THE ROAD TO DIVERSITY:
ARE WE THERE YET?

On January 20, Barack Obama became the first African American to be sworn in as President of the United States. On that day television screens carried images of African American men and women moved to tears as they watched the historical event—one that many of them thought they would never witness in their lifetimes. **By Laura Bonetta**

Women, together with African American, Hispanic American, and Native American men, constitute almost two-thirds of the US population. Yet, too few from these groups hold professional leadership positions—and that is certainly the case in academic science. But the situation is changing.

"Over the past 20 years the position of women in science has changed dramatically. It is not where it needs to be. But women have reached a critical mass in many areas. They now have influence on committees for awarding tenure and hiring faculty," says **Linette Watkins,** former chair of the American Chemical Society (ACS) Committee on Minority Affairs. "We are going that way for ethnic and racial minorities as well, but for people with disabilities or of different sexual orientations, it may take even longer."

Women Scientists Reaching Critical Mass

Women's share of science, technology, engineering, and math (STEM) faculty positions has increased steadily. A study by the US National Science Foundation (NSF), published in July 2008, shows that tenured and tenure-track women faculty increased from less than 10 percent in 1979 to 28 percent in 2006, with distributions varying considerably by field. In 2006, women's share of tenured or tenure-track faculty was 17.4 percent in mathematics and 17 percent in physics but 32 percent in the life sciences and 33.9 percent in social sciences.

"The first tenure-track woman faculty in my department was hired three years before me," says Watkins, currently associate professor in the department of chemistry and biochemistry at Texas State University–San Marcos. "I was the second hire in 1997, and now we have five tenure-track women faculty."

Broadly, most women hold instructor and assistant professor positions (42 percent), with fewer of them at the associate (34 percent) and full professor (19 percent) levels. According to a 2007 report by the National Academies of Science, "Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering," women face several barriers to hiring and promotion in research universities in many fields of science and engineering, including having to contend with questioning of their abilities and commitment to their careers, and arbitrary evaluation systems that favor men. In addition the report found that "structural constraints and expectations built into academic institutions assume that faculty members have substantial support from their spouses."

Faculty members like Watkins agree that it is not easy to balance career demands with starting a family. "I found my way to do it," says Watkins, who has a six-month-old son whom she sometimes takes to work with her. "But I waited to have a child until I was tenured. Women who are coming along after me won't have to wait." That's in part because many universities and medical schools are putting in place more family-friendly policies, such as ones to "slow" the tenure clock, extending the time until tenure review.

Underrepresented Minorities Looking for Role Models

At ACS, Watkins oversaw the ACS Scholars Program, which provides financial assistance as well as mentors to undergraduate underrepresented minority (URM) students to encourage them to pursue degrees in the chemical sciences. (Most programs, including the ACS Scholars Program, define URMs as US citizens or permanent US residents who are African American, Hispanic American, or Native American). Launched in the fall of 1995, the ACS program boasts 45 scholars who have earned their Ph.D.s. "We are probably approaching 10-12 of its alumni who are now faculty," says Watkins. continued »

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Top: **Tuajuanda Jordan**; Bottom: **Richard Tapia**

UPCOMING FEATURES

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Diversity Feature: Asian American Scientists — May 29

Focus on Cambridge/Oxford/London — June 26

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"Over the past 20 years the position of women in science has changed dramatically"
—Linette Watkins

One person who benefited from the program is **Thomas Epps III.** "The scholarship allowed me to perform laboratory research for credit during the semester rather than find a separate job. It also helped me decide that I wanted to do research," says Epps, who completed his undergraduate degree at the Massachusetts Institute of Technology (MIT) in Cambridge, Massachusetts, under the mentorship of chemical engineering professor Paula Hammond. "She counseled me through some of my struggles. She was one of the few minority faculty who I interacted with at MIT, so it was helpful to speak with her about the pressures at a top-tier institution. We are still in regular contact."

Epps became assistant professor in the Department of Chemical Engineering at the University of Delaware in 2006. He is amongst the just 5.6 percent of faculty at the top 50 departments of chemical engineering who are URM individuals, according to a 2007 study by **Donna Nelson** at the University of Oklahoma.

Having a mentor who shares a similar background is critical, says Epps, but URM students should not limit their pool of mentors to only minority faculty. "It's important to have a range of mentors. I find that sometimes if I am not available, minority students choose not to ask anyone else in the faculty for help and so they end up not getting any assistance," says Epps. "But in many cases, their questions can be addressed by any faculty member."

Although URM students and junior faculty can benefit from having nonminority faculty mentors, the importance of having role models cannot be overstated. "If I see someone who looks like me, I think I can make it too. If you are a woman and you think you should be faculty, but everyone on the faculty is male, you don't see the feasibility," says **Richard Tapia,** professor of engineering and director of the Center for Excellence and Equality in Education at Rice University.

Math is one of the disciplines most resistant to change. In 2007, within the top 50 math departments less than 2.3 percent of members of the faculty were URMs, compared to 3.8 percent in biology. "In an ideal world we would like to see 30 percent of all science faculty URM, but I would be pretty happy to see even 5 percent or 10 percent," says Tapia. "Anything below these numbers does not provide the leadership, guidance, or role models that the country needs."

Waiting for a Sea Change

Although the number of minority students in science fields, according to Nelson's study, has increased dramatically in recent years, especially at the undergraduate level, the proportion of URM faculty has not kept pace. In 2005, 16.7 percent of the students graduating with a B.S. in chemistry were URMs but in 2007 only 3.9 percent of faculty at the top 100 chemistry departments were URMs. For women those numbers are 51.7 percent and 13.7 percent, respectively. In contrast, for white males the percentages are 37 percent and 74.2 percent, respectively.

Featured Participants

American Association for the Advancement of Science
www.aaas.org

American Chemical Society (ACS)
www.acs.org

California Polytechnic State University
www.calpoly.edu

EntryPoint! Program
www.entrypoint.org

Howard Hughes Medical Institute (HHMI)
www.hhmi.org

Massachusetts Institute of Technology
www.mit.edu

National Federation of the Blind
www.nfb.org

Penn State University
www.psu.edu

Rice University
www.rice.edu

University of Delaware
www.udel.edu

University of Oklahoma
www.ou.edu

US National Science Foundation (NSF)
www.nsf.gov

Web Accessibility Initiative (WAI)
www.w3.org/WAI/

"I went to college in the 1960s, and at that time I never saw a minority faculty member. Today it is still possible to have that experience," says **Shirley Malcom,** head of the Directorate for Education and Human Resources Programs at the American Association for the Advancement of Science (AAAS), publisher of *Science*. "The student body looks so much different than when I went to school. But the faculty is not moving at the same pace."

Part of the problem, says Malcom, is that the "current faculty selects the next faculty. Most often that means they look at research productivity alone." Instead, faculty should view themselves as a unit "and evaluate what that unit is missing in terms of experiences and perspectives, and not just in research," says Malcom. "The faculty job is not just research. It is also about mentoring, teaching, and larger issues of service to the community."

But although change may be slow to come, Malcom believes there is reason to be optimistic. "I see many programs reaching into institutions," she says. "There has been a strong focus on advancing women faculty, and the same will happen for other groups. Things are happening."

Supporting Minority Students

NSF is one government agency that has made a strong commitment to increasing diversity in the sciences by providing funds to universities willing to establish programs to recruit and retain URM students, as well as by establishing several scholarships and fellowship programs for students. Other agencies and organizations are making similar efforts, albeit on a smaller scale.

The Howard Hughes Medical Institute's (HHMI) Gilliam Fellowships, for example, provide full support for up to five years of study toward a Ph.D. for outstanding students who are from groups underrepresented in the sciences or from disadvantaged backgrounds. "We give them the means where they can be successful in graduate school. The expectation is that they will someday be really good faculty," says **Tuajuanda Jordan,** director of HHMI's Science Education Alliance. continued »

CREDIT: PHOTO BY CHANDLER PRUDE

"It's important to have a range of mentors."
—Thomas Epps III

But Jordan points out that these grass-root efforts will go only so far. "Unless someone up top makes a definite commitment to this type of training, current efforts will remain small and are going to take a long time to have an effect," she says. "One of the main problems I see is that the way we *teach* science in this country is counter to how we *do* science. What I see is that if a student is even remotely interested in science, we get them into college and lecture to them—a completely passive experience. This is the exact opposite of what we should be doing. Science is about mental and physical engagement. It is truly a holistic experience that we, as scientists and educators, can do a better job communicating."

Early Research Exposure

Jordan and others believe that providing opportunities for students to be exposed to research early on will increase the number of students—from all walks of life and backgrounds—entering scientific careers. To this end, AAAS established the EntryPoint! program for students with disabilities. "Our primary goal is to introduce students to internship opportunities using and expanding the skills they have and to promote them to employers," says **Virginia Stern,** director of the Project on Science, Technology and Disability at AAAS.

According to NSF figures, 20 percent of the population in 1993 had some form of disability and persons with disabilities were 13 percent of all employed persons and around 5 percent of the science and engineering labor force. In 2006, 18 percent of the population reported some kind of disability and scientists and engineers with disabilities made up 7 percent of all scientists and engineers. Although there has been only a slight increase in employment status among scientists and engineers with disabilities, in a span of 10 years the number of students with disabilities in STEM fields has increased.

"There is a definite increase in students with disabilities at the undergraduate level. Students realize that STEM fields are interesting and very marketable. Counselors may be the biggest barrier because they themselves often have not had math or science training, and they think these are too hard for their clients with disabilities," says Stern.

One of the biggest developments in the past 15 to 20 years that has helped students with disabilities enter STEM fields has been the availability of assistive technologies. "Legislation and assistive technologies have helped tremendously," says Stern. They include text and video relay services for people who are deaf, speech recognition software for people who may not be able to use a keyboard, text-to-speech software and spelling programs for people with some learning disabilities, and refreshable Braille displays and Braille printers for people who are blind.

When **Cary Supalo** started his Ph.D. in chemistry at Penn State University, he had to find individuals who could follow his directions, acting as his eyes and hands in carrying out experiments. He also had to employ, with financial assistance from his university, people capable of reading scientific papers to him. "At the time, that was the only way to get timely access to the scientific literature," says Supalo. Today, screen reader technology makes it possible to read some scientific information online. This has been one of the most important developments in the past decade for people who are blind. But "the technology is not where it should be," says Supalo. "Reading math equations is difficult and so is accessing organic chemistry molecular structures."

Making STEM Careers Accessible

Supalo learned what he needed to do to pursue a Ph.D. in chemistry through the National Federation of the Blind. By participating in the organization he met blind scientists and mathematicians who shared their strategies and advice. "Meeting scientists who were blind like me was tremendously inspirational. I don't know if I would have stuck it out in chemistry without those role models," says Supalo. "Knowing that someone had done it before me, that it was possible to do—that was very empowering."

Without the needed resources to pursue STEM careers, people with disabilities are cut off from these fields. "To increase representation of women, people of color, and of different sexual orientation, things have to change in terms of attitudes as well as policy," says **Trey Duffy,** director of the Disability Resource Center at the California Polytechnic State University. "But for people who have disabilities, you have to change the world physically. In a way it is harder because you can't stop at eliminating discriminatory beliefs and policy, you have to take the extra step of modifying material and tangible aspects of the environment. It is not just a matter of welcoming people, which is in itself difficult; there is an infrastructure that goes with it."

Although technological advances and laws requiring facilities and employers to make the workplace more accessible have removed some roadblocks, many remain. For example, "There are no required standards for building web pages; therefore, some designs inhibit accessibility by people who are blind," says Duffy. There are, however, signs that some of these obstacles will eventually be removed. The Web Accessibility Initiative (WAI) works with organizations around the world to develop strategies, guidelines, and resources to help make the web accessible to people with disabilities. "Programs by NSF for technology development, initiatives to make the web more accessible, and the focus on science under the new Obama administration are all positive things," says Duffy. "We are definitely heading in the right direction."

Most people share this optimism. Science fields are not yet representative of the diversity in the US population, but already more women have made their way into leadership positions in many STEM disciplines, and the student body in the life sciences is heavily female. There are also many minority undergraduates in STEM fields. Individuals with disabilities and of different sexual orientation are still few and far between. However, many government agencies, including NSF, as well as several private entities have made strong commitments to make science more inclusive.

Laura Bonetta is a scientist turned freelance writer based in the Washington, D.C., area.

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