

From the Editor-in-Chief: Questions of Gender Equity in the Undergraduate Biology Classroom

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I have participated in many conversations about achievement gaps and retention in science, technology, engineering, and mathematics (STEM) education over the years. Within these conversations, a common observation is that biology is a more equitable STEM discipline because we have an abundance of women in the field. While the presence of women is certainly a prerequisite step toward gender equity, a recent paper by Grunspan et al. (7) illustrates how female representation is not enough to promote equal treatment between genders within the undergraduate biology classroom. This new information about an old problem led me to consider what we know about gender dynamics and success in the biological sciences and to contemplate specific actions that we can take to alleviate existing problems.

The reasons why students leave STEM fields are complex (13). Indeed, discipline-based science education research (DBER) has its roots in questions about training and retention; increased production of scientists and engineers was necessary to meet demands of the space race in the mid-20th century (15). Biology came late to DBER in the 1990s and 2000s, a full 20 years after physics (15, 16). In my opinion, this was due in part to greater participation of women in biology than in other STEM fields; the need for retaining diverse biologists was not considered critical because of better gender representation. Biology lacks representation for many groups, including people of color, low socioeconomic status, disability, and first generation college students (14). We still have work to do to fix this problem. But in the case of gender, are we truly the more equitable STEM discipline?

By sheer numbers, we are (at least in the United States). Women are taking advanced biology-related courses in high school at a higher rate than men (4). Women graduate with degrees in biological and biomedical sciences in equal or higher numbers than men at all degree levels (Fig. I). Historically, women reached this threshold by the 1990s and continue to graduate with more biological science degrees today (Figs. I and 2). The median time to graduation with a life sciences doctorate is similar for men (8.2 years) and women (8.3 years) (10), indicating that thesis committees consider the amount of doctoral work between genders as equivalent to graduate within the same timeframe.

However, we lose these women when it comes to employment upon graduation (Fig. 3). Employment as a biological or medical scientist follows graduation rates for Bachelor's degrees. However, graduate-level work shows a disparity, with fewer women working as scientists after receiving Master's and Doctoral degrees (Figs. 2 and 3). Indeed, this matches studies showing gender biases in hiring and promotion of women in the sciences (2, 9), though differences in life goals between men and women and perceptions of power may also play a role in such decision-making (3, 6).

What does this mean for the undergraduate biology classroom? Should we be satisfied if equal numbers of men and women are receiving Bachelor's degrees and moving on to graduate work? Grunspan et al. (7) indicate that we may need to rethink equity within the dynamics of the undergraduate classroom. Their study shows that males are consistently nominated as the highest performers in biology courses by their undergraduate peers, and that this bias is driven by male students. Men do perform slightly better in these large classes (200–800 students), even though the majority of students are female (5, 7). However, men overestimated the course performance of their male peers



FIGURE 1. Percentages of men and women who earned biological and biomedical science degrees in the United States from 2010 to 2012. Data gathered from (18).

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FIGURE 2. Percentage of students by gender earning Bachelor's (A), Master's (B), and Doctoral (C) degrees in biological and biomedical sciences in the United States over time. Data gathered from (18).

(at an average of one half letter grade), while women were more gender equitable in their peer nominations of high performers. A previous study showed that women are less likely to contribute to introductory biology classroom discussions than men (5). However, even when controlling for verbal participation, male bias still exists within these peer nominations (7).

This represents an opportunity for change. Studies show that current faculty may be resistant to gender bias data (8), making it problematic to change the culture of science at the workforce level. However, implicit biases (like those shown in (7)) can be reduced when they are specifically



FIGURE 3. Percentages of men and women employed in biological and biomedical sciences by degree level in the United States in 2010. Data gathered from (11).

addressed (1, 12, 17). Perhaps reducing this peer bias in the undergraduate classroom will eventually moderate gender bias in the STEM workplace, where structured exam grades are replaced by written evaluations.

How can we do this? Think about your classroom structure and grading schemes. Do you grade participation? Is it measured by who is loudest, or are there different ways of making contributions to the class? In what ways can individual students show scientific competency, not only to you but to their peers? Do you discuss bias with your students? By my personal observations, the current generation of college students is very open to questions about bias and privilege in a way not discussed even five years ago. We can leverage this to promote gender equity if we abandon the notion of scientific impartiality, recognize that biases do exist, and make it a priority to address them in the classroom. Our classrooms are where our students begin their journey as scientific specialists. I argue that if our students do not learn about the culture of science along with the content of the discipline, then we are not training them to be successful scientists. The culture shift starts with us.

Let's start a conversation. Should we do anything? What do you think can be done? Write a *JMBE* Letter to the Editor and share your thoughts and ideas!

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