Women in physics: Why and why not? FREE

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Physics Today **59** (12), 14 (2006);
https://doi.org/10.1063/1.4797341

Yet the data she cites suggest gains that appear to exemplify vigorous affirmative action. Disparities in the number of women in the physical sciences, engineering, and mathematics are easily explained by objective data. Due to biological differences, significantly more men than women are at the extremes of mental ability. Charles Darwin pointed out the greater variability of males in his *The Descent of Man* (1871). For example, the ratio of male to female math geniuses is 13 to 1.

Studies of mathematically gifted young women in special programs such as the Johns Hopkins Study of Mathematically Precocious Youth reveal striking sex differences in values and interests. Most of the women preferred careers in law, medicine, and biology where they could work with people and living things rather than with inanimate objects. Even though mathematically capable young women are aware of their abilities and opportunities, they choose these fields far less frequently than do young men. Less than 1% of females in the top 1% of mathematical ability are pursuing doctorates in math, engineering, or physical sciences. Eight times as many similarly gifted males are doing so. The mathematically gifted woman's first career choice is medicine, followed by law, humanities, and biology.

The relative lack of women in mathematics and certain science fields, then, is due to two factors: the far greater number of gifted males, and the propensity of gifted females to choose other fields.

Ideologies that portray gender differences as tantamount to gender discrimination are troubling because they ignore the facts and threaten freedom of choice. Radical proposals to solve the perceived discrimination would result in hiring and promoting less-qualified women over more-qualified men in mathematics, chemistry, engineering, physics, and computer science.

Joseph Spicatum
Missoula, Montana

With regard to the equal treatment of male and female physicists, I think the playing field has been level for a while. Female physicists have the same level of recognition and approval as males, at least at the University of Toronto.

We can continue to have a level playing field for men and women in physics. Instead of trying to change women's preference for future careers, we should change ourselves. We should think of new ways to make physics more appealing to female students. This has been the key to the success of other professions such as law and medicine in attracting larger numbers of women.

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Gates replies: Vicente Aboites poses an important question: Why should the physics community care about the number of women in its ranks? Or the number of minorities for that matter? The most compelling reason is because we want to create and work within a system that is fair and unbiased, a system that identifies, encourages, and supports the brightest and most motivated scientists and science students.

The difficulty is convincing some members of our community that we are not yet a pure meritocracy. Many male and female physicists believe that, as Kamyar Hazaveh states, "the playing field has been level for a while"—that they themselves, and their colleagues, are completely gender neutral in all of their scientific interactions with colleagues and students. Unfortunately, this is not true for any of us. Physicists are human and we are subject to the cultural and social influences that pervade society.

The evidence that gender inequalities in science continue is presented in the references of my original piece, and in the more recent report, *Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering* (National Academies Press, 2006). I strongly recommend this report to all the letter writers and anyone else interested in this issue. The report's authors do an excellent job of presenting and summarizing, in far more detail than is possible here, statistics on women in science and engineering, current data on gender biases in academia, and institutions' structural obstacles that impede the progress of women and minorities. The authors also offer specific recommendations for addressing the inequities.

Jerry and Wei Smith would like to believe that these gender biases do not exist—an attitude that is not supported by the data.

The data also do not support Joseph Spicatum's hypothesis that the low percentage of women in physics can be explained by a combination of gender differences in ability and interest. His first point, that the gender imbalance is due to a difference in mathematical ability at the very high end, has two problems. The ratio of 13:1 he quotes arises from studies done in the early 1980s.[1] If that ratio reflects an innate difference between males and females at the highest end of the mathematical-ability spectrum, it should remain constant over time. It has not. This same study has been repeated by researchers at the Johns Hopkins University several times since 1983. The ratio decreased to 5.7:1 in 1994 and to 4:1 in 1997; and the most recent data from the Johns Hopkins group show a 3:1 ratio.[2] Obviously, one should be careful in interpreting these results. Perhaps we should wait until the data have stopped moving before drawing strong conclusions from them. Second, mathematical genius as defined by high math scores is not a prerequisite for success in science and engineering. Fewer than one-third of college-educated professional men employed in science and engineering have SAT math scores above 650.[3]

Spicatum's second argument is that women, even those with high math ability, are less interested in physics. If this is true, we need to ask why. Physics is a broad and fascinating field, from cosmology to nanotechnology to medical physics. The low number of women in undergraduate physics programs (23%) cannot be explained by some purported innate lack of interest in the physical sciences and math; chemistry undergraduates are nearly 50% female, and chemistry is inherently no more "feminine" in its subject matter or work environment than physics. Women also earn close to 50% of undergraduate degrees in mathematics, so interest in math seems to be independent of gender. (Data from the American Institute of Physics Statistical Research Center are available at http://www.aip.org/statistics.)

The field of computer science may hold some interesting lessons that we can apply to our own field. For example, an article in the 18 December 2005 issue of the *Boston Globe* explored the dramatic drop in the number of young women studying computer science and questioned why women were "shunning a field once seen as welcoming." The percentage of bachelor's degrees in computer science awarded to women rose to a high of 37% in the mid-1980s before declining to about 27%—and lower at research institutions—by 1998. Innate differences in interest do not change over such short time periods; however, the culture within computer science experienced dramatic changes during that period as huge numbers of students flocking into the rapidly growing field strained departmental resources.