The recent report on the situation of women scientists at the Massachusetts Institute of Technology (MIT) has brought the working conditions and treatment of women scientists into the consciousness of many in the academic community. In all of the publicity about MIT and local campus conversations about women scientists, however, women scientists of color and their absence in major research departments have not been discussed. Among the 14 tenured women on the faculty at MIT, there are no women of color. A recent survey of the top 50 research departments in Chemistry by Donna Nelson at the University of Oklahoma confirmed that there were very few men or women of color in any of these 50 departments. Yet for the past two decades these same research universities have steadily been awarding Ph.D.s in science and engineering to persons of color, the majority of whom have been men. Still, more than 4,877 women of color have earned Ph.D.s in science and engineering. (See Table 1) So where are they?

If the field of vision is altered from the current faculty distributed among institutions to the Ph.D.s awarded from one institution, it is possible to gain some insight into where minority Ph.D.s may have gone. The following discussion is based on preliminary results from *A Longitudinal Study of Minority Ph.D.s from 1980 to 1990: Progress and Outcomes in Science and Engineering during Graduate School and Professional Life*, in which careers of University of California (UC) Ph.D.s are tracked. One of these, UC Berkeley, has been among the leading institutions to graduate minority Ph.D.s in the last twenty years. Many of its science and engineering departments enjoy the highest academic rankings in the country. It is assumed that Ph.D.s earned from such departments prepare the holder for a distinguished life in science. The question immediately arises in this context: If there are distinguished minority graduates of this institution why are they not filling faculty positions at equally prestigious universities?

One simple answer is that they are there, but invisible, as there are so few minority degree holders. In the years between 1980 and 1990 Berkeley graduated 52 African American Ph.D.s from all science and engineering departments. Fifteen of those were women. In the same period it graduated 24 Chicanos, five of whom were women, and nine Native Americans, three of whom were women. In all these years then, only 23 Ph.D.s were awarded to women from these traditionally underrepresented American groups, although
continuing on page 4
### Table 1: U.S. Citizen Women Ph.D.’s in Science and Engineering, 1988-1999

<table>
<thead>
<tr>
<th></th>
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<tr>
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<td>2,066</td>
<td>33</td>
<td>72</td>
<td>87</td>
<td>6</td>
<td>5</td>
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<td>1989</td>
<td>2,316</td>
<td>38</td>
<td>93</td>
<td>108</td>
<td>9</td>
<td>8</td>
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<td>1990</td>
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<td>85</td>
<td>119</td>
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<td>1992</td>
<td>2,549</td>
<td>36</td>
<td>147</td>
<td>126</td>
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<td>16</td>
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<td>1993</td>
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<td>150</td>
<td>5</td>
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<td>399</td>
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<td>1994</td>
<td>2,812</td>
<td>77</td>
<td>156</td>
<td>148</td>
<td>9</td>
<td>20</td>
<td>410</td>
<td>2,402</td>
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<td>1995</td>
<td>2,906</td>
<td>79</td>
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<td>130</td>
<td>8</td>
<td>20</td>
<td>461</td>
<td>2,445</td>
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<tr>
<td>1996</td>
<td>2,958</td>
<td>74</td>
<td>240</td>
<td>150</td>
<td>18</td>
<td>20</td>
<td>502</td>
<td>2,459</td>
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<td>1997</td>
<td>3,015</td>
<td>76</td>
<td>244</td>
<td>172</td>
<td>8</td>
<td>31</td>
<td>531</td>
<td>2,484</td>
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<tr>
<td>1998</td>
<td>3,166</td>
<td>111</td>
<td>233</td>
<td>199</td>
<td>16</td>
<td>33</td>
<td>592</td>
<td>2,574</td>
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<tr>
<td>1999</td>
<td>3,132</td>
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<td>246</td>
<td>214</td>
<td>18</td>
<td>28</td>
<td>617</td>
<td>2,515</td>
</tr>
<tr>
<td>Total</td>
<td>32,450</td>
<td>775</td>
<td>2,048</td>
<td>1,711</td>
<td>119</td>
<td>224</td>
<td>4,877</td>
<td>27,573</td>
</tr>
</tbody>
</table>

*Source: Science and Engineering Doctorate Awards 1999, NSF 2001*

### Table 2: UC Berkeley Science and Engineering Ph.Ds 1980-1990

#### By Gender and Ethnicity

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Total</th>
<th>Men</th>
<th>%</th>
<th>Women</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asian</td>
<td>347</td>
<td>282</td>
<td>81.30%</td>
<td>65</td>
<td>18.70%</td>
</tr>
<tr>
<td>Black</td>
<td>54</td>
<td>39</td>
<td>72.20%</td>
<td>15</td>
<td>27.80%</td>
</tr>
<tr>
<td>Chicano</td>
<td>24</td>
<td>19</td>
<td>79.20%</td>
<td>5</td>
<td>20.80%</td>
</tr>
<tr>
<td>Filipino</td>
<td>5</td>
<td>3</td>
<td>60.00%</td>
<td>2</td>
<td>40.00%</td>
</tr>
<tr>
<td>Nat. American</td>
<td>9</td>
<td>6</td>
<td>66.70%</td>
<td>3</td>
<td>33.30%</td>
</tr>
<tr>
<td>Other Hispanics</td>
<td>57</td>
<td>43</td>
<td>75.40%</td>
<td>14</td>
<td>24.60%</td>
</tr>
<tr>
<td>Others</td>
<td>142</td>
<td>125</td>
<td>88.00%</td>
<td>17</td>
<td>12.00%</td>
</tr>
<tr>
<td>White</td>
<td>2464</td>
<td>1909</td>
<td>77.50%</td>
<td>555</td>
<td>22.50%</td>
</tr>
<tr>
<td>Foreign</td>
<td>1036</td>
<td>941</td>
<td>90.80%</td>
<td>95</td>
<td>9.20%</td>
</tr>
<tr>
<td>Total:</td>
<td>4138</td>
<td>3367</td>
<td>81.40%</td>
<td>771</td>
<td>18.60%</td>
</tr>
</tbody>
</table>

*Source: UC Berkeley Graduate Division Database*
Hayward, and Sonoma and Gonzaga Universities. Research positions at academic institutions include UC Office of the President, UC San Diego, and Stanford University. One woman is now a lawyer, four work for the federal government at Sandia and Lawrence Berkeley National Laboratories, the Department of Energy and the Center for Disease Control. One works as the science librarian in a technical high school, while three currently work for major corporations as senior researchers. A fourth resigned from such a position to have her children.

Women chose their career paths for many different reasons with different degrees of purposefulness. For several women there was a conscious desire to work at institutions which would enable them to serve their communities. In some of these cases that also meant returning to the area where their families lived. Others chose jobs or a succession of positions to accommodate spouses. Several wished to remain in the Bay Area. Given the range of parameters behind the desire to continue to do serious science, it is striking how almost all of these women were able to find desirable positions.

Although one study participant maintains she was “lucky” as jobs “fell out of the sky,” the pattern of employment shows how training and talent pay off. Another characteristic, which should not be under-rated, is the degree of determination and commitment to succeed. As one woman remarked, an important factor to her success, “my perseverance and ability to handle suffering.”

In the group of 19 women discussed here, only four received their degrees before 1985, the rest finished their degrees in the late 1980s. Fourteen of the 19 had one or more postdoctoral positions. Although one postdoctoral position was “a loser experience,” and another “unpleasant,” on the whole these first postdoctoral appointments were very important to developing skills essential for the eventual career. Comments range from “I learned everything I know there,” “learned new techniques, a different way of looking at problems,” “developed independent research area,” to “realized I was inter-

Continued on page 5
ested in alternatives to doing research science in academia,” while another “missed teaching, I learned I didn’t enjoy full time research.”

Only two women started their current job directly out of graduate school. One went to a national laboratory where she does “interesting stuff at times, but loses an incredible amount of time in bureaucracy.” One went directly to a tenure track job at a California State university. Most of the other women reached their current positions within two or three job changes including postdoctoral positions. Only two women required seven or more job changes to get to their present position. Most report a high satisfaction rating in their current positions with a score of one or two on a five-point scale, with one the highest. A surprising number of women managed to find satisfying work while being constrained geographically, with an astounding total of nine succeeding in staying in the Bay Area, although not without some major effort.

One respondent’s postdoctoral experience was so negative she was turned off by academic politics and earned a law degree. Another trained as a librarian. Few were completely free to follow their fancy, as motherhood, elderly parents, and other family responsibilities required creative solutions to scientific employment. For some, however, there was no conflict, as job and other responsibilities could be resolved.

In comparing the percentages of men and women who hold academic jobs currently, 31.6 percent of women and 56.8 percent of men hold such positions. Not only are there fewer women, but fewer proportionately in academic jobs. One reason for this is that women have left academic positions, as the academic experience often led them to seek another kind of scientific work. Two had temporary teaching jobs as their first position. Both were jobs of convenience. Neither promoted a desire to stay in academic teaching. The attorney taught at a community college and an extension program for many years. Another could not sustain the uncertainties of her teaching position because her husband died and she needed to have a permanent regular position to support her children. Yet another now employed in industry, had an academic postdoctoral position as well as a subsequent teaching position and ended up being put off academic work forever. Still another, who taught briefly, learned she preferred being in a lab. If all these women had stayed in the academy, then the percentage would have been higher than that of the men in the study: 63 percent.

Clearly some of the choices which led to the positions now currently held by these women were idiosyncratic, but the decision to leave for several was preceded by unpleasant treatment or conflict. Although there are generally high levels of satisfaction articulated about current employment, there are traces of regret. Two of the women not in the academy always wanted to teach at a HBCU. Those who do teach are generally very satisfied, but two raised issues of inadequate opportunities to pursue research. One had a very difficult promotion to professor in a situation in which “the dean almost implied bias.” Another is unhappy with the new chair. Even if one is doing excellent science and working extensively to promote students’ participation in science, the quality of life in the academy can fluctuate for many other reasons. Does science discriminate against women? Certainly several women in this study have had difficulties in sustaining research careers, or when in them have had to bounce against barriers to promotion in the organization even, as in one case, when she was winning national and company prizes for innovative science. Nineteen women are a small sample. Yet these 19 manifest such a deep commitment to their work, and ingenuity and determination to make their work successful, that the pattern of success is dominant. Obstacles—sexist, racist or other—have been overcome one way or another.

Endnotes

1I would like to thank the Spencer Foundation and the UC Industry University Cooperative Research Program for their generous support of this work. Thanks to Mia Ong and Kara Sammet for their work on this project.


Introduction

The underrepresentation of women in general, and African American and Hispanic women in particular, is a critically important issue for the United States (U.S.)—especially as people of color are rapidly becoming the numerical majority of the population. Women of Hispanic origin (of any race) are one of the fastest growing population groups in the U.S. Who does science largely determines who will do science insofar as scientists act as gatekeepers who determine who is qualified to be a scientist. Scientists are humans who bring their socio-cultural and historical backgrounds to the practice of science. This background affects what is studied, how it is studied, and how results are to be used (Leggon, 1995).

An important prerequisite for discussing African Americans and Hispanics in science and engineering (S&E) is a clear specification of terms. The term “African American” is used to refer to Americans born in the United States who are the biological, socio-legal descendants of people with origins in Africa. Particularly within the context of data on the S&E workforce, it is vital to distinguish between Blacks born in the U.S., and non-U.S.-born Blacks. Data that combine U.S.-born-and-raised Blacks with Blacks born and raised outside of the U.S. are problematic because they greatly underestimate the extent of African American participation in S&E. Moreover there are significant social and cultural differences between Blacks born in the U.S. and those born and raised elsewhere. One of the most noteworthy differences is that African Americans were educated in a race- and class-based school system (Weber 2001).

Just as the term “Black” obscures important intergroup differences, the term “Hispanic” is problematic for the same reason. “Hispanic” is an umbrella term encompassing Puerto Ricans, Mexican Americans, Cubans, and people with origins in Central and South America. It obscures critical socio-economic, cultural and historical differences among groups. For example, Mexican Americans are different from Puerto Ricans, and Puerto Ricans who grew up on the island are different from those who grew up on the mainland. Puerto Ricans raised on the mainland (sometimes called “New Yoricans”) share similarities with African Americans. Mexican Americans (sometimes called “Chicanos”) are similar to Native Americans.

Data on the S&E workforce should be disaggregated not only by race/ethnicity but also by gender. Collecting data by either race/ethnicity or gender masks critical intra-group differences. This is especially problematic for women of color, such as African Americans and Hispanics. Most studies do not focus on minority women in science and engineering; those that do rarely focus on the structural conditions surrounding Ph.D. training (MacLachlan, 2001). Often these women tend to be in a “double bind” in at least two ways. First, when they are not included in either research on women or research on African Americans and Hispanics; second, when they are included, but relegated to footnotes or parenthetical discussion. Although they share some issues with white women and men of color, women of color have issues and concerns that differ from those of both groups. It is my contention that issues stemming from both race/ethnicity and gender are not merely additive, but synergistic. This article discusses the underrepresentation of African American and Hispanic women not only in the S&E education pipeline, but also in the S&E workplace.

S&E Education Pipeline

African American women and Hispanic women comprise 75 percent of the students at minority-serving institutions (MSI). For these groups MSIs include Historically Black Colleges and Universities (HBCUs), predominantly Hispanic-serving institutions (HSIs), and the University of Puerto Rico (UPR) system. The UPR system consists of three graduate campuses and eight four-year colleges. UPR is the baccalaureate-source institution for approximately 20 percent of all science, mathematics, engineering and technology (SMET) doctoral degrees earned by Hispanics in the U.S. (Weiner, 2000). Similarly, HBCUs are major producers of African American students who later earn doctorates in the biological and physical sciences (Leggon and Pearson, 1997).

At the undergraduate level in MSIs, Hispanic and African American women are well represented in mathematics, physics, and computer science. At the graduate level, although both Hispanic and African American
women out-earn their male counterparts in terms of the total number of Ph.D.s in all fields, these women either do not enter graduate programs in mathematics or, if they enter these programs, they are not retained through to the Ph.D. Hispanic and African American women do not persist in science because they are not encouraged to do so (NCES, 2000). Research on women in science indicates that not encouraging women to persist produces the same result as actively discouraging them (Hall and Sandler, 1982; Sonnert and Holton, 1995).

Table 1 shows the percentages of women among Blacks and Hispanics in S&E by degree level from 1995-1997.

For both Blacks and Hispanics, there is an inverse correlation between degree level and the percentage of the race/ethnic group that is female. This correlation holds for Blacks in every field, and for Hispanics in every field except engineering and mathematics. Women comprise at least half of Blacks in S&E with: bachelors degrees in physics, mathematics, biological science, agricultural science, psychology, social science; masters degrees in mathematics, biological science, psychology, and social science; and doctorates in biological science and social science. Women comprise at least half of Hispanics in S&E: in biological science, psychology, and social science at the bachelors level; agricultural sciences and psychology at the masters level; and in no S&E field at the doctoral level.

### The S&E workforce in the U.S.

For the overall U.S. labor force, the U.S. Department of Labor projects that after Hispanic women and men, Black women will comprise the largest share of non-white labor force entrants between 1994 and 2005 (U.S. Dept. of Labor, 1997b). Although they have a lower participation rate in the U.S. labor force than both Black and white women, Hispanic women are one of the fastest growing groups of working women in the U.S.

Among those women who graduated in 1990 or later, women comprise 30 percent of the S&E labor force. In 1997, women comprised 23 percent of the U.S. S&E labor force, and women of color accounted for 4.6 percent of all scientists and engineers in the labor force. Within each racial/ethnic group, women were a smaller percentage of the S&E labor force than were men. Women comprised higher percentages than men in computer science, biological science and social science, but lower percentages in engineering. In 1997, 20 percent of all women in the S&E labor force were women of color.

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**Table 1: Percentage Women of Blacks and Hispanics in S&E by degree level 1995-1997**

<table>
<thead>
<tr>
<th>Field</th>
<th>Black BS</th>
<th>Black MS</th>
<th>Black Ph.D.</th>
<th>Hispanic BS</th>
<th>Hispanic MS</th>
<th>Hispanic Ph.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering</td>
<td>34.3</td>
<td>33.4</td>
<td>23.7</td>
<td>22.5</td>
<td>23.0</td>
<td>23.7</td>
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<tr>
<td>Physics</td>
<td>58.0</td>
<td>48.6</td>
<td>20.0</td>
<td>44.2</td>
<td>38.1</td>
<td>22.9</td>
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<tr>
<td>Mathematics</td>
<td>52.4</td>
<td>50.1</td>
<td>28.6</td>
<td>41.5</td>
<td>29.6</td>
<td>33.3</td>
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<tr>
<td>Computer Science</td>
<td>48.9</td>
<td>44.8</td>
<td>25.0</td>
<td>39.9</td>
<td>28.4</td>
<td>11.8</td>
</tr>
<tr>
<td>Biological Science</td>
<td>68.4</td>
<td>71.6</td>
<td>54.0</td>
<td>57.9</td>
<td>48.6</td>
<td>43.2</td>
</tr>
<tr>
<td>Agricultural Science</td>
<td>54.8</td>
<td>41.7</td>
<td>24.0</td>
<td>47.1</td>
<td>51.4</td>
<td>26.9</td>
</tr>
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<td>Natural Sci.&amp; S&amp;E</td>
<td>60.8</td>
<td>44.6</td>
<td>34.2</td>
<td>39.7</td>
<td>31.0</td>
<td>31.0</td>
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<td>Psychology</td>
<td>79.2</td>
<td>77.0</td>
<td>26.5</td>
<td>75.7</td>
<td>73.0</td>
<td>63.3</td>
</tr>
<tr>
<td>Social Science</td>
<td>60.0</td>
<td>57.8</td>
<td>51.8</td>
<td>54.4</td>
<td>45.0</td>
<td>39.2</td>
</tr>
<tr>
<td>Total S&amp;E</td>
<td>60.1</td>
<td>57.6</td>
<td>46.9</td>
<td>52.3</td>
<td>43.8</td>
<td>40.6</td>
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<tr>
<td>Non S&amp;E</td>
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<td>70.1</td>
<td>64.5</td>
<td>62.7</td>
<td>63.7</td>
<td>56.8</td>
</tr>
<tr>
<td><strong>All Fields</strong></td>
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<td><strong>68.7</strong></td>
<td><strong>57.2</strong></td>
<td><strong>59.2</strong></td>
<td><strong>60.1</strong></td>
<td><strong>47.8</strong></td>
</tr>
</tbody>
</table>

*Source: NSF 2000*
Among this group, Black and Hispanic women comprise one percent each (Asian women comprised two percent, and Native American women approximately one-tenth of one percent). Hispanics have the most proportional distribution among those in S&E occupations. White women scientists and engineers had a lower unemployment rate in 1997 than did nonwhite women, 2 percent and 2.8 percent, respectively. Moreover, a higher percentage of Hispanic women (17 percent) than of Black women (9 percent) worked part time in 1997.

There are three major employment sectors for S&E degree holders: business or industry; national, state and local government; and academia. In 1997, among both sexes employed in the S&E workforce, 55 percent of Hispanics and 53 percent of Blacks worked in for-profit business or industry. Among all racial/ethnic groups employed in business or industry, women were less likely than men to report research and development as a primary or secondary activity, and more likely than men to report computer applications as a primary or secondary work activity. Moreover, Black and Hispanic scientists and engineers are more likely than any other groups to be employed in government at all levels (federal, state, local)—including the military. Among all employed in the S&E workforce, women are more likely than men to be employed in educational institutions, and less likely to work in business or industry. Among those employed in educational institutions, females are more likely than males to work in 2-year colleges.

Within 4-year colleges and universities, there is an inverse correlation between gender and rank: the higher the rank, the fewer the women. Black and Hispanic females with S&E degrees are less likely than both white women and men of any racial/ethnic group to be full professors. Moreover, Black and Hispanic females are less likely than men of any racial/ethnic group and white women to be tenured.

In 1997, 29 percent of both Black and Hispanic women held tenure. For white women and white men, the tenure percentages were 38 percent and 63 percent, respectively.

**Discussion/Summary/Conclusions**

Black and Hispanic women with S&E degrees employed in academia are critical to the future of S&E. They have a direct impact on who will do science, insofar as they teach, advise and mentor the next generations of scientists and engineers. The absence of Black and Hispanic female S&E faculty in undergraduate and graduate classrooms and laboratories sends the message not only to Black and Hispanic students but also to all students that Black and Hispanic women cannot be scientists. However, the presence of Black and Hispanic females in classrooms and laboratories is necessary but not sufficient to counter this message. If Black and Hispanic women are present but treated poorly by their colleagues and/or students, Black and Hispanic female students will choose not to enter academic science in particular, or any S&E field in general.

Therefore, the focus should be on improving the professional environment for Black and Hispanic female faculty as well as for their student counterparts.

**How can this be done?**

Regardless of employment sector, management—e.g., department chairs, academic deans, managers, and division directors—can and should be made accountable for the extent to which women of color (also men of color and white women) are mentored and their careers developed. In academia at the institutional level, this should be a major factor in awarding research funds and grants. In other words, the focus should be on the macro-level of institutions, not on the micro-level of individuals. Things can—and must—be done to improve both the representation and professional experiences of under-participating groups in the S&E workforce. Not being part of the solution perpetuates the problem.

**ENDNOTES**

1 The term “Black” is now used because that is the term used by the source of these data, the National Science Foundation.

2 The National Science Foundation (NSF 00–327) defines scientists and engineers in terms of occupation, not degree field.

3 Nelson (2001) makes these points about women in chemistry.

**BIBLIOGRAPHY**


An Interview with Dr. Raymond Johnson

Each issue of Making Strides features a short interview with a science, mathematics or engineering (SME) professor who has been instrumental in mentoring and encouraging students through the pipeline, as well as demonstrating leadership and outstanding accomplishments in the world of SME.

This issue profiles Dr. Raymond Johnson, Professor of Mathematics at the University of Maryland, College Park. As Chair of the Mathematics Department, Dr. Johnson has been instrumental in diversifying the graduate student body. He has won UMCP’s Distinguished Minority Faculty Award and was the co-organizer of the first Conference for African American Researchers in the Mathematical Sciences and Minorities and Applied Mathematics: Connections to Industry and Laboratories.

MS: Tell me about your background and the reasons you chose math.

Johnson: I was a student in high school when the Soviet Union launched Sputnik. This event triggered a renewed interest in science and math, and my high school offered special math enrichment classes. I took those classes and found that I liked it.

MS: What was it about math specifically that you liked?

Johnson: It wasn’t really math but the classes that I enjoyed. The supplemental classes just happened to be in math. What I liked about them is that they went beyond the basic material in the textbook. I learned more about what math was going to be like as a profession.

Then when I went to the University of Texas and had to choose a major, I found I liked math better than anything else. My professors then suggested I go on to graduate school.

I applied to Rice University. Rice University was, at the time, due to a stipulation in William Marsh Rice’s will, for the white citizens of Texas only. This was being contested, however, and I was accepted. Some alumni of the university then contested integration, and so it took a year before I was formally admitted to the school.

MS: Was it difficult for you being one of the first African Americans at Rice?

Johnson: Not really. It was an unusual time—1963, and the Civil Rights Revolution was in full swing. All my fellow graduate students were very supportive, and I made friends that I have kept to this day. Most everyone I met there felt that my admission and the integration of the campus were the appropriate things to do.

MS: Did any of your own experiences as a graduate or undergraduate student influence your later activities on behalf of graduate students?

Johnson: I was very much alone in graduate school. I didn’t learn anything about building a community or anything like that. But I was welcomed into the group of other math graduate students at Rice. We were a small group starting out together and were put under heavy pressure. So we all stuck together because we were going through the same thing. I was the only Black graduate student at Rice at the time, and there was only one other Black undergraduate student, whom I never met.

MS: Where did you go after that?

Johnson: My advisor at Rice took a job at the University of Chicago before I was finished with my doctorate. I went to Chicago with him, but finished my degree at Rice. After that I came to the University of Maryland.

MS: What were your own experiences in the academic job market?

Johnson: I graduated at a time when it was much simpler. My advisor asked me where I wanted to go. I said East and he made some phone calls. He called the University of Maryland and I was told that I got the job. There were lots more jobs then than now.

MS: You made a conscious effort to diversify the math program at UMCP. Those efforts have led to a third of your current graduate students being female and 15 percent coming from underrepresented groups.

What steps did UMCP’s math department institute to reach this level of success?

Johnson: Our efforts started when I was Associate Chair with direct responsibility for the graduate program. I began to try to recruit minority students by visiting Historically Black Colleges and Universities (HBCUs). I was successful in getting some students to come.

At some point we began to have a number of Black students, but they weren’t really talking to each other. There was a feeling that you were not supposed to cluster together. I wasn’t directly involved with all the African American students either. Our program coordinator came to me to see if we could get some money to get the Black students together. I began to meet with them as a group. I wanted them to know that it is all right to mingle with everyone—even each other. Once we began to meet as a group, we made much more progress in recruiting more African American students to the program. Students saw that there was a place to anchor onto, that there were significant avenues for interaction, and this made them more willing to select us.

MS: Why was there this feeling among the African American stu-

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dents that you weren’t supposed to cluster together?

Johnson: I think that its part of the social conditioning. People look suspiciously at groups of African Americans. The students felt that. They also felt they should interact with everyone. They are right about that, but that doesn’t mean that they can’t interact with each other as well. They just didn’t realize that they had so much in common. Their interaction with each other was productive because they were able to look at another dimension of what was going on in graduate school by talking with each other. They did not know each other at all is what we discovered.

MS: Once you did begin to meet as a group, what specific activities did you do that seemed to attract more students?

Johnson: I specifically invited other Black professionals with Ph.D.s to meet with them. Meetings were about once a month and were definitely thematic. For example, I brought in a professor of math education, Dr. Genevieve Knight from Coppin State University, to talk about her work and how her education at the University of Maryland prepared her to do her job. Meetings were based on a professional theme that allowed the students to contemplate their future professions.

MS: Have you found that having a critical mass of minority students has made a difference, and is it sustainable over the long run?

Johnson: I found that it has made a difference and is sustainable. Students see others like themselves and that makes them want to come. There are so many questions that students ask when choosing a program. Is this the school for me? Do they have the academics that I need? But most African American students find that simply asking the academic questions isn’t enough. Once we had a critical mass and a community it has become self-perpetuating. Critical mass is the thing that did it.

MS: What constitutes a “critical mass”? How many students?

Johnson: I don’t really know. More than one. I think it depends on the size of the school and would be different at different schools. There should be enough so that the Black students feel comfortable and that they are not alone or will be singled out. I knew we reached a critical mass when the students became more comfortable at the university.

MS: How did your efforts affect the overall climate in UMCP’s Math Department?

Johnson: That’s hard to say. I think it helped but I can’t prove it. Some of the things that we did for the African American students were incorporated into our orientation for all new graduate students. We found that for all graduate students there was a problem in making connections with each other. So our graduate office began assigning each entering graduate student with a student mentor. Some of the things we saw that worked with the African American students were adapted to all students.

MS: What effect has the current anti-affirmative action climate had on your diversity efforts?

Johnson: It has had an impact in that our university used to have scholarships reserved specifically for African American students to attract them to Maryland. These were lost in the wake of the Michael Williams scholarship ruling. Now individual departments have to use their own resources. We’ve been lucky in that our department has stepped up to the plate in terms of using its own resources.

The university-level program, though, did offer us a certain amount of flexibility that allowed us to bring in students that might not have looked so great on paper. There were times that at the departmental level we might not have considered a candidate because their applications didn’t seem strong. But then the university would rank them as a top candidate in their recruitment efforts and we would be able to accept them into the program. Then with some mentoring, we were able to nurture them and allow them to grow in the program.

After these university-wide programs were eliminated, they were replaced by grant programs to individual departments to help in minority recruitment efforts at the departmental level. Recruiting is essentially a departmental activity. If a department didn’t use these grant opportunities then nothing came of it. The math department made the effort to use it and from there we were able to continue to diversify. In the end it all comes down to departmental activity.

MS: I have read that you have been somewhat disappointed in the post-doctoral job market experiences of some of your students. Where have your graduates ended up in general? Have you found that most go into the professoriate?

Johnson: I have been somewhat disappointed in the academic jobs that our African American students have attained. Many have found positions at HBCUs such as Howard University, Morgan State University, and North Carolina A&T. But current legend would have them receiving job offers from Rutgers, the University of Virginia, or other Research I universities. This has happened sporadically with some of our white students. But our Black students have not even been contacted or gotten interviews there.

Our students who have gone into industry, though, have done extremely well, landing positions at the Departments of Energy and Defense and in top corporations. Those are the kinds of places and the level at which I would like to see the people who choose academia be in as well. Lately we have been encouraging students to consider non-academic jobs more.

MS: What is the best way to recruit more women and minorities into SME disciplines?

Johnson: When I made the decision to consciously go out and recruit students from underrepresented groups, I first sat down and identified the schools that had sent us students in the past who had been successful. I then focused my recruitment efforts there. I visited those schools in an effort to make contact with them. Every school has a different recruiting area, and that is where efforts should begin.

Once you’ve recruited the students, you need to have institutional procedures in place to evaluate them. Again, this was where campus wide fellowship commit-
When asked why he chose a career path in academia instead of industry, Charles Glass replies: “There are very few African American environmental engineers in academia. I thought my presence could make a difference.” Glass, who earned his Ph.D. in civil engineering at the University of Colorado at Boulder in 1997, is currently an assistant professor of civil engineering at Howard University. He is pleased that the University of Colorado’s AGEP award will help increase the successes that CU’s minority students in science, math and engineering have had at the University.

The National Science Foundation funded AGEP grant provides funding for the new Colorado PEAKS Alliance, a partnership between CU-Boulder and Colorado State University, to develop a model of minority graduate education in which the graduate schools coordinate recruiting pipelines and support programs. The PEAKS Alliance initiatives are designed to triple the number of underrepresented minorities graduating with Ph.D.s and entering the professoriate in the fields of science, math and engineering. CU-Boulder, ranked 16th in the nation in awarding doctoral degrees to minority students in SME fields, is the lead institution of the Colorado PEAKS Alliance.

One of the reasons CU-Boulder and CSU competed successfully for the AGEP grant is because the infrastructure to recruit and retain minority students in science, math and engineering was nearly in place at both institutions. CU-Boulder’s Summer Multicultural Access to Research Training (SMART) program brings talented minority undergraduates to campus to work with faculty mentors on research projects and to introduce them to graduate education. Colorado State University is the lead institution for the Colorado Alliance for Minority Participation (CSU-AMP), which has built a strong pipeline of minority undergraduates at eight baccalaureate-degree granting institutions, five community colleges and four Native American tribal partners in Colorado and the Four Corners region.

The SMART program, begun in 1989, has established a successful infrastructure that supports diversity at CU-Boulder. SMART provides undergraduates the opportunity to prepare for graduate school, and to consider CU-Boulder for their graduate education. SMART is also extremely effective in generating high levels of faculty involvement in campus diversity efforts. The program is so rewarding for faculty, despite the additional commitment of time and energy, that the number of faculty who volunteer to be mentors each year far exceeds the number of students the program can financially support. Many SMART faculty mentors also learn about and take part in other Graduate School diversity programs—such as a program that supports faculty travel to minority-serving institutions to recruit graduate students.

SMART also reaches out to current CU-Boulder graduate students. Between 5 and 10 minority graduate students receive a small stipend to facilitate the rapid integration of the SMART interns into CU-Boulder’s research environment. These graduate students become committed to SMART, and often remain in touch with the program after graduating. Eight graduate students who worked for SMART are now in faculty positions across the United States and Puerto Rico. They are among the best recruiters for the program.

Charles Glass knows firsthand the benefits of CU-Boulder’s SMART program. After participating in SMART as an undergraduate in 1991, Glass returned to CU as a graduate student in order to continue to work with his faculty mentor. Upon receiving his Ph.D. at CU-Boulder, Glass taught at the University of Nevada-Reno, and then landed his current position at Howard, where he is continuing the minority mentorship cycle by sending his talented undergraduates to the SMART program. SMART was a key factor in inspiring Glass to attend graduate school. “CU is a really supportive place,” he says. “It wasn’t until I participated in the SMART program that I really learned to enjoy research and thinking. The professors involved in the SMART program were genuinely interested in our future and that’s one reason why I decided to go to CU for graduate school.” Glass is now excited about the additional support and professional opportunities that the Colorado PEAKS Alliance will provide to minority graduate students.

**Colorado’s AGEP Initiative**

As part of the AGEP initiative to increase the number of minority Ph.D.s entering the professoriate, CU-Boulder is offering 10 Chancellor’s Teaching Fellowships annually for minority doctoral students. These new teaching fellowships provide full support for first-year minority doctoral students to serve as teaching assistants within an SME field. CSU is also providing two new PEAKS graduate teaching fellowships that provide full support plus tuition. These teaching fellowships encourage PEAKS students to become involved in campus teacher training programs, such as the Graduate Teacher Program and

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the Preparing Future Faculty program, at the beginning of their doctoral studies and to consider the professoriate as a future career.

The CU-Boulder and CSU Graduate Schools also offer PEAKS Fellowships in addition to the teaching fellowships as an incentive to entering minority doctoral students. These fellowships consist of a $2,500 diversity fellowship for students during their first year of doctoral study and a $3,500 research award to support their research during the summer following their first year of study. SME departments accepting students who receive the teaching and research fellowships must guarantee an additional four years of funding for each student’s doctoral education.

CU-Boulder offered its first round of Chancellor’s Teaching Fellowships last spring to minority students who entered doctoral programs during the 2000-01 academic year. Alexander Villacorta, a doctoral student in applied mathematics and a former SMART intern, is a member of the first group of graduate students to benefit from the AGEP program. After working as a teaching assistant for Introduction to Differential Equations, Villacorta says that he discovered that “I truly loved teaching. Every week I looked forward to those classes and the new techniques I would try.” As for his future plans, Villacorta says,” even though some experience in industry is important in my field [applied math], I’d like to end up in academia.” Villacorta agrees that the SMART program “definitely” influenced his decision to attend graduate school; before attending SMART, he says, “I had thought of grad school, but not seriously.” Villacorta is now working in the residence hall for this summer’s SMART program. In fact, five of the first ten recipients of the AGEP Chancellor’s Teaching Fellowships are working with SMART this summer.

Charles Glass, who was the keynote speaker for the annual CU-Boulder Multicultural Engineering Program awards banquet in April, 2001.

“...the SMART program helped to inspire me to give something back,” says Charles Glass. “I believe in programs like SMART—that’s why I continue to be a recruiter for them.” With the NSF-funded AGEP grant, the University of Colorado at Boulder and Colorado State University are committed to creating a sustainable graduate school infrastructure that produces future generations of faculty that are representative of our increasingly diverse society.

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Department heads might have had an advantage in that they were better able to see potential. It’s a calibration problem. Departments need to work at assessing the quality of students based on information that the students have provided, but whose import may not always be immediately apparent.

MS: What is the best way to retain more women and minorities in SME disciplines?

Johnson: For us, the most important issue is to get students to pass their qualifying written exams. We found that success depended on students talking to one another. Once this dialog was opened up they could easily form groups to study together. We found an increase in study sessions for both African Americans and the more general student body. People chose study groups as appropriate, based on subfields or affinity or whatever. That was the main benefit of our activities for retention. Students were able to reach out and form groups more easily. Research shows that reaching out does not take place until students feel comfortable and know who they are. Then they are able to reach out and participate in activities organized by other groups.

MS: Did you do anything to help other faculty assume mentoring roles?

Johnson: Yes and no. Actually, I didn’t really have to. Once a student passes the written exam, they have to choose a faculty advisor, and that has always been a strong mentoring position. But, if you don’t get to that point you don’t get a mentor. When more students began to work together to pass the exam, more African American students were able to get past that hurdle. Through that process, we exposed a number of faculty members to high quality African American students and that did have an impact on the faculty. From there things just took their natural course.

Thank you so much for your insights, Dr. Johnson!