

## **OVERVIEW**

# **BROADENING PARTICIPATION IN SCIENCE AND ENGINEERING RESEARCH AND EDUCATION**

## **BACKGROUND**

Education has always been vital to the success of individuals and the science and engineering enterprise. In the technology- and knowledge-based economy of the 21<sup>st</sup> century, science, engineering, and technology education is also an investment in the United States' collective future as a nation and as a society. For decades, the United States has excelled in building and sustaining institutions of higher education that attract science and engineering talent from all over the world. The Nation has done less well in encouraging and developing the mostly untapped potential of underrepresented minorities, women, and persons with disabilities. Developing this potential will lead to expanded opportunities for individuals as well as improving national competitiveness and prosperity.

To address these concerns, the National Science Board Committee on Education and Human Resources hosted a group of distinguished panelists to participate in a workshop entitled, "Broadening Participation in Science and Engineering Research and Education" on August 12, 2003. The workshop was very well attended by people concerned with diversity in U.S. academic institutions and the workforce. The workshop had two objectives: first, to celebrate the progress that American universities have made in bringing diversity to science and engineering; and second, to identify strategies for further increasing the diversity of the nation's science and engineering workforce.

## PANEL SUMMARIES

The workshop consisted of four separate panels, each introduced by a moderator and featuring three or four speakers on a specific topic within the broadening participation theme. Presentations were followed by a general discussion session between panel members and the audience.

**Dr. George Langford**, Chair of the NSB Committee on Education and Human Resources, and **Dr. Rita Colwell**, Director of the National Science Foundation, provided opening remarks for the workshop focusing on the challenges that the National Science Foundation and the Nation face in science and engineering. Dr. Langford outlined some of the major questions to be considered during the workshop:

- What incentives must be provided to bring diversity to faculty at liberal arts colleges, research universities, and ultimately, the workforce itself?
- What are the barriers that Americans face in the science and engineering workforce?
- What policies can federal agencies such as the NSF put into place to change the culture and the hiring practices of university faculties?

Dr. Colwell emphasized the need to create effective policies and invest in developing the largely untapped resource of “home grown” talent in America — underrepresented minorities, women, and persons with disabilities. Dr. Colwell identified several NSF programs, including ADVANCE, and the Undergraduate Mentoring in Environmental Biology program, and recommended that these types of programs be emphasized through collaborative efforts to “go beyond policy and polemic.”

The Models of Success for Broadening Participation panel, moderated by **Dr. Joseph Bordogna**, Deputy Director of the National Science Foundation, focused on the need to develop successful models to recruit diverse talent into science and engineering research and education. Other countries are making significant investments in science and engineering capacity development and as a result, the United States must invest in strategies that keep America competitive in the global economy.

**Dr. Shirley Ann Jackson**, President of Rensselaer Polytechnic Institute, outlined several components of successful models for broadening participation at the undergraduate level and provided numerous program examples. Programs included the Meyerhoff Scholars Program, the Louis Stokes Alliance for Minority Participation, and the Gateway Coalition. Some of the key components of successful programs included: a vision and overall strategy; structuring to meet the individual needs of students; and periodic evaluations to assess program goals and achievements.

**Dr. Shirley Tilghman**, President of Princeton University, highlighted challenges in broadening participation at the faculty level, and the need to restructure the training path within science and

engineering to make it more attractive to under-represented groups, particularly women. Dr. Tilghman made several suggestions as to how this could be accomplished, including establishing programs that bridge the gap between the completion of graduate school and the first job. She also outlined one successful paradigm for recruiting and retaining faculty from underrepresented groups: Princeton's "target of opportunity" search process.

**Dr. Norbert S. Hill Jr.**, Executive Director of the American Indian Graduate Center, focused on the factors that affect the productivity of students and faculty in academic environments. Dr. Hill identified the key idea of "change interrupted." That is, providing adequate mentoring, networking, financial support, and other support mechanisms throughout the education and teaching process to allow students and faculty to succeed.

The Changing Demographics and Challenges of the Future panel, moderated by **Dr. Diana Natalicio**, President of the University of Texas at El Paso and Vice Chair of the National Science Board, highlighted the rapidly increasing number of non-white groups in the American population contrasted with a slow growth in the number of non-whites at all levels of science and engineering research and education.

**Dr. Beverly Daniel Tatum**, President of Spelman College, suggested strategies for overcoming subtle perceptual factors that affect how universities recruit non-white faculty. Dr. Tatum outlined the work of John Dovidio and Samuel Gaertner in the area of "aversive racism" and suggested several effective ways to overcome this barrier to increasing diversity and science and engineering. Recommendations included the need for institutional leaders, federal agencies, and other interest parties to clearly identify the diversity goals of institutions so that appropriate behaviors at all levels can follow. In other words, leaders need to help "keep our eyes on the prize."

**Dr. Shirley Malcom**, Head of the Education and Human Resources Directorate at AAAS, pointed out that the relatively few non-whites at higher positions within academia discourages non-whites from pursuing science and engineering careers as undergraduates. Dr. Malcom proposed several ways to create positive outcomes in this area, including: reducing the time to degree; and holding grantees accountable for establishing feasible mechanisms to improve diversity in the student and faculty makeup.

**Dr. Richard Tapia**, Professor at Rice University, highlighted the low numbers of non-whites in higher education and stressed the need to have recruiting and support systems that bring all of those who are qualified to excel into science and engineering fields. Dr. Tapia recommended that these systems concentrate on creating friendly, encouraging environments that are realistic in their expectations of students to prevent "burn out." By meeting students where they are, and showing them where they can go, the precious few can achieve leadership positions at higher institutions.

Discussion continued on how universities recruit for faculty positions and the need to make educators feel that they are an integral part of the overall science and engineering community.

The Diversity Gap between Students and Faculty panel, moderated by **Dr. Esin Gulari**, Division Director in the Engineering Directorate at NSF, concentrated on the lack of Hispanic, African-American, and Native American faculty at top liberal arts colleges and research universities.

**Dr. Evelyn Hu-Dehart**, Director of the Center for the Study of Race and Ethnicity in America at Brown University, suggested that Asians have found success in securing faculty positions because they earn degrees from top universities. This is in contrast to Hispanics, African Americans, and Native Americans, who may earn doctoral degrees from less prestigious institutions, but, due in part to poor recruiting efforts on the part of universities, are seldom identified or given a chance to compete for positions. Dr. Hu-Dehart stated that this is a cultural problem, and one that can be overcome by a three-step process: 1) Creating means to identify candidates from underrepresented groups; 2) Hiring qualified candidates from this pool; 3) Providing support mechanisms to help faculty from underrepresented groups succeed.

**Dr. Emilio Bruna**, Assistant Professor at the University of Florida, emphasized the need for policies that increase funding opportunities for underrepresented minorities to improve their exposure and get them into the pipeline. Dr. Bruna gave specific examples of ways to get individuals from underrepresented groups into the pipeline, including: expanding NSF's fellowship program for minority scholars; increasing funding opportunities for junior faculty from underrepresented backgrounds; making Research Experiences for Undergraduates grants available to faculty that do not have full NSF grants; holding grantees accountable for achieving the broader impacts of their grants.

**Dr. Lilian Shiao-Yen Wu**, Program Executive at IBM, used her experience in business at IBM to explain how changing diversity policies to a business imperative, instead of just a moral imperative, can bring diversity in the science and engineering workforce. She recommended and expanded on several potential strategies that can be used to increase diversity in the workforce. From inside the organization, leaders need to push to make diversity a part of what everyone does day-to-day, such as: holding conferences on multiculturalism to improve culture competency; mentoring; and creating executive task forces to solve problems and get senior executives personally engaged and become advocates. From outside the organization, professional societies, government, and the media need to push for more transparency on how well organizations are doing in diversity.

General discussion focused on the outdated systems of faculty recruiting that university departments often use, the rankings used by university departments to assess their progress, and the effect of homeland security policies on international students in American universities and the American workforce.

The Policy Options Development panel discussed methods for implementing effective policy practices. **Dr. Judith Ramaley**, Assistant Director of the Directorate for Education and Human Resources at NSF, challenged current policy assumptions and identified limitations that policies have in bringing diversity to the science and engineering workforce. She summarized areas of agreement on the challenges the U.S. science and engineering community faces and suggested three guidelines for policy-makers to follow as they develop approaches to increasing national

competency in science, technology, engineering, and mathematics: 1) Modeling policies on solid evidence; 2) Demanding evidence of the success of those supported by federal funding; 3) Challenging assumptions on the system works to better understand the context of the problem that is being confronted.

**Dr. Clifton Poodry**, Division Director at NIH, suggested expanding the definition of “success” for programs to include a clause on improving diversity. This expansion, coupled with mentoring of individuals from underrepresented groups can lead to improvements in hiring at universities and liberal arts colleges. Dr. Poodry also hypothesized that providing financial incentives to institutions that send individuals from underrepresented groups on to graduate studies could be an effective method to improving diversity in science and engineering.

**Dr. Willie Pearson Jr.**, Chair of the School of History, Technology and Society at Georgia Tech, presented an overview of important issues to consider when discussing ways to improve diversity in science and engineering research and education. Among other things, Dr. Pearson recommended that interested parties concentrate on collecting better data on the state of diversity in science and engineering so that assessments can be more effective at measuring progress, and policies can be better formed. Also, Dr. Pearson recommended that this issue be confronted by federal agencies, public and private sectors, and individuals themselves to fundamentally address this important issue.

Open discussion focused on how to make science and engineering careers look more attractive through media portrayals, and through attitudes within fields that help encourage students to pursue these paths.

**Dr. Langford**, in conclusion, encouraged a continuing dialogue about issues raised during the workshop at the attendees’ respective institutions, and welcomed any feedback from the panelists and audience on broadening participation in science and engineering research and education.

