

Barriers for women in STEM

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Why are only 24% of science, technology, engineering and math (STEM) occupations filled by women when they make up [49% of the entire workforce](#)? Why do half the U.S. population fill such a small portion of approximately 20 million jobs? The answer is our culture.

This takes the form of barriers ranging from implicit bias and subtle stereotyping to willful ignorance and blatant discrimination. With predictions of a shortfall of trained STEM professionals, the stubborn blockade of sexism is now getting attention.

A summary of peer-reviewed research, [Why So Few? Women in Science, Technology, Engineering, and Mathematics](#), published in 2010 by the [American Association of University Women](#) (AAUW), explains the role culture plays in how women are treated. There was an “outpouring of interest” from media, social media and businesses that continues today, according to one of the co-authors, Catherine Hill, [AAUW Director of Research](#).

Hill says the focus on what is behind all of the research results related to girls and women is startling to the people who read the report. While the focus of each piece of research is on individual issues such as girls and testing, university hiring practices or biological capabilities, the collective analysis of those results revealed the obvious, single source of culture.

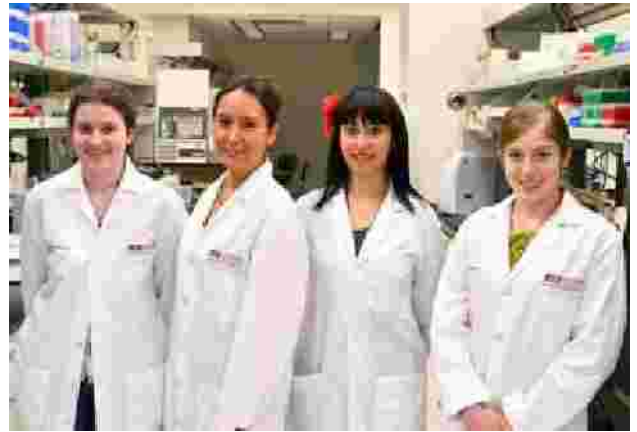
“Everything was already published,” Hill says. “We were simply reporting on it. What is new was trying to bring together all of the cultural reasons that we see at play and trying to be very concrete and specific about how we can change them.”

Why so Few? does more than just point out the common ground of female experiences. It also makes recommendations that are manageable – ideas that are simple once the need to address diversity is included in consideration of hiring practices, testing procedures or trying to solve problems raised in just about any area of education and employment.

The first step to solving any problem is understanding what it is.

“It’s not about bad people trying to be mean to others,” Hill says. “What we also know is that perfectly good people can have biases and they may not be aware of them. When you’re not aware of them is when it’s dangerous because you don’t know you have this proclivity. So learning about your biases, whether it’s through some of these tests that are available – the [Harvard Implicit Bias Test](#) is one that comes to mind – they can really help you understand some biases that you may have.”

An example of an unknown bias influencing decisions is shown in the report [Science faculty’s subtle gender biases favor male students](#). Science faculty members at “research-intensive universities” were given the [application](#) materials of male and female students with randomly assigned names for a laboratory manager position. When the credentials of the students were the same, the applications for male students were seen more favorably.



[Arizona State University](#) School of Life Sciences undergraduates conduct research with their mentor, Susan Holechek, a postdoctoral research associate at ASU's Biodesign Institute in Joseph Blattman's immunology lab. Blattman is an assistant professor in School of Life Sciences. (L-R) Courtney Bruce (senior), Susan Holechek (postdoctoral research associate), Vanessa Guzman (junior), Lizbeth Nieves (junior). (Photo: Jacob Mayfield)

"The men and the women faculty members were more likely to make an offer to the male candidate who had the identical [resume](#) to the female candidate, and they offered more money to the male candidate," Hill says. "These were highly educated people (who) I'm sure would tell you they are not biased in any way."

"Whenever people tell me they made a decision from their gut, I always suggest that they think about it again because your gut instinct may be the right thing, but we all are creatures of bias and we can see that people of good conscience can still have these biases."

A prejudice in favor of one group over another can result in a stereotype. One that persists about girls is that they aren't capable of doing well in science or math. While research has eliminated the possibility of biological inequity across genders, there is a pervasive cultural norm that categorizes STEM fields as "male." Despite the fact that many women have made significant contributions in a variety of fields, they remain few and largely unknown. Albert Einstein and Charles Darwin are names known to most children. While Gertrude B. Elion and Maria Goeppert-Mayer (both Nobel Prize winners) aren't.

For all ages, role models are essential to countering biases and stereotypes. This is why Susan Holechek, a post-doctoral research associate at [Arizona State University](#), is involved as a member of the [American Association for Women in Science in Central Arizona Chapter](#) who helps to organize the AWIS symposium [Jumpstarting STEM Careers](#) and workshop series. The seminars include time for networking and presentations relevant to [undergraduate](#), graduate or post-graduate students in STEM fields. The emphasis is on skill development essential to successfully completing a degree and transitioning into a related professional position after graduation.

The goal of the series is to help with student retention as much as it is to increase the number of people going into allied professions, with a special emphasis on women. A native of Peru, Holechek immigrated to the United States and pursued her passion for science because it did not occur to her that the field of science was closed to her.

"I actually became a biologist because (of) my high school teacher," she says. "There was a class about the digestive system, and my teacher brought in the whole digestive system of a cow. ... Usually we would see things in the books, but seeing it and touching it was amazing. That changed my perspective. If somebody can be as passionate as her, I want to be like her."



The Jumpstarting STEM Careers symposium at ASU . (Photo: Sandy Leander)

Intentionally including girls in science activities and encouraging their interest is another recommendation of Why So Few? AWIS in Central Arizona provides an example of how to do that. In addition to the usual prizes at the state science fair, the group created their own prize category for girls. Girls request to have their projects included in the AWIS competition, and one of the prizes is participation in the Hands-On Science day at ASU.

The girls tour various labs and STEM departments at the school. In addition to seeing women doing science, students from sixth grade through high school get to participate in science activities.

Page Baluch, AWIS-CAZ president and W.M. Keck Bioimaging lab manager at ASU, says one of the former winners came back to her a year later looking for help.

"She wanted to do analysis on food samples, so she was coming up with a way to help with preserving food for a longer (period of time.) She needed a way to detect if there was contamination. But of course things cost a lot of money and it's hard to find people (who) can host you that have the equipment and the time to donate."

A local hospital lab was helping her with testing the results of her experiments, but told her it was too expensive for them to continue the work free of charge.

"She's interested in microbiology, and I have a colleague who runs the microbiology [classes](#) and he was all excited to get on board," Baluch says.

What appears to be a large obstacle to a student could be a simple task for a professional in the field, but if the two don't come together, a future scientist can be lost. That is why Baluch is actively assisting other women.

"All my colleagues are male. That does make a difference. I'm just really fortunate that all the people I work with are great – not that I haven't come across people that have a very negative output. I've run into people who have said women have never made any major advances in microscopy: 'What do you think you're going to do? You think you're going to make a difference?' Wow, to have somebody tell you, 'You really don't belong here.' "

In the university environment, particularly in computer science, engineering and physics – the fields with [the lowest percentages of women](#) – a female faculty member can be the only professional woman in a department. This is another area where simple changes can result in great improvement. Conducting a review of the workplace environment to assess the climate in support of or opposition to female faculty, formal and informal mentoring of junior faculty and taking steps to create a supportive work/life balance are a few, according to Why So Few?

Beyond the lack of diversity in training offered to students by a well-balanced faculty, women are less likely to be in leadership positions, making it difficult for them to make a positive contribution to the department culture or the direction of the body of research conducted. Fewer perspectives and fewer opinions stifle opportunity for those who are different.

"Sometimes the common sense that we bring to our workplaces simply opens up the discussion and that diversity that is so important. Scientists, even social scientists, tend to be hierarchical – that's not where things trickle up," Hill says. "It's important that the diversity has an effect on the individual woman in the question of fairness, but it also has that effect on more diversity on our workforce."

Despite the seemingly impossible task of changing cultural mores that serve to keep women out of STEM fields, Hill is optimistic that change can and will occur.

"It's something we can achieve in a couple of decades, and it will contribute enormously to the diversity of our scientific thought and our leadership in these fields....It's attainable as a goal. It's a goal that's going to help all of us."

Published: February 25, 2013 – Qualia Blog

<http://membercentral.aas.org/blogs/qualia/barriers-women-stem>