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# Recruiting for science, technology, engineering, and mathematics disciplines: perspectives of Black and Hispanic entomologists[1, 2]

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## Abstract

This study reports the results of a survey focused on the views of Black and Hispanic entomologists toward the recruitment of under-represented groups to entomology. The respondents, 7 Black and 11 Hispanic out of an estimated population of 43 Black entomologists and 54 Hispanic entomologists, were asked to comment on several open-ended questions including challenges and prospects for the future. Implications about recruitment of under-represented groups to the field of entomology included using same-race mentors, establishing programs linking entomology departments to historically black colleges and high schools, and developing entomology-based programs in the inner city. With regard to challenges for the future and future prospects, many of the respondents voiced concern about the future of entomology as a separate discipline, discrimination against minorities in science, and lack of opportunity.

An obstacle to workforce diversity in entomology and other natural sciences is the ability to recruit and retain students from underrepresented groups. Over thirty years of effort to increase the number of underrepresented groups in entomology and other "STEM" disciplines (collectively known as science, technology, engineering, and mathematics) have met with mixed success. Surveys and interviews have revealed numerous barriers (Trankina, 1992; Brazziel & Brazziel, 2001; Maton & Hrabowski III, 2004; Armstrong, Berkowitz, Dyer, & Taylor, 2007). These barriers include the possibility of obtaining gainful and meaningful employment, debt and the subsequent ability to repay student loans, advanced degrees perceived as teaching degrees associated with low salary, insufficient information coupled with little or no advisement on how to pursue the degree, lack of family support, low math and science involvement in high school, perception of science being dominated by and more suited for Caucasians, and poor or no mentorship.

We hope that this article will stimulate discussion of recruiting under-represented groups to STEM disciplines, including those related to psychology, such as comparative psychology and behavioral neuroscience. An ancillary concern is recruiting underrepresented groups to the National Science Foundation Research Experience for Undergraduate Program (NSF-REU; Page, Abramson, & Jacobs-Lawson, 2004). These programs have been shown to increase minority involvement and retention by exposing students to research and involving them in STEM fields.

We use the field of entomology as a model for two reasons. Firstly, the primary contribution of the senior author is in the study of invertebrate behavior including insects. Unlike entomologists, the senior author has the benefit of extensive experience in both psychology and entomology. Secondly, unlike the social sciences, there are few Blacks and African Americans in U.S. entomology departments (Chang, Cerna, Han, & Sàenz, 2008).

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Focusing recruitment efforts on African Americans and other underrepresented groups in entomology would have several advantages. These include: increasing the number of entomology students at the undergraduate and graduate level, diversifying the cadre of extension agents so they better relate to farmers of diverse backgrounds, broadening entomological research to include topics of specific interest to underrepresented groups, creating diversity within entomology departments, and developing future professors who can serve as mentors to help recruit and guide students from under-represented groups.

In a recent article highlighting the contributions of the African American entomologist Charles Henry Turner (1867–1923), the thesis was advanced that his life could serve as a stimulus to recruit African Americans to the field of entomology (Abramson, 2009). When walking through any entomology department across the U.S., it is obvious how few minority students and faculty are present. It was noted that of 1,348 websites associated with faculty members from Ph.D.-granting entomology departments, only eight members could be identified as Black. In contrast, 204 women were identified as professors, while Latinos and Asians held 75 professorships, not an uncommon phenomenon among the STEM disciplines (Chang, *et al.,* 2008). Websites associated with students and adjunct professors were also surveyed and none contained photographs which could be identified as African American or Black (Abramson, 2009).

To our knowledge, no data exists on the needs of African American or Black entomologists, their experiences, their perceptions regarding the best methods of recruiting underrepresented groups to entomology, and their views on the important issues in training young African American and Black entomologists. It is important to note that the comments of the respondents apply to other STEM disciplines and to the social sciences as well. Previous research has worked to show correlations between a lack of involvement and understanding of the sciences in minorities through comparison between minority and majority students (Chang, *et al*., 2008). Some studies look into the lack of funding through financial aid analyses and finally retention studies in the STEM field (Fenske, Porter, & DuBrock, 2000; Palepu, Carr, Friedman, Ash, & Moskowitz, 2000). We designed a brief survey to help answer these questions. In addition to soliciting answers on how to recruit African Americans, we also took the opportunity to ask questions on what African American and Black entomologists consider to be (1) challenges, and (2) prospects for the future. These questions were asked to estimate whether the views of entomology as a science differ between Blacks and Hispanics. Any differences could influence the recruiting process. The survey included both Likert-type scale questions and open-ended questions. Since the number of African Americans and Blacks in entomology is so small, an estimated 43 nationally**,** we also included another underrepresented group (Hispanic Americans) as a separate sample of respondents.

## Method

### *Sample*

Fifty-four Hispanic participants were identified in 2007 using the Directory of Hispanic American Entomologists available on-line. African American and Black participants were identified using the 2007 online membership list of Black Entomologists, which provided places of employment and e-mail addresses. Thirty surveys from entomologists of both ethnicities were returned as undeliverable, which reduced the potential pool of respondents to 97. Of those 97, only 18 returned completed surveys producing an 18.6% overall return rate, a figure lower than expected. This limits the generality of conclusions (Yu & Cooper, 1983). The surveys were returned in a prepaid envelope without identifiers.

### *Sample Description of African Americans and Blacks*

The sample consisted of seven respondents (6 men and 1 woman) out of an estimated 43 Black entomologists throughout the United States**.** Three identified themselves as between 41–50 years old, two between the ages of 31–40, and two over 50. Five held Ph.D.'s, one held a Master's and the other a Bachelor's. Two were born in the United States with the others from Canada, Jamaica, and Uganda. Two of our respondents work as university professors, two as government employees, and one is employed in industry. Two respondents identified themselves as students. One of the seven respondents also self-identified as retired. The number of publications produced by respondents ranged from 4 to 183 ($N$ = 384; $M$ = 54.9, $SD$ = 62.2).

### *Sample Description of Hispanics*

The sample consisted of 11 respondents, 10 men and one woman. Nine identified themselves as over the age of 51 and two between the ages of 41–50. Seven held Ph.D.'s, two held Master's, and two did not answer the question. Four identified themselves as being born in the United States, four in Puerto Rico, and one in Cuba. Two respondents did not respond to this question. Six of our respondents work as university professors, two as government employees, two in industry, and one did not answer the question. The number of publications produced by an individual respondent ranged from 12 to 165 ($N$ = 528; $M$ = 64.2, $SD$ = 61.1).

### *Survey*

The design of the survey was based on that developed by Hershey, Boyd, and Turner (1999) in their study of training issues, advances, and challenges in the field of cognitive aging. The first part of the survey was a demographic questionnaire. It was followed by both Likert-type and open-ended questions. The open-ended section focused on important advances, challenges, training, recruitment places of employment, and public awareness of the field. The seven-point Likert-type scale surveyed views on recruitment strategies, ethnic work preference, funding, perceived bias, mentors, and international collaboration with rankings from Strongly agree (1) to Strongly disagree (7).

It should be noted at the time this article was submitted for publication that the Directory of Hispanic American Entomologists no longer exists on the web. Moreover, the organization of Black Entomologists does not have an active link on the web. It appears that these two sites may have merged into the Directory of Black and Hispanic Entomologists[3]. However, after opening this site, the user is redirected to two separate directories and gives the URL for the Directory of Black Entomologists in North America[4] and the URL for Directory of Hispanic Entomologists in North America[5]. When these addresses are used, the message that appears is "the webpage cannot be found."

We would also like to note that given the small sample sizes, we used descriptive statistics rather than inferential statistics. The small sample sizes provided us an opportunity to qualitatively evaluate the comments of respondents through example responses. These comments are useful and can serve as the basis for discussion and future studies on how to increase under-represented groups in entomology.

In addition to small sample size, we were also faced with the issue of the appropriateness of combining the Black and African American respondents into a single sample, since respondents came from several different countries, rather than assuming that race determines attitude. We had a similar concern with our Hispanic respondents. African Americans, for example, may have views and experiences differing from respondents whose countries of birth were Canada or Jamaica. This issue has not been studied with African Americans and Blacks but has been studied with Hispanic populations (Becerra & Zambrana, 1985). The data, which should be viewed with caution, suggests that combining Hispanic populations showed no overall differences (Weaver & Martinez, 2000).

[3]http://www.google.com/search?hl=en&rlz=1W1RNTN_en&q=directory+of+black+and+hispanic+entomologists&btnG=Search&aq=f&aqi=&aql=&oq=&gs_rfai=
[4]www.life.umd.edu/entm/black.htm
[5]www.life.umd.edu/entm/hispanic.htm

## Results

### *Rated Questions*

The majority of respondents strongly agreed that efforts should be made to recruit Black and Hispanic students into entomology (Black respondents $M$ = 1.71, $SD$ = 1.25; Hispanic respondents $M$ = 2.54, $SD$ = 1.91). Paradoxically, they did not agree, however, whether ethnicity should be a factor in recruiting (Black respondents $M$ = 3.71, $SD$ = 1.89, Hispanic respondents $M$ = 5.09, $SD$ = 2.59). Both groups agreed that an interactive website designed by Black and Hispanic entomologists would help in recruiting (Black respondents $M$ = 3.14, $SD$ = 2.27, Hispanic respondents $M$ = 2.27, $SD$ = 1.62). Recruiting would also be enhanced by offering entomology in the high school curriculum (Black respondents $M$ = 2.29, $SD$ = 1.60; Hispanic respondents $M$ = 3.45, $SD$ = 2.3) and by setting up entomology exhibits at inner city libraries (Black respondents $M$ = 2.14, $SD$ = 1.21; Hispanic respondents $M$ = 2.91, $SD$ = 1.37). Both groups of respondents strongly believe that it would be easier to recruit under-represented groups to entomology if mathematics and science tutoring were provided at an early age (Black respondents $M$ = 2.42, $SD$ = 2.15; Hispanic respondents $M$ = 2.50, $SD$ = 1.90).

While both groups of respondents supported pre-college activities such as library exhibits, high school entomology, and math and science tutoring to increase the presence of underrepresented groups, the strongest factor was the presence of a mentor to encourage students to pursue entomology as a vocation (Black respondents $M$ = 1.80, $SD$ = 1.30; Hispanic $M$ = 1.71, $SD$ = 1.89). Both groups supported the use of visiting mentor programs at the junior high and high school levels (Black respondents $M$ = 2.14, $SD$ = 1.86; Hispanic respondents $M$ = 2.91, $SD$ = 2.26) and believed that more international collaboration and mentoring programs could be offered by Black and Hispanic entomologists (Black respondents $M$ = 1.86, $SD$ = 0.90; Hispanic respondents $M$ = 3.18, $SD$ = 2.36). Both groups of respondents viewed as especially important student attendance at professional meetings and the opportunity to present posters highlighting their research (Black respondents $M$ = 1.43, $SD$ = 1.13; Hispanic respondents $M$ = 1.91, $SD$ = 1.81).

In regard to obtaining funds for recruiting entomologists from under-represented groups, both Blacks and Hispanics believe that the government should be spending more money to help recruit students into entomology (Black respondents $M$ = 3.43, $SD$ = 2.37; Hispanics $M$ = 3.50, $SD$ = 2.22). Interestingly, Blacks and Hispanics did not express a strong opinion on whether universities should offer funding, scholarships, and tuition waivers for under-represented students entering entomology (Black respondents $M$ = 4.43, $SD$ = 1.51; Hispanic respondents $M$ = 4.00, $SD$ = 2.40), nor did

they believe that it is necessary to establish a national curriculum for the training of entomologists (Black respondents $M = 3.17$, $SD = 2.14$; Hispanic respondents $M = 4.82$, $SD = 2.4$).

Coming from a background of social science, and perhaps reflecting our own biases, we were surprised that the respondents did not believe that there was a Black or Hispanic perspective to entomology (Black respondents $M = 4.29$, $SD = 2.56$; Hispanic respondents $M = 4.18$, $SD = 1.94$). In the social sciences, ethnicity and gender often play a role in what research topics are investigated (Boykin, Franklin, & Yates, 1979). Both Black and Hispanic respondents reported similar involvement in basic research (Black respondents $M = 3.71$, $SD = 2.14$; Hispanic respondents $M = 2.91$, $SD = 2.12$), applied research (Black respondents $M = 2.14$, $SD = 1.07$; Hispanic respondents $M = 2.80$, $SD = 2.12$), and extension activities (Black respondents $M = 3.86$, $SD = 1.95$; Hispanic respondents $M = 2.80$, $SD = 1.62$).

It was also reported that some of the Black entomologists, relative to the Hispanic sample, believed they experienced bias and were not given opportunities they felt they had earned (Black respondents $M = 3.40$, $SD = 1.52$; Hispanic respondents $M = 6$, $SD = 1.56$, Hispanic respondents M = 6.00, SD = 1.56).

## *Open-ended Questions*

### What do you see as significant challenges for the future?

#### *Black Respondents*

Of 13 statements, four were concerned with the continued relevance of entomology, three were concerned with the lack of funding, two were concerned with the lack of taxonomists, one mentioned problems with replacing retired entomologists, and other statements focused on such practical issues as the impact of global warming on insects, insect resistance, problems of invasive species, and insect-borne viruses. Sample statements included, "It is hard for persons outside of integrated pest management to be taken seriously and given good funding," "Remaining relevant, making practical contributions to society," "Lack of funding to keep departments alive, many are absorbed into other departments," and "Not enough taxonomists".

#### *Hispanic Respondents*

Of 18 statements, six dealt with issues of insecticides and biological control, four dealt with the lack of insect taxonomists, four dealt with bioengineering and transgenic plants, three dealt with the loss of entomology programs or their identity, and one dealt with the lack of operational expertise in field entomology.

Sample statements included, "Loss of entomologists specializing in certain insects (the U.S. is no longer producing specialists in certain insects)," "Convincing the general public that transgenic plants are safe for consumption," "Loss of entomology programs," "Loss of insect taxonomists," and "Sociopolitical pressure and economic pressure to push entomology in directions that are not compatible with sustainable management of food crops or environment."

### What do you see as the most significant issues in training young Black entomologists?

#### *Black Respondents*

Of 13 statements, three were concerned with improving the public education system, three with the lack of Black role models in entomology, three with negative stereotypes of entomology, two with the lack of funding opportunities in graduate school, and one statement was concerned with the lack of training in systematics and taxonomy and the lack of well paying jobs, respectively. Sample statements included, "Lack of proper guidance and encouragement in elementary and high school," "Overcoming cultural biases toward the field of entomology and the way insects are viewed – most people just see insects as pests," "Daily discrimination both in school and society," "Lack of mentors," "Denied opportunity available to others," "Recruitment of young blacks to undergo training in entomology," "Role models that are African American (Black) in the sciences, particularly entomology," and "Assistantships, scholarships".

### What do you see as the most significant issues in training young Hispanic entomologists?

#### *Hispanic Respondents*

Of 17 statements, 12 cited the need for better education in mathematics, the sciences, critical thinking skills, and communication skills, two cited the need for early exposure to the study of insects, and one cited inadequate funding, mentoring, and lack of purpose, respectively. Sample statements included, "Lack of early education and outreach," "Finding Hispanics with an interest in entomology," "Lack of role models," "Lack of adequate funding," "Lack of glamour in field entomology," "Need for fundamental, robust and rigorous K–12 education," "Poor public school education in biology and science," "Develop good communication skills," "Develop basic skills early in middle school by performing research," and "Lack of purpose".

### What research areas do you feel should receive more attention in the next 20 years?

#### *Black Respondents*

Of 20 statements, four mentioned integrative pest management and control of disease vectors. Mentioned twice were biological control, invasive species management,

taxonomy and systematics, and plant-insect interactions. Mentioned once were aquatic insect biology, medical entomology, and insect-physiology-toxicology. Sample statements included, "Conservation," "Use of molecular techniques against vectors of human diseases," "Taxonomy," "Plant-insect interactions," "Increase use of Integrated Crop Management," "Invasive species management," "Vector management," "Medical entomology and parasitology," and "Aquatic insect biology."

### *Hispanic Respondents*

Of 23 statements, nine dealt with insecticide and integrated pest management issues, five mentioned insect-plant interactions, five dealt with apiculture and taxonomy and systematics, two mentioned apiculture and insect pollination, one mentioned public health entomology, and one mentioned global warming and its effect on insect species. Sample statements included, "Host plant resistance," "Integrated pest management," "How to minimize the impact of non-native insects into a new ecosystem without eradicating them," "Public health entomology, development of environmentally friendly molecules and formulations for malaria and Chagas disease," "Insect genomics," "Use of non-chemical management options," "Global heating and its impact on insect species," and "Apiculture".

## How has the paradigm of entomology changed in the past 20 years?

### *Black Respondents*

Of eight statements, four dealt with the growth of interdisciplinary research, two suggested a change from natural history studies to more experimental investigations, one dealt with a change from basic to applied research, and one suggested more of a concern on the conservation of rare and endangered species. Sample statements included, "More cooperation," "Change from taxonomic/natural history investigations to experimental approaches," "Overlap of basic and applied research has been lost with more emphasis on applied research (perhaps due to funding)," and "Interdisciplinary (but there has also been a reduction in the number of entomology departments and more have been integrated with other departments)."

### *Hispanic Respondents*

Of 27 statements, 10 dealt with increase diversity of research problems within entomology, five dealt with new approached to insect control, four dealt with the lose of expertise especially in taxonomy and systematics, four dealt with the decrease importance of maintaining entomology as a distinct discipline, three dealt with political issues such as decreased funding, pressure to publish, and influence of lobbying groups on research. One respondent believed that no change had occurred in the last 20 years. Sample statements included, "Entomologists trained outside of entomology departments (i.e., horticulture, molecular biology)," "Increase in the number of approaches used to study insects," "Employment in non-traditional venues (biotech companies)," "More international collaboration," "Lack of funding with an emphasis on applied rather than basic research," "The decrease in grant funding has made entomology less open and more competitive and closed," "Chemical and molecular approaches to entomological questions have exploded," "Multi-investigator research projects," "Reduction in rigorous applied research," "Development of transgenic plants for insect control," "Increase focus on molecular techniques," "Less focus on taxonomy and systematics," "Too much emphasis on publications," and "A decline in entomological positions."

## What strategies would you use to recruit Black high school students and college freshman into entomology?

### *Black Respondents*

Of 12 statements, five suggested conducting symposia, and giving seminars describing job opportunities and interesting research. Two suggested better public schools, two suggested creating work study and internship opportunities in entomology laboratories, one suggested making use of retired Black entomologists, one suggested using media such as creating websites, and one respondent was hesitant to recruit Blacks to entomology if the jobs are not there. Sample statements included, "Begin before high school," "Create internships," "Seminars on job opportunities," "Newsletters," "Directives to encourage work study students to enter entomology labs," and "Take advantage of retired Black entomologists to recruit students to the field."

## What strategies would you use to recruit Hispanic high school students and college freshman into entomology?

### *Hispanic Respondents*

Of 16 statements, 10 suggested some form of outreach program such as visiting schools, using the cooperative extension service, and forming entomology clubs in high schools. Two suggested increasing financial support in the form of internships and summer funding. Of four individually categorized statements, one suggested using Hispanic role models, another suggested teaching better and more exciting biology courses with an emphasis on insects, a third indicated ensuring that entomology was not associated with agricultural jobs their relatives may have had, and finally it was suggested that Hispanics or any other ethnic group not be given special consideration. All should have the same opportunity. Sample statements included, "Increase outreach to Hispanic neighborhoods," "Start entomology clubs at high schools, even as early as middle schools," "Target recruiting strategies to areas/schools with high

Hispanic populations," "One on one graduate student or faculty to student contact and interactions," "Summer camps for Grades 9-11 with laboratory experiences in the science of entomology," "Student ambassadors to promote studies in entomology," "Promote studies in entomology through cooperative extension service agents," and "No ethic group or race should be given special attention or consideration. What is needed is a level playing field."

**What strategies, including media, would be best for the government to use to recruit Blacks into entomology?**

### *Black Respondents*

Of nine statements, four suggested using multimedia approaches, two suggested using Blacks and not Caucasians to recruit African Americans into entomology, and individual statements suggested contacting Historically Black Colleges, establishing career fairs, and recruiting before high school, respectively.

Sample statements included, "Using retirees to recruit," "Use and create websites," "Start recruiting efforts before high school," and "A black entomologist, not a white entomologist, would have more of an influence encouraging young black students to pursue training in entomology."

**What strategies, including media, would be best for the government to use to recruit Hispanics into entomology?**

### *Hispanic Respondents*

Of eight statements, two suggested publishing salary scales and offering clear career paths, two suggested outreach programs through the Cooperative Extension Service, two suggested that Hispanics prefer one-on-one contact, one suggested not involving the media, and another respondent suggested increasing scholarships and fellowships. Sample statements included, "Offering clear ladders that outline expectations and outcomes, makeshift proposals lead to predictable failure," "Mentoring from fellow entomologists," and "Public campaign through the Cooperative Extension Service."

**When Black people who are not entomologists think of entomology, do they think of just a laboratory or the benefits to humans?**

### *Black Respondents*

Of eight statements, four respondents believed that entomology is only associated with laboratory work, two others believed that it is associated with pest control, one states that African Americans do not think of entomologists, while another stated that the popular media has expanded the view of entomology outside the laboratory. Sample statements included, "Just think laboratory", "Pest control," and "Do not think of entomologists".

**When Hispanic people who are not entomologists think of entomology, do they think of just a laboratory or the benefits to humans?**

### *Hispanic Respondents*

Of eight statements, all eight indicated that few Hispanics know much about the science of entomology and consider it pest control. Of these statements, two respondents specifically mentioned that the lack of knowledge about entomology extends to Anglo-Americans. Sample statements included, "They do not normally know what entomology is, usually think of pest control operators," "Many think of applied positions or jobs such as exterminators or field hands who use sprays against crop pests," and "No, they think, like the general public that entomology is pest control."

**What type of international collaboration and mentoring opportunities for Blacks should be offered?**

### *Black Respondents*

Of twelve statements all were directed toward working with countries with large African populations. Sample statements included, "Visits to Africa, South America or tropical areas with diversity of plants and animals to pique student interest," "Joint research grant writing where U.S. and international researchers could be co-principle investigators," "Visit countries where public health departments can be involved in the experience, Africa, Ghana, South Africa, Kenya," "Undergraduate mentoring with students from other countries," and "Working with institutions such as the International Center for Insect Physiology (ICIPE), and the consultant group for the International Agricultural Research (CGIAR) based in Black countries".

**What type of international collaboration and mentoring opportunities for Hispanics should be offered?**

### *Hispanic Respondents*

Of six statements no one theme emerged. The point was made that if any international collaboration and mentoring program is to be successful it is important to realize that all Hispanics cannot be grouped together. Sample statements included, "Our Hispanic students indicate that they would like to do entomology back in the country of their parents/grandparents," "Collaborate internationally yes, mentoring internationally, no: we have plenty of Hispanics here," "Recognition that the term 'Hispanic' encompasses many diverse groups. International outreach programs program should be targeted to specific groups if they are to be successful," "Such programs should take place through organizations such as the Entomological Society of America," "Establish collaborative work between U.S. universities and those in Latin America," and "Recruiting of Hispanic

entomologists with Ph.D.'s, to establish programs with universities of Hispanic origins for advanced training (training in new molecular techniques, training in pest management and bio-security, offering formal courses, extension services to communities."

## Discussion

One of the issues that must be addressed is the small sample size. It is our opinion that the small sample size does not decrease the importance of the results. The sample sizes are small despite efforts to increase the number of respondents, for reasons unrelated to science. For example, the Institutional Review Board at Oklahoma State University required that we not contact potential respondents directly to protect their confidentiality. We also left surveys at a recent meeting of the Black and Hispanic Entomology Association held in conjunction with American Entomological Society meeting, but could not be sure that they were made available. None were returned.

The number of African Americans and Blacks in the sample, however, closely resembled the number that was found in a survey of websites of Ph.D. granting entomology departments (Abramson, 2009). In the websites survey, eight African American and Black entomologists were identified and in the present sample seven were surveyed – two of which self-identified as professors, representing an increase in the survey return rate from 18.6% to 25% with regard to professors. There is no way to get around the fact that there are very few African American, Black, and Hispanic entomologists in the United States. Despite the small sample sizes, the respondents provided useful responses and suggestions that could serve as the basis of discussion.

We would also like to mention that we did not compare the sample to Caucasian entomologists. The goal was to solely focus on the views of African American, Black, and Hispanic entomologists. We made this decision prior to conducting the survey because we wanted to respect respondents by not comparing them to a majority Caucasian sample. Perhaps the low return rates on the survey can be contributed, in part, to some of the respondents not wanting to be considered "laboratory rats." The data are presented, however, in such a way that the reader can make comparisons between their own views and those of respondents.

The data reported here represent the first time views of African American, Black, and Hispanic entomologists have been sampled on a wide range of issues related to both recruitment efforts and the state of entomology in the United States. In regards to recruitment efforts, respondents offered concrete and useful suggestions that should be considered, not only in the recruitment of under-represented groups of all STEM disciplines, but in the recruitment of Caucasian students also. These suggestions include: (1) better middle and high school education in science and math, with tutoring assistance as needed, (2) creating an interest in entomology as early as middle school, (3) developing this interest by designing interactive websites authored by Black and Hispanic entomologists, (4) establishing high school entomology clubs associated with university entomology departments, (5) hosting entomology themed summer camps, (6) establishing work/study programs in entomology and allowing high school students to experience entomology research in university entomology laboratories, (7) presenting entomology exhibits in areas of large Black and Hispanic population, and (8) finding opportunities to attend professional meetings and present the results of their work.

The suggestion considered the most important by both groups of respondents was the use of a mentor. The importance of a mentor of the same ethnicity was revealed in both the Likert-type scale and open-ended questions and is consistent with the literature showing the importance of ethnicity in recruiting and retaining students (Jacobi, 1991; Lee, 1999; Fenske, *et al.*, 2000; Palepu, *et al.* 2000; Chang, *et al.*, 2008). It was further suggested that these mentors be recruited among retired Black and Hispanic entomologists and from departments of entomology.

The answers to the opened-ended question regarding the most important issues in training young African American, Black, and Hispanic entomologists were revealing. Once again, both groups of respondents noted the lack of mentors. Without increasing the number of African American, Black, and Hispanic mentors, efforts to increase the number of under-represented groups in entomology will be difficult at best. Both groups of respondents also commented that there appeared to be a cultural bias about the way insects are viewed. This, too, must be overcome if underrepresented groups are to be recruited. In addition to cultural biases toward the way insects are viewed, some African American and Black respondents noted that discrimination against them may play a role in the low number of African American and Black entomologists. Whether there is actual discrimination or not, the perception of discrimination must be addressed.

The cultural bias issue was further elaborated in the question regarding what African American, Blacks, and Hispanics who are not entomologists think of entomology. The answers provided by both groups of respondents were discouraging if not unexpected. Respondents commented that many, if they think of entomology at all, believe it is synonymous with pest control. An important but overlooked issue mentioned by one of our Hispanic respondents was that entomology recruitment efforts should not be associated with the agricultural jobs their relatives may have had. Several other Hispanic respondents also made the point that all Hispanics cannot be "lumped" together in a single group and another specifically mentioned that

Hispanics prefer one-on-one contact. We believe these suggestions are invaluable in the recruiting of underrepresented groups to entomology.

When asked specifically what recruitment strategies could be used, the strategies suggested by our respondents did not differ. African Americans, Blacks, and Hispanics agreed that recruitment efforts should start before high school and that students should be offered entomology experiences including internships and summer camps, targeting schools with high populations of African Americans, Blacks, and Hispanics, and visits from African American, Black, and Hispanic entomologists or graduate students. One of our Hispanic respondents suggested that "Student Ambassadors" be sent to schools.

In regard to the question about how the government could help recruit African American, Black, and Hispanic entomologists the point was strongly made by both groups of respondents that the mentors be either African American, Black, or Hispanic when recruiting from their specific populations. One African American respondent noted that a program could be established linking entomology departments and/or government agencies to Historically Black Colleges. The federal government could also develop websites not only highlighting entomology but also including accurate information on salaries and opportunities. One respondent suggested a public campaign administered through the Cooperative Extension Service.

The lack of African American, Black, and Hispanic mentors is a recurring theme throughout our survey. When asked what type of international collaborations and mentoring opportunities could be offered by African American, Black, and Hispanic entomologists, African American and Black respondents mention working with scientists from countries with predominately Black populations and serving as mentors from these countries. While the responses from the African American and Black respondents were similar, the responses from the Hispanic respondents were diverse. One respondent agreed with the ideal of international collaborations but opposed mentoring Hispanic students in other countries. The reason he/she gave was that there are a large number of Hispanic students that can be mentored in the United States. Other respondents suggested that Hispanic Ph.D.s be recruited to help establish programs in Hispanic universities overseas, and that collaborative work between U.S. universities and those in Latin America be undertaken.

Suggestions offered by the respondents were valuable. We encourage entomologists to use the life and contributions of Charles Henry Turner as a recruitment tool (Abramson, 2009). We urge the Entomological Society of America to establish a Charles Henry Turner Award for important contributions to the recruitment and training of underrepresented groups in Entomology. Retired African American, Black, and Hispanic entomologists could be interviewed as a source for oral histories. These interviews can be placed on YouTube and other outlets. Finally, journal editors in the STEM disciplines, such as entomology, have to have the courage to publish papers that are "inconvenient."

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