

## 10. CENTER DIVERSITY—PROGRESS AND PLANS

The NSEC based at Harvard University is committed to increasing the diversity of the science and engineering workforce, and to making science and engineering accessible to a broad audience. NSEC faculty participants are dedicated to increasing participation by members of underrepresented groups and to giving these scientists and engineers the resources and guidance needed to succeed in each stage of their careers so as to become leaders in both education and research. Our strategic plan for increasing diversity builds on connections we have made through various programs, and seeks to increase our impact by developing new partnerships, both internally and externally. The recently released reports of the Task Force on Women Faculty and the Task Force on Women in Science at Harvard present several opportunities for leveraging NSF and University support to increase participation of women and underrepresented groups in science and engineering.

We have identified five broad goals that will be accomplished through a variety of initiatives: (1) to intensify the recruiting, support and professional development of a more diverse group of graduate students and postdoctoral researchers; (2) to increase the diversity of faculty participating in the NSEC; (3) to strengthen recruiting and mentoring of members of underrepresented groups through our joint REU programs; (4) to mentor pre-college students as they consider careers in science and engineering; and (5) to develop long-term partnerships with predominantly female and minority-serving institutions.

### **Goal 1: Recruiting, Professional Development and Support of a Diverse Group of Graduate Students and Postdoctoral Researchers**

Graduate students and postdoctoral researchers are at crucial stages in their careers. Their experiences in terms of professional development, mentoring, and access to facilities and other opportunities have a significant impact on their career choices. Our goal is to leverage NSF and University support to recruit graduate students and postdoctoral researchers from underrepresented groups in science and engineering, and to provide resources to the students that will empower them to become educational and research leaders.

**Strategy 1: Recruiting.** Many of the strategies in place in the REU program to recruit highly qualified undergraduates to the summer program have been shared in recruiting of graduate students and postdoctoral researchers, including publicizing the graduate program and postdoctoral positions at conferences and on websites that reach a large population of underrepresented minorities. The Director of Educational Programs Kathryn Hollar coordinates with the Minority Recruitment Officer for the Harvard Graduate School of Arts and Sciences and the Graduate Program Administrator in Physics to share resources in these efforts.

More directly, we are using the REU program as a method to recruit students to our graduate programs and encourage students to continue on to graduate school in general.

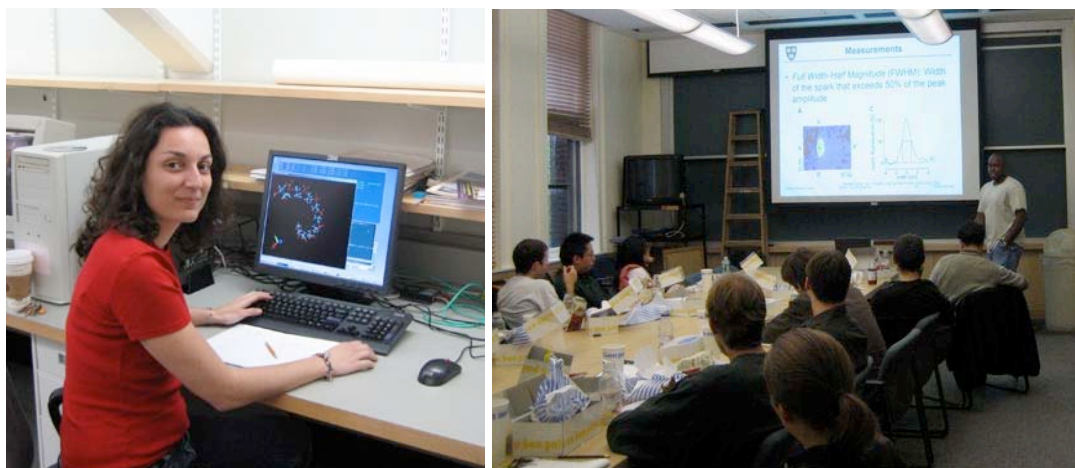
Since 2002, at least 19 former REU students have been accepted into graduate programs at Harvard, including minority students and 11 women. Twelve of these students are currently graduate students at Harvard (3 minority and 6 women).

**Strategy 2: Professional Development and Mentoring.** The NSEC has developed a program of professional development for NSEC-affiliated graduate students and postdoctoral researchers through the research exchange seminar and the AP298r course. Postdoctoral researchers and graduate students also have the opportunity to participate in our educational programs, including developing mentoring and project management skills through our REU program and experience in presenting to K12 classrooms through connections with the Cambridge Public Schools and our RET programs, and engaging the public at the Museum of Science, Boston.

The NSEC will also work in concert with the School of Engineering and Applied Sciences, the Chemistry and Chemical Biology Department, the Physics Department, and the University administration to leverage support for more professional development opportunities for graduate students and postdoctoral researchers. We will use some of our funding to support these professional development activities and for travel support.

**Strategy 3: Support.** We have established Center fellowships to encourage the participation of women and minority groups in science and engineering. Fellows are integrated into the research and educational community of the NSEC, and connections with faculty and institutes across the university are facilitated through this program. Access to research facilities and educational and professional development opportunities helps develop a strong pool of well-prepared researchers for faculty positions and the scientific community (Figure 10.1). In 2007, these Postdoctoral Fellows include:

- Maria Fyta (Advisor [Efthimios Kaxiras](#))
- Xiaolin Zheng (Advisor [Charles Lieber](#))
- Mark Bray (Advisor [Kevin Kit Parker](#))
- Raquel Perez-Castillejos (Advisor [George Whitesides](#))



**Figure 10.1.** (Left) NSEC Postdoctoral Fellow Maria Fyta. (Right) Mark Bray presents at the NSEC Research Exchange.

## Goal 2: Increase Diversity of *Faculty Participating in NSEC*

One of the major challenges facing the science and engineering community is to increase the diversity of the faculty ranks. The collaborative and interdisciplinary nature of the research of the NSEC provides a supportive environment that effectively integrates young scientists and engineers into a vibrant scientific community at the beginning of their academic careers. The NSEC also provides access to cutting-edge instrumentation facilities, which are a valuable resource at an early career stage. Furthermore, several NSEC Faculty have leadership roles at Harvard—e.g., Narayanamurti, Dean of Physical Sciences and DEAS, and Friend, Chair of the Chemistry Department and Associate Dean of FAS—and are committed to making progress in this key area. Taken together, the NSEC at Harvard is ideally positioned to play a leading role in diversifying the faculty in science and engineering at Harvard.

**Strategy 1: Partnership with Radcliffe Institute.** As discussed in Section 12, we partnered with the Radcliffe Institute this past year. Radcliffe Fellows continue to collaborate with NSEC faculty; recent examples include Dr. Tayhas Palmore, 2006–2007 Radcliffe Fellow and Paula T. Hammond, 2003–2004 Radcliffe Fellow.

**Strategy 2: Leadership and focus in faculty hiring.** The sciences and engineering at Harvard are experiencing a period of rapid growth, and faculty in the NSEC are in leadership roles at Harvard that can influence the recruitment and support of new faculty. The highly collaborative environment of the NSEC and the availability of world-class instrumentation also provides an ideal opportunity to develop the careers of new faculty. Junior faculty at Harvard contribute significantly to each research cluster within the NSEC. Close interaction with senior faculty helps new faculty to develop stronger individual research and educational programs. Senior faculty in the NSEC who are also in leadership positions at the department and university level include:

Professor Cynthia Friend: Former Chair of Chemistry and Chemical Biology  
Professor Robert Westervelt: Member of Diversity Committee, Physics Department  
Professor Howard Stone: Associate Dean of Academic Programs, SEAS  
Professor Venkatesh Narayanamurti: Dean of SEAS

These faculty and others have a strong commitment to increasing diversity, as evidenced by participation in this dialogue at a national level. For example, Cynthia Friend co-chaired the recent workshop on *Building Strong Academic Chemistry Departments through Gender Equity* at NSF in Arlington, VA, January 19–21, 2006 (<http://www.chem.harvard.edu/groups/friend/GenderEquityWorkshop/resources/pdf/Recommendations.pdf>). This workshop, funded jointly by NSF, NIH, and DOE, produced a major report that serves as a blueprint for increasing diversity in academia.

Since 2002, we have increased the number of junior faculty supported by the NSEC from 1 in 2002 to 9 in 2007; the number of women faculty supported has increased from 1 in 2002 to 4 in 2007. In 2007, Joanna Aizenberg was hired as a senior faculty in SEAS

and CCB, and has assumed leadership roles as a member of the Executive Committee for the NSEC, and as part of the Directors Group for CNS.

### **Goal 3: Strengthen Recruiting and Mentoring of Underrepresented Groups through REU Program**

NSF support for the REU programs of the NSEC and allied programs in Materials Research provides core funding for a growing undergraduate research program that includes substantial funding from Harvard. These joint programs, which now support over 45 students each summer, share a common infrastructure for recruiting, providing community and professional development activities during the program, intensive mentoring during the summer and post-program, and program evaluation and tracking. Connections made through our REU program's focus on diversity also serve as critical building blocks for our strategic diversity plan.

**Strategy 1: Recruiting.** A special initiative spearheaded by Howard Stone recruits and engages excellent students from Historically Black Colleges and Universities (HBCU) in our summer REU programs. This recruiting effort has expanded to include universities with predominantly Hispanic enrollments, and primarily undergraduate institutions that serve women. Faculty and staff have visited Morgan State University, Howard University, Morehouse College, Spelman College, Florida Agricultural and Mechanical University, the University of Puerto Rico (Rio Piedras and Mayagüez campuses), Sweetbriar College, Texas Prairie View Agricultural and Mechanical University, and North Carolina Agricultural and Technical State University. At these recruiting visits, we discuss not only the opportunities available at Harvard, but also the



**Figure 10.2.** Graduate students in SEAS, Physics, and Chemistry and Chemical Biology, along with physics/SEAS faculty Vinodhan Manoharan, Physics Director of Graduate Admissions Sheila Ferguson and Director of Educational Programs Kathryn Hollar attended the NSBP/NSHP annual conference to network and recruit for graduate school and the REU program. Funding was provided through the Graduate School of Arts and Sciences, HSEAS, Physics, and Chemistry and Chemical Biology.

characteristics of a strong application for a research experience program. Former REU students at these institutions often lead discussions on the summer research experience. Additionally, faculty and staff recruit at professional and research conferences and career fairs for underrepresented groups, including the joint annual conference of the National Society of Black Physicists and the National Society of Hispanic Physicists (Figure 10.2); the National Society of Black Engineers, a National Conference on Hispanics in Engineering;

New England Board of Higher Education Minority Career Fair at MIT. To reach a wider audience of applicants for our REU program, we partner with the Graduate Admissions Offices of various departments, including SEAS and Physics, to distribute materials advertising our program at these conferences and career fairs. Attendance at these conferences aids us in recruiting students and in following up with past REU alumni. In 2007, we recruited 2 very talented students from these conferences to our REU program. In February 2007, we hosted a reception and laboratory tours in conjunction with the National Society of Black Physicists and Hispanic Physicists joint annual conference in Boston, MA. We also hosted a visit by Morehouse College students who were exploring graduate programs during their spring break.

In addition to these recruiting visits, we also advertise on many websites and listservs that are resources for underrepresented groups. REU participants report that the internet is an important resource for finding summer programs; therefore, we also advertise on web sites and listservs that target underrepresented groups in engineering, such as the Faculty for the Future website ([www.engr.psu.edu/fff/](http://www.engr.psu.edu/fff/)), and the Women in Engineering Professional Advocates Network (WEPAN). These efforts resulted in an increase in applicants to the joint programs from 247 in 2004 to over 350 in 2007. Applications for the 2008 REU program are projected to be in excess of 500. As discussed in **Section 11—Education**, targeted recruiting efforts have resulted in a diverse REU program. In 2007, 2 of the 8 NSEC-supported REU students were African American, and 1 was a Pacific Islander; 6 of the 8 students were women.

Through the National Research Centers Educators Network (NRCEN), Kathryn Hollar has also made many connections with minority-serving institutions and organizations.

**Strategy 2: Mentoring and Professional Development.** The summer REU program includes many community-building and professional development activities for both REU participants and mentors, including a workshop on presentation skills, a luncheon on applying to graduate school, and weekly presentations by faculty on research and ethic. An intimate luncheon hosted by the Harvard Foundation for Intercultural Affairs gives students from underrepresented groups a unique opportunity to interact with a small group of faculty (Figure 10.3). This luncheon has resulted in many instances of mentoring that have extended beyond the summer program, and will continue to be an integral part of our plan for students from underrepresented groups.



**Figure 10.3.** Dr. Allen Counter, President of the Harvard Foundation for Intercultural Affairs and Race Relations, talks to REU students during the annual luncheon for minority students hosted by the Foundation.

**Strategy 3: Post-Program Mentoring and Long-term Tracking.** The relationships developed during the program extend past the summer: mentors provide guidance and support as students apply to graduate school, and also include students in the process of writing and submitting papers that are based on their summer work. Students are encouraged to present their work at local and national conferences, and funds are available through the REU/RET Site in Materials Research to support travel for mentors and REU participants to national conferences.

**Goal 4: Introduce *Pre-college Students* to Science and Engineering Programs through Summer Opportunities or Year-round Programs**

We continue to expand our repertoire of activities for pre-college students and teachers, focusing on collaborations that effectively impact schools and students that have high need or significant achievement gaps between student groups. We continue an informal partnership with the Cambridge Public Schools, and are developing a collaboration with a relatively new public school in Boston, The Engineering School at the Hyde Park Educational Program. Both of these schools have significant populations of students who have historically been underrepresented in science and engineering careers. The Cambridge Public School District is an urban district that is over 60% minority, with 37% of students enrolled in a free or reduced lunch program. The Engineering School, one of the small schools that are a result of the recent reorganization of several large Boston Public Schools into smaller learning communities, is comprised of 56% Black and 34% Hispanic students, with 65% of the students enrolled in a free or reduced lunch program. In both partnerships, we focus on supporting students in school-based scientific research or engineering design projects, rather than formal curriculum development. This strategy capitalizes on our strengths as a highly disciplinary research institution, and allows us to meet critical student and teacher needs in terms of mentorship and professional development skills that are not explicitly covered in science curricula.

**Strategy 1: Increase Collaboration with Cambridge and Boston Public Schools at the High School Level**

In 2006–2007, Cambridge Rindge and Latin School (CRLS) for a second year offered a course, “Research Seminar in Science, Technology, and Design,” for advanced students. In 2007–2008, the model proposed by this course, student internships for 10 hours per week, was integrated into several courses, including a Marine Sciences elective course. We continue to support these efforts by CRLS by exploring internship opportunities and giving students feedback on poster presentations prior to competitions.

A new partnership with The Engineering School (TES) at the Hyde Park Educational Complex builds on the model developed with Cambridge Public Schools. The NSEC has supported the goal that TES has to increase student engagement in science and engineering competitions by providing expertise and feedback on student-defined science and engineering fair projects via email, class and student visits to Harvard, and visits to TES. Following the model developed with CRLS, our graduate students and postdoctoral fellows have



**Figure 10.4.** TES students work on developing an engineering exploration for middle school students. The students pictured also won first prize at the Boston City Science Fair.

worked with TES students on poster presentation skills, experimental design, and finding resources for projects. Two TES students recently received first prize in the Boston City Science Fair, and another student placed third. Our goals in the next year are to formalize this relationship to reach a wider population of students in the school, as well as give students more exposure to current NSEC research areas so that students will be able to propose a wider variety of science and engineering fair projects. We are also working with TES faculty and students to develop engineering exploration modules to be included in a TES student-led mentoring program for local middle and elementary schools to encourage a higher enrollment of girls from these schools in TES in future years (Figure 10.4)

**Strategy 2: Continue Collaborations with Cambridge Middle Schools, Parents, and the Community.** As discussed below in *Section 11—Education*, NSEC Faculty participate in Project TEACH (The Educational Activities of Cambridge-Harvard), which brings each 7<sup>th</sup> grade class from CPSD to Harvard for a college awareness and science presentation day.

**Strategy 3: Develop Connections with Urban Schools through RET.** Our RET program recruits teachers from local urban schools to participate in the Center’s research and educational activities for 6-8 weeks during the summer. We encourage many follow-up activities with teachers, including classroom visits and field trips to Harvard. As we continue to build research and educational programs in close partnership with CPSD and Boston Public Schools, we will integrate our RET teachers and their students into these activities. For example, a middle school teacher from CPSD participated in our joint RET programs in Summer 2007, and we have identified a teacher from The Engineering School who will be a part of our RET program in 2008.

**Strategy 4: Pursue Internal Partnerships.** A partnership with the Harvard Graduate School of Education has developed links with pre-service teachers in the sciences through the NSF Noyce Scholarship Program. In the first year of the 3-year Noyce program, several teachers took graduate science or engineering courses with NSEC faculty. In the second year of the grant, a Noyce Scholar was recruited to our RET program.

These four initiatives, natural extensions of established relationships, are examples of how we will continue to develop science education partnerships that engage students, teachers, and parents.

**Goal 5: Develop Long-term Research and Educational Collaborations with Predominantly Female or Minority-serving Institutions**

We will build on the connections we have made with predominantly minority-serving institutes through our REU program to develop research and educational collaborations. For example, Howard Stone has visited Morgan State University (one of the HBCUs) each year to recruit students for our REU program. In March 2007, we also hosted a visit by students from Morehouse College as part of their annual graduate program trip during spring break. In fall 2007, Eric Mazur visited Morehouse College and publicized the REU program during his visit. As a result, we have offered 2 students from Morehouse College positions in our REU 2008 program.

Our goal over the course of NSF support is to formalize these research and educational partnerships with predominantly female and minority-serving institutions by facilitating the exchange of educational strategies and developing research collaborations.



## 11. EDUCATION AND HUMAN RESOURCES

Center participants continue to be actively involved in programs that engage the public, teachers, students, and young scientists and engineers in the excitement of scientific discovery and increase awareness of the impact of scientific research on their daily lives. Our broad goals are to increase public engagement in and awareness of advances in nanoscale science and engineering, and to promote career advancement for a diverse group of young scientists who represent the future of science and engineering. We continue to enhance and expand existing programs and collaborations that address the needs of a diverse population ([www.nsec.harvard.edu/education.htm](http://www.nsec.harvard.edu/education.htm)). Our educational initiatives at the pre-college, undergraduate, graduate, and postdoctoral levels include embedded diversity initiatives and strategic collaborations whenever possible to encourage individuals from underrepresented groups to pursue careers in science and engineering. In addition to increasing public understanding of nanoscale science and engineering for a broad and extensive audience, our long-standing partnership with the Museum of Science, Boston enhances the university-based activities such as our REU and RET programs, as well as professional development of postdoctoral fellows and graduate students.

### University-based Activities

**Public Presentations—Holiday Science Lecture for Children and Families.** For the sixth year, Professor Howard Stone, along with HSEAS Postdoctoral Fellow Amy Rowat, Daniel Rosenberg (Harvard Science Center demonstration staff), and Educational Programs Director Kathryn Hollar developed and presented our annual interactive Holiday Lecture. This year's lecture, "Squishy, Goey, Stretchy: The Science of Making Pizza," that was held December 15, 2007. This children- and family-friendly science presentation is modeled after the Christmas Lectures first presented by Michael Faraday at the Royal Institution. Due to popular demand, this year's lecture was presented twice to with 350-400 people in attendance at each show.



**Figure 11.1** Professor Howard Stone asks young audience members to help with a demonstration on the action of enzymes on large biomolecules.

**Community Engagement—K12 Students, Teachers and Parents.** In addition to NSEC-organized events on the Harvard campus that engage the public, faculty, postdoctoral researchers, and graduate students also participate in public science events such as science fairs and community science days. For example, J.E. Hoffman presented her research at the Harvard Foundation for Intercultural Affairs and Race Relations' annual *Albert Einstein Science Conference: Advancing Minorities and Women in Science, Engineering and Mathematics* in March 2007 to an audience of primarily African-American middle school students from the Boston area.

**Pre-College Activities—Project TEACH.** Through a continuing program, NSEC faculty share their enthusiasm for science through Project TEACH (The Educational Activities of Cambridge and Harvard). This early college awareness program is a joint effort of the MRSEC, the NSEC based at Harvard, and the Harvard Office of Community Affairs. Coordinated with the Cambridge Public Schools, Project TEACH brings each 7<sup>th</sup> grade class (approximately 320 students each year) from the Cambridge Public School District to Harvard University throughout the school year. During the visit, students receive information about college admissions, and learn about college life from Harvard undergraduates. The class visit culminates in an interactive science presentation by a NSEC faculty on his or her research and its societal benefits.

**RET Program.** The NSEC, in conjunction with an REU/RET Site in Materials Research and Engineering and an RET Site of the National Nanotechnology Infrastructure Network, hosted 3 teachers in 2007. These teachers work with faculty, postdoctoral researchers, graduate students, and REU participants on research or science curriculum projects. Teachers commit to 6–8 weeks during the summer, and are invited for a second summer to refine educational modules that are developed as a result of their research experience.

In addition to a research/educational project, RET participants also attend weekly seminars on educational and research topics and on research ethics. The integrated nature of RET and REU activities, particularly the faculty seminars during the summer, provide ample opportunity for teachers to explore development of small classroom modules based on seminar content. Participation in the NSF Nanoscale Informal Science Education Network (NISE-Net, discussed under Museum of Science activities, below) has also enhanced our RET program. In May 2007, RET Joshua Bridger participated in the week-long Nanoscale Education Outreach Workshop offered by the NISE-Net at the Exploratorium, and then led several elements of this workshop for our RETs and graduate students during a 1.5-day mini-workshop (Figure 11.2).



**Figure 11.2.** (Left) RET participants discuss applying elements of inquiry learning in their classrooms during an adaptation of the NISE-Net NEO workshop led by Joshua Bridger. (Right) Josh Bridger shares his summer research and educational activities with other teachers at the end of summer RET symposium.

RET participants also met weekly over lunch to discuss informally their research projects and how to best relate their summer research project to their curricula. The

summer research experience for teachers culminated in a poster session. Teachers took these posters back to their classrooms to give students an introduction to scientific research, and to emphasize that science and engineering careers are accessible, interesting, and that science and engineering profoundly affect everyday life. These posters have also served as the basis for talks at regional and national conferences for teachers and faculty (Figure 11.2). Materials developed by teachers can be accessed at our website, [www.eduprograms.deas.harvard.edu/RET.htm](http://www.eduprograms.deas.harvard.edu/RET.htm). NSEC-supported participant and project information can be found in Table 11.1.

**Table 11.1: NSEC RET Participants, 2007**

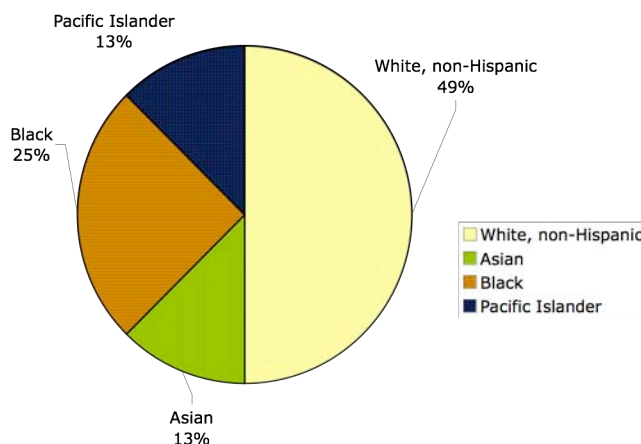
RET Participant Subject/School	Project Title
<b>Joshua Bridger*</b> <i>Physics</i> (Dover Sherborn High School, MA)	<i>Reactive Ion Etching Techniques and the High School Physics Curriculum</i>
<b>Lisa Perazone</b> <i>2<sup>nd</sup>-3<sup>rd</sup> grade</i> (Dallin School, Arlington, MA)	<i>Electronics in High School: Introducing Transistors</i>
<b>Jan Mattimoe</b> <i>Science</i> (H. Dearborn Middle School, Roxbury)	<i>Development of Peer Instruction Modules for Middle School Science to Address Common Misconceptions</i>

\* Joshua Bridger partially supported by NNIN RET program.

RET participants will attend the National Science Teacher Association Annual Meeting in March 2008 to share modules with other RET participants across the nation through the NNIN RET program.

**Undergraduate Activities—REU Program.** The NSEC has increased the number of REU participants by substantial supplemental funding from the School of Engineering and Applied Sciences (SEAS), Harvard College, and the Rowland Institute at Harvard (Frans Spaepen, Director). An NSF-funded REU/RET Site in Materials Research (PI Howard Stone) has also allowed us to expand our professional development opportunities for participants.

Figure 11.3 shows the demographic make-up of the 8 REU participants who were fully or partially funded through the NSEC. Of these students, 3 were from underrepresented minority groups in science and engineering, and 6 were female. Five of the students had no previous research experience. Of the 8 participants, 1 was a rising sophomore, 1 was a rising junior, and 6 were rising seniors. REU participants and projects are shown in Table 11.2.



**Figure 11.3.** Racial and ethnic demographics of students receiving NSF support through NSEC.

**Table 11.2: REU Participants, 2007**

REU Participant/Institution	Project Title
<b>Sarah Brittman</b> /Harvard University	<i>Electronic properties of nanowires of antimony telluride, a phase change material</i>
<b>Max Chalfin</b> /Harvard University	<i>Building a magnetic force microscope (MFM)</i>
<b>Mary Gloria</b> /University of Texas - Austin	<i>Magnetic self-assembly of poly(dimethyl siloxane) sheets utilizing Concepts from Protein folding</i>
<b>Katherine Phillips</b> /North Carolina State University	<i>Silica nanowires: Manipulating light at the nanoscale</i>
<b>Sarah Nam</b> /Duke University/Harvard University	<i>Synthesis and characterization of crystalline Ag nanowires for nano-plasmonics</i>
<b>Jennifer Sanders</b> /Westminster College	<i>Stains in clothing: Capture of colloidal particles in a porous media</i>
<b>Stefan Wernli</b> /Harvard University	<i>Control and analysis programs for scanning tunneling microscopy</i>
<b>Laurel Wixson</b> /University of California – Santa Barbara	<i>Oxidation reactions on Au(111)</i>

The enhanced infrastructure provided by the REU/RET Site Program has allowed us to expand the program of professional development workshops, faculty seminars, and social and cultural activities that are designed to create community among participants and research advisors. These activities continue to include mentor training prior to the program start; weekly faculty-led research and ethics seminars; professional development workshops, including written and oral presentation skills workshops; large and small group discussions on applying to graduate school; and various athletic and social events during the summer.

One goal of our REU program is to develop essential skills in communicating effectively with scientists and the public. In collaboration with the Museum of Science, Boston, we hold a presentation skills workshop for REU students (see Figure 11.4). During this workshop, students engage in discussions with Tim Miller and other education associates from the Museum of Science, Boston, on how to present complex scientific concepts. This format is very effective in increasing the confidence of these young scientists and engineers in discussing science with their peers and mentors. The



**Figure 11.4.** (Left) REU students give feedback to each other at presentation skills workshop led by Tim Miller and Lisa Regalla of the Museum of Science, Boston. (Right) REU student Jennifer Sanders is introduced by session chair Thomas Ward before she presents her summer work in the laboratory of Howard Stone at the APS Fall meeting 2007.

workshop is followed by evening practice sessions in the week prior to the final symposium.

In addition to the end-of-summer research symposium, mentors are encouraged to seek out opportunities for their students to participate in professional meetings. This type of early exposure to the professional life of an academic is essential in encouraging young scientists and engineers to continue in academia. Two NSEC REU participants, Jennifer Sanders and Sarah Brittman, presented at professional conferences following the REU program.

Mentoring an REU student is a valuable professional development opportunity for a graduate student or postdoctoral researcher, allowing this population to explore effective models for project management. To enhance this experience for mentors, we have implemented a series of program preparation sessions with REU mentors. New mentors participate in a series of luncheons in which faculty and other experienced mentors share strategies for mentoring undergraduate students, including planning a realistic project, modifying project goals, effectively managing time, and motivating students to work independently and as part of a team.

**Graduate Activities—Course and Seminar Development.** In addition to the mentoring and professional development activities embedded in our other educational programs, graduate and advanced undergraduate students participate in AP298r, *Interdisciplinary Chemistry, Engineering and Physics*, an interdisciplinary graduate survey course of ongoing research at the Center. This course has a new component, which requires students to translate each lecture into a short synopsis that is understandable at the level of a bright high school student. Lectures are also recorded and archived for future use by teachers in conjunction with presentations that are posted at the course website. These activities are further discussed in

### **Activities Led by Museum of Science, Boston**

**Research Goal and Approach.** The focus of Museum of Science participation in the NSEC is on increasing public engagement in nanoscale science and engineering. We seek to expose a broad and diverse audience to the research work of the NSEC and to nanoscale science and engineering generally, and to develop best practices in outreach and education that can be shared among the broader research and informal science education communities. Over the past year we have continued to pursue successful strategies pioneered in previous years, while prototyping some new promising initiatives. These activities are led by Carol Lynn Alpert, Director of Strategic Projects and Tim Miller, Nanoscale Science and Engineering Education Associate, in close collaboration with the NSEC leadership.

Museum staff have continued to develop new presentations related to nanoscale science and engineering and deliver them 3–5 times a week on in the Museum’s popular Gordon Current Science & Technology Center. In 2007, Tim Miller delivered 100 live presentations to a total audience of more than 3,000. He hosted 5 Museum guest presentations by NSEC researchers, and contributed 10 nano research science news

stories to the *Sci-Tech Today* feature on New England Cable News, which reaches 14 million homes throughout New England. The NECN broadcasts are being evaluated by Barbara Flagg of Multimedia Research. Tim Miller also researched and delivered 10 nano-related podcasts on the Museum's Current Science & Technology podcast program, which has a weekly audience in excess of 5,000. In collaboration with the Center for High-rate Nanomanufacturing, the Harvard NSEC and MOS hosted our third annual Nanotech Symposium for Educators and Journalists. NSEC researchers George Whitesides and Eric Mazur gave talks at this special one-day event. The addition of journalists to the program was an important new development. The Museum completed a summative evaluation of the very successful 2006 Symposium, which will be shared broadly with the field.

2007 also saw the development of some new education outreach initiatives in partnership with the Harvard NSEC. The first, an experimental effort to engage family audiences in learning about atoms, molecules, nanoscale properties and the origins of nanotechnology, was a year-long collaboration with a comedy juggling team, the Airborne Comedians, to develop an entertaining and educational performance that could be performed on a regular basis in the Museum's Cahners Theater and also travel to middle school auditoriums. The performance will be premiered on March 30, 2008, and, in test performances, has been succeeding at engaging and entertaining family audiences. A comprehensive evaluation will be undertaken in 2008. The show was written and directed by Carol Lynn Alpert in collaboration with The Airborne Comedians, Dan Foley and Joel Harris.

Also in 2007, at the suggestion of Robert M. Westervelt, and in collaboration with the NSEC, Tim Miller developed a Public Communication Internship program for NSEC graduate students. This program brings graduate students from the NSEC to the Museum for an intensive one-week practicum in communication, education, and outreach. Each participant completes a public communication project, which can be a video of their work or a live presentation before a Museum audience. This program successfully completed its first cohort of students in April 2007, and its second cohort in December 2007.



**Figure 11.5.** Museum of Science PCI Intern Tina Shih gives a talk at the Gordon Current Science & Technology Center at the Museum of Science, Boston.

Perhaps most significantly, in 2007, the Harvard NSEC and MOS participated broadly in leadership roles in the activities of the NSF-funded Nanoscale Informal Science Education Network. Robert M. Westervelt served as chair of the Advisory Board, researchers George M. Whitesides and Eric Mazur served on the Advisory Board, the NSEC Education Outreach Director Kathryn Hollar served as a “Thinking Partner,” Carol Lynn Alpert served as a Co-PI, and Tim Miller contributed significantly to the work of the NISE Net programs team. Tim’s live presentations, developed with Harvard NSEC support, are being “packaged” for distribution throughout the NISE Network, and program presenters at other museums and research centers will be able to adapt and present them for their own audiences. Carol Lynn Alpert began spearheading a new NISE Net initiative, Research Center – Informal Science Education partnerships (RISE), which will collect and disseminate best practices in forming and carrying out educational outreach partnerships between research centers and science museums, using the Harvard NSEC–MOS partnership as one successful example. Robert M. Westervelt is contributing the research center perspective to this initiative, and joined Carol Lynn Alpert in publishing articles about it in the *ASTC Dimensions* journal. Also, three NSEC graduate students (Tina Shih, Geoff Svacha, David Issadore, and Joshua Bridger) participated this year in the NISE Net’s Nanoscale Education Outreach residency at the Exploratorium and attended the NISE Net Annual Meeting, learning about effective means of public engagement.

## 17. HONORS AND AWARDS, 2007–2008

### Joanna Aizenberg

Ronald Breslow Award for the Achievement in Biomimetic Chemistry, American Chemical Society (ACS), 2008  
Fellow, American Association for the Advancement of Science (AAAS), 2007  
Industrial Innovation Award, American Chemical Society, 2007  
Named “Highly Influential Author” by Essential Science Indicators<sup>SM</sup>  
Member of the Board on Physics and Astronomy, National Academy of Science (NAS), 2006–present  
Member of the Board of Directors, Materials Research Society, 2006–present  
Member of the National Academies Committee on Biomolecular Materials and Processes, National Research Council (NRC), 2006–2008

### Moungi Bawendi

Langmuir Lecture, American Chemical Society, 2007  
Harkins Lecture, The University of Chicago, Department of Chemistry, 2007  
Elected Member, National Academy of Sciences, 2007

### Cynthia M. Friend

Alexander von Humboldt Award, Humboldt Foundation, 2007–2008

### Arthur C. Gossard

Newcombe Cleveland Prize, Best article of the year award in *Science Magazine*, with Charles Marcus *et al.*, 2007

### Bertrand I. Halperin

Dannie Heineman Prize (awarded once every two years; covers all fields of Science), Akademie der Wissenschaften zu Goettingen, 2007

### Efthimios Kaxiras

*Multiscale Modeling of biopolymer translocation through a nanopore*: Best Paper in a Workshop award, International Conference on Computational Science (ICCS), 2007

### Eric Mazur

New Chair — Balkanski Professorship, 2007  
Harvard Australia Fellow, 2007  
Phi Beta Kappa, Visiting Scholar, 2007  
Baetjer Lectureship, Princeton University, 2007

### Venkatesh Narayanamurti

Elected Fellow American Academy of Arts and Sciences, 2007  
Member, Engineering Dean’s Council, Cornell University, 2003–2008



Member, Engineering Dean's Council, Brown University, 2004–2008  
Member, Engineering Dean's Council, Public Policy Committee, American Society for Engineering Education (ASEE), 2005–2008  
Member, Center for Integrated Nanotechnologies Board, Sandia National Laboratories, 2005–2008  
Member, Mork Family, Department of Chemical Engineering and Material Science Advisory Committee, University of Southern California, 2006–2008  
Member, President's Council, Olin College, 2006–2008  
Member, Review Committee, Tata Institute for Research, Mumbai India, 2007  
Overseer, NRC Report on Future of Condensed Matter and Materials, Physics, 2010, National Research Council, 2007  
Member Stokes Programme, Physics Panel, Science Foundation of Ireland, 2007  
Chair, Advisory Panel on Light Source Facilities, National Science Foundation, 2007–2008

### **Hongkun Park**

Camille and Henry Dreyfus Teacher-Scholar Award, Dreyfus Foundation, 2003–2008

### **Howard A. Stone**

Chair, American Physical Society, Division of Fluid Dynamics, 11/2006–11/2007  
Plenary Speaker, Annual Dutch Physics Meeting, Veldhoven, The Netherlands, January 2007  
Stewartson Memorial Lecture, British Applied Mathematics Conference, Bristol, UK, April 2007  
Plenary Speaker, MicroTas, Paris, October 2007  
G.K. Batchelor Prize in Fluid Mechanics (1<sup>st</sup> award; given every four years), 2007

### **Robert M. Westervelt**

Director, Board of Advisors, NISE Network of Museums . 2007  
Board of Advisors, Center for Integrated Nanotechnologies (CINT), Sandia National Laboratory, 2003–present  
Fellow, American Physical Society, 2007

### **George M. Whitesides**

Priestley Medal, American Chemical Society, 2007  
August-Wilhelm von Hoffmann Vorlesung, German Chemical Society, 2007

### **Ziaowei Zhuang**

Coblentz Award, Coblentz Society, 2007