Connecting with the World's Best Talent: Attracting and Retaining Diverse Entomologists

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Entomologists are a group well-acquainted with the concept of diversity. Genetic diversity is understood by all types of biologists as a necessary condition for population fitness and evolution. Given the universal nature of this understanding, it may strike some as curious that only recently is the positive impact of human diversity in industry, government, and academia being widely acknowledged, from evidence for enhanced innovation (Østergaard et al, 2011) to superior business performance (Slater et al, 2008). Of course, there are many definitions of human population diversity—about as many definitions as there are conceivable demographic categories. In 2013, for example, Entomological Society of America members claimed 38 different areas of employment and six different ethnicities, with over 1,000 members' ethnicity listed as "unknown" in the database (ESA 2013). Over 3,000 members were listed in the database as male, over 1,200 listed as female, and over 1,500 members did not identify gender. Age is another way to look at demographics: 22% of members' ages were unknown, 17% were between 50-59 years old, 30% were under 40, and just about 6% were over 70. Members expressed interest in 35 different insect orders. Surely ESA is a rich population to engage in a dialogue on fostering diversity in our discipline.

Visibility for the dialogue on diversity is what we as co-organizers of this symposium were seeking when we proposed the topic. We were energized by the outstanding scientists we were able to secure as speakers and gratified when it was accepted as one of six Program Symposia in the 2013 annual meeting. We feel strongly that it is important for entomology students and young professionals to be able to identify role models at all levels in the society and in their professions who share their cultural, ethnic, and gender experiences. It is important that the diversity of entomology is represented in the awards that are given, officers elected, honors bestowed, and employees hired. It was our goal for the symposium, therefore, to highlight diverse role models who could speak to their status as minorities in the science and scientific society and also emphasize positive steps we can take to ensure diversity and strengthen ESA for the future.

Note: One of our speakers, Kei Koizumi, Assistant Director for Federal R&D at the White House Office of Science and Technology Policy, was unable to contribute a paper for this Instant Symposium.

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Asian Americans in Entomology, and the Future of the Science and Engineering Workforce in the United States

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Asian Americans (and Pacific Islanders [AAPIs]), who accounted for a mere 4.4% of the U.S. population in 2004 (6% in 2013), consist of a diverse group of ethnicities, including Chinese (23%), Asian Indian (19%), Filipino (18%), Vietnamese (11%), Korean (10%), Pacific Islanders (7%), Japanese (7%), and others (5%) (Anonymous 2008). This group can be roughly sub-divided into three groups according to their religions and cultural background. The Chinese, Vietnamese, Koreans, and Japanese have been influenced by Confucianism and the associated imperial examination system for recruiting grass-root talents in civil service. While Buddhism is the traditional religion of this group, Christianity has had a strong influence in modern Korea. Christianity is also popular among Filipinos and Pacific Islanders, with regional varieties of indigenous beliefs. Hinduism is deeply rooted in Indian society and its value system.

Model Minority or Forgotten Minority?

Despite being a small group, Asian Americans account for 16% of the science and engineering (S&E) workforce in the U.S. (Fig. 1), over-representing their population's share by >3-fold. More than 50% of Asian Americans have college degrees, surpassing the 27% of degree holders among adult Americans (Anonymous 2005). The strong participation of Asian Americans in the S&E workforce and higher education has earned this group the nickname of "model minority," but its under-representation in leadership positions such as university administrative and corporate CEOs (2%) also earns it the nickname of "forgotten minority" (Ruttimann 2009). Asian Americans account for 6.2% of full-time faculty of higher education in the U.S., but only 2.4% of senior administrative positions; 1.5% of university presidents are of Asian descent (Anonymous 2005). Of the total workforce of National Institutes of Health (NIH), 13.5% were Asian Americans in 2006, but only 3.3% of senior executives were Asian (Ruttimann 2009). The 2008 data showed that while 23% of the tenure-track positions at the NIH were filled by Asian Americans, they comprised only 12% of tenured/senior scientists and 6% of laboratory chiefs, and only one of the 27 directors of NIH research institutes was an Asian American.

Asians in Entomology

According to the 2013 data of the Entomological Society of American, 12% of ESA members identified themselves as Asians (including non-U.S. nationals). While the figure is indicative of their overall strong participation in science and higher education, the numbers of Asian entomologists honored by their ESA peers are less impressive (Table 1). The ESA Fellow, for example, was established in 1938 to recognize "individuals who have made outstanding contributions to entomology," and of the 356 Fellows awarded between 1938 and 2013, only 15 Asian entomologists (4.2%) received this distinction. Of the 738 entomologists who received at least one of the eight professional honors and awards, only 28 (3.8%) are Asians. The figure is substantially lower than the 12% share of Asian entomologists among ESA membership, and is indicative of the under-representation of Asian Americans in leadership positions.

Bamboo Ceiling and Stereotypes

This trend of bottom-heavy and top-light representation of Asian Americans in the scientific and academic community is coined "the bamboo ceiling" (Ruttimann 2009). Stereotypes associated with Asian Americans often result in negative repercussions and produce barriers to their advancement. The perception that Asian Americans are hard-working, highly-educated, and good in math and science, for example, overlooks the diversity of this group, leading to the lack of networks to assist those who need help (Anonymous 2008). This "model minority" stereotyping also creates unreasonable expectations upon Asian Americans and marginalizes those who do not meet the expectations. Asian Americans are viewed as being quiet, passive, non-complaining, and inclined to workplace harmony over individual aspiration, and thus are thought to be incapable of self-promotion and aggressive pursuit of leadership positions (Anonymous 2005). Discrimination due to language and accent are commonly faced by Asian Americans who are regarded as "perpetual foreigners" lacking verbal and linguistic skills

Table 1. Numbers of Asian entomologists who received ESA professional honors and awards established before 1983*

Honors and awards	Asian	Total	%
ESA Fellows (1938 -)	15	356	4.2
Founders' Memorial Award (1958 -)	0	55	0
Certification Program (1978 -)	1	90	1
Recognition in Entomology (1980 -)	3	33	9.1
Horticulture Entomology (1980 -)	3	33	9.1
Teaching (1980 -)	2	33	6.7
Extension (1980 -)	0	33	0
ESA Honorary Members (1983 -)	4	105	4
Total	28	738	3.8

*honors and awards established after 1984 were omitted due to insufficient data

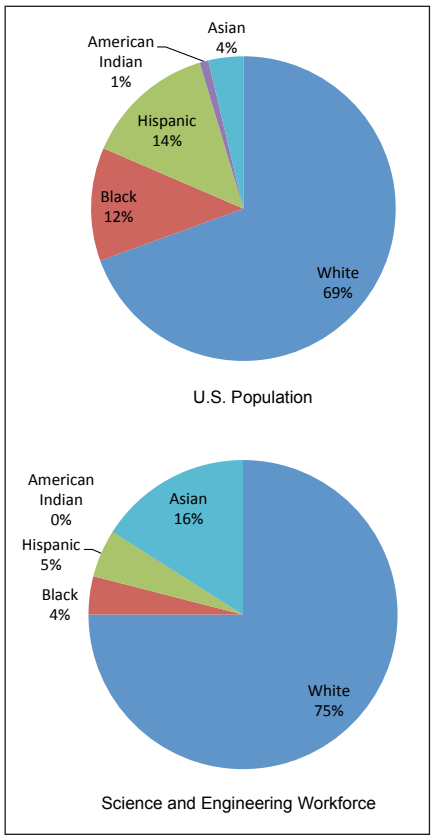

Fig. 1. Ethnic makeup of U.S. population and science and engineering workforce in 2006.

(Anonymous 2008). The behaviors of being independent, aggressive, and competitive are prerequisites to being a leader in U.S. society, but such behaviors often go against the grain of Asian cultures, especially that of Confucianism and Buddhism.

Diversity and U.S. Competitiveness in the Global Economy

The overrepresentation of Asian Americans in S&E translates into the under-representation in these fields by other ethnic groups, especially Hispanics and African Americans (Fig. 1). It is projected that between 2006 and 2050, the white population will decline from 69% to 47%, while the Hispanic population will increase from 14% to 31% for the same period (Fig. 2). The Asian population will gain slightly (4% to 8%), but the African American population will stay almost the same. In 2006, 73% (white and Asian) of the U.S. population accounted for 91% of the S&E workforce, but the 29% of African Americans and Hispanics accounted for only 9%. By 2050, white and Asian groups will account for 55% of the U.S. population, and if the participation in S&E workforce remains the same, ethnicity-wise, as in 2006, the number of those involved in S&E will decline by 16% in 2050 from the 2006 level. Such a decline will compromise the U.S. competitiveness in the global economy (Anonymous 2011), but the 16% reduction is probably an optimistic estimate, because younger generations across all the ethnicities in the U.S., including Asian Americans, have increasingly shunned the S&E fields.

There is a need to attract more youths among underrepresented minorities to enter the S&E fields, but this could be a challenging task. The traditional values shared by some Asian Americans probably contributed to their successes in science and higher education in the past. For example, Asian American youths with the background of Confucianism and imperial examinations benefit from the U.S. education system that rewards students with exam-taking skills. Such traditions, however, are not easily transferred to other ethnic groups. As the newer generations of Asian Americans become more detached from their traditions and acclimated to American culture, they will be more inclined to select careers other than S&E.

Anti-Intellectualism and Science in the U.S.

The U.S. public's lack of understanding of science and their negative views of scientists in particular further dissuade younger generations from entering the S&E workforce. A recent NSF survey (Anonymous 2014a) showed that only 48% of U.S. respondents agreed with the statement that "human beings, as we know them today, developed from earlier species of animals." This figure is considerably lower than those of other developed countries, e.g., 70% of Europeans and 76% of Japanese, and lower than those of emerging countries such as China (66%), India (56%), and South Korea (64%). Among the developed world, only Americans held the view that Darwinian evolution is a "controversial" issue (Jacoby 2008). Only 39% of U.S. adults believed that "the universe began with a huge explosion" (Anonymous 2014a). Interestingly, when the question of human evolution was prefaced by "according to the theory of evolution," 72% of U.S. respondents agreed. Similarly when the question of "Big Bang" was prefaced by "according to astronomers," the figure increased from 39% to 60%. The differences suggest many Americans are aware that these are accepted views in science, but they do not necessarily agree with scientists' opinions. A similar trend can be seen in Americans' opinions on climate change. In a survey of peer-reviewed literature published between 1991 and 2011, Cook et al. (2013) found that >97% of climate scientists endorsed the position of anthropogenic global warming. Among U.S. adults, however, only 61% believed global warming is actually happening, and only 50% believed that global warming is caused by human activities (Anonymous 2014b). Despite the >97% consensus among

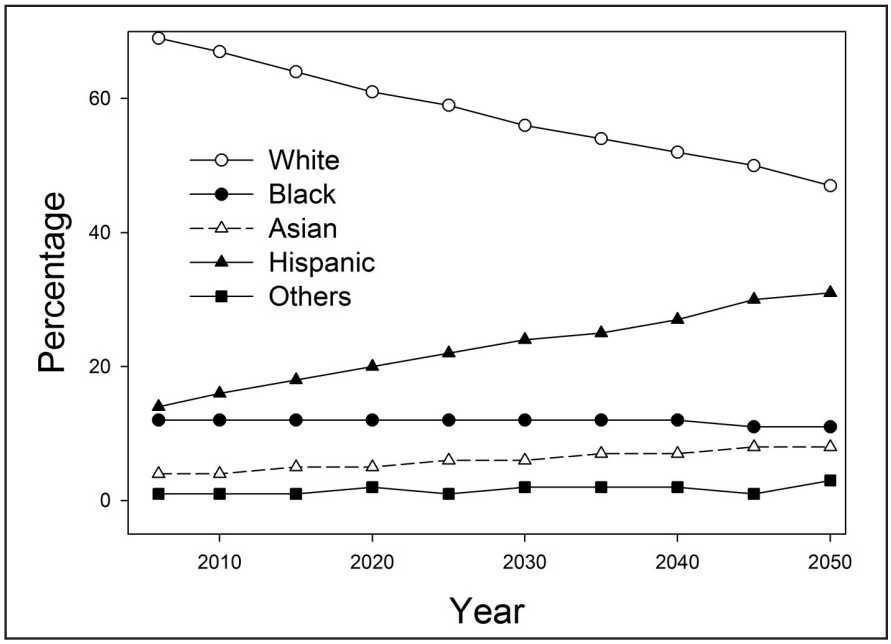

Fig. 2. Ethnic groups in U.S. population 2006–2050 with projected figures for 2010–2050 (Anonymous 2011)

climate scientists, only 34% of U.S. public agreed with the statement that "most scientists think global warming is happening" and 45% believed that "there is a lot of disagreement among scientists about whether or not global warming is actually happening."

These discrepancies may be the result of poor communication by the scientific community to the general public, but one underlying element that cannot be overlooked is the general distrust in the U.S. public of scientific elites, which is a deeply rooted anti-intellectual tradition of American culture. Sowell (1999) argued that because the U.S. was built by immigrants who escaped religious persecution by the European upper-class elites including clergy and nobles, there has been a tradition of distrust against elites. The founding fathers of this country were mostly well-educated men, but bookish elites were considered useless and unappreciated by the populace, whose daily life was filled with physically demanding tasks. This anti-intellectual tendency remains strong in today's U.S. culture. U.S. students competent in math and science are often ridiculed as "nerds" with few social skills, despite the fact that some of the most successful members of our society (Bill Gates, Jeff Bezos, and Steve Jobs, just to name a few) are undoubtedly "nerds." Hollywood movies tend to depict scientists as villains draped in white lab coats who tinker with monstrous devices that threaten humanity—never mind that almost all of the modern technologies we enjoy today are due to the efforts of lab-coated scientists. Some may blame the media and politicians for deliberate misinformation used to gain financial and political advantage, but conversely, the media and politicians may be only playing the stories that their audience wants to hear.

A Personal Perspective

There is no quick or easy answer to cure the U.S. public's ignorance of science, and to remedy their distrust in scientists. As an Asian entomologist who grew up in Japan and now resides in the U.S., however, my personal observations may offer some insight.

The physical facilities of public schools in the early 1960s in Japan were extremely rudimentary. More than 15 years had passed since the end of WWII, but some families still lived in rustic tin-roofed shacks that dotted the landscape surrounding the elementary school I attended in Osaka. An industrial city and financial center of Japan, Osaka was heavily bombed during the war, and the scars remained visible even in the 1960s. Our classrooms were housed in a one-story wooden building with many broken windows covered with cardboard. A lone wood stove warmed the room filled with more than 50 students. All teachers shared a large room crowded with small desks and a few wood stoves. The principal's office had a larger desk and a couch with worn-off corners and burn marks on the back. Cardboard-covered windows were also common features shared by the teachers' room and the principal's office. There was no gym. The schoolyard was nothing but a piece of bare land with scattered weeds and no equipment to speak of.

"There is no quick or easy answer to cure the U.S. public's ignorance of science, and to remedy their distrust in scientists."

In this humble facility, there was one room in the school that was the envy of all: the science room. Inside the science room were six brand-new lab benches with dark chemical-resistant bench tops, deep sinks, vacuum-generating faucets, electric outlets, and gas burners. Laboratory glassware sat neatly on the shelves of covered cabinets along with solvent bottles. There were no broken windows in that science room. It was a sacred place in the minds of many sixth-graders who had the privilege to enter. There was no doubt among us as to what we wanted to be. That modern science laboratory in my humble elementary school was probably replicated in schools elsewhere in Japan at that time. It sent a strong message to Japanese children in the 1960s as to what their society valued the most, what their adults expected them to be, and where the rewards would be found. After the devastation of WWII, the post-war recovery of the Japanese economy is often considered a miracle. The advanced electronics, automobiles, and other industrial goods produced by Japanese scientists and engineers still dominate the world market today, and I have no doubt that many Japanese of my generation with the shared experience of that science room have contributed to this success. The miracle originated from the minds of many inspired Japanese youngsters who chose to enter the fields of S&E. The question facing us today is how to motivate and inspire U.S. youth of all backgrounds to do the same.

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Female Entomologists in Academia

SHARRON S. QUISENBERRY

A "chilly" climate can exist for female entomologists pursuing tenure-track faculty positions. Over the past two decades, the number of female graduate students has grown, but the number of female faculty has remained relatively unchanged, with numbers lower than male faculty across ranks (CEDA 1993-1998; CEDA 2007-2011). Women are most capable of being successful in entomology at the tenure-track faculty level. However, numerous obstacles impede success, including a chilly and non-inclusive academic environment; a sub-critical mass of females that are needed to serve as role models and mentors, which may result in isolation and marginalization; and limited support within and external to the department. Universities can no longer afford to devalue contributions through gender or minority inequities. The consequences of not implementing change will result in detrimental effects to our nation's competitiveness, because diversity and inclusiveness promote innovations and solutions to problems. It is imperative that we build an inclusive and diverse culture and environment, which means moving beyond any existing biases and barriers.

The Gap

The number of female doctorate students in entomology increased from 1993-1998 to 2007-2010, 28.1% to 45.9%, but this increase did not translate into corresponding increases of women in tenure-track faculty positions (Quisenberry 2011). This trend continued in 2011 (Fig. 1), but the number of doctorate students and faculty, male and female, showed declines indicating fewer faculty hires and an increased number of retirements; thus, a corresponding decline in the number of doctorate students trained (CEDA 2007-2011). From 2007-2011, women represented an average of 17.3% of faculty across all ranks (Fig. 2). The 28.6% average gap between female doctorate students (45.9%) and tenure-track faculty (17.3%) is significant and discrepancies have remained consistent. If analyzed within rank, the percentages are even more revealing, with women comprising only 23.4% of faculty at the assistant professor rank, 28.6% at the associate professor rank, and 10.9% at the professor rank (CEDA 2007-2011).

> "There is a tenure-track gender gap in entomology that continues even though there is equality in the number of doctorate students."

Issues and Obstacles That Impact Climate

There is a tenure-track gender gap in entomology that continues even though there is equality in the number of doctorate students. To address this gap, a series of questions need to be considered—specifically, what are the issues and obstacles that impact the climate, including biases and barriers? Departments have done an excellent job in increasing the number of women in doctorate programs and thus filling the pipeline. It is understandable that at the professor rank, the numbers would be lower because there were fewer women being trained in the past (CEDA 1993-1998). This does not explain why less than 30% of faculty hired at the assistant professor rank are women, far below potential. There are major issues and obstacles that women still encounter. Women and men, depending on the academic culture of the department and institution, may be socialized, hired, mentored, networked, and retained differently (Matyas 1985a, 1985b). Climates often become difficult and non-supportive for women, including problems in building supportive networks; their scholarly accomplishments may be devalued, trivialized, and ignored due to differences in socialization and inclusion in scholarly activities (Quisenberry and Leach 2001). Women may be placed in different roles, with more teaching, student advising, and committee assignments, which impacts their research and publishing (Schneider 1998). This action can adversely affect tenure and promotion because research activities are often more highly valued than teaching, advising, and committee activities. Additionally, without a critical mass of females in leadership and mentorship roles, the development of critical and effective networks among women and other

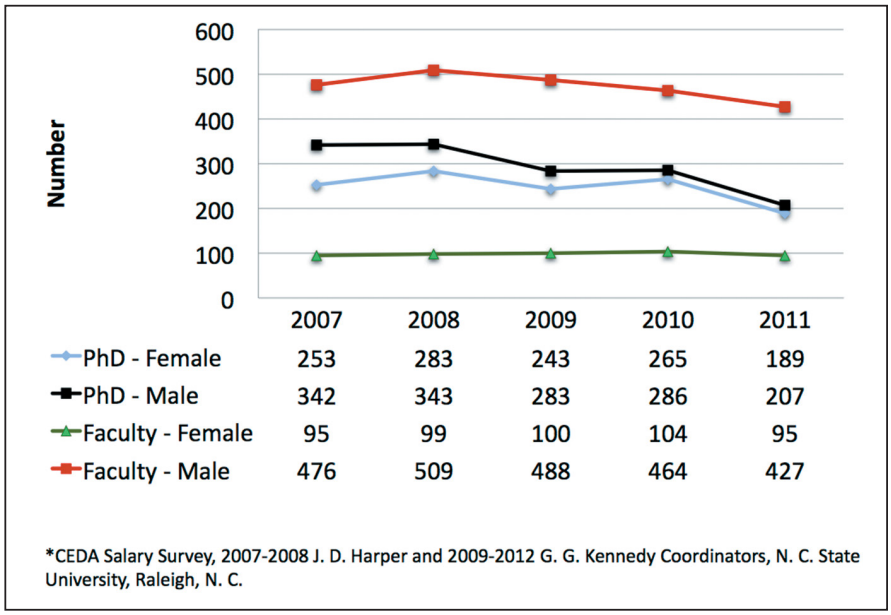

Fig. 1. Doctorate student and faculty numbers by gender, 2007-2011.

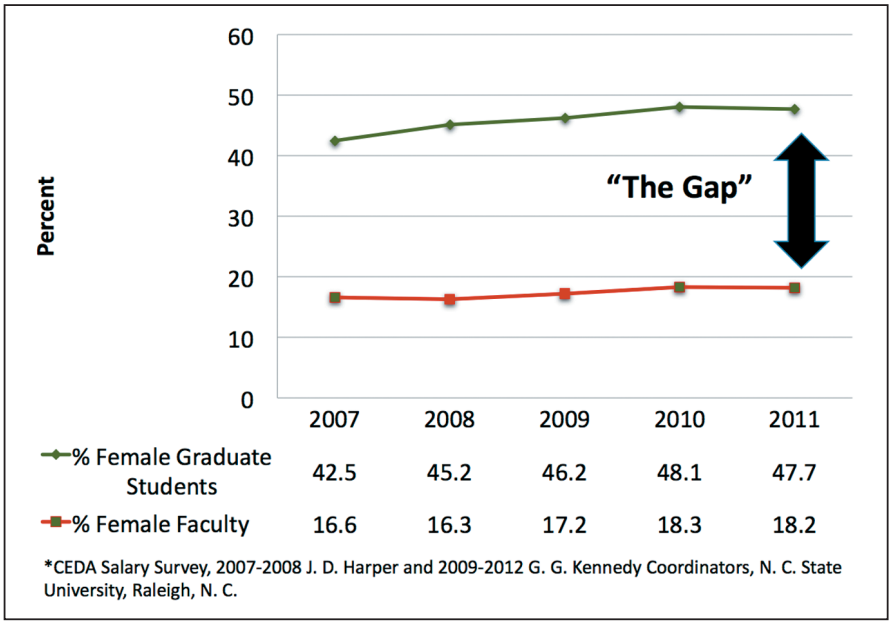

Fig. 2. Female doctorate student and faculty percentages by gender compared with totals, 2007-2011.

faculty as well as professional growth and development becomes problematic. Overall, women are not necessarily part of the decision-making process. This promotes a lack of transparency that impacts tenure and promotion, resource equity, and life-work balance. The "biological clock" and childbearing issues can also dramatically affect women in the tenure-promotion process, unlike the majority of their male counterparts.

Move Beyond Bias and Barriers: Best Practices

Moving beyond bias and barriers requires changes in policies (department and university) that adopt best practices in communication and transparency of processes. Effective communication and transparency of processes translates into consistent recruitment, hiring, and evaluation criteria; enhanced communication providing feedback and clarification of expectations; and forward mentoring and networking of faculty (Bird 2011; Bird et al 2011). Building an inclusive and diverse climate promotes innovations and solutions while establishing an environment that empowers faculty and the institution. Clear expectations and criteria for recruiting, hiring, tenure, and promotion processes reduce impediments, provide transparency for frequent and accurate communication and feedback, and facilitate resource acquisition. The promotion of effective faculty mentoring, networking, and integration establishes an environment of respect, recognition, and reward. It is imperative that best practices promote the value of contributions, prevent inequities, involve faculty in decision-making processes, and balance academic and personal responsibilities (Bird 2011; Bird et al. 2011).

Striking a Balance

The number of female doctorate students has improved significantly over the last two decades; however, this has not translated into more women in tenure-track faculty positions (Figs. 1 and 2). The number of women in tenure-track positions can improve if there is a commitment to change by institutions and departments. In particular, corrective actions must be developed that require campus frameworks to monitor progress and to analyze and utilize data that promote organizational change and lead to a diverse and supportive environment. As stated previously, the adoption of best practices that improve communication and transparency of processes are key to the development of this culture. An inclusive and diverse culture will be achieved if barriers and obstacles are addressed and action steps are developed to overcome existing problems. It is time to harness our innovative and solution-based capacities that will provide equal educational and professional development opportunities for women and minorities, and promote an environment and culture that is inclusive, diverse, formative, creative, entrepreneurial, and empowered.

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Lesbian, Gay, Bisexual, and Transgender (LGBT) Entomologists

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As the U. S. population rapidly changes to reflect a much more diverse population and the white male paradigm shifts to the background (Frey 2013), there has been increasing interest in looking at diversity in academia. Although laudable, these efforts too often focus on the more visible signs of diversity, such as race and gender. No attitudes have changed as rapidly in recent times as those that concern the LGBT community, with huge swings to support same-sex marriage and protection from discrimination within the workplace (Richey 2014). Understanding lesbian, gay, bisexual, and transgender (LGBT) needs within entomology or the broader sciences is currently difficult due to remaining societal stigma attached to being LGBT. LGBT workers and their families often are held back by bias, fewer workplace benefits, and higher taxes (Anonymous 2013) and are not a protected class within the United States, creating concern over career loss. Therefore, precious few data points are available and many are based on self-disclosure through such means as surveys.

As of this writing, it is currently legal to be fired in twenty-nine of the fifty states for one's sexual orientation or in thirty-three states for gender identity. Only seventeen states and the District of Columbia offer protection for both sexual orientation and gender identity (Fidas and Cooper 2013). Furthermore, protections can vary within each state so that a college community might offer protections against discrimination, while the nearby town where most students live might not. This patchwork of protections and rights has led many to hide their true identity.

Our workplaces and universities are also much more global than in the past, with employees originating from many countries. Concurrently, sabbaticals and overseas travel are also much more frequent than in the past. The patchwork of laws related to LGBT individuals is even more profound on the global level. Recent events in Russia, where being LGBT is heavily stigmatized and where some have even been brutally murdered, highlight the concerns of LGBT traveling to other countries (http://tinyurl.com/no2dval). LGBT individuals from such countries can also be much more concerned about being open at the university or workplace based on past discrimination. Currently, there are ten countries where homosexuality may carry a death sentence (Rupar 2014). Conversely, countries such as those in the European Union have seen much broader LGBT rights than are currently available in the U.S. (http://tinyurl.com/oyxbktl).

There is a cost in hiding your true identity and not engaging fully in your career. A recent *Wall Street Journal* article by Feintzeig (2014) found that employees who were not "out" in the workplace reported less satisfaction with their jobs and were more likely to leave. The author also found that closeted workers are more likely to avoid certain clients or social events and report feeling tired, unhappy, and depressed (Fidas and Cooper 2014). The closeted employee can obviously create a retention issue for employers. Surprisingly, that *Wall Street Journal* article reported that only seven percent (7%) of employees between the ages of 18 to 24 are "out" at work, while thirty-two percent (32%) of employees between 35 and 44 are "out" at work, despite the popular perception that the younger generation is more open with their sexual orientation or gender identity. Not being a protected class within the United States would obviously influence whether the newly hired or those who feel vulnerable in their positions would disclose any information that could be detrimental to their advancement or retention.

Looking specifically at entomologists, there is no study or research on LGBT individuals. Personal conversations have identified four "out" entomologists over the past 30 years (including myself), but current research suggests that roughly 3.5% of the U.S. population is LGB and 0.3% is transgender (Gates 2011). Inferring that entomologists should reflect the population as a whole provides an estimate that roughly 114 of the 3,000 entomologists listed in the ESA database (ESA 2013) are LGBT.

Although not specific to entomology, there has been recent and ground-breaking work on LGBT within the population of workers and students in STEM (science, technology, engineering, or mathematics) fields. A recent survey by Yoder and Mattheis (2013) of 1,354 self-identified non-straight scientists in STEM found that the largest cohort of these scientists were those working in life sciences (603 or 41.8% of the total responding to the questionnaire). Approximately half of the respondents had or were working on doctoral degrees.

One of the primary indicators of a welcoming environment for LGBT is how comfortable they feel about "coming out." In Yoder and Mattheis' (2013b) work, they found that the majority of participants were "out" in the personal context of their family and friends, but when looking at their work relationships, there was a strong dichotomy: just slightly more people were "out" at work than those who were completely closeted, and there were few in-between. What was striking in Yoder and Mattheis' work was that when asked to rate if their workplaces felt safe and welcoming—and whether their employers provide benefits to LGBT employees—participants' responses were highly correlated. In other words, if the workplace increased efforts to welcome LGBT individuals by offering specific protections or benefits (e.g., spousal benefits), employees felt comfortable in disclosing their orientation or gender identity at work. If employees felt that their workplace was unwelcoming or if they were not sure how they would be received, then they often chose not to disclose their sexual orientation or gender identity within the workplace.

In this day and time, it would be nice to assume that anti-LGBT comments are relegated to the dark recesses of the science field. However, negative comments still abound within the sciences, and not just at the water cooler. A recent letter published in the American Society for Engineering Education diversity magazine *PRISM* (Helmer 2013) posed the following: "Any and all diversity is good and therefore should be encouraged. But is it?…We

"In this day and time, it would be nice to assume that anti-LGBT comments are relegated to the dark recesses of the science field. However, negative comments still abound within the sciences, and not just at the water cooler."

would do well to teach the truth about the homosexual/lesbian/bisexual/transgender lifestyle. These dear people caught up in this destructive way of life need true help and true hope and not encouragement or approval of a detrimental, negative lifestyle. They deserve better than that. This is not God's plan for their lives." Although the letter was swiftly condemned and resulted in publication policy revisions, the damage would have already been done for any LGBT considering disclosing their true identity.

Given the fast-paced change in acceptance for LGBT within the sciences and more broadly within our culture, what are ways for LGBT or those questioning their orientation or gender identity to identify an accepting environment? For those still in college, there are now widely available surveys of universities for LGBT support. These indices consider basics such as inclusion in the university statement on non-discrimination, but also items like housing, safety, and counseling support. Campus Pride (www.campuspride.org) has a very comprehensive list currently consisting of 421 colleges and universities. Outside the U.S., there are some additional resources. For example, Stonewall, a leading advocate for LGBT parity within the United Kingdom, has rated all 157 universities based on their inclusion efforts (Day 2013).

Within the workplace, it is still common to alter/hide appearance, affinity, advocacy, or association (Goffman 1963) that one is LGBT. In a recent survey, 91% of LGB responded that they "cover" and 59% of respondents said that they felt the company encouraged covering; leading to less commitment to the workplace (Yoshino and Smith 2013). Conversely, Badgett et al. (2013) found that when a workplace allows LGBT employees to be open, this is linked to greater job commitment, improved workplace relationships, increased job satisfaction, and improved health outcomes among LGBT employees. A valuable resource for workplace acceptance is the Human Rights Campaign's Corporate Equality Index (http://www.hrc.org/campaigns/corporate-equality-index). The 2014 survey found that 304 top businesses received 100%, the highest score on the index. This index considers the basics, but also covers cutting-edge criteria, such as transgender health benefits and supplier diversity, in determining scores.

If we can agree that it is beneficial for the employer and employee to encourage LGBT openness, what ways can we as entomologists encourage the same? For all of us, but certainly for advisors and those working with students or in recruitment, it is important not to make assumptions based on orientation and gender identity, but to use inclusive language and be open in dialogue. If unsure of a proper answer or policy, be honest but open in discussions. This will go a long way in encouraging more engaging behavior. Be aware of policies that might affect LGBT, such as domestic partner benefits or transgender health benefits, but also realize that many use items like this to serve as a litmus test for an overall supportive work/study environment.

For LGBT students or prospective applicants, there is a common concern about how and when to disclose their gender identity or sexual orientation. Although it is a personal choice, anecdotally, it appears that these young people are disclosing earlier in the process, often while on the job interview. Most LGBT applicants will have looked at the information on-line, such as diversity employee resource groups (ERGs) and non-discrimination statements, and will be trying to gain a feel for the true culture and atmosphere.

Finally, allies (commonly defined as those who support LGBT parity) are key in creating a more welcoming space and are instrumental in making advancements for LGBT inclusion. It is common that an ally might have concerns over showing support for LGBT as they fear they themselves may be labeled as such. Allies often experience a "coming out," in much the same sense as someone who is LGBT. Often, there is concern from the ally about asking questions or making assumptions, but if done in a positive and supportive way, it will usually be well received. An ally can send reassuring signals and ask respectful questions that are inclusive to all within the workspace.

With increased support, understanding, and cultural change, it is hopeful that there will be an increase in LGBT who will bring their complete selves to the entomological profession. As I have discussed above, this will have positive effects not only for the individual, but also for the profession, encouraging increased engagement and passion.

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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 (Jablokow 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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African American Voices in Entomology

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Early Pioneers

The earliest published insect-related papers by African American entomologists appeared in the late 1800s. Charles Henry Turner is recognized as the first African American to publish papers involving insects (Abramson 2009). He was trained in comparative physiology and obtained his B.S. and M.S. degrees from the University of Cincinnati, and finally was awarded a Ph.D. from the University of Chicago in 1907. His pioneering research on insect learning involved bee behavior. His professional career was marked by considerable movement among Historically Black Colleges and Universities (HBCU), both on non- and tenured appointments. He finally settled down as a high school teacher in St. Louis until his retirement in 1922. He published 71 papers, many on insect systems, in basic biology and behavioral journals, including *Science*.

Although not academically trained as an entomologist, George Washington Carver is recognized as an expert on pests of peanuts (http://tinyurl.com/q9sadj3). He made numerous contributions to agriculture when serving as the Director of the Agriculture Department at Tuskegee University. His research and teaching gained him international acclaim.

Dr. Margaret Collins is considered by many to be the first African American woman to receive an advanced degree in zoology/entomology from a major U.S. university, the University of Chicago, in 1949. Her mentor and thesis advisor was Professor Alfred E. Emerson, a legendary isopterist who maintained the largest termite collection anywhere in the world during that era. Upon completing her dissertation, Dr. Collins went on to have a distinguished academic career at three universities: Florida A&M, Federal City College, and Howard University, all with tenure. She was considered a world authority on the termites of the Caribbean and published 41 papers. She finished her career as a volunteer curator for the termites of the Caribbean Islands and Guyana collections at the Smithsonian Institution, Washington, DC. She was an amazing individual, raising two sons as a single parent during a time when neither women nor African Americans were welcomed in many institutions of higher education. A short biography on Dr. Collins and her achievements can be found in Warren (1999).

Surveys

By today's estimates, fewer than 100 African Americans have self-identified as entomologists. These estimates were compiled from membership files from the Entomological Society of America (ESA 2013) and a recent survey (Abramson et al. 2013). However, from these sources, it is difficult to determine the type of degrees (B.S., M.S., or Ph.D.) or the type of profession (academic, government, or self-employed) identified by responders. When compared to the total number of professional entomologists maintained in the ESA membership files, African Americans represent < 2% of the total: 74 of 5,903. There are several bio-sketches for a number of contemporary African Americans entomologists that can be found at www.blackentomologists.org, and in a soon-to-be published book (Dr. Eric Riddick, personal communication).

> "By today's estimates, fewer than 100 African Americans have self-identified as entomologists."

Institutions of Higher Education and African American Students

Based on the survey conducted by Abrahamson et al. (2013), there are few African American entomologists working as academics or professionals. This begs the question: what are the feeder systems that train and produce African American entomologists? Nationwide, there are 4,140 public and private two-year and four-year institutions of higher education with a combined undergraduate and graduate enrollment of over 17 million students (http://www.infoplease.com/ipa/A0908742.html; 2005 data). These data also include information from the HBCU schools (106 in total). Although African Americans comprise 13.1% of the U.S. population, only 2.7% actually received at least one college degree for those fields involving science, technology, engineering, and mathematics (STEM) (National Academies 2011). Within the listing of private and public institutions of higher education are 56 institutions that offer separate degrees in entomology (http://www.entsoc.org/resources/education/colleges). In 2011, the number of B.S., M.S., and Ph.D. degrees awarded in zoology (including entomology) was 2,174, 346, and 258, respectively (National Center for Education Statistics 2012, http://tinyurl.com/layzca2). Regrettably, these same data show a steady decline for all degrees awarded, and for Ph.D. degrees, a 29% decline since 1970. It is from these data that the numbers of current and potential African American entomologists originate for graduate school and professional careers in entomology.

African American Students and Faculty at UC Berkeley

The University of California, Berkeley, is a venerable institution of higher education. Its current undergraduate and graduate student enrollment is 36,204. The campus prides itself on academic excellence as well as its student diversity. The oldest of the ten University of California campuses, Berkeley is considered by many to be the highest-ranked public university in the world (http://admissions.berkeley.edu/rankings). The campus has student enrollment and self-identifying race/ethnicity data that go back more than 30 years. These data provide an opportunity to historically review the levels of African American students over the decades. With the cooperation of the UC Berkeley Equity & Inclusion Office, I was able to obtain data on the percentages of African American undergraduates, graduate students, and faculty to review

Table 1. African Americans either employed by or receiving degrees in entomology or related fields and awarded dates in the College of Natural Resources, UC Berkeley.[1]

Herbert Griffin III	B.S., Entomology 1963
Dwayne Lee	Ph.D., Medical Entomology/Parasitology 1971
Wellington Otineo	Ph.D., Entomology 1974
Samuel Nwabufo Okiwelu	Ph.D., Entomology 1975
Stephen Misari	Ph.D., Entomology 1979
Vernard Lewis	B.S., Agricultural Sciences 1975; M.S., Medical Entomology 1979; Ph.D., Entomology 1989; Cooperative Extension faculty 1991
Earl White	B.S., Conservation of Natural Resources 1976 (No degree in Entomology but took several courses)
Kenneth Boutte	Ph.D. Zoology 1983 (took medical entomology courses but awarded degree was in the College of Letters and Science, UC Berkeley)
Carroll Williams	Adjunct Faculty Forest Entomology 1987
Marion Page	M.S., Entomology 1989
Leslie Casher	Ph.D., Medical Entomology 1991
Eric Riddick	Ph.D., Entomology 1993
Becca Carter	Ph.D., ESPM[2] 2009
Alexandra Harmon-Threatt	Ph.D., ESPM 2011
Rakim Turnipseed	New Ph.D. student, ESPM

[1]The names, degrees and dates are maintained in an alumni database, Development and Public Information, College of Natural Resources, University of California, Berkeley.

[2]The former Department of Entomology was reorganized as a division within the Department of Environmental Sciences, Policy and Management (ESPM) in 1993 (http://ourenvironment.berkeley.edu/welcome-our-environment/history-of-espm/). Awarded degrees are now labeled ESPM.

enrollment and hiring trends.

In the fall of 2013, African Americans comprised 3% of the undergraduate students at UC Berkeley (Source: UC Berkeley, Cal Answers). However, this number was historically as high as 7% during the years from 1988 to 1991 (data provided by the Office of Equity & Inclusion, University of California, Berkeley). There has been some debate that the drop in percentages of African American undergraduate students over the last sixteen years can be attributed to the passage of State Proposition 209 in 1996, which mandated that the University not consider race in student admission procedures (http://tinyurl.com/pq5o2j5). The total student undergraduate population in the fall of 2013 was 25,951 and has been near this level for eight years. African American graduate student enrollment percentage was similar, at 4% of a total enrollment of 10,253. For comparison, African Americans make up 6.6% of the general population of California (http://tinyurl.com/ovuh).

Because entomology is a subset of biology, the total number of African American undergraduate and graduate students in the biological sciences on campus was separated out and also reviewed. The percentages of African American undergraduate and graduate students in the biological sciences at UC Berkeley have varied little, between 1% and 3% (respectively) over the last thirty years. For the current academic year, African Americans make up 2.5% of the 3,894 students in the biological sciences (Office of Equity & Inclusion, University of California, Berkeley).

The total number of African American ladder-rank faculty at UC Berkeley is currently 47 (Office of Equity & Inclusion, University of California, Berkeley). Over the last 30 years, the trend in hiring African American faculty has been flat, constituting approximately 3% of about 1,500 ladder-rank faculty members on the campus. The first recognized African American faculty members were Professors David Blackwell in Mathematics and Joseph T. Gier in Engineering, both in 1952. Professor O'Neil Ray Collins was the first African American botanist and biologist at UC Berkeley in 1969. Today, counting all faculty titles that include ladder-rank, lecturer, and cooperative extension, there are three African American biologists on the UC Berkeley campus.

African American Entomologists at UC Berkeley

UC Berkeley is also home to a famous entomology program that spans 141 years. Over this time frame, at least 790 degrees in entomology have been awarded (CNR Development Alumni Database). Today, the Department of Entomology no longer exists, but has been reorganized into the Division of Organisms & Environment within the Department of Environmental Science, Policy & Management (ESPM), which includes 30 ladder-rank, adjunct, lecturer, cooperative extension specialist, and emeriti faculty (http://tinyurl.com/oqqpsct). Although the word "Entomology" on degrees has been replaced with ESPM, the emphasis in entomology still remains in courses, programs, and mentorship. With the help of the College of Natural Resources Development Office, I was able to review the alumni database and its rich history of names and degrees received in entomology. I was also able to interview Professors Emeriti David Wood and John Anderson (also my mentors) for their memories of African Americans who took courses and received degrees in entomology. This was a difficult research assignment to undertake because collection of ethnicity data only began on the Berkeley campus after an executive order in 1968 that created the Equal Opportunity Program.

What I found was startling: 15 African Americans received at least one entomology degree or were awarded faculty positions between 1955 and 2004 (CNR Alumni database; Table 1). The degree predominantly awarded (11 in total) was a Ph.D. I was also able to verify the ethnicity of all names through thesis acknowledgements, interviews with emeriti faculty who had served during that era, and personal meetings with most of the individuals listed in the table since I came to Berkeley in 1971. Most of the individuals were males (13), but two were females. Half of those in the table are still actively working. The first individual on the list was an undergraduate in mid-1955, verified by one of the emeriti faculty who was enrolled in the same class. The most recent individual is in his first full year of graduate school. Two individuals were in a joint medical entomology and parasitology program during their studies, and a single individual did not receive a

degree in entomology but took several courses. Most of the individuals on the list worked for government agencies, but several had academic appointments at UC Berkeley, and a single individual started a pest control company. Three individuals were international students, and upon completion of their studies, returned to their home countries.

Obstacles and Achievements

I interviewed three African American entomologists on the list and an additional three from other institutions for their thoughts on obstacles they faced during their academic training. Several mentioned the need to leave the South and the bigotry and racism that they experienced. For some, attending HBCU was their most economical option; it was too costly to leave the region. However, with the exception of Florida A&M, there were no recognized entomology programs among the other HBCU schools, and sadly, many mainstream academic institutions denied African Americans from attending. Also gleaned from those interviewed was the importance of family members providing financial support or subsidy for their academic training in entomology, or of benefits and subsidies provided by the military or federal agencies to partially support their time in school. All mentioned the need for a mentor to guide them, and the difficulty in finding such a mentor because of prejudice against African Americans. Regarding achievement, for the 15 individuals mentioned in Table 1, there are at least several hundred published papers covering many insect groups and aspects of entomological investigation. One individual even had his first paper appear in *Science*, and the photo of his research organism appeared on the cover (Ayala and Lee 1970).

Concluding Comments

African Americans have a long history in entomology that includes basic and applied research, as well as applications of science-based investigations to society in general. Though their numbers in academic institutions and science-related jobs are low when compared with their demographic percentages in the general population, African American entomologists still found a way to express themselves, even in the most prestigious journals. Attracting and retaining African Americans in entomology-related fields as students, academics, and practitioners has been and will continue to be challenging for many reasons. Going forward will take substantial resources and efforts by K-12 schools, academic institutions, government agencies, private sector industries, and the public if we are to realize a significant pipeline and participation of African Americans in STEM-related courses and subsequent careers (National Academies 2011). Until this is realized, it will be difficult for students and young professionals to connect with teachers and mentors who share their ethnic experience, which is critical if we are to achieve greater numbers of African Americans entering careers in entomology.

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INSTANT SYMPOSIUM 6

Attraction and Retention of Latin American Scientists: A Student Perspective on Diversity

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A diverse workforce enables many companies to become more economically competitive in today's global economy (Cox and Blake 1991). Workforce diversity influences six major areas within companies: cost, attraction of human resources, marketing success, creativity and innovation, problem-solving quality, and organization flexibility (Cox and Blake 1991; Taylor et al. 1991). These six areas create a competitive advantage for industrial, academic, and government organizations. Because of the competitive advantage that diversity offers, many U.S. companies have invested in increasing the diversity of their workforce through "diversity hiring programs." As an example, Microsoft significantly boosted their diversity recruiting budget and increased the staff that handles diversity recruiting from one to seven employees in 2006 (Reveron 2008). Another example is the College of Nursing at The Ohio State University, which is intensifying its efforts to build a diverse college population

(Menon 2014). Private companies and public institutions are gaining an understanding of the cultural and societal differences that contribute to the effectiveness of future professionals and organizations.

In the past decade, the Latin American demographic groups have grown rapidly. According to the U.S. Census Bureau (2013), the Latino population in 2012 was 53 million, making up 17% of the U.S. population. At the college level, enrollment by Latino students in 2012 increased to 49% of Latino high school graduates enrolling to college, which surpassed the enrollment of Caucasian students (Lopez and Fry 2013). However, more work needs to be done to increase Latin American representation within the STEM (science, technology, engineering, and math) careers in higher education. In 2012, the proportion of Latino student enrollment for M.S. and Ph.D. degrees was 3% in the Agriculture and Natural Resources Programs (FAEIS, 2012). Within entomology, Latinos represent about 5% of the total Entomological Society of America members. The inclusion of Latin Americans could bring a different perspective in developing new ideas, new products, or new processes in research.

Although Latino students are enrolling in college, they are less likely to earn a degree in biological sciences, mathematics, engineering, health professions, and related sciences (Crips and Nora 2012). Latino students face several internal challenges that might affect their retention within STEM careers. Some of these challenges are English language skills, cultural differences, lack of mentoring/guidance from family and friends, low self-confidence, and financial concerns and family responsibilities, especially for first-generation immigrants (Garcia and Hurtado 2011; Villarreal and Cabrera 2012). Currently, there is a national effort to increase the participation and success of minority groups into the STEM careers (National Academy of Sciences 2011). Of those Latinos who successfully earn a bachelor's degree, few go on to obtain a graduate degree.

There is a need to attract not only Latin American talent, but also talented Latinos who return to their home countries with a higher science degree. Latinos go back to their countries for several reasons. Some reasons are cultural differences between Latinos and other community groups in the U.S., family inclinations, and immigration status. Latin Americans who stay in the U.S. with an advanced science degree tend to focus on academia as a major employment sector and do not consider private industry or government jobs (multiple personal communications).

"Some of these challenges are English language skills, cultural differences, lack of mentoring/guidance from family and friends, low self-confidence, and financial concerns and family responsibilities, especially for first-generation immigrants…."

Among Latinos, there are also misconceptions about job roles and little knowledge of the scope of possibilities for their professional careers. Creating an awareness of the different opportunities for new scientists in universities, government agencies, and corporate America is important for the attraction and retention not only of Latin American graduates, but also for other minority groups going into the job market.

I believe that developing internship programs focused on graduate students could help expose a new generation to the different job and career possibilities that are available. As a group, we need to participate and take ownership in diversity and inclusion programs to find Latin American talent. An example of such a program is the collaboration between The Ohio State University and Zamorano University. In 2003, the Department of Entomology started an internship program with B.S. graduates from Zamorano University. After finishing the internship program, most students decided to continue their post-graduate studies in the U.S., as well as in Europe. Other agriculture, science, and natural resources organizations also contribute to networking with Latino and other minority groups: the Association of Zamorano Alumni–USA, http://www.ageap-usa.org/all/; Latinos in Agriculture, http://latinosinagriculture.org/; MAES Latinos in Science and Engineering, http://mymaes.org/; and Minorities in Agriculture, Natural Resources and Related Sciences, http://www.manrrs.org/.

As scientists, we have a commitment to train and mentor the next generations of Latinos and other minority groups. Increased exposure, such as the article on Dr. Juliana Rangel-Posada, an entomology professor and bee researcher at Texas A&M who was named "Inspiring Latina of the Week" by *Latina Magazine* on August 2013, could help increase awareness of Latin Americans in scientific careers. This type of exposure can motivate and inspire new Latino populations to start or persevere in a scientific career and show them the vast career opportunities available to them in industry, academia, or government. It is our responsibility, as career entomologists, to work as a team to attract and retain new talented entomologists from different backgrounds and transform our traditional Society into a multicultural one.

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