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INSTANT SYMPOSIUM 4

Differently Abled in Entomology

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In today's environment of budget reductions and increased public scrutiny of educational and governmental institutions (Arimoto and Sato 2012), entomologists face diverse accountability, behavioral, and social challenges in addition to the ongoing scientific challenges of their research. One approach to address these diverse challenges is to build teams that combine talents of individuals with correspondingly diverse backgrounds (Jablowkow 2005). Fortunately, the workforce of the twenty-first century includes persons with a greater variety of backgrounds than ever before (National Academy of Sciences 2010). The fraction of women, Hispanics, and African Americans in our modern workforce is steadily increasing, while the communities of persons who self-identify as lesbian, gay, bisexual, and transsexual are growing in prominence. In addition, 13% of persons of typical working age in the U.S. (National Science Foundation 2009) self-identify as having a disability or as "differently abled," including increasing numbers of veterans (Duerstock et al. 2014). The adaptability and strong work ethics of veterans and persons with visual and other disabilities are well known (e.g., <http://tinyurl.com/o2fxolk>, <http://tinyurl.com/nz98hp6>). However, despite many efforts to increase the diversity of the science, technology, engineering, and mathematics (STEM) workforce, persons with these diverse heritages and experiences remain significantly underrepresented in

research (Mankin 2005, Quisenberry 2011, Moss-Racusin et al. 2014).

The results of multiple initiatives by different organizations suggest that no single approach to increasing scientific workforce diversity meets the needs of all concerned (e.g. Malcom-Piqueux and Malcom 2013; Mühlenbruch and Jochimsen 2013). The optimal mix of institutional change, mentorship, and networking has been difficult to achieve, and the scientific workforce remains primarily a non-minority-dominated field, especially at the mid- and upper professional career levels (Tabak and Collins 2011; Vernos 2013).

In the original symposium on entomological workforce diversity, we discussed different strategies for ensuring that diverse voices are included in the entomological research environment. Such strategies involve institution-wide articulation of a commitment to inclusiveness, enabling of increased access of underrepresented minorities to graduate education and training, and development of efforts to increase minority student awareness of STEM career opportunities and participation in research activities (National Academy of Sciences 2010, Quisenberry 2011). Here, we discuss several strategies for recruitment and mentorship of differently abled students that have proven successful at the Center for Medical, Agricultural, and Veterinary Entomology (CMAVE).

Recruitment

Participation and networking in organized scientific meetings and symposia are traditional ways for researchers to contact graduate and undergraduate students

who may have an interest in their research area. Because students also are likely to use nontraditional methods such as Web sites or social media to investigate areas of personal interest, it is beneficial to establish a prominent presence on the Internet or participate significantly in science education outreach activities (Mankin et al. 1996). Researchers who have developed strong laboratory training and research programs may already be recommended to incoming undergraduate or graduate students by others who have conducted research successfully in their laboratory. A student's peers can be among the biggest factors that enable a student with disabilities to be recruited for a research experience.

Nevertheless, entomologists with particular interest in introducing students with disabilities to laboratory research often must seek out additional resources beyond the traditional channels of contact because few campuses have the "critical mass" of persons with disabilities needed for efficient networking among student peers or among professional colleagues with strong commitments to inclusiveness (Booksh et al. 2014). Several organizations with programs and services of interest to communities of persons with disabilities have Web sites with helpful contact information. The American Association for the Advancement of Science Entry Point program encourages STEM students with disabilities to apply their skills in a real-world professional setting (<http://entrypoint.org>). The Foundation for Science and Disability (<http://stemd.org>) promotes the integration of students and scientists with disabilities into all activities

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of the scientific community and provides opportunities for researchers to post job openings. The Institute for Accessible Science, which focuses on inclusion of persons with disabilities in biomedical science careers, has a number of useful links and publications dealing with assistive technology (<http://iashub.org>) In addition, campus accessibility offices and national programs such as the Minority-Disability Alliance in Science, Technology, Engineering, and Mathematics (Hunter College, New York, NY; City University of New York; New York, NY; and Southern University, Baton Rouge, LA), funded by the National Science Foundation, often participate in recruitment of students with disabilities for research opportunities.

Mentorships

There are several formal methods to help students with disabilities explore career options in the scientific workforce, including assistantships and internships. Internships can introduce undergraduate and graduate students with disabilities to a variety of stimulating research experiences and enable them to determine necessary accommodations for laboratory and field experiments. Typically, persons with disabilities have little prior exposure to hands-on experience in STEM and they may accrue exceptional benefits from such internships (Shingledecker et al. 2014). Because fear, caution, or unfamiliarity often raise high barriers to interactions with persons who have disabilities, summer research projects have been developed at CMAVE that engage not only the students, but also encourage structured interactions with the students' colleagues, advisors, and institutions. The students gain confidence and visibility by conducting and presenting their inquiry-driven studies in a variety of settings, and the networking interactions have enhanced the research and personal perspectives of all involved. During the mentoring process, the colleagues and advisors can observe first-hand the creative efforts of differently abled students thinking "out of the box" to solve problems hindering their research projects, which gives credence to the adage that "necessity is the mother of invention." In previous studies, for example, customized golf cart and instrument carrier setups were developed that proved of benefit to all field-experiment participants, not just those with disabilities.

To enhance the effectiveness of summer

internships, we have begun to implement internship assessment tools such as those described in Lopatto (2004). For example, student feedback led to increased numbers of visits to nearby laboratories on the University of Florida campus where students could experiment with different instruments and research methods.

Trends and Challenges Affecting Futures of Differently Abled in Entomology

Modern assistive technology (Duerstock et al. 2014) will likely enable increasingly greater fractions of persons with disabilities to integrate into the entomological workforce over the next few decades. Such innovations also enable greater opportunities for growing numbers of persons with age-related or military service disabilities to continue participation in the work force (e.g., <http://tinyurl.com/lxfajtc>). Consequently, it is likely that the differently abled will be less underrepresented in the entomology workforce in future years. There are other factors, such as reductions in funding or large increases in the number of young career professionals competing for limited numbers of research and teaching positions, that could delay these trends. Thus, it is important to maintain commitments to inclusiveness, training, and mentoring that can help ensure that differently abled researchers participate fully and enhance professional capability at all levels of the entomological workforce. Each of us is a channel through which humanity can explore and solve universal questions. Failure to encourage and develop the talents of all who wish to participate in solving important entomological research questions will waste precious human capital.

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