Continued Minority Underrepresentation

In 1994, the National Research Council Committee on National Needs for Biomedical and Behavioral Research Personnel emphasized the specific need to involve minority students in the biomedical workforce:

> *The nation's need for research scientists has also been affected by demographic changes: the number of individuals from racial and ethnic minority groups is increasing but not as fast as might be expected given federal efforts to encourage the participation of minorities in this area. The work force of the future will consist of an increasing proportion of women and minorities; it is important that these changes are reflected in the biomedical and behavioral science work force* (1994, p. 11).

In their 2000 report, the Committee reiterated this call, emphasizing that, although there was not a current need to increase the overall national production of biomedical researchers, the need to increase the number of minority researchers continues (NRC, 2000).

Unfortunately, progress in increasing the representation of minorities[1] among science students and scientists continues to be slow. The numbers and percentages of minority students earning degrees in the life sciences remain small, especially when compared to their representation in the overall population. The percentage of the traditional college age population (U.S. 18-24 year-olds) who are members of these racial/ethnic groups rose from 22% to 30% over the last two decades (1980-2000) (NSB, 2002). They now account for nearly a third of the college age population. However, the percentage of bachelor degrees in biological sciences awarded to underrepresented minorities increased only moderately during the same general time frame, from 8% in 1977 to 15% in 2000 (NSB, 2002).

Graduate enrollment of underrepresented minority students in biological sciences rose only slightly during this period, from 6% in 1993 to 8% in 2000 (NSF, 2002). Similarly, the number of biological sciences doctoral degrees awarded to minorities only rose by 2%, from 5% in 1991 to 7% in 2000 (Table 1). The number of degrees awarded to Native Americans remains less than 20 per year, less than 1% of total degrees for all biological sciences fields.

Table 1
Biological Sciences Doctoral Degrees Awarded to U.S. Citizens or Permanent Residents, by Racial/Ethnic Group and Year[2]

Racial/Ethnic Group	1991		2000	
	Number	**Percent**	**Number**	**Percent**
Total – All groups	3,525	100%	4,260	100%
Asian/Pacific Islander	261	7%	550	13%
White	3,041	86%	3,306	78%
Black	64	2%	123	3%
Hispanic[3]	95	3%	173	4%
Native American	10	<1%	17	<1%

[1] Underrepresented minorities in science generally refers to African-Americans/Blacks, Hispanics (including Puerto Ricans, Mexican Americans, and Other Hispanics), and Native Americans/American Indians/Alaskan Natives.
[2] NSF, 2001, Table 3.
[3] Includes the categories of Puerto Rican, Mexican American, and Other Hispanic.

Total Underrepresented Minority Groups[4]	169	5%	313	7%

With the numbers of minority students working toward and completing doctoral degrees in biomedicine so small, it is imperative that efforts be made to not only recruit additional students into the field but to make every effort to assure that minority graduate and postdoctoral students in biomedicine are supported, have access to exceptional professional development opportunities, and successfully make the transition to postdoctoral and professional positions.

Cultural Issues

An atmosphere that provides not only excellence in scientific training but also attention to important cultural issues may be especially important for minority students. A 1995 study of NSF Minority Science Graduate Fellows (1979-1981) found that, in every field, fellows who had received their undergraduate training at historically Black colleges and universities (HBCUs) completed their degrees at a higher rate (54%) than did comparable Black fellows from other types of institutions (37%). The study concluded that "…the climate of support provided by HBCUs during the undergraduate training period provides a strong foundation for success in graduate training" (Baker, 1995, p. 30). Brown (2002) found similar results concerning the success of Hispanic undergraduate science and engineering honors students. Likewise, the American Physiological Society's recent study of its graduate and postdoctoral minority Porter Fellows called attention to the importance of minority undergraduate institutions. The Porter Fellowship is a nationally competitive graduate or postdoctoral fellowship for minority students in physiology. In a retrospective study of 1967-2001 fellows (N=73), more than two-thirds of the fellows had received their undergraduate training at historically minority institutions (Matyas & Frank, 2004).

With such a strong effect evident at the undergraduate level, it is expected that climate and support are important factors at the graduate level as well. The APS Porter Fellowship study noted above found that two-thirds of the minority graduate students in the program studied at historically minority institutions, especially minority medical schools. The culture of the school can have a tremendous impact on students. The 1995 National Research Council study, *Reshaping the Graduate Education of Scientists and Engineers*, touched only minimally on issues related to graduate education for minority students (NRC, 1995). One participant in the study did, however, offer a powerful example of the importance of an understanding of professional development issues for students from diverse cultures:

"Feniosky Pena, a doctoral candidate in engineering at MIT…told the committee that he experienced a troublesome culture gap when he began his studies. As a native of the Dominican Republic, he had been taught to respect authority. At MIT, he was reluctant to question his adviser, who in turn thought that Mr. Pena lacked a grasp of his subject. Furthermore, the adviser used a technique of persistent interrogation, which Mr. Pena found humiliating. He heard this difficulty described by others at minority-group conferences, where students told him that they felt "stupid" when dealing with their advisor, classmates, or teachers…He suggested that if faculty were familiar with other cultures, such misunderstandings could be avoided. He said that minority-group students need more nurturing if they are to reach a good understanding of the education environment in the United States. Mr. Pena added that the racial diversity that minority group members bring to campuses is not valued by everyone. He suggested training for both the

[4] Includes data for Blacks, Hispanics, and Native Americans.

minority and the majority so that each gains a better understanding of the other's culture" (NRC, 1995, p. 60).

In their review of studies on mentoring of minority graduate students, Davidson & Foster-Johnson (2001) found a similar disjuncture between mentoring and culture:

> *"The traditional model of mentoring ignores differences between racial and ethnic groups. All graduate students are treated the same, with little regard for strengths or differences that might be due to race and culture. There is also an unspoken expectation that graduate students conform to the dominant behavioral norm and assimilate into the graduate school culture…The expectation of conformity and assimilation in the workplace often places tremendous stress on persons of color, creating a dissonance between their cultural values and behaviors and the norms of the workplace"* (p. 557).

These issues continue to have impacts later in the career paths of minority researchers. One large study of African-American faculty found that they often "…do not perceive that they are in the professional mainstream at their institutions" and "…hold a different view about the factors important to career advancement, compared to white faculty members" (Tack & Patitu, 1992, p. 60).

Critical Impact Points

There are numerous studies and reports detailing the key factors leading to the underrepresentation of women and minorities in science and engineering careers (see Literature Cited). The factors are both personal and systemic and include differences in precollege education and extracurricular experiences, lack of knowledge about science careers, lack of financial support, lack of adequate mentoring and development of professional skills, and overall lack of expectation that women and minorities can and should succeed in these fields.

Because the reasons are diverse, efforts to increase the representation of women and minorities must be multifaceted, involve a number of key "players," and utilize a long-range approach. There is no single solution that will increase the diversity of the scientific research community overnight. Rather, it will require a long-term effort where educators, researchers, professional societies, federal and state agencies, and private foundations focus effective strategies on critical impact points (Table 2), that is, important steps in educational transition and progress where minority students are often lost from the science career path.

While the retention of graduate and postdoctoral students is critical, coordinated retention efforts are rare at this level and, historically, little research has been done to guide their development (Matyas & Malcom, 1991). In 1997, the Andrew W. Mellon Foundation provided funding for the National Research Council to determine whether national data sets were available to study levels of attrition from U.S. graduate programs. The study concluded that "…it is not feasible to design a system to produce national estimates of attrition from Ph.D. programs" (p. 1), primarily due to the diversity of U.S. graduate programs (NRC, 1996). They did, however, review several studies conducted at individual institutions. One study by Jacks, Chubin, Porter, and Connolly (1983) found that science and engineering graduate students who exited graduate programs with "all but dissertation" (ABD) cited "financial difficulties" most often as the reason for leaving the program. The next most often cited factor, however,

was difficulties with advisors or doctoral committees: “Some respondents reported that advisors were inaccessible owing to research work and/or travel schedules, or that dissertation committees lacked interest in a student’s project. In other words, there was no one there ‘to encourage and give good ideas’ to the students.” (NRC, 1996, p. 30).

Table 2
Critical Impact Points for Increasing Diversity in Science and Engineering

Impact Point	Description of Intervention Strategies
Precollege education	Effective efforts usually focus on providing high quality education in science and mathematics, stimulating interest in and understanding of science-related careers, and developing support networks of parents, teachers, counselors, and others who can promote science interests and achievement.
Transition: High school to undergraduate	"Bridge" programs have worked well for minority students at this critical impact point, bringing them onto campus the summer before their freshman year.
Undergraduate retention	Retention programs at the undergraduate level work to create a supportive environment that encourages achievement, career exploration, and, often, research experiences in science or engineering. Historically, the large majority of these programs have not been evaluated for their effectiveness (Matyas & Malcom, 1991; Matyas & Frank, 1999) but more recently, efforts to assess impacts have been supported by funding agencies such as NIGMS (Matyas & Triana, 2001).
Transition: Undergraduate to graduate	Although this is a critical impact point and programs such as NIGMS-Bridges have proven very successful, there are only a limited number of efforts at this level (Matyas & Malcom, 1991).
Graduate and postdoctoral retention	The retention of graduate students to completion of degree is a particularly important impact point since it represents the culmination of many years of study and the investment of considerable resources in the student's education. There is only limited research and program development in this area.

Again, it is clear that the issues of climate and culture are powerful ones in the successful completion of graduate studies in the sciences and that additional models and resources are needed at this critical impact point.