Minutes for the
Basic Energy Sciences Advisory Committee Meeting
November 3B4, 1999, Gaithersburg Marriott Washingtonian Center
Gaithersburg, Maryland

BESAC members present:

Boris W. Batterman
Collin L. Broholm
Jack E. Crow
Patricia M. Dove
D. Wayne Goodman
Jan F. Herbst
Linda Horton
Anthony M. Johnson
Stephen R. Leone
Marsha I. Lester
Anne M. Mayes (Wednesday only)
C. William McCurdy, Jr.
Franklin M. Orr, Jr., Vice Chair
Geraldine L. Richmond, Chair
Zhi-Xun Shen
Richard E. Smalley
Joachim Stohr
Samuel I. Stupp
Patricia A. Thiel

BESAC members absent:

David D. Awschalom
James A. Dumesic
Robert B. Horsch
Walter Kohn
Sunil Sinha
David E. Tirrell
Edel Wasserman

Also present:

Robert Astheimer, Office of Basic Energy Sciences (OBES), DOE
Bruce Brown, Director, Intense Pulsed Neutron Source, Argonne National Laboratory
Daniel S. Chemla, Dir., Advanced Light Source, Lawrence Berkeley National Laboratory
Patricia Dehmer, Director, OBES, DOE
Judy Franz, Executive Officer, American Physical Society
Michael Holland, Office of Management and Budget (OMB)
Martha Krebs, Director, Office of Science, DOE (Wednesday only)
David Moncton, Executive Director, Spallation Neutron Source Project
Frederick O=Hara, BESAC Recording Secretary
Tom Picraux, Director, Physical and Chemical Sciences, Sandia National Laboratories
Roger Pynn, Division Director, Los Alamos Neutron Science Center
Charles V. Shank, Director, Lawrence Berkeley National Laboratory
Steve Shapiro, Associate Chair, Neutron Scattering Group, Brookhaven National Laboratory
Guebre Xabiher Tessema, Department of Physics, Clemson University
Iran L. Thomas, Director, Division of Materials Science, OBES

In addition, about 65 others were in attendance as observers.

Chairwoman **Geraldine Richmond** called the meeting to order at 8:40 a.m. and asked each panel

member to introduce himself or herself. She then introduced **Martha Krebs** to present highlights from the Office of Science (SC).

Krebs started with the announcement that she is departing from the directorship of the Office. She then presented the final budget for FY 2000. The overall FY-2000 budget maintains a constant level of funding when compared with that for FY 1999. Fusion funding increased, and high-energy physics and nuclear physics actually received increases over requested amounts. These results demonstrate an openness in Congress to funding physics. However, the Spallation Neutron Source (SNS) and computing [specifically, DOE=s portion of the President=s Scientific Simulation Initiative (SSI)] suffered a significant cut in funding in the first case and total elimination in the second.

Program-direction funding (funds for managing and coordinating the Department=s programs) has increased from $52 million to $131.1 million in the final FY-2000 budget because Headquarters has now been given responsibility over the field offices. The objective is better coordination of the work of the national laboratories. All but one of the national labs have been assigned to SC, so the majority of this funding has accrued to the SC budget. Pacific Northwest National Laboratory is the only lab to report to a division other than SC; it reports to Environmental Management (EM). With this shift in responsibility and funding, Congress now expects to see a reduction in the number of field personnel. However, those personnel produce a lot of value added, so this situation will have to be worked out with Congress during the next few years.

Krebs then touched on some key programmatic issues. Moving forward on the SNS is critical. After reducing current-year funding, Congress put seven conditions on releasing those funds. Six of those were addressed to DOE (e.g., recruitment of senior personnel, reorganization, production of an annual report, and conducting an independent review).

In the final budget, Congress directed DOE not to undertake its piece of the SSI despite DOE=s expertise in scientific simulation in materials, combustion, climate, and other areas. The Department will look for ways to modify what it has already been doing to make use of the computing research that will be done in the next few years. Given the scientific challenges to be attacked and the critical need for advanced computing as part of that attack, DOE=s emphasis on scientific computing will have to be maintained, even in the absence of the SSI.

The main challenge remaining for the technical community is to make the case for the physical sciences. Congress is willing and able to fund the life sciences. Those life sciences depend on the knowledge and tools provided by the physical sciences. The people in Congress seem willing to hear this story not only from DOE but also from the physical-science community.

As a funder of research, SC is not involved in the development of the National Nuclear Security Agency. However, nuclear security is an issue for SC=s program because SC funds several weapons labs as well as nonweapons labs. SC, therefore, has a major interest in how this new agency=s work will be carried out. The creation of this agency will have implications for *all* of the laboratories as well as for DOE=s international efforts, such as at CERN (Conseil EuropJen pour la Recherche NuclJaire, now the

Organisation EuropJenne pour la Recherche NuclJaire). One question is whether such sites as the Oak Ridge Y-12 Plant, Lawrence Livermore National Laboratory (LLNL), and Los Alamos National Laboratory (LANL) will continue to report to their current field offices, to the Albuquerque Field Office, or to Washington. The power of the weapons laboratories lies in their connections to the basic-research laboratories. Moreover, SC has made a significant investment in these laboratories and relies on the synergism between basic research and weapons research and development.

The question arises whether the national laboratories can survive as they are currently constituted. Congress has been concerned with the number of contractors in Washington and at the field sites. It has asked that DOE reduce the number of contractors by 50%, especially in Washington, and that the labs reduce their travel costs by 35%. As a result, Headquarters will be looking into the budgets of the labs as they have not done heretofore. Before the next fiscal year, DOE will have to demonstrate a limitation on the activities of the labs and must also validate the lab overhead structure. In labs like PNNL, where only 25% of the funding comes from SC, this mandate becomes a real concern. The Department does not want to become the chief financial officer running these labs. In addition, LDRD (Laboratory-Directed Research and Development) funds have been reduced at the weapons labs and eliminated at the nonweapons laboratories.

Considerable attention will be directed to security and cyber security. Headquarters is feeling a lot of pressure to put these security measures in place quickly and despite the cost. These measures are to be taken not only to protect the national interest but also to take advantage of what has been learned from safety concerns and corrective measures. The process of developing security procedures will require inputs from several of the Department=s advisory committees. Several labs do not require the same constraints on them for developing secure computer systems that the weapons labs do. Therefore, the advisory committees (including a new one on advanced scientific computing) will be asked to look at the connections between DOE=s programs and the services that provide computational capabilities to those programs.

Krebs then thanked and congratulated all the people that had helped her during her tenure as head of the Office of Science and thanked BESAC for its efforts (listing the published outputs of the Committee=s activities) through 18 full committee meetings and 11 charges.

Richmond then introduced **Patricia Dehmer**, who observed that the final FY-2000 budget was disappointing. The SNS received only about half of its request, materials sciences is down about $3 million, the $7 million request for the SSI was not funded, geosciences was reduced by the Office of Management and Budget (OMB) even before the budget went to Congress, and energy biosciences is down about $3 million from the requested amount. In 1999, the National Institutes of Health (NIH) got an increase of about 7%; and this year, got a 14 to 16% increase. This *increase* is greater than the budget of SC or the budget of the National Science Foundation (NSF).

Dehmer then addressed complex systems and nanotechnology and started by recounting the history of the National Nanotechnology Initiative. In September 1998, the NSTC (National Science and Technology Council) Committee on Technology established the Interagency Working Group on Nano

Science, Engineering, and Technology (IWGN). In January of 1999, a workshop on research priorities was held for industry, academia, and government. Since then, the IWGN has met roughly monthly and produced the first draft of the IWGN National Nanotechnology Initiative (NNI). It listed five high-priority research areas for additional funding beginning in FY 2001 that would nearly double the current spending on nano science, engineering, and technology (NSET):

1. fundamental research,
2. grand challenges,
3. centers and networks of excellence,
4. research infrastructure, and
5. education and training in nanotechnology.

In August, two brochures were published, the BES working group report *Nanoscale Science, Engineering, and Technology Research Directions* and the report from the March BESAC workshop at LBNL *Complex Systems: Science for the 21st Century*. These brochures were used in a series of briefings to OMB and PCAST (the President=s Committee of Advisors on Science and Technology) in preparation for the recommendations to be issued by the PCAST Nanotechnology Panel. In January 2000, the nanotechnology initiative will be described unofficially so it will not be a surprise when it shows up in the February release of the President=s budget submission to Congress.

In the briefings to OMB and PCAST, DOE stressed that a major challenge to be addressed by the NNI would be to learn from Mother Nature how to make advanced materials and tools. The role of DOE in this enterprise was cast in terms of its mission, which includes science and technology, national security, energy resources, and environmental quality. In furtherance of this mission, DOE is the nation=s largest supporter of fundamental research in the physical sciences, the major supporter of materials sciences, and the number-one supporter of major scientific user facilities. DOE is interested in NSET because:

- Technologies associated with the energy, security, and environmental missions of DOE are limited by the properties of available materials.
- Nanoscience and nanoscale processing will make possible materials with vastly improved or fundamentally new properties.
- Nanoscale building blocks can be used to create self-organized structures that Mother Nature did not envision.

These areas of interest can be grouped into several categories of application: high-surface-area materials, consolidated materials, dispersions and coatings, nanodevices, and molecular machines that use nanoscale building blocks.

DOE has been engaged in this type of science and technology research since the 1980s and is now looking at materials with novel or enhanced functionality via nanostructuring (e.g., layered structures, nanocrystals, and nanocomposites); at materials with new optical properties via nanostructuring (e.g., photonic lattices and vertical-cavity, surface-emitting lasers); and at three-dimensional self-assembled materials via nanostucturing (used for their high adsorption capacity for mercury and other heavy metals in the environment). New materials produced with nanotechnology have the promise of improved energy efficiency and performance because they have tailorable magnetic properties, demonstrate superior strength, and greatly reduce friction and wear. They also hold the promise of addressing old

problems in new ways. For example, research at LBNL has produced semiconductor nanocrystals that link to biomolecules and fluoresce at different frequencies (colors) according to the functionality of the molecule to which they are linked, even though they are excited to fluorescence by the same wavelength of light.

Characterization and modeling will be the key to the development of nanotechnology, and DOE has unique capabilities in these techniques and tools, including the largest collection of photon-, neutron-, and ion-scattering facilities in the world. In the FY 1999 budget, DOE=s current investment in nanoscience activities (not including facilities) is about $47 million. This research lays the groundwork for four initiative focus areas in DOE:

1. the study of the properties and behavior of nanostructures and nanostructured materials;
2. the study of novel materials;
3. the establishment of interdisciplinary centers for nanoscience, engineering, and technology; and
4. increased user support and instrumentation for nanotechnology at the current BES user facilities.

She closed by saying that the NNI offers the promise of things yet unimagined and that it is SC=s best hope for making the case for the physical sciences. The National Institutes of Health had no initiative to make the case for its 90% increase in funding over the past few years; rather, that increase came from Congress=s belief that significant results would come from such an investment.

The floor was opened for questions addressed to Krebs or Dehmer. Charles Shank asked about the likelihood of an additional recission of 1%. Krebs noted that the President had said that he would veto that bill but that the threat was a real concern in that such a recission would reduce the SC budget by $25 million. Orr asked what happened to the two cases of earmarked funding, and Dehmer said that they had gone away. Mayes asked how the cutbacks in SNS funding would affect its ability to come in on time and on budget. Dehmer responded that the cuts will definitely affect the timing and quality; but if full funding is received next year, the long-term effects will be minimal.

Stupp asked, assuming the NNI goes forward, which agencies might be the winners in terms of funding and leadership. Dehmer said that she could not predict what the administration nor the PCAST will do, but that she could not think of an initiative for which DOE is better positioned to take a leadership role because of its history of research and tool development in materials science. Krebs noted that they had been watching the development of this situation and recognized the opportunity it represents for the Department and, accordingly, had made commitments in the budget requests for this year and the next.

A portion of the meeting was then devoted to testimonials about Martha Krebs. Dehmer said that Martha leaves quite a legacy. She is a pure visionary who has transcended the ordinary and talked about the Office of Science, its programs, its science, its facilities, and its people convincingly. She pushed the Office to do roadmapping and has taken a leadership role in advancing the causes of new facilities needed by the scientific community. She has overseen major program initiatives and recognized the need to pursue initiative-driven science. She tackled the byzantine world of the national laboratories and their organization and management and has left a legacy of personnel through whom her style and philosophy will live on. Charles Shank said that he will miss Martha because she demonstrated a

knowledge of the labs and science and placed a priority on the performance of excellent scientific work while exhibiting an inerrant sense of what was going to be excellent work. David Moncton said that Martha is a genuinely nice person who cares about science and scientists. She loves science, the labs, and her job. She shares credit when she succeeds and, when she fails, she learns a lesson and moves on. She has a natural political instinct, and the scientific community has benefitted tremendously from her strategic sense. She has been critical in getting the SNS where it is today. Richmond said Martha=s leadership, advocacy, excellence in standards, and attention to people have been appreciated. Her attendance at BESAC meetings and openness to questions have also been appreciated. She has allowed BESAC to play a role in making the decisions and has made the Committee feel vested.

A break was declared at 10:43 a.m. for a brief reception for Krebs. The Committee was called back into session at 11:06 a.m. Richmond introduced **Charles Shank** to speak on the implementation of a program in complex systems. He pointed out that a miniworkshop had been held on the previous day on the implementation of an initiative on complex systems. That workshop focused on the program definition. In the course of that discussion, the participants identified a number of scientific themes for follow-on workshops:

1. controlled synthesis and processing of nano-objects,
2. assembly/organization of large numbers of nano-objects for new functionalities, and
3. collective phenomena in quantum-confined systems.

An attempt was made to define a vision that states where this technology is going to go in terms of advanced technologies (electronics, defense, communications, etc.). The effort essentially asked the question, what tools will complex systems and nanotechnology provide for the 21st century? Sensors, biomedical systems, and other products were mentioned. The discussion also sought to address what understanding of materials and phenomena these systems will provide and what they will contribute to energy and the environment.

The participants considered how this effort should be organized and whether research centers should be established. They felt that a balanced portfolio of programs should be maintained in terms of size, scope, and fundamental research vs applied research. Diverse skills will be needed, each critical to the research goals. Also needed will be a network of universities and laboratories. Competitive peer reviews should be employed to ensure excellence, and the administrative infrastructure should be minimized.

The resources that would be necessary include the establishment of a core research program and a doubling of that core research program in five years. Existing facilities are facing increased demand and provide science-driven research in instrumentation. New labs and facilities will be needed in synthesis/processing and assembly/organization. Extremely high simultaneous time (femtosecond) and space (less than a nanometer) resolutions are expected to be possible for in situ physics and chemistry, and dynamic imaging of complex, nonperiodic structures is possible, also.

Community support will have to be engendered by this effort being scientist-driven. The fact that it encompasses a breadth of scientific disciplines provides lots of room for promotive activities. The support of professional societies needs to be sought, and industrial support needs to be garnered. If

industry supports the need for such research, it could have a huge effect.

Richmond noted that there is strong support for the idea that small groups (three to four people could produce very good advances in this area and that younger scientists need to be drawn into this area. Smalley said that *need* must be emphasized; to get $1 million for three or four people is very difficult. Thiel added that getting smaller groups also emphasizes the bottom-up, science-driven approach. Shank said that some tasks would require the efforts of more than three or four people (contributions that could be made by the national laboratories), and that is why the participants had stressed balance.

Smalley pointed out that this is a technologically driven enterprise. The purpose of just putting the person in a lab coat to work will not be a convincing argument to the public or Congress. Shank noted that curiosity-driven science is another term for this type of work. The areas that this initiative touches are so wide that we have to be careful what we promise. Thomas said that this initiative should be driven by what is possible; it should be driven by where we are in science today.

Thiel made the observation that funding for new initiatives is currently being taken out of existing programs. Shank responded that the imagination of the scientific community will have to be captured, that everyone should be able to see that they are going to benefit from this work. Leone said that we should be defining what DOE can do that others (such as NASA) cannot do. Shanks noted that this initiative is really a subset of what was identified in the original workshop, the first step in the process alluded to by Leone. Tying this work to the DOE mission and the discussions in the follow-on workshops should identify those areas of special capability.

Smalley asked why this initiative would not fall within the mission of the NIH, and Stupp said that they did not have the infrastructure in their portfolio. Smalley responded that, with $4 billion, they could have it. Stupp replied that they do not have it now and DOE does.

Crow noted that an important aspect is training the students and workforce for the 21st century. Thomas observed that the National Science Foundation (NSF) has a very strong program to address that aspect within this interagency initiative. Johnson asked if the miniworkshop participants had discussed whether individuals from these small groups would be eligible for fellowships at the national laboratories. Shank said that the loose network between the universities and the national laboratories would take care of that. Tessema Xabiher said that the NSF will ensure that university and industry personnel will be able to work at the national-laboratory user facilities.

Smalley commented that what was missing was a connection to energy. He asked what compelling reason existed for this initiative to be carried out by DOE. Shank repeated the question to the DOE personnel, asking how strongly they felt that this initiative should be included in the Department of *Energy*. Dehmer said that BES has the largest materials science program in the nation and that program would feel the greatest impact from nanotechnology. All of the little subtopics impacted by nanotechnology grew up in energy research. Spinoffs from the natural sciences affect all sciences, but that should not be a rationale for performing this research.

Johnson asked if any overtures had been made to any of the professional societies, such as the American Institute of Physics, to get the word out. Shank said that a concerted effort is going to have to be made to do just that.

Mayes asked what organization had been envisioned for the centers. Shank suggested that they may be localized at national laboratories, at universities, or in industry. The key is that there is so much to be explored that administration should be minimized. Thomas commented that the Committee should not get hung up on something that has not been created yet. The most intriguing aspect of the previous day's workshop is that grants to three to five people are not frequent. However, it should not be stated that one has to fit this pigeonhole in order to get funding. In some instances, a physicist will need to have some compound synthesized.

Richmond said that this initiative should not be an umbrella program for all manner of nanotechnology research. On the other hand, there will be instances where the complexity is so great that a large group will be needed to address the problem. Stupp observed that a new reviewing process will have to be invented to address the broad nature of the discipline. Shank said that he thought that the problem was very much in hand and that it can be handled by the peer review process as we know it.

Richmond noted that an interdisciplinary proposal is often turned down because of the narrow interests of the reviewers and suggested that, perhaps, an interdisciplinary *panel* would be the answer here. Thomas said that DOE already has review processes that address interdisciplinary proposals successfully (e.g., in the chemical sciences). Dehmer observed that the challenge is to pick the right reviewers to address the diversity of topics to be assessed. Smalley asked to what degree DOE managers are constrained by the review results, and Dehmer said that there are no constraints on them at all as long as a funding decision is defensible. Shen commented that to have the program managers discuss this problem rather than having a popular vote is a promising approach.

A lunch break was declared at 12:00 noon. Richmond called the committee back to order at 1:38 p.m. and introduced **Roger Pynn** to talk about the Manuel Lujan, Jr., Neutron Scattering Center, which has operated only 2 months of the past 2 years. The Center is part of a larger facility, the Los Alamos Neutron Science Center (LANSCE), which serves the weapon program as well as SC. As part of its commitment to stockpile stewardship, Defense Programs (DP) is making long-term investments in LANSCE infrastructure improvements, and LANSCE is addressing stockpile stewardship through the measurement of nuclear cross-sections, conducting nuclear-resonance spectroscopy, studying the structure of high explosives, and performing proton radiography for movies of dynamic (a few microseconds in length) events. The DP commitment to LANSCE (increasing from $36 million in FY 1999 to $48 million in FY 2000) will provide BES with an opportunity for considerable funding leverage. When all targets are operational, BES customers will get about 22% of the total beamtime for about 14% of the total operating costs.

All general users gain access to LANSCE through a peer-review process conducted by the Program Advisory Committee (PAC) whose members are nominated by the LANSCE Users Group. The PAC evaluates the importance of each proposal as well as the relevance of the experimental data that could

be obtained, ranks the experiments, and advises LANSCE management. The User=s Group at LANSCE is active; in 1997, half of the Lujan Center users were from academia, and many of them were students and postdocs. The Group has sent a letter saying that they would like to be involved in the upcoming BESAC review of the Lujan Center.

Existing neutron-scattering spectrometers at the Center are over-subscribed. A lot of improvements are being made to address systematically the problems that have resulted in a low availability at the Center. As a result of the systematic analysis and improvement of key accelerator subsystems, the operating rate has increased significantly between 1991 and 1998. The operating time for the Lujan Center was severely impacted in 1998 and 1999 by planned and unplanned outages. A planned 12-month outage for upgrades to the target and injection systems lasted 14.5 months, and a long-term run was terminated by an unscheduled LANSCE stand down. During the stand down, an evaluation of all Lujan Center target subsystems was started and is now continuing. When the stand down is completed, recent upgrades (a new target-moderator system, new mercury shutters, a new proton-storage-ring injection scheme, and a new bridge crane) will improve the Lujan Center=s safety, reliability, and performance.

In 1998, the peak proton current to the Lujan Center increased from 70 to 100 :A, and the Center now has seven neutron-scattering spectrometers and four beamlines for nuclear physics. The LANSCE SPSS (short-pulse spallation source) enhancement project will provide the United States with a national ISIS-level facility in the near term. Five new neutron-scattering spectrometers will be constructed during the next five years with OBES and OBER funds. One of these spectrometers, HIPPO (a high-pressure B preferred orientation instrument), is designed for the in situ study of material properties, such as texture. These additional spectrometers will increase the neutron-scattering capability of the Lujan Center by 70%, opening up new areas of science, collecting data 10 times faster than before, and providing a new model for building neutron-scattering spectrometers in the United States. At the same time, enhancements to the accelerator will provide 180 kW of proton beam and double the neutron flux at the Lujan Center. Recent tests of the proton storage ring have set a new record for accumulated charge (8.6 :C) that exceeds the level needed (6.7 :C) to achieve project goals. Institutional (LDRD) funds are being used to develop a novel approach to cold-neutron spectroscopy.

Currently, LANSCE=s highest priority is to resume operation of the Lujan Center as soon as possible. LANSCE will not restart until all subsystems and system integration provide the highest possible confidence in reliable and safe operation in the future. When the Lujan Center resumes operation (possibly in spring 2000), it will provide (1) the highest-peak-flux spallation source until the SNS comes online and (2) neutron-scattering spectrometers specially designed to meet users= scientific needs.

Batterman asked what happened to the Center=s user base during the downtime. Pynn said that he was encouraged by the fact that they still had a large user base. The number of users at the other user facilities [e.g., Institute Laue Langevin (ILL)] have been stable. Herbst asked if there was a basis for resuming full-time operation. Pynn said that it was the 297 safety analysis document. Goodman asked if a lot of internal projects had built up during the shutdown. Pynn said that they intended to work off the internal and external backups by scheduling longer blocks of machine time. They serve a user community, and internal users have to go through the PAC just like everyone else. Horton asked if any

of the other buildings at LANSCE were Category 2 or Category 3 facilities. Pynn replied that there are rumors that the Accelerator Production of Tritium (APT) project will get more funding; some work is done at the Lujan Center, but not the Category 3 portions because the Center is not a Category 3 facility.

Broholm commented that there has been a real loss in not having these facilities available; as a result, the opportunity has been lost to do some exciting work and advances. He asked if there were anything that could be done to make this a productive facility. Pynn replied that the operating budget had been too low and that they had worked on that and the funding has been increased. He said that the main problem is that the facility was built by a bunch of scientists and that it never was designed to be a nuclear facility. Asked if there could be a show stopper, he said that there could be but they did not know of any.

Goodman asked if they taxed all of the users to support the operation of all the equipment of the facility, and Pynn replied that BES provides funding for support of the instruments and Defense Programs (DP) does something similar. The LDRD funds are a different matter.

Mayes asked what steps must taken between now and startup. Pynn said that the goals that had to be met have repeatedly shifted. Originally, DOE put forward some incredible accident scenarios. Under the conditions specified, analyses found that 2% of the radioactive material might be released. DOE then said that 100% had to be contained. Because the goals might be shifted again, he was not sure when the facility would be restarted.

Richmond then introduced **Bruce Brown** to talk about the Intense Pulsed Neutron Source (IPNS), which is the subject of a BESAC review requested by Martha Krebs. Brown said that the IPNS has operated at about 95% reliability since 1981 with a beam power between 7 and 50 kW depending on the source/moderator pairing. It has been the originator and test bed for a large number of new concepts for instruments, targets, and moderators. Its vision for the future includes increasing, broadening, and training the neutron community for the SNS and operating the SNS instruments.

The U.S. neutron-scattering community currently numbers about a thousand scientists; the European community is about twice that. The U.S. community must be at least doubled to fully exploit the capabilities presented by the SNS, and the IPNS will play a lead role in accomplishing that increase.

The IPNS has 14 instruments (diffractometers, inelastic spectrometers, and reflectometers) hung on the main beamline. It has a user program; performs instrument development; develops instruments, targets, moderators, accelerator systems; is integrated with ANL-s materials science and other research programs, producing very attractive opportunities for users to collaborate with ANL scientists; and has a lead role in developing the SNS-s instruments and the conceptual development of its second target station. It supports about 350 experiments per year, including research on

- the negative thermal expansion over a range of more than 1000 K and the pressure-induced phase transition of ZrW_2O_8 and
- the suppression of peptide aggregation by copolymer formation.

The facility operates about 25 weeks, has more than 200 visiting users, and produces about 150 publications per year. That figure translates to 14 publications per million dollars of budget, comparing favorably with ISIS=s 16 and ILL=s 6, especially when one considers that ISIS has a staff of 260 and IPNS one of only 81. Operation is staff-limited.

In FY 1996, the Scientific Facilities Initiative increased the operating budget by $3.6 million per year, increased operation from 19 to 25 weeks per year, returned all instruments to the user program, increased user beamtime by 55%, added 23 staff positions (while decreasing administrative personnel), and upgraded instruments and the accelerator. Since then, the beam time available to users increased more than 50% from that specified in the Scientific Facilities Initiative.

The IPNS issues a call for proposals every six months. Those proposals are reviewed by the facility=s PAC, 12 of whose 15 members are from outside ANL. Twelve of the instruments are in the user program, and 75% of instrument time is scheduled for users (25% is devoted to the ANL instrument scientists). It has the ability to pay for travel and living assistance for North American university users. One instrument scientist and about half as many technicians are assigned to each instrument.

Potential users must submit a four-page proposal form, which may submitted electronically. The sole criterion for selection is scientific merit, although safety requirements must be satisfied. Instrument time is oversubscribed by a factor of 2. Some proposals are rejected, and more are given less time than requested. A fast-access option is available for one-day experiments.

Users were surveyed and found to be overwhelmingly satisfied with the fraction of the year that the facility operates, its schedule and service, its performance, and its support for users. Other amenities that users can avail themselves of include a user van, Thursday lunch talks, a chemical preparation lab, online reporting of facility status or problems, and the neutron and X-ray school.

The IPNS has had 15 reportable safety incidents since 1990, none of which involved significant personal injury. It has adopted a zero-tolerance policy on expired radiological worker training. Stop-work authority is accorded all employees and users.

The IPNS has been a world leader in spallation source technology and science for 25 years. The first instrumented spallation neutron sources were developed at ANL. The first generation of most pulsed-neutron instruments were conceived, developed, built, and operated at IPNS. It also developed many pulsed-source technologies.

For the SNS, the IPNS is proceeding with conceptual designs for five instruments (a high-resolution crystal analyzer spectrometer, a third-generation powder diffractometer, reflectometers, a chopper spectrometer, and a single-crystal diffractometer), is addressing target and moderator issues, and has proposed to the NSF the design and construction of the long-wave target station (LWTS). In the future, IPNS will develop scientific programs targeted at SNS needs, will increase the user community, focus its instrument and target-system development on SNS needs (especially for cold neutrons), and develop

a Web-based control and data-analysis system. The IPNS has the responsibility for instrument and target systems for the LWTS at SNS. This activity is expected to lead to a major role for (remote) instrument operation.

Herbst asked why the NSF was asked to fund the LWTS, and Brown said that they had expressed an interest early on and that it was a way to bring them into the SNS work. Moncton interjected that NSF is very committed to neutron scattering and the LWTS will double the scientific capacity of the facility at a 20% increase in costs.

McCurdy asked how they determine the optimum operating period for the source. Brown replied that it is determined by the accelerator; there are certain maintenance operations that you have to perform. The best in the world (ISIS) runs 25 weeks a year. Mayes asked how they build up a suite of instruments and the team to develop and operate them. Brown said that priority is established among the tasks that are interesting and then one of the instrument scientists takes over the development of a given instrument.

Smalley, commenting on the list of publications presented, asked if the budget was $15 million/year. Brown said that it is; the equipment budget is only about $1 million/year. Some of the funding is SNS. Batterman asked what the importance of the restart of the High Flux Beam Reactor (HFBR) was. Brown replied that it is the quickest, easiest, and cheapest way to give neutron science a shot in the arm. Overnight, you could have 200 more people doing neutron science. Crow asked if there were other ways to grow this community besides with the summer school. Brown suggested getting more money into the universities, increasing the available time of the facility, and expanding the school.

Crow asked if there were any NSF-supported activities at the facility, and Brown replied that there were not. Crow went on to ask if anybody had discussed with NSF the need to grow the community. Jack Rush commented that the experience at NIST was that, when you make facilities and experiment time available, they will come and that NSF is very open to good proposals for neutron scattering. Mayes asked how many of the students in the school came from nontraditional neutron-scattering places, and Brown replied that more than half of them did.

A break was declared at 3:40 p.m. The meeting was restarted at 4:15 p.m. with a review of the Committee=s charges and schedule by **Geraldine Richmond**. She presented the tentative schedule for the next year and the proposed topics that would likely be addressed at each:

<	Feb. 24-25, 2000	E-Beam Subpanel report
	Advanced Light Source Panel report	
<	July 11-12, 2000	IPNS and MLNSC Subpanel report
<	Fall 2000	Committee of Visitors report

With the increased number of subpanel activities, it is important to understand the distinction between the full Committee and its subpanels. The full Committee is led by a chair and a vice chair, it receives charges from the director of the Office of Science, and it reports to the director of the Office of Science. Subpanels (or subcommittees) are led by chairs appointed by the chair of BESAC; receive charges

from the chair of BESAC; focus on specific issues; and report to the full Committee for the review, acceptance, and forwarding to the director of the Office of Science of their recommendations. The subpanels currently active are those on

- Complex systems
- E-beam microscopy centers
- Advanced Light Source
- IPNS and MLNSC
- Committee of Visitors

The subpanel on complex systems is defining a research agenda and roadmap for the study of complex systems, considering what resources (people, facilities, and equipment) are necessary to make significant progress in a reasonable amount of time. Issues being addressed include whether research centers should be established and what roles should be undertaken by universities and national laboratories. The chair is Charles Shank, and the subpanel has held a one-day workshop on the scope of potential research (held Feb. 11, 1999).

The E-beam subpanel is looking at the Electron Microscopy Center for Materials Research at ANL, the National Center for Electron Microsopy at LBNL, the Center for Microanalysis of Materials at the University of Illinois, and the Shared Research Equipment Program at ORNL. It is assessing the scientific and technological impact of these centers during the past decade and the impact they may have during the coming decade, looking at user demand, how that demand may change, the special needs the centers serve, the complementation among the centers, the visions for the centers, and the opportunities for improving the techniques practiced by the centers. The chair is John Stringer, and the subpanel had a planning meeting on Aug. 13, 1999, and will tour all four centers between Dec. 6 and 10, 1999.

The Advanced Light Source subpanel is reviewing that facility to examine the issues raised by the prior BESAC report, *DOE Synchrotron Radiation Sources and Science*, exploring the ALS=s vision for the future, the quality and diversity of its science programs, the user demand, and interactions with and relationships with the user community. The panel is currently being recruited.

The IPNS and MLNSC subpanel is reviewing the science and the user programs at the Intense Pulsed Neutron Source at ANL and the Manuel Lujan, Jr., Neutron Scattering Center at LANL. The panel is addressing the effectiveness of the user programs, user support, and proposal-review mechanisms; the availability, dependability, and reliability of the facilities; and their visions for the future. The panel is currently being recruited.

The Committee of Visitors (COV) subpanel is establishing committees of visitors through which BESAC can provide assessments of program decisions on a regular basis. The panel is currently being recruited.

Leone asked what this COV constitutes. Thomas said that the Office currently has the Government Accounting Office (GAO) periodically looking at its programs (such as solid-state physics), and the Office would like to have BESAC checking to see if it is doing all the things that should be being done.

McCurdy commented that the NSF=s COVs look at procedures *and* quality, whereas the GAO looks only at procedures. Richmond said that several BESAC members would be on a panel that would be involved in this process of sampling and looking at programs. Horton suggested considering what conflict-of-interest issues would be involved, and Richmond commented that, if an individual is from an institution that is being looked at, he or she will not be assigned to that panel, but to another.

Richmond observed that, during the next few months, the complex-systems subpanel must carry out a lot of activities to prepare something for the FY 2001 budget. Crow commented that, if the complex-systems workshops were held regionally, it would indicate an openness. Thomas said that he had not thought of that.

Leone commented that many agencies have a website where one can subscribe to the agency=s list of solicitations and suggested that DOE establish a similar capability. Bob Astheimer said that SC has a page for grants and proposals. Listing workshops can be done, but is now done only in a scattered manner. It was hoped that each division would do it on its own. Thomas interjected that that was a vain hope. Astheimer continued that SC should probably have a page on upcoming workshops and conferences. Leone said that he would like to see something that was more proactive, with e-mail notification of subscribers when DOE has something coming up in a subject area in which the subscriber has registered an interest.

Richmond suggested that BESAC send out a weekly e-mail update, telling where each charge panel is. Daniel Chemla asked who is deciding on the workshops, and Richmond responded that that is in flux. Thomas said that the topics and makeup of the workshops are up to the Committee; if BESAC has any ideas for workshop topics, the Office would be glad to hear them. Richmond said that themes had been suggested for the workshops, but the sentiment was not for themes but for scientific-problem orientations (such as how do you make a living plant). The question is, should the workshops center on topics people are familiar with or on problems that DOE is interested in. Lester said that one problem is that it is not known who is to be on that subcommittee. At this point, the only member is Charles Shank. It would be good to have a small panel to contact. Richmond agreed and set the contact subcommittee as Stupp, Thiel, Smalley, and Richmond. Dove asked if this action was just adding levels of bureaucracy, and Richmond responded that, if it were left to all of BESAC, the group would be too large; right now, Shank is the only continuing presence. Thomas said that BESAC should be very involved; if it wants additional meetings, they can be arranged.

Stupp noted that all of BESAC should see the summary of the previous day=s miniworkshop. Richmond agreed that all of BESAC would see Shank=s report after several BESAC members review it. Horton said that the only way to ensure a general buy-in is if, as Crow suggested, lots of people around the country are involved, not just a few people at a few workshops. Richmond said that she was encouraged by the interest exhibited, but there must be communication that keeps everyone abreast of what is going on. McCurdy asked if this initiative was intended for the FY 2001 budget. When Thomas responded affirmatively, he went on to say that it is not clear that what has been said here has added any value; the topic of these workshops is portrayed not as an important issue but only as a short-timeline issue.

Thiel said that she understood that complex systems is being folded into the nanotechnology initiative and asked how that folding is to be done. Thomas responded that the complex-systems effort is a roadmapping rather than an initiative. Within that roadmap are several possible research efforts, including nanotechnology, which the Interagency Working Group (IWG) is looking at as an initiative that will provide support for research. Thiel noted that it is the NNI that must be developed quickly, then. Thomas responded that that was correct; PCAST is holding a meeting on this topic on Nov. 25. Mayes asked what BESAC should do. Thomas said that BESAC had workshops back in January; it needs to get people starting to think about these things and needs to get people behind the concept. BESAC can develop the scientific agenda *and* develop the support for the concept.

Richmond said that what was unresolved is what is the science. Thomas said that we are hunters and gatherers; people need to start thinking about this. Stupp observed that that is exactly what workshops can do. Smalley commented that, if there were a big meeting about what nanoscience can do in the next century, people would come away from it with great excitement; otherwise, you are going to have seven agencies all saying the same thing. Horton said that regional meetings are today=s paradigm. Stupp observed that the internal structure of such meetings could be managed in many ways. Richmond noted that a large workshop has a lot of goals and you have to set your priorities. Thomas said that if you have the science driving it, the rest will fall into place. Richard Kelley said that the NIH is a small player in the NNI; it is connected to nanotechnology in spirit; next year, it will push to involve the physical sciences in the life sciences.

Richmond then

1. moved to publish a monthly e-mail update on subcommittee activities, Lester seconded, and it was accepted by consensus;
2. charged Thomas with the task of getting a web page up on upcoming workshops; and
3. said that there would be one large workshop focusing on how nanotechnology can address the energy issues of the coming century.

She then opened the floor for public comment; there being none, she adjourned the meeting at 5:26 p.m.

Thursday, Nov. 4, 1999

Chairwoman Richmond called the meeting to order at 8:23 a.m. and introduced **Iran Thomas** to review the status of BES=s Division of Materials Sciences. He started with the organization chart, pointing out that the Division is made up of the Metal and Ceramic Sciences Program, the Condensed-Matter Physics Program, and the Materials Chemistry Program. The Division is headed by two administrative teams: Metal and Ceramics Sciences and Materials Chemistry. He highlighted the work of Helen Kerch on scientific misconduct; Richard Kelley and Robert Price on nanoscience; and Jerry Smith on the selection of a new contractor for ORNL. He then noted that the budget is about the same this year as last. The Division had requested $407.57 million plus $196.1 million for SNS construction and was appropriated $398.733 million plus $100 million for SNS construction.

To advance the frontiers of an emerging but rapidly expanding field of endeavor, the Division has

established the Computational Materials Science Network to foster partnering and collective activities. This network is being supported through the funding of cooperative research teams at $200,000 to $300,000 per year and of focused workshops. The research teams focus on a critical science; build on an existing BES program; include scientists from DOE laboratories, academia, and industry; last about three years; and end with a formal review. In the first round of funding, three proposals competed, and one was funded; in the current round, four proposals are being considered. Five focused planning workshops have been held:

- Microstructural Evolution Based on Fundamental Interfacial Properties,
- Microstructural Effects on the Mechanics of Materials,
- Polymers at Interfaces,
- Magnetic Materials: Bridging Basic and Applied Science, and
- Excited-State Electronic Structure and Response Functions.

He reviewed the mission and project chronology of the SNS, ending with the observations that Congress had appropriated $117.9 million for FY 2000, which was $96.1 million short of the requested $214 million. The Department is now awaiting OMB guidance on out-year funding levels that might be requested. The Project Execution Plan has been updated, and the baselines approved by SC. Site preparation is scheduled to start in November of 1999 and a full-scale mockup of the mercury target has been constructed.

The neutron science support building at the High-Flux Isotope Reactor (HFIR) has been completed.

A National School on Neutron and X-ray Scattering was held at Argonne National Laboratory in August. It was a very exciting development, an experiment that will be broadened and expanded.

He noted the participation of the Materials Science Division in EPSCoR (Experimental Program to Stimulate Competitive Research), which has the objectives of enhancing the capabilities of designated states, conducting competitive energy-related research, and developing science and engineering manpower to meet current and future needs in energy-related areas through implementation grants and laboratory-partnership grants. This year, the Division received 450 new applications and funded 64 and received 86 proposals for renewals of existing grants and renewed 57 of those.

Examples of work performed under grants from the Division include the development of molecule/polymer-based magnetic materials and the calculation of the constrained local moment of bcc (body-centered cubic) crystals of iron, which was the first real calculation conducted with teraflop computers.

He observed that there are extremes of peer review. A major problem is that novel proposals (such as molecule/polymer-based magnetic materials) are likely eliminated. BES uses merit review in which the peer reviewers= comments go up the chain of command, and a manager can make a recommendation for award (which then has to be agreed to by the rest of that office).

He highlighted the work of the DOE Council on Materials Science, which each year considers the

literature produced in that discipline and writes a summary of the state of the science. He displayed the membership of the DOE Council on Materials Science for 1998-99 and distributed a list of examples of R&D integration and interagency activities engaged in by the Division during 1998; these are activities that bring together different segments of the Department and researchers funded by those different segments.

Johnson asked who was on the Council from BES. Thomas said that the Council is made up of active researchers, not of research managers. Industry, academia, and national laboratories are represented on the Council. It is a self-assembled outside group brought together to consider BES=s materials-science research portfolio and to identify other areas that BES should be supporting.

Leone asked how much of the decline in the number of proposals was in the proposals to the core program. Thomas noted that the number of proposals can easily be increased, but not the number of awards. The constant funding level of the core program has caused the number of awards (and therefore the number of proposals) there to fall off. He did not know the relationship in number of proposals between the core program and the specific programs. Stupp asked how many single-principal-investigator (PI) projects were in the corporate research group and how their proposals were solicited. Thomas responded that the office always gets phone calls about these. BES does not say it wants proposals from individuals and small groups, but perhaps it should. The great majority of the awards to academics are for one- and two-investigator efforts. At the national laboratories, the groups tend to be larger (five or six PIs). Goodman commented on the fairly high attrition among the renewals, and Thomas noted that, if the budget is steady-state, the only way to fund new work is to have attrition.

When he had finished his presentation, Dehmer announced that Thomas had received the Presidential Rank Award this year.

Richmond then called upon **Bill Millman** to review the status of the Chemical Sciences Division. He compared the chemical sciences budgets of various federal agencies to reveal that DOE is the second largest supporter of such research. He presented the organization chart to show the structure and makeup of the Division, noting that there are a number of vacancies that they hope to fill in the near future. He also noted that the Division=s program in heavy-element chemistry is the only one in the U.S. Government to consider the chemistry of the transuranic elements. A chart of federal funding of research showed that DOE is the second largest supporter of chemical sciences behind the NIH. This research is broken down into (1) work at the molecular level (heterogeneous chemistry and homogeneous-phase chemistries) and (2) fundamental interactions (spectroscopy, combustion, catalysis, and solar energy conversion).

The Phase-II construction of the Combustion Research Facility at Sandia National Laboratories in Livermore, Calif., was completed on schedule and on budget. It is to be dedicated Nov. 18, and it doubles the Facility=s laboratory space with 16 new laboratories currently being occupied. One advance to come out of the combustion research already is the ability to measure combustion chemistry on the fly, one molecule at a time. Other notable research results produced by the Division include:

< the first experimental observation of Thomson scattering, 60 years after its prediction;

- the experimental and theoretical confirmation of the first isolation of an oxametallacycle catalytic oxidation intermediate; and
- the development of complexes that sequester transuranic ions (e.g., neptunium, plutonium, americium, and curium) from aqueous solutions, allowing their removal from groundwater.

During the past three years, the Chemical Sciences budget has generally gone up. It has lost some congressional-direction funds, but has received increases in climate-change funding. This funding is distributed among university research (21%), national-laboratory research (34%), facility operations (33%), and other (e.g., Small Business Innovative Research) expenditures (12%). Among the research programs, the distribution is: electrochemical energy storage and conversion (3%); atomic, molecular, and optical physics (6%); chemical energy (15%); chemical engineering sciences (2%); chemical physics (18%); heavy-element chemistry (4%); photochemical and radiation sciences (12%); separation and analysis (8%); and other (34%).

With this funding, the Division supports 429 programs (81 at national laboratories and 348 at universities) and 7 facilities. The distribution in the size of grants to universities peaks at $120,000. Overall, the Division received 513 proposals in FY 1999 and funded 332 of those proposals. As part of the Complex and Collective Phenomena Initiative, it received 51 preproposals, received 37 full proposals, and funded 6 proposals (4 at universities and 2 at national laboratories). As part of the Carbon Management Initiative, it received 107 preproposals, received 89 full proposals, and funded 14 proposals (9 at universities and 5 at national laboratories).

The Division has a number of linkages with other DOE programs, especially those of the Office of Nuclear Energy and the Office of Environmental Management.

This year, the Department has established environmental molecular-science institutes at Princeton, Columbia, and Northwestern. From FY 1996 to FY 1999, the Environmental Molecular Science Program has received funding from a variety of divisions in BES: chemistry, 41%; engineering, 15%; geosciences, 19%; materials sciences, 10%; plant biology, 3%; and other sources, 12%. This effort has really helped the core programs in BES but has placed significant demands on the time of the BES staff.

Finally, during FY 1999, the Division contributed to several workshops: BESAC workshops (one on complex systems and one on novel coherent light sources), the Council for Chemical Sciences workshops (two are currently in the selection process), and general programmatic workshops.

Leone asked if they had found any barriers to being an effective advocate, and Millman said that they had not. Crow asked what programs of other agencies they had cooperated with. Millman said that they cooperated with many other programs and that he had not been able to fit them on the slide. Stupp asked why organic chemistry does not play a major role in the program. Millman said that it does. The alignment between the NSF and chemistry departments is very straightforward; in contrast, DOE=s is less traditional, more transdisciplinary, and incorporated into separation and catalysis chemistry. Stupp asked if chemistry would make any contributions to nanoscience. Thomas interjected that polymer chemistry would make such contributions. Millman noted that one of the slides that he had skipped over

(on molecular wires) dealt with a major effort in that area.

Lester said that the holes in the organization chart concerned her; junior people need to be hired to anticipate retirements. Dehmer noted that a reorganization team had made a number of recommendations that included a politically incorrect recommendation for strategic downsizing. But the edict came down from on high to downsize uniformly across the board. A recent analysis of how much talent could walk out the retirement door right now was a real wakeup call. As a result, authority has been granted to hire new, younger personnel, and priorities were developed for the positions to be filled by those new personnel now being recruited. Stupp asked if there were any rotation, and Dehmer replied that there are detailees from the national laboratories and Intergovernmental Personnel Act workers (IPAs) from academia and the national laboratories. McCurdy noted that IPA assignments attract people temporarily who would not be attracted permanently and asked Dehmer why BES does not have more. She said there were limitations on how many IPAs an office can have. Millman notes that the temporary personnel are also subject to certain restrictions (no contacts with their home labs etc.) that limit the attractiveness of these positions. The participants also encounter salary problems.

Johnson asked what impact earmarking had had. Millman said the only cases he could think of were the two items in the FY 2000 budget that were subsequently cut out. Thiel asked about the underpinning dynamics of the establishment of the three molecular-science institutes at Princeton, Columbia, and Northwestern. Millman replied that it was a partnership between DOE and NSF, with NSF handling the solicitation and peer-review process and DOE providing the funding.

A break was declared at 10:00 a.m. When the session was reconvened at 10:19 a.m., Richmond announced that the presentations by Dilworth and Thomas scheduled for the remaining portion of the morning session had been postponed until the February BESAC meeting to allow Dehmer to expand on the Committee of Visitors (COV) concept that underlies a new charge to BESAC from SC. Dehmer said that a COV program will be more difficult to establish at DOE than it was at the NSF, where it had a positive influence. There, however, the one-page writeups on discussions were not indicative of the rationales of the decisions arrived at and recommendations made. As a result, DOE is now looking at the one-page writeups its managers do. As a federal official, Dehmer cannot ask for a consensus report from an unofficial group. Therefore, any committee providing an outside assessment of DOE activities must come from within the Department-s employees or from a committee governed by the Federal Advisory Committee Act (FACA), such as BESAC. The recommendations from that COV subcommittee must be reviewed and approved by BESAC before they can be passed on to the Department. Thus, Martha Krebs has charged BESAC to provide a periodic (every 3 to 4 years) assessment of the Office of Basic Energy Sciences. BESAC needs to empanel a subcommittee to report to the full Committee. The first area to be reviewed will be decided upon jointly by BESAC and the Office; BESAC will then select an appropriate review panel. Stohr moved that the subcommittee be called the Program Management Review Committee. Goodman seconded, and the motion passed unanimously.

Richmond said that BESAC needs to be involved in the nanotechnology initiative, which is moving along quickly. Because of the fast pace, she recommended that the contact group named on the first day of

this meeting (Stupp, Thiel, Smalley, and Richmond) be available to have telephone conferences about any way that BESAC can assist in the implementation of this initiative. That group would also be a conduit for information transfer to the rest of BESAC in getting advice or any other input to help move this initiative along. It is too cumbersome to have all of BESAC involved.

Herbst asked where the money is coming from for this national initiative, and Dehmer introduced the OMB examiner responsible for OBES, **Michael Holland**, to address that question. Holland summed it up this way: The two brochures produced by BESAC, one on nanotechnology and one on complex systems, created an interest in the topic of nanotechnology within a number of federal agencies. A briefing was held for OMB examiners, and a request was made within each agency=s budget. Those preliminary budgets are passed back to the agencies by Thanksgiving in preparation for rollout of the president=s budget in February. But in this case, no budget space has yet been created. The next opportunity for added requests is during passback. At that point, this and other initiatives will be considered and ranked by priority. So, there is a chance for input to the OMB from DOE (only) at that point. After the budget goes to Congress, the scientific community can have its say to the appropriation committees and the science committees. Members of Congress have to recognize that this is the direction that science is going to move in.

Dehmer said that, right now, BESAC has to provide information to the Department to educate it on how to negotiate with OMB. After February, BESAC needs to go to Congress and its staffers to provide them with the information they need and seek. Thiel asked how this money comes down. Holland said that OMB has department-by-department targets and tradeoffs need to be made. It can happen that a program can be funded by raiding the core program. Another way is to move around or move over target money; then, one must strive to maintain a portfolio balance.

Stohr asked what efforts had been made to get the scientific community involved. Holland said that the advisory committees like BESAC are the starting points and that they should pass their advice on to decision makers. Also, you can uses congressional recesses to introduce congressmen to the topic. Crow suggested that Shank=s group produce a two-page document to describe this initiative. In a discussion of what level of funding to ask for or whether to even set a possible funding level, Johnson asked if a request that did not specify a funding level might be regarded too anemic to be considered. Holland responded that the federal official=s job is to determine the funding levels; a request that comes in with specific levels can produce unintended effects.

McCurdy said that the Committee needs to make the scientific community aware of this initiative and that the Committee therefore needed to revisit the question of workshops. Richmond said that the question comes down to whether (1) a huge workshop that is useless in terms of the number of participants, (2) a lot of workshops that cannot be coordinated, or (3) a small group that does not reflect a broad consensus is wanted. Dehmer asked if anything like this was needed now; after all, the two brochures lay out the framework of a program, and time is running short.

Horton suggested that Dehmer and her staff prepare a one- or two-page description of the initiative in generic terms that could be communicated to the technical community, universities, and professional

societies.

Crow noted that there are large society meetings coming up and asked if they could be used to get the message out. Horton agreed with that suggestion, saying that what is needed is communication, not workshops. Leone suggested that a lot of this would work well on the Web, especially if people could thereby provide feedback. Crow suggested that, in the spring, some committee members could write short articles on the initiative for submission to such publications as *Physics Today* and *C&E News*. Stohr put forward the possibility of holding national symposia. Smalley suggested that the BESAC chair draft a statement to the director of the Office of Science expressing the Committee=s strong support for this initiative and its willingness to assist in whatever manner that would be helpful in carrying it through. This suggestion was reformatted into a motion that was seconded by Goodman. The motion carried unanimously.

Stupp asked if DOE had ever held a meeting at a national professional society meeting, and Richmond said that it had in several areas. He suggested a number of upcoming meetings at which the initiative could be announced and discussed. Horton suggested that the user groups at the user facilities could be encouraged to speak out and to communicate with their colleagues.

Richmond then summarized the discussion:

- As soon as OBES can put together a one-page summary of the science involved in the nanotechnology initiative, Richmond will pass that on to the membership of BESAC to be used in whatever mechanism it chooses, such as forwarding it to colleagues, editors of publications, or others that might be interested in getting the information. She asked that any attempt to place the information in a major publication be communicated to her by e-mail so she can coordinate the effort.
- A subcommittee of individuals will work with Dehmer and Thomas on the issue, but that will not preclude other BESAC members from feeding their inputs to that subcommittee and the Office.
- Richmond will write a letter to Krebs expressing the Committee=s enthusiasm for the NNI and its willingness to support the initiative.
- Richmond will send a two-page summary of the miniworkshop conducted by Shank to the BESAC members so they will be aware of what occurred at that workshop.

Richmond opened the floor to public comment. Daniel Chemla of Lawrence Berkeley National Laboratory said that the scientific community is not looking for a one-time increment but for a restoration of funding for the physical sciences to its rightful level. Michael Holland offered to convey that to his colleagues at OMB, but noted that it is difficult to spread this benefit across many disciplines effectively. Tom Picraux of Sandia National Laboratories asked if the Committee=s letter to Krebs could be shared with a broader community. Richmond said that she thought the BES web page might be a good way to do that. Steve Shapiro of Brookhaven National Laboratory asked what the other agencies are doing to promote nanoscience. Dehmer said that they are very supportive, but DOE is the only one to come in with two brochures. Judy Franz of the American Physical Society (APS) noted that the APS meeting schedule is already set but she would be glad to work with the Committee to work something in.

There being no further public comment, the meeting was adjourned at 11:18 a.m.

Respectfully submitted,
Frederick M. O'Hara, Jr.
Recording Secretary