (MCB), a division that has significant co-funding with CHE. Seidel said that in a large organization such as NSF there are often many barriers for such reorganization efforts unless people think this is scientifically very compelling.

Abruña discussed the idea, (proposed by Joseph DeSimone), of connecting NSF to venture capital. These often have very different visions from NSF. DeSimone agreed that such involvement could have major impacts on aspects such as the peer review system. He felt this could have transformative impacts and change the way we live. Seidel agreed it is an interesting idea that deserves some thought. Tohline commented on an overlapping idea with AST, pointing out the success of astronomy community in obtaining private donations to push for large facilities that NSF couldn't fund.

Division of Materials Research (DMR)

Dr. Elsa Reichmanis reported on the breakout session for DMR. The session began with an overview of the division. One particular aspect of DMR is its interdisciplinary nature. Reichmanis singled out two specific areas, climate change and energy. While both areas require research that involves all of the MPS divisions, DMR is the core discipline on the role that materials play in dealing with both areas.

An issue that arose during the breakout session was is how to increase the funding base for DMR. This base has been essentially flat recently. One issue surrounding this is the challenges of supporting public facilities for which DMR is a steward but for which very little support comes from other divisions or government organizations. It is therefore important to form partnership mechanisms with other divisions and agencies to deal with such challenges.

Reichmanis then discussed a number of questions that came up during the breakout session:

1. Is DMR's current program alignment such that it can quickly respond to developing new trends in scientific research? The feeling was that DMR is uniquely positioned to address grand challenges in MPS. She pointed out some successful instrumental developments in new programs, *e.g.* the Biomaterial Program, started in 2006, is now the largest program within DMR.
2. Are there new trends in DMR that need to be addressed and is the current structure within DMR suitable to allow this? The answer is yes. She noted that there are clear trends in computational science that need to be addressed, particularly in the area of materials by design where DMR could take the lead.
3. How can DMR and MPS better respond, in a timely manner, to important issues that are critical to the nation? The feeling was that DMR needs to be very nimble in order to be able to do high risk research. It needs to partner with other divisions and engage in communications with communities through workshops and other mechanism in order to be able to do this.
4. Is the Solar initiative adding value to research funded by other agencies? The answer is yes. Reichmanis pointed out that the partnership between CHE, DMR, and DMS is something that DOE is unable to do at the time. But MPS has to think carefully about this activity in order to be sure it is not contrived in order to gain support for the program. MPS must make sure it adds value, and one area where NSF clearly adds value is in training, education, and broad participation.

5. The breakout group was also asked whether DMR should encourage new collaborations with DOE, national laboratories, and academia. The breakout group encourages NSF to identify programs where NSF can be the leader. Partnering with DOE is a good way to establish the leadership of NFS. Materials are one example, computational sciences and technology is another.

6: Given the global implication of energy and climate issues, what involvement in international institutes and networks should DMR have? It was felt to be an excellent question that can be best answered by bringing the community together and asking them to address the question.

7. Should DMR consider and lead an initiative in sustainable infrastructure science? The feeling was that there should be an initiative in this area and there should be a long-term strategic vision in the area.

8: How should DMR better accommodate single investigator proposals for instruments whose costs are of the order of \$100,000? Currently, there is a significant gap in the support of proposals between \$60,000 and \$500,000. DMR should investigate mechanisms to deal with this problem.

Some discussion on program reorganization took place. Seidel asked whether DMR could benefit from a program realignment similar to what CHE had done. Abruña said that one motivation for CHE doing the realignment was to deal with the problem of proposals falling into cracks between fields. It was felt that more data on this is needed before DMR decided whether such an action was needed. It was also pointed out that CHE had discussions with the broader community to address the issues such as how chemistry could be better taught. This is an issue that DMR could address as well. Echegoyen briefly explained the process of how CHE accomplished the realignment of its programs. Kafafi commented on some reorganization efforts that took place within DMR, including the creation of two very successful new programs in recent years, and the ongoing study by the National Academy of Engineering and National Academy of Science to look into new opportunities in ceramic, polymers, and other materials.

Division of Mathematical Sciences (DMS)

Dr. Jim Berger discussed the DMS breakout session. DMS has three major themes:

- Discovery - DMS supports research that leads to fundamental discoveries in mathematics and statistics;
- Connections - connections between mathematical sciences and other fields are not only important for those fields, but also lead to interesting new mathematics and statistics that are driven by interaction with those other fields; and
- Community - we are a community of students and professionals that form our workforces.

He reported on results from the ARRA funding in FY 2009 and quoted an observation from Peter March that, despite additional ARRA funding, there remained too many “heartbreakingly good” proposals that were unfunded last year. Berger showed some specific numbers from the ARRA awards. Over 50% of ARRA awards went to new principal investigators (PIs). Postdoctoral fellowships were doubled. In addition, 45 additional postdocs were supported by DMS through the DMS-supported mathematical institutes. There were 783 applications for these 45 postdoctoral positions with 359 being from US citizens or permanent residents. In addition, DMS tripled the number of Graduate Research Fellows in mathematics and statistics.

Berger discussed some of the activities within DMS. These include the ongoing Mathematics Institute competition (10% of DMS budget), the SOLAR initiative, the Cyber-enabled Discovery and Innovation (CDI) competition in which DMS invested in 18 out of the 55-60 awards (the exact number is still to be determined), and the DMS/DTRA joint program on Threat Detection with the Department of Defense. Berger noted that some joint programs require at least one PI from mathematics, and at least one PI from the other discipline.

Berger commented on the need to restate the case for basic research, and how to best sell the importance of basic research to the world. A phrase from NIH “Curiosity creates cures” was felt to be a good slogan. He reported on a newly proposed DMS initiative “Research Network Program” that aims to fund a network of researchers in different institutions to work on a joint project. This was felt to be very timely, given the positive response from a workshop held on April 9-10, 2009. He also discussed the need for international connections. Then he

reported on some highlights. A specific example, nicknamed “From Poincaré to Polyyps,” was a recent application of Perelman’s work on the Poincaré conjecture to medical images.

Berger mentioned the upcoming Committee of Visitors (COV) external review for DMS. This review takes place once every three years. He also reported on the review process for the Mathematics Institutes program which is underway. An AAAS fellow, Katherine Socha, has been appointed to assist with the review process. Berger noted that DMS is recruiting for a new division director, as Peter March, the current Division Director, will be completing his term in September 2010.

He also reported on some upcoming events. DMS is working with the National Nuclear Security Agency (NNSA) on uncertainty quantification. A workshop “Towards the Science of Sustainability” is being planned for November 30 -Dec 2, 2009. The topic of climate research has already being discussed frequently at various mathematical institutes and an upcoming new report “Mathematics 2025” is expected to discuss the role of mathematics in science and society.

Presentation by Jeff Nesbit, Director, Office of Legislative and Public Affairs (OLPA)

Jeff Nesbit, Director of the Office of Legislative and Public Affairs (OLPA) gave a presentation of current activities within that office. His presentation focused on the activities of OLPA with media and communications and the theme throughout his presentation was on the changing media landscape. He noted that there is a need for the scientific community to communicate its results directly to the public. The New York Times is now the only national newspaper that devoted coverage to science.

The presentation consists of two parts: PARTNERSHIPS and TRANSPARENCY

OLPA underwrites programs that are presented on the Public Broadcast System (PBS) and is underwriting a new science section in US News and World Report by providing support for a science editor. In the upper right-hand side of this science page there is a section where NSF publishes three stories. This science page often provides links to videos and pod-casts supplied to the public by NSF. He noted that in January 2009 Cable Network News (CNN) no longer supported its science editors, and these editors are now producing weekly videos for NSF. The editor is free to select whatever he wishes in the main section of the page but he often places NSF-released material there. This differs from the upper-right-hand section that contains NSF material and is identified as such. He commented that this is not a traditional business model, but the fact is that while science news is widely popular, there are no advertisers to support it. He also noted that NSF is partnering with NBC to support the science of the winter Olympics.

Neal asked whether OLPA had considered an analog to Book TV. He responded that OLPA is looking for ways to broaden the reach of science news and to reach a mass audience. NSF is seeking to partner with NASCAR and this involves taking risks. This is an experiment in which the external partners retain editorial control. Another project is Live Science, a web-based news service. Behind-the-scenes stories are very popular; addressing the feeling of what it is like to do research. Discover magazine has NSF as a partner and Nesbit noted that many magazines are now closing down.

NSF has found that if you take media to the where the science is being done, they will cover it, an example was Anne Curryu of NBC and her coverage of Antarctica. Science Nation weekly is available to all PBS stations, and OLPA is creating the Research Channel, a consortium with the participation of 150 universities. This will reach approximately 40 million homes. Another project is building a library of science and engineering profiles for the classroom. These should help make the point that science is cool. To date, twelve have been funded by OLPA and the Engineering Directorate will support the next series of profiles.

In the question period that followed Nesbit’s presentation, Seidel asked how MPS might work with OLPA to identify areas of interest to the public. Nesbit responded that one should not be afraid of trying anything, and OLPA would like MPS to come talk with them. Roberts asked how OLPA selected the topics to work on and to highlight. In particular how does OLPA highlight basic research so that it appeals to a wide audience? Nesbit responded that OLPA has a team that rewrites scientific highlights and puts them into layman’s language. Aizenman commented that NSF asks every Program Director to provide examples of research accomplishments

within their programs and state why the accomplishments are important. In the near future NSF would be launching a web site where these research accomplishments would be made available to the public.

Neal asked whether OLPA was planning or doing anything along the lines of CSPAN book TV and Nesbit replied that OLPA will try both short form (3 minute) and long form (45-60 minute) versions of a story. One can make both available for viewers to choose according to their interest. Aizenman asked how one conveys the excitement of science and Nesbit responded that it is essentially a content management system. One has to make content accessible to the public, so that they can see the adventure, wonder and beauty of science. He cited the example of the Hubble Space Telescope.

Adjournment

The meeting was adjourned at 5:45 P.M.

Friday, April 3, 2009
Morning Session

The MPSAC convened at 8:30 A.M.

Report from CEOSE

Dr. Theresa Maldonado was unable to attend the meeting and so her presentation was canceled.

Report on Meeting of Advisory Committee for GPRA Performance Assessment

Dr. Joel Tohline, the MPSAC representative to the Advisory Committee for GPRA Performance Assessment (ACGPA) reported on the ACGPA meeting that took place in June 2009. He began by noting that the purpose of the Government Performance Results Act (GPRA) of 1993 was:

- To improve the confidence of the American people by systematically holding Federal agencies accountable for achieving program results;
- To initiate program performance reform;
- To improve Federal program effectiveness and public accountability by promoting a new focus on results, service quality, and customer satisfaction;
- To help Federal managers improve service delivery, by providing them with information about program results and service quality;
- To improve congressional decision-making by providing information on the relative effectiveness ... of Federal programs and spending; and
- To improve internal management of the Federal Government.

He commented that the Advisory Committee for GPRA Performance Assessment was established in June 2002 to provide advice and recommendations to the NSF Director regarding the Foundation's performance under the GPRA. The committee meets annually to assess the NSF's overall performance according to the strategic outcome goals in the current NSF Strategic Plan (FY 2006-2011). The committee is comprised of (~ 20) representatives from academia, industry, and government research organizations. The current Chair is David Spencer, Chairman & Technical Officer, wTe Corporation, Bedford, MA and the Vice Chair is Sharon Dawes, Center for Technology in Government (CTG), SUNY-Albany. About one-third are also members of NSF Directorate or Office advisory committees, providing linkages to those bodies (*e.g.*, Tohline represents the MPS/AC on the AC/GPA). The committee works closely with NSF staff during the 3-4 months prior to the annual meeting to ensure they receive performance information for programs across the NSF.

The NSF Strategic Plan "Investing in America's Future" was released on September 30, 2006 and had the following Strategic Outcome Goals:

DISCOVERY – Foster research that will advance the frontiers of knowledge, emphasizing areas of greatest opportunity and potential benefit and establishing the nation as a global leader in fundamental and transformational science and engineering.

LEARNING – Cultivate a world-class, broadly inclusive science and engineering workforce, and expand the scientific literacy of all citizens.

RESEARCH INFRASTRUCTURE – Build the nation's research capability through critical investments in advanced instrumentation, facilities, cyberinfrastructure and experimental tools.

STEWARDSHIP – a capable and responsive organization.

Tohline commented that the ACGPA assessed NSF's performance with regard to the three long-term strategic outcome goals for FY 2009, using primarily "performance highlights" prepared by NSF program officers and staff. Generally, highlights were written by program officers, summarizing results reported between March 2008 and February 2009. Three subcommittees were given access to 1776 "highlights"; over 1000 of these were read by at least one individual from the AC/GPA. From these "nuggets" of information, an assessment was made of outcomes (significant achievements resulting) from NSF investments in the three key areas of Discovery, Learning, and Research Infrastructure. He then presented a few examples of highlights selected by the ACGPA.

The ACGPA examined alternate methods of performance assessment, and a “Future Assessment Task Group” was organized to undertake a more holistic view of ways in which NSF might demonstrate longer-term achievement of its strategic goals. Recommendations were formulated that, hopefully, will lead to a richer understanding of the inherent value of NSF’s investments in science and the nation.

The ACGPA recommended that NSF consider an assessment framework that uses multiple measures and methods, applied over various time scales. NSF should use both quantitative and qualitative evidence, including highlights and should emphasize the dynamic relationships among strategic goals and outcomes. It should use performance assessment as an opportunity and means to document the strategic value of NSF’s science investments to the nation and the public. It should engage the scientific community as a partner in performance assessment.

NSF should build assessment into the organizational and programmatic infrastructure of NSF. The ACGPA felt that as a permanently and professionally-trained staff function, performance assessment can become a process of continual feedback and learning. NSF can begin by capturing and sharing what is already being learned from program- and directorate-level assessments (*e.g.*, from COVs). It should be prepared to learn from unsuccessful, as well as successful, investments and should place some of the focus of the “Science of Science Policy” program on NSF itself.

Presentation on New Concepts by Chairs of the MPS Working Groups

The MPSAC heard presentations on the activities of the MPS working groups in the following areas:

Computation:

Lee Jameson, Chair of the MPS Cyber Working Group described its activities. He began with a discussion of the Oden Report of May 2006. This was a blue ribbon panel commissioned by John Brighton of NSF. The Panel was composed of Tinsley Oden, Ted Belytschko, Jacob Fish, Thomas Hughes, Chris Johnson, David Keyes, Alan Laub, Linda Petzold, David Srolovitz, and Sidney Yip. Its study focused on modeling and simulation for prediction of physical events and behavior of complex engineered systems. He noted that the report stated the competitors in Europe and Asia are making major investments in simulation research and that the US is rapidly losing ground.

The MPS Cyber Group has members from all 5 MPS Divisions and the MPS Front Office. The cyber group addresses every activity at the NSF and beyond that has any relationship with computing, software, *etc.* When new activities begin such as CDI, PetaApps, TeraGrid, High Performance Computing Track 11 and Track 2, it is always the MPS Cyber Group that offers the MPS point of view and input. The group interacts closely with the Office of Cyberinfrastructure on many topics such as data, computing, workforce development, large facilities, and of course software.

Jameson then described the structure of the Simulation Based Science and Engineering study. It was intended to build on Oden report and expand breadth to include both science and engineering. It focused on three thematic pillars: materials, energy and sustainability, and life sciences and biomedicine and was initiated July 2007. A US baseline workshop was held in November 2007, and a bibliometric analysis was performed to identify “hot spots.” The panel visited 57 sites in Europe and Asia and sites included universities, national labs, industrial laboratories. A public workshop on study findings was held in April 2008, with a final report published in April 2009 (www.wtec.org/sbes). This was followed by a Strategic Directions Workshop in April 2009 at the National Academies of Science (NAS).

Major findings of the study were that inadequate education & training threatens global advances in SBE&S, with students having insufficient exposure to computational science & engineering. There is insufficient training in high performance computing (HPC) and an educational gap between domain and computer science – domain scientists treat codes as “black boxes.” The investment in algorithm, middleware, software development lags behind investment in hardware and there is a lack of support and reward for code development & maintenance. The study noted that progress in SBE&S requires crossing disciplinary boundaries, and talented students are

choosing curricula that prepare them for lucrative careers in finance, for example, rather than in science, technology, engineering, and mathematics (STEM) disciplines.

Jameson described other important workshops/studies that had been conducted. He described the workshop entitled “Computation-Based Engineering (CBE) Summit: Transforming Engineering through Computational Simulation” that was organized by Art Ratzel of Sandia National Laboratories. It was held at NAS in September of 2008 (www.sandia.gov/tecs/TECSsummit.html). Another workshop was the Integrated Computational Materials Engineering (ICME). It recommended that the Department of Defense should be an early champion and coordinator of ICME and that NSF should (1) fund cross-disciplinary research to establish the taxonomy, knowledge base, and CI, (2) incentivize the placement of data and information in open-access infrastructures, and (3) develop talent by supporting innovative curricula and student internships. Global infrastructure and coordinated efforts are needed, and ICME holds significant potential to transform MSE and to enhance US competitiveness and national security

In summary, with respect to simulation-based engineering and science, interoperability of software and data are major hurdles, the use of simulation software by non-simulation experts is limited, in most S&E applications algorithms, software and data are primary impediments, visualization of simulation outputs remains a challenge, the treatment of uncertainty (UQ) is inadequate, links between physical and system level simulations are weak, and training of engineers and scientists is inadequate to address simulation and modeling needs.

Broadening Participation:

Kathleen McCloud, Chair of the MPS Broadening Participation Working Group, described its activities. She began by noting that NSF defines broadening participation in terms of individuals from underrepresented groups as well as institutions and geographic areas that do not participate in NSF research programs at rates comparable to others.

The NSF-wide Broadening Participation Working Group was formed in April 2008, is open to any NSF member who wishes to participate, meets on the fourth Thursday in each month, and arranges to have speakers, mostly inside NSF from other Directorates, MPS Divisions, and from outside NSF. It is surveying best practices across NSF.

The MPS Broadening Participation Working Group Provides a forum for MPS Program Officers to discuss broadening participation and contribute to NSF-wide activities. It shares best practices, explores new ideas, discusses what works and what doesn't, works with the NSF-wide Broadening Participation Working Group, and explores the benefits of a potential MPS strategic plan in this area.

The group provides feedback on diversity plans for MPS facilities and other large projects when asked, and ensures that MPS is represented at area events focused on broadening participation. It provides information to MPS staff on ongoing MPS efforts and NSF-wide resources. It makes available a PowerPoint presentation on MPS/NSF activities in broadening participation areas and provides electronic resources that are accessible to all MPS staff. MPS working group members attend various workshops and conferences and report back to the group.

McCloud said that the group's main effort at present was collecting and synthesizing information as broadening participation efforts vary widely across MPS and NSF. A question that arises is whether the broadening participation efforts should be uniform across MPS. Another question is how MPS can, as a whole, reach out to the communities that are under-represented. One has to determine which methods actually work and for which communities.

McCloud then provided examples of activities related to broadening participation within MPS. She gave examples of activities within the MPS divisions, and concluded her presentation by describing MPS-sponsored workshops directed at department chairs. These included a chemistry workshop on gender equity, a physics workshop on gender equity (co-funded by AST, PHY, and DMR), a materials science and engineering workshop on gender equity, a CHE workshop on under-represented minorities, and a workshop entitled “Excellence

Empowered by a Diverse Academic Workforce: Chemists, Chemical Engineers and Materials Scientists with Disabilities”

Climate:

NSF is developing a Climate Research Investment (CRI) activity that is agency-wide, and is expected to be a driver for the NSF portfolio. NSF Directorates/offices have requests in the pending 2010 budget with 2010 climate activities centering around four new themes:

- Modeling: BIO, GEO, MPS, OCI, OPP, CISE, SBE + other agencies
- Water: GEO, BIO, ENG, SBE + other agencies
- Ocean acidification: GEO, OPP, BIO + other agencies
- Function of biodiversity: BIO, GEO

Each of these themes will have a solicitation for proposals in 2010. The total CRI FY 2010 request is for \$197,000,000.

Science and Engineering Beyond Moore’s Law:

The presentation began with the statement that Moore’s Law (1965) is the empirical observation that the number of transistors on an integrated circuit doubles about every 2 years. And computer power doubles about every two years. However, due to quantum effects and power density constraints, current silicon technology is approaching its final limits in the next 10-15 years. We can ask how close the world is to a paradigm shift, and the argument can be made that we are already there in the sense of multicore technologies. However, research and development on a new physical foundation is needed now. In many cases, algorithms have outpaced hardware improvements. What is needed is:

- New hardware based on new materials, devices, and processes.
- New architectures that organize and integrate new hardware.
- New algorithms that exploit hardware and architecture.
- New software to use new hardware effectively.
- New paradigms to go from bits to qubits.
- New awareness about energy efficiency (MIPS/watt).

Nevertheless, there is a long way to go. A modern PC is approximately 100,000 times better than the ENIAC computer, but the human brain is about one million times better than a modern PC. The Science and Engineering Beyond Moore’s Law plan involves the MPS, ENG, CISE and OCI directorates with \$50,000,000 in the FY 2010 budget request and plans for future growth.

Energy

Carol Bessel of CHE described the charge of the MPS Energy Working Group. It serves as the main point of contact for MPS on all issues related to energy and is involved in the collection of baseline data on energy expenditures, staying informed about current energy activities and advances in the US and the world, and developing new fundamentally transformative research areas as well as the workforce required for their discovery and implementation.

MPS is considering how to respond to the recent NSF NSB report that was published in August 2009. This report concentrated on US Government leadership and coordination, research and development investment, policy and development, energy education and workforce, global cooperation and public energy awareness and action. Each of these areas was found to have significant weakness and thus it will be the goal of the working group to develop new strategies in energy research and education.

Bessel then went on to describe the MPS contribution to energy. She stated that it is multi-faceted, with contributions to new facilities and instrumentation, training at all levels, and the use of computational/theoretical and experimental methods.

The DMR energy portfolio is the largest in MPS and focuses on a wide variety of topical areas ranging from the more traditional energy areas (hydrogen storage, fuel cells, batteries, solar cells and solid state lighting) to the more forward thinking topics such as superconductors for possible future energy transmission. It has developed a unique Center program that includes efforts in energy such as the MRSEC at the Colorado School of Mines that focuses on renewable energy and specifically includes a partnership with NREL (a DOE funded laboratory).

CHE holds the second largest portfolio in MPS energy research. While CHE also has strong efforts in traditional energy areas and in international activities Bessel chose to highlight the CHE Centers program. The first two Phase II efforts are in energy research – Center for Enabling New Technologies through Catalysis and Powering the Planet were bottom up efforts introduced by the community. Small molecule activation, *i.e.* H₂, CO₂, CH₄, is a fundamental part of the CHE portfolio and some of these discoveries are making their way to chemical industry.

Activities in DMS are considerably smaller than DMR or CHE but include important multi-scale mathematical modeling especially in the area of batteries and fuel cells. DMS often works on developing collaborations using an institute model and has recently held an institute on the Scientific Challenges in Solar Energy Conversion and Storage to promote our CHE-DMR-DMS SOLAR Energy Initiative.

The investment in energy research in PHY is small but there are important niche areas such as nuclear and plasma physics. Bessel noted that student training in nuclear energy is at a critical point if we are to use nuclear in the US portfolio (many retirements, few new facilities). We have been told that DOE EERE efforts in nuclear energy have been zeroed out in the current budget. Thus, PHY may be one of the few remaining supporters of training for nuclear scientists.

Bessel described the MPS energy portfolio as it was in 2009. The total MPS investment in energy spending is approximately \$150,000,000 with the largest spending amounts in solar, hydrogen, fuel cells, and batteries. Other areas of investment such as hydrocarbon conversions, superconductivity and molecular wires are also substantial. There is very little or no funding in several areas – biofuels, wind, geothermal, clean coal, and fuel cycles. MPS is collaborating with the ENG Emerging Frontiers in Research and Innovation program (EFRI).

The MPS Directorate initiated a new collaborative program in 2009 – the CHE-DMR-DMS Solar Energy Initiative. These require the collaboration of a chemist, a materials scientists and a mathematician. MPS has made eight awards from an initial field of over 120 preproposals.

Meeting with NSF Director Dr. Arden Bement, Jr.

Johnstone welcomed NSF Director Dr. Arden Bement Jr., and, after introductions, provided a short update on MPSAC activities that had taken place during the meeting. He then invited Bement to make some remarks.

Bement began with an update on 2010 budget and status in Congress. He noted that the 2011 budget looks lean, and that preparations for the 2010 and 2011 budget may put a lot of pressure on the agency. He then reviewed the performance of the Foundation during FY 2009. Johnstone then told the Director that the MPSAC wanted to express their thanks to NSF staff for their hard work this year, particularly in view of significant effort involved in dealing with the ARRA funds. This was followed by a discussion with about reporting requirements involved with those who received ARRA support. It appears that NSF performance was extremely good in comparison to that of other agencies.

Bement provided an update on the search for position of MPS director and Johnstone then asked members of the MPSAC to discuss topics that had arisen during their preparation for this meeting with the Director. Tohline discussed major multiuser facilities, and the NSB study was going to be undertaken for the major facilities programs. Bement commented that a new NSB subcommittee is now looking into construction and also lifecycle costs, the impact on other programs, and the NSB becoming involved in early stages of these projects (after conceptual design) in order to gauge scientific merit.

Abruna reviewed ideas about directorate structures and realignment, especially the concept of a directorate of molecular sciences. Bement commented that NSF's was continuing its efforts in interdisciplinary activity, and stated that directorate organization issues are very complex.

DeSimone discussed connections with the venture capital community and the value of establishing formal or informal contact in order to initiate a dialog between this community and NSF. Bement outlined his own efforts in this area and expressed the view that NSF has a strong role in research training for graduate students who later go to the private sector and work in startup companies.

Cornell, participating by teleconference, was concerned that investigator-driven research or individual grants may not receive sufficient importance if NSF focuses on energy or climate issues. Bement reviewed NSF's challenges in a climate of changing worldwide funding for science, but also stressed that the agency must pay attention to Congress, who wants a return on the investment it is making in NSF, and this includes relevant fundamental research). There was considerable discussion of this issue.

Hawley raised the issue of NSF's support for potentially transformative research.

Johnstone thanked Dr. Bement for taking time in his very busy schedule for meeting with the MPSAC.

MPSAC Working Groups

He then described how MPSAC membership for the MPSAC working groups had been developed and encouraged MPSAC members to feel free to join whichever of the working groups they wished.

The meeting then adjourned for lunch with MPS staff.

Lunch with Breakout Groups (Computational Science; Life Science Interface; Climate; Energy; Science and Engineering Beyond Moore's Law; Broadening Participation)

The MPSAC reconvened in plenary session at 1:15 PM.

Other Business

Johnstone gave some opening remarks concerning potential next steps for the subcommittees and asked the MPSAC subcommittee Chairs to report on their meetings with the MPS staff.

Computational science: Glotzer stated that the group had discussed what software can enable. The major issue that emerges from the community is that software is equivalent of a major instrument. While one can get funding for science which includes software development, long-term sustainability of software development is a challenge. An idea that emerged from the discussion is to create software institutes, centers of excellence, to look at languages, compilers, etc. to enable science. There are great opportunities for MPS to influence the Office of Cyberinfrastructure's programs that are being developed, and this will also to help MPS needs. Tohline brought up the point of using such centers as major facilities. These facilities would not only support users, but also developers. The group spent a lot of time summarizing both tactics and strategies. They also discussed the data needs of the MPS community and how one can better capture, store, and retrieve data to enable scientific discovery.

Climate: Roberts discussed the status of new solicitations being developed in NSF for climate research. He mentioned biodiversity issues that are relevant to climate change, as well as issues such as ocean acidification and water supplies (potable water, water for agriculture, etc.). The group's discussion emphasized the importance of fundamental research to attack underlying issues in this area. There is a need for new ideas, not just incremental improvements on existing models. The group also discussed mitigation versus adaptation. There could be joint activities with SBE and the security community. There is a need to produce very short (1-2 page) write-ups, and make the case that the community is already involved in these issues and to obtain a list of workshops that had been held on this topic in recent years.

Energy: Bortoletto said that this is a complicated issue for the NSF, given the many activities of the Department of Energy. She reviewed NSF and DOE efforts and facilities, and the relative contributions of the various MPS divisions in these efforts. There is a need to identify areas where NSF clearly has leadership and strength. The group had developed a set of action items, and had set up a meeting schedule. She also commented that it would be good if NSF could participate in meetings of DOE center directors. NSF could supplement DOE funding by solicitations targeted at DOE-funded researchers at universities. Some committee members then questioned Dr. Bortoletto about the role that PHY could play. Dr. Seidel commented that more communication with program directors would help get ideas for physics participation.

Science and Engineering Beyond Moore's Law: Orozco said that the group needs to get a sense of what the research portfolio might look like. He thought that the research would combine fundamental issues with practical problems. He concluded by describing the continuing efforts of the subgroup.

Life Sciences: Berger said that the group was looking into connections with the Life Sciences, and reviewed potential issues such as biohazards, climate, hydrogen production, energy, health. NSF staff has identified a set of challenges, and have identified the need for an interdivisional group for handling these. Actions will include reviewing National Research Council (NRC) reports on these issues, participating in discussions, and identifying new challenges. He concluded that there was a need for identifying areas that NSF fund that NIH and other groups do not support.

Broadening Participation: Neal summarized the efforts of the group in Broadening participation. She reviewed what data has been collected, and stated that they have an awareness that most efforts are not making much of a difference. She presented details of where the group wishes to focus (identify effective programs, connect good programs and sustainable programs, involve scientists who are not in marginalized groups, promote inclusive scientific workforce, encourage risk-taking, and include feedback and revision). She concluded by reviewing the plan for the working group activities.

Following these presentations, Johnstone and Seidel made some closing remarks. Johnstone thanked members of the MPSAC and MPS staff for their participation in the meeting.

Adjournment

The meeting was adjourned at 3:05 PM.

APPENDIX I

ATTENDEES

MPSAC Members Present at NSF

Hector D. Abruna, Cornell University
James Berger, Duke University
Daniela Bortoletto, Purdue University
Kevin Corlette, University of Chicago
Eric Cornell, JILA and the University of Colorado
Juan de Pablo, University of Wisconsin-Madison
Joseph DeSimone, University of North Carolina, Chapel Hill
Barbara J. Finlayson-Pitts, University of California, Irvine
Irene Fonseca, Carnegie Mellon University
Sharon C. Glotzer, University of Michigan
Suzanne Hawley, University of Washington
Iain M. Johnstone, Stanford University
David E. Keyes, Columbia University (present by phone)
Jerzy Leszczynski, Jackson State University
Ramesh Narayan, Harvard-Smithsonian Center for Astrophysics and Harvard University
Sharon L. Neal, University of Delaware
Luis Orozco, University of Maryland
Fred S. Roberts, Rutgers University
Joel E. Tohline, Louisiana State University

MPSAC Members Absent

Taft Armandroff, W. M. Keck Observatory
Dennis L. Matthews, University of California, Davis
James W. Mitchell, Howard University
John Peoples, Jr. Fermilab
Theresa A. Maldonado, Texas A&M University
Geoffrey West, Santa Fe Institute

MPS Staff

Morris Aizenman, Senior Science Associate, MPS
Carol Bessel, Division of Chemistry, MPS
Charles Bouldin, Program Director, Division of Materials Research
Denise Caldwell, Deputy Division Director, Division of Physics
Joseph Dehmer, Director, Division of Physics
Luis Echegoyen, Director, Division of Chemistry
Craig Foltz, Acting Director, Division of Astronomical Sciences
Janice Hicks, Executive Officer, Division of Chemistry
Mary Ann Horn, Program Director, Division of Mathematics
Carmen Huber, Acting Executive Officer, Division of Materials Research
Lee Jameson, Program Director, Division of Mathematical Sciences, MPS
Zakya Kafafi, Director, Division of Materials Research
Deborah Lockhart, Executive Officer, Division of Mathematical Sciences
Peter March, Director, Division of Mathematical Sciences
Kathleen McCloud, Program Director, Division of Physics
Celeste Rohlifing, Head, Office of Integrative Activities
Edward Seidel, Acting Assistant Director, MPS
Nigel Sharp, Acting Deputy Division Director, Division of Astronomical Sciences
G. Wayne van Citters, Jr., Senior Advisor, Facilities, MPS (present via phone)
Zeev Rosenzweig, Program Director, Division of Chemistry, MPS

Visitors

Arden Bement, Jr., Director, NSF
Tinsley Oden, University of Texas

Appendix II
BREAKOUT SESSION ROOMS
MPS Advisory Committee Meeting
Thursday Afternoon, November 5, 2009

		DIVISIONAL ASSIGNMENTS FOR MPSAC MEMBERS						
		AST	PHY	CHE	DMR	DMS		
		Room	Room	Room	Room	Room		
		688	770	1060	1120	390		
Term Ends 09/30/10								
	JOHNSTONE					X		
A	KEYES							
A	MALDONADO							
	ABRUNA			R				
	CORNELL		R					
A	MATTHEWS							
	TOHLINE	R						
Term Ends 09/30/11								
	BERGER					R		
	BORTOLETTO		X					
	FINLAYSON-PITTS			X				
	FONSECA					X		
	HAWLEY	X						
	NARAYAN	X						
	NEAL			X				
A	PEOPLES							
	REICHMANIS					R		
A	WEST							
Term Ends 09/30/12								
A	ARMANDROFF	X						
	CORLETTE					X		
	DE PABLO				X			
	DESIMONE			X				
	GLOTZER				X			
	LESZCZYNSKI			X				
A	MITCHELL							
	OROZCO		X					
	ROBERTS					X		
All breakout sessions will be held in Stafford I building								
A	Absent							
R	Breakout CHAIR, MPSAC member who will summarize Divisional meetings activities to MPSAC							

APPENDIX III

MPSAC Working Group Membership

Computation	Climate	Energy	SEBML	Life Sciences	Broadening Participation
Glotzer Keyes Tohline Fonseca Leszczynski	Finlayson-Pitts Johnstone Roberts Armandroff Reichmanis	Maldonado Abruna Bartoletto Peoples West	Orozco Cornell Corlette DeSimone Mitchell	de Pablo Matthews Berger Narayan Mitchell	Neal Hawley Matthews Leszczynski DeSimone
Lee Jameson (DNS) 703-292-4833 ljameson@nsf.gov	Zeev Rosenzweig (CHE) 703-292-7719 zrosenzw@nsf.gov	Carol Bessel (CHE) 703-292-4945 cbessel@nsf.gov	Charles Bouldin (DMR) 703-292-4920 cbouldin@nsf.gov	Mary Ann Horne (DMS) 703-292-4879 mhorn@nsf.gov	Kathleen McCloud (PHY) 703-292-8236 kmcccloud@nsf.gov

APPENDIX IV

March 18, 2010

Dr. H. Edward Seidel,
Acting Assistant Director
Directorate for Mathematical and Physical Sciences
National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230

Dear Ed:

I have reviewed the final version of the minutes of the Directorate for Mathematical and Physical Sciences Advisory Committee meeting that was held November 5-6, 2009 (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,

Signed

Iain Johnstone
Chair, Mathematical and Physical Sciences Advisory Committee