Diversity as a National Imperative
Ongoing efforts to increase the representation of underrepresented groups in STEM (science, technology, engineering, and mathematics) fields have resulted in small but significant gains in increasing diversity among researchers and science educators. Yet this issue is far from resolved and requires renewed attention and new strategies to both attract and retain students and professionals from underrepresented groups. For example, while their proportions have increased steadily in the overall US population, Hispanic men and women comprise only 4% of scientists and engineers, and Black men and women comprise only an additional 3% [1]. Native American, Native Alaskan, Native Hawaiian, and Other Pacific Islanders are too few to break into distinct statistical categories [1]. Moreover, the percentage of biological sciences degrees earned by underrepresented minority students and their rise to full professorships has been nearly flat for the past decade [1]. Students with disabilities comprise more than 10% of the undergraduate student population and nearly as large a proportion of life sciences majors [1]. With the urgent need for research on diseases such as diabetes and heart disease, the need to engage attract and retain future scientists is acute. The fact that these diseases, along with numerous others, are especially prevalent among underrepresented populations, especially underrepresented minority populations, makes the need to engage the next generation of underrepresented students in science even more imperative.

The “Gathering Storm” report emphasized this point, citing the increased participation of underrepresented groups as “critical to ensuring a high-quality supply of scientists and engineers in the United States over the long term” (p. 167) [2]. Similarly, the recent National Research Council (NRC) “Crossroads” study on expanding minority participation in STEM pointed out that the sources of the future US STEM workforce are uncertain, especially since the population demographics are shifting toward the groups most underrepresented in STEM [3]. They go on to advise that diversity is “an asset we cannot afford to waste” (p. 3) because the U.S. growth and global leadership has always been related to its educational attainment [3].

The Role of Undergraduate Research Experiences
By the late 1980’s, differences in the desire for an undergraduate degree in STEM fields had disappeared; about 30-35% of all racial/ethnic groups enter undergraduate training hoping to major in a STEM field [3]. However, STEM degree completion rates for underrepresented minority students (14-16%) are lower than for White (24%) or Asian (32%) students [3]. The “Crossroads” report emphasizes that several important factors contribute to persistence to degree for underrepresented students: preparation, access to information, self-motivation and identification with STEM as a profession, institutional strategies for inclusion, and professional development. They particularly cite summer programs and research experiences as effective approaches, promoting interest in STEM careers, the development of support networks among peers, identification with the STEM community, and enhancement of academic competitiveness [3].
The completion rate for undergraduate students has been shown to be greatly enhanced by a research experience [4-6]. Student researchers learn how to review primary literature, generate a research hypothesis, develop experiments to test the hypothesis, gather and interpret data, and communicate the results [7-9]. In addition, undergraduate students participating in a research experience perceive themselves as exhibiting increased understanding and tolerance, independence, self-confidence, and awareness [6, 10]. They have a greater interest in research and are more likely to pursue advanced degrees [4, 6, 10-13]. In addition, retention and success in advanced degree programs and/or careers in science have been related to science skills and research experience [5, 13-15]. Finally, programs that engage students in the broader scientific enterprise provide important professional socialization experiences [3].

Studies have shown that undergraduate research programs are providing a pathway to a scientific career regardless of ethnicity or gender, and the data indicate that most of these students intend to continue on this path [4, 5, 10, 12]. Making undergraduate research opportunities widely available to minority biology students should increase the number of minority students who choose to pursue biomedical Ph.D.’s [16, 17]. In addition, no major differences across ethnicity or gender are seen in rates of retention and success in advanced degree programs or careers in science among participants of undergraduate research programs [4, 5, 10, 13, 14, 18].

The Role of a Professional Society
Professional societies play an important role in both the training and professional socialization of future STEM professionals [3]. Scientific societies cannot fill the critical one-on-one mentoring roles that advisors have with their students. However, scientific societies can make important contributions to both the psychosocial and career mentoring activities in which a trainee engages. Psychosocial mentoring activities enhance the student’s “sense of self and their social relation with their environment” (p. 551) [19]. Fellowship programs such as undergraduate research and travel fellowship programs contribute to this aspect of mentoring of students, especially underrepresented students. Career mentoring activities “…provide access to career-related services, particularly through opportunities that enhance skills and professional contacts” (p. 552) [19]. Scientific societies contribute to this aspect through scientific meetings, publications, and special activities, such as the fellowships and professional skills listings [20]. For underrepresented students, specific efforts that incorporate cultural aspects are critical. These aspects are often not recognized and not addressed by individual advisors and mentors (see [19] for review of numerous studies).

REFERENCES


