

## **6.0 EDUCATION AND HUMAN RESOURCES**

### **BrownOut: The Classroom Visits Program**

In this program, MRSEC faculty and students make presentations to local science and math classes (grade K-12) to discuss issues in engineering as examples of the joint application of math and science. These presentations are developed by faculty and students and are often based on our current research, and/or teaching. We aim to make the materials hands-on and exciting, but also quite quantitative. They usually involve detailed calculations and careful measurements. A full list of available topics is sent to all area schools and is available online. Teachers apply online to arrange a presentation, free of charge. Every effort is made to adapt the presentation to fit in with the current studies of the classes, and teachers are encouraged to incorporate the materials into their curricula. We make special efforts to reach area schools with large minority populations, such as Hope High School, and the Paul Cuffee Middle school in Providence.

The Brown students who are selected to make the presentations undergo training before they are sent to schools; they are coached on making sample presentations. The students gain an appreciation of the responsibility of a technical professional to share his or her knowledge with the younger generation. We've worked to increase the participation of underrepresented minority students from Brown, who serve as important role models for the K-12 students. The Brown Student Chapter of The National Society of Black Engineers is participating this year.

### **RET: Research Experience for Teachers**

This program has run since the summer of 2001 under the direction of Professor Blume. K-12 teachers spend the summer doing paid research with Brown faculty and students. A major goal is to help the teachers bring their experiences to the classrooms with suggested problems, projects, and demonstrations. Applications are solicited from public and private schools in Rhode Island and Massachusetts via email and paper notices. Teachers are typically offered a two-year commitment. Each week, the teachers hear lectures or attend tours of different research labs on campus, and off-campus industries. Professor Blume gives informal lectures on other engineering topics and classroom demonstrations, according to the interests of the group. Bicycle design, archery science and surveying are some example topics.

This year, four teachers participated, in addition to Mr. John Shilko, our program facilitator. All teachers developed curricular projects, which aimed to bring math and science together in an applied setting meant to motivate and excite students. Two of these projects are detailed below.

<b>Name</b>	<b>School</b>	<b>Brown Faculty Partner</b>	<b>Topic</b>
David Pasquariello 2008	Chemistry, Tolman High School Pawtucket, RI	Professor R. Hurt	Colorimetric Assay of Bio-available Iron in Graphite
Adam Flynn 2008	Science, Davies V&T High School, Lincoln, RI	Professor J. Blume	Renewable Energy: Hydroelectric Power
Timothy Newbold 2008	7 <sup>th</sup> grade Science, The Gordon School East Providence, RI	Professor D. Paine	Building a working Solar Cell
Mary Markey (with NSF GK-12) 2008	Biology and Physics, Hope High School, Providence, RI	Profs J. Blume and T. Webster	Muscle Models for the classroom
John Shilko	Goff Junior High, Pawtucket, RI	Prof. Blume	Teacher/Brown liaison

This year, a formal assessment of our outreach program was carried out by the Educational Alliance at Brown. The Alliance is an administrative department at Brown, funded through contract and grant activities awarded through federal programs, private foundations, professional organizations and regional agencies. Consequently, they are well positioned to serve as an external evaluator, providing both formative feedback and outcome-based information on the strengths and developmental needs of this program. Their scientifically-based surveys and other means of data collection evaluated the impact of our programs from several years back. Their 21-page report was received in September, 2008. Among the main points of the reports are:

- *RET Program was judged as highly effective*
- Suggestions: website development, other variables to measure
- 100% of surveyed participants rated the program logistics as Very Good/Excellent
- 100% said activities were organized and clear, related to current instruction, easily applicable to the classroom, and in line with personal and district goals for professional development. 91% said the activities were compatible with the personal level of knowledge
- 82% said the program guided their teaching on a daily or monthly basis, even years after the program has ended, implying a long-term effect on their teaching.

Suggestions for improvement, such as developing better websites, will be implemented this summer.



## REU: Research Experience for Undergraduates

**Sheldon** and **Haberstroh** were responsible for organizing the summer REU program in 2008. Fourteen students participated (including 6 women and 7 underrepresented minorities). Dr. **Haberstroh** led the REU students in a wide range of activities, both inside and outside of the laboratory. In particular, students: (1) attended weekly lab meetings where they presented and updated their work to date; (2) attended workshops on preparing a poster and oral presentation; (3) participated in an interactive panel discussion with graduate students and a post-doctoral associate; (4) attended hours of evening courses on GRE test preparation; (5) made presentations at a campus wide poster symposium on undergraduate research; (6) visited local industry (Instron, a smaller company in Norwood, MA), and where they toured the facilities and joined a panel discussion with company employees at various levels of their career.

<b>Name</b>	<b>School</b>	<b>Advisor</b>
Baker, Christopher '09	Brown	Jeff Morgan
Fisher, Brian '10	Brown	Tom Roberts
Fuller, Patrick '09	Lehigh Univ.	Brian Sheldon
Goldner, Julia '11	Brown	Jeff Morgan
Goodfellow, John '08	Brown	Brian Sheldon
Kissoon, Nicola '09	FSU	KS Kim
Lee, Jungwoo '10	Wellesley College	Eric Chason
Litts, Katie '10	U. of Rochester	Jeff Morgan
Manian, Jeffrey '09	Brown	Pradeep Guduru
Perlmutter, David '09	Brown	Rod Beresford
Sookram, Heidi '09	Florida A&M Univ.	Sharvan Kumar
Vanterpool, Jessica '09	FSU	KS Kim
Velez, Francisco '09	U. of Puerto Rico	Rod Beresford
Wasserman, Jake '10	Brown	Eric Chason

In collaboration with FAMU/FSU, Brown hosted five students from FAMU/FSU. Three undergraduate students, all minorities, participated in the REU program, performing research work under the guidance of Profs. **Kim** and **Kumar**. Two graduate students, both minority women pursuing their PhDs in mechanics and materials, worked with **Curtin**. The two students, Ms. Davy and Gordon, learned and applied the molecular dynamics method to problems related to their PhD research. Ms. Davy worked on simulating the structure and deformation of nanoscale Ag-Cu multilayer composites, which she has fabricated and tested experimental at FAMU/FSU. Ms. Gordon worked on simulating dislocations in Aluminum at high temperatures near melting, which is relevant to her experimental research work on friction stir welding.



### **Other Outreach Activities**

Day-long visits to the Brown campus have been organized to allow students, teachers, and parents to take advantage of science facilities at the University and to help bridge the gap between K-12 students and the college experience. In February, 2009, 40 students (39 minorities) from Hope High School in Providence, RI came to Brown for discussions with graduate students and various student groups regarding careers in Engineering, various module workshops and laboratory visits.

In November, 2008, students and faculty at Brown's MRSEC and the Division of Engineering hosted over 70 girls and their parents, as well as 10 area K-12 teachers, during a one-day conference entitled "Empowering your Future", aimed at engaging girls in a range of hands-on science and engineering activities. Graduate and undergraduate students led workshops showcasing real-life applications of scientific principles. The girls worked in teams to tackle an

engineering problem or explore a scientific principle while their parents learned ways to encourage curiosity, foster strong study skills, and help their daughters complete college applications. The day culminated in a Floating Raft Design competition.

### **Postdoctoral Mentoring Plan**

Our post-doctoral research mentoring program consists of a number of facets aimed at addressing the full scope of professional skills needed for success in careers in research and/or teaching. In creating this program, we are leveraging existing infrastructure and programs at Brown that serve the various needs of post-doctoral research associates (PDRA), and augmenting those programs with additional local activities. Below we present the six facets of our program, the specific planned activities for the coming year in each area, and the associated Brown University programs that will be utilized to accomplish our goals. Professors **Kumar** (materials) and **Shenoy** (mechanics) will oversee the post-doc mentoring program, with participation from many materials and mechanics faculty expected.

- **Training in preparation of grant proposals**

The planned activities to train postdoctoral research associates (PDRA) in preparation of grant proposals will consist of

- 1) Organization of a Career workshop in Fall 2009 where we will invite recent NSF career awardees to meet with the PDRA and discuss strategies to prepare successful proposals.
- 2) In spring 2009 we will invite a program manager from the NSF, DOE or DOD to visit Brown and present a seminar particularly focusing on grant opportunities for new faculty.
- 3) The participating MRSEC faculty will be encouraged to involve PDRA in preparing and writing grant proposals. In the case of PDRA using supercomputing and other national user facilities, advisors will be encouraged to include them as lead or co-principal investigators.

The outcome of these activities will be reported in the next annual report.

- **Career counseling**

The planned activities to provide career guidance to postdoctoral research associates (PDRA) will consist of:

- 1) Starting Fall 2009, we propose to set aside an hour for external visitors to collectively meet with the PDRA from the materials and mechanics groups. These one-on-one interactions with leading scientists should allow PDRA to get first hand information on career opportunities at leading institutions. The materials and mechanics groups at Brown run a joint seminar series where we invite university faculty, scientists and engineers from industry and national labs to visit Brown.
- 2) The sciences librarian (Dr. Lee Pederson) will be invited to present seminar to the postdocs on job and career resources available through the library.

3) The MRSEC will work with the Brown University Postdoctoral Association (BUPA) to enhance participation of mechanics and materials post-docs in the BUPA activities. Specifically, BUPA runs seminars on preparing CV/Resume and other application materials for jobs in academia and industry. (<http://www.brown.edu/Administration/bupa/index.html>)

- **Publications and presentations**

To teach postdoctoral research associates (PDRA) strategies for effective publication and presentation, we will:

1) We will organize a postdoctoral seminar series, starting in Summer 2009, where all the PDRA in the materials and mechanics groups will be invited to present their work to an audience that consists of graduate students, summer REU students and faculty. MRSEC faculty who attend the seminars will be encouraged to provide their feedback on the technical content as well as the organization and delivery of the presentation.

2) To help PDRA with improving their writing and presentation skills, we will leverage the resources of the BUPA, in particular BUPA's workshops on scientific writing and presentation and BUPA's seminars on academic job interviewing.

- **Guidance on ways to improve teaching and mentoring skills**

Improving teaching and mentoring skills of PDRAs will be accomplished through the following activities:

1) PDRAs will be invited to participate in the MRSEC annual summer workshop aimed at developing mentoring skills for graduate students called "FER", (Facilitating Effective Research).

2) We propose to tap into the well-orchestrated and experienced resource at the University's Sheridan Center for Teaching and Learning, to enable our PDRA to develop the necessary teaching skills in today's competitive academic job market. The Sheridan Center for Teaching and Learning at Brown University

([http://www.brown.edu/Administration/Sheridan\\_Center/resources/postdocs.html](http://www.brown.edu/Administration/Sheridan_Center/resources/postdocs.html)) offers a variety of Programs for PDRA to enhance their teaching skills. The Sheridan Center Portfolio includes consulting services, formal programs that award teaching certificates upon completion of a set of presentations and workshops, and a variety of teaching resources including teaching

tips, handbooks and on-line workshops and newsletters.

3) We will identify courses in Engineering where PDRA can serve as teaching assistants or run tutorial sessions for smaller groups of students, providing them experience in class-room-like settings.

- **Guidance on how to effectively collaborate with researchers from diverse backgrounds and disciplinary areas**

The Institute for Molecular and Nanoscale Innovation (IMNI) was founded at Brown University in 2007 as an umbrella organization to support centers and collaborative research teams in targeted areas of the molecular and nanosciences. IMNI is a “polydisciplinary” venture with 55 faculty participants representing nine departments across campus. IMNI serves as a focal point for interaction with industry, government, and our affiliated hospitals. The Institute’s research is organized around three main themes: 1) Center For Advanced Materials Research, 2) Center for Nanoscience and Soft Matter, and 3) Nanohealth. The Faculty roster includes expertise in Engineering, Physics, Chemistry and Biology. The IMNI activities provide a logical vehicle and a rich option for PDRA in Engineering to interact and collaborate with researchers (faculty, fellow post-docs and graduate students) in a substantial cross-disciplinary environment. Frequent seminars from international experts hosted by IMNI provide a venue for PDRA to learn about cutting edge work from across the globe and to develop new interactions with faculty across campus.

- **Training in responsible professional practices**

Brown University, and in particular The Division of Biology and Medicine, is actively involved in training graduate students and postdoctoral researchers in the responsible conduct of research (RCR) and views this training as part of an institution-wide focus on ethical concerns in all aspects of teaching and research. Support for these efforts comes from institutional resources as well as specific awards to expand RCR training. In 2006 Sheila Bonde, Dean of the Graduate School, was awarded a Research Ethics Education Grant from the Council of Graduate Schools and the National Science Foundation for expansion of RCR training at the predoctoral level. In 2007, Nancy Thompson, Associate Dean for Graduate and Postdoctoral Studies, was awarded a pilot grant from the National Postdoctoral Association (NPA) to implement new postdoctoral RCR initiatives. The approach to ethics education within the University involves multiple mechanisms: 1) discipline-specific RCR training, 2) the *Academy in Context*—a university-wide dinner-seminar series devoted to ethical issues—and 3) continuous expansion of web-based resources for intramural as well as global outreach. It is the intention of the Division of Engineering to partake of this on-going effort by consulting with the Division of Biology and Medicine on how best to adapt a part of the effort to the Physical Sciences. More information on this program may be found at <http://biomed.brown.edu/grad-postdoc/rcr.html>.