Announcing the New *Computing in Science & Engineering* Diversity and Inclusion Department

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I t's one thing to have a conversation about the importance of diversity in computational science and engineering (CSE). It's another to make a commitment to dedicating resources and working together to deeply explore the assumptions, problems, challenges, and promise of inclusion. Diversity has not only been on the minds of the *CiSE* editorial board for some time, it's also been a priority for our editorial calendar, the most recent example being the May/June 2017 "Best of RESPECT" special issue showcasing the

Research on Equity and Sustained Participation in Engineering (RESPECT) 2016 conference. In this special issue, four articles present compelling research that explores quantitative and qualitative ways to make computing more accessible to people from underrepresented groups.

At a recent meeting of the magazine's editorial board, a commitment to diversity was affirmed in a decision to form a Diversity and Inclusion department, and I'm honored to be its inaugural editor. Although there has been progress in

the state of affairs and plenty of research on issues associated with diversifying the scientific workforce, there's still much work to be done.

For example, gender variation has been marked in computing baccalaureate and doctorate attainment across countries, with minorities showing even greater disparities.[1] In the US, while women earn approximately 40 percent of undergraduate degrees in mathematics, there's still an underrepresentation of African Americans and Hispanics in mathematics.[2,3] Recent economic projections call for 1 million more science and technology (S&T) professionals over the next decade in the US, yet fewer than 40 percent of entering college students who intend to major in S&T disciplines actually complete an S&T degree.[4] Disparities in the representation of women and minorities compound these challenges.[5–8]

Although S&T fields have been historically dominated by a white male population, data indicate a movement toward diversification in academics and employment. Yet, the underrepresentation of women and minorities continues to be problematic, especially in computing and mathematics. In 2012, women represented 49 percent of the US college-age population and earned 42 percent of S&T associate degrees, just over 50 percent of bachelor's degrees and 46 percent and 41 percent of masters and doctoral degrees. However, their representation in the computer and mathematical sciences workforce decreased from 30.8 percent in 1993 to 25.1 percent in 2010. Underrepresented minorities have seen progress, with Hispanics earning 20 percent and African Americans earning 14 percent of all US S&T associate degrees in 2012. However, Asians/Pacific Islanders earned almost 10 percent of the S&T doctoral degrees, while Hispanics earned 6 percent and African Americans earned 5 percent (www.nsf.gov/nsb /sei/edTool/index.html). In computer science, the number of African Americans earning PhDs in 2006 was so low it was hardly noticeable at less than 2 percent.[1]

Progress has been made to improve these numbers through research aimed at supporting individuals from underrepresented backgrounds. Examples include the recent formation of the IEEE Special Technical Community on Broadening Participation, which aims to create a community of researchers exploring diversity and inclusion in computing. Another example is the Symposium on the Science of Broadening Participation (SoBP) recently convened in Arlington, Virginia. The SoBP Symposium brought together researchers and practitioners from fields as diverse as sociology, economics, education, chemistry, engineering, and medicine to build a better understanding of what it takes to make a quantum leap toward a more diverse and inclusive scientific workforce.

On the programmatic side, over 20 years of the Grace Hopper Celebration (GHC) of women in computing has had a dramatic effect not just on the lives of women in technical fields but also on industry. In 2016, GHC brought over 15,000 people from 87 countries to celebrate women in computing and provide opportunities for women to network, build community, and learn, and for organizations to learn how to build inclusive environments and recruit women into technical fields (https://ghc.anitaborg.org/wp -content/uploads/sites/2/2017/01/ghc16-impact-report-web .pdf). For over 15 years, the Tapia Celebration of Diversity in Computing conference has grown from a little over a hundred attendees to nearly 1,000 in 2016. Last year, more than 50 percent of Tapia attendees were students and more than 50 percent were women, with a racial distribution that included African American (29 percent), Hispanic (23 percent), Caucasian (21 percent), Asian (13 percent), multiracial (3.6 percent), American Indian (.7 percent), and Pacific Islander (.2 percent). At Tapia, attendees have the opportunity to build community and explore career options.

Other programmatic efforts include the Southeastern Universities Research Association (SURA) outreach efforts to develop a diverse user base in the Extreme Science and Engineering Discovery Environment (XSEDE), a major US high-performance computing virtual environment. improvscience, a US-based consulting firm, uses a unique approach to help scientists grow their research abilities and develop their collaborative skills by learning to co-create with other scientists who may think or look differently from them.

At the Sustainable Horizons Institute (SHI), where I'm located, sustainability is an important mission as is redefining mainstream communities to be more inclusive. It's indisputable that the need for high-quality computing scientists is continuing to grow. Yet, sadly, workforce development isn't meeting this growing need, at least partly due to the attrition seen in larger numbers by people from underrepresented backgrounds. SHI programs aim to overcome this disparity by using evidence-based methods[9] to support individuals who are underrepresented in computing sciences, including women, racial and ethnic minorities, and people with disabilities, as well as individuals identified as underrepresented on the basis of, for example, gender identity, or socioeconomic status. However, this is sustainability in its simplest form. Our vision is deeper than this, and SHI programs are intended to address several dimensions of sustainability. We also address sustainability by maintaining relationships with program alums (http://shinstitute.org /growing-commitment-to-sustainability), by engaging them long after their initial participation in SHI programs, and by providing continuous support throughout their education, into their career and beyond. Another dimension of sustainability we address is by working to transform communities into places where diversity and inclusion are the norm. That means not just working with people who are

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marginalized, but working with the broader community to create environments where all people are not just welcome but are productive and thriving. This includes education, open dialogue, and engaging conversations about how to significantly change the numbers. SHI work is conducted in mainstream CSE environments such as the SC conference series, SIAM's Computational Science and Engineering conferences, and within the US Department of Energy's national laboratories (http://shinstitute.org/bright-scientists -supporting-diversity-the-csgf-and-be-connection and http:// shinstitute.org/srp_article/).

Although a variety of recent work aims to illuminate the reasons why the workforce remains predominantly homogenous and strives to transform those environments, progress is slow, and many challenges remain. But the progress we've seen creates a ray of hope and an open door through which we can create a new reality: computing science environments where ascription doesn't determine participation, a place where talented scientists and engineers can thrive, co-create, collaborate, and share the excitement of discovery through broader perspectives and approaches—computing science environments where diversity and inclusion are the norm. It's time to make a jump to the next rung in the step function of diversifying the workforce. It's time for everyone to take responsibility for changing not only their own thinking but also their behaviors, attitudes, and surrounding environments.

It's our hope that this new Diversity and Inclusion department will foster an engaging discourse and open discussion on what works and what doesn't, challenges to advancing the cause, and new approaches. We also hope it serves to catalyze not just the way people think about diversity but also a change in their behaviors. Each light that goes on in a reader's head can spark change in our everyday relations and environments, ultimately leading to better science. We invite all members of the *CiSE* community to ponder the discussions presented through this department as well as express your own thoughts through articles and letters. We're especially interested in hearing from community members from different perspectives and backgrounds—minority, majority, and anything in between. If you're interested in contributing, please contact me directly at mleung@shinstitute.org or via https://www.computer.org/cise/write-for-us.

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