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The Science on Women and Science

Amy L. R. Bug

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Inequity certain, cause disputed

The Science on Women and Science

Edited by
Christina Hoff Sommers
 AEI Press, Washington, DC, 2009.
 \$20.00 paper (330 pp.).
 ISBN 978-0-8447-4281-6

Reviewed by Amy L. R. Bug

Scientific information often collides with ideology in the area of sex-differences research. Many people agree on a host of quantifiable differences between the sexes, but intense debate surrounds which, if any, are relevant to the scarcity, the slow academic-career progress, and the “second-classness” of women in science. If you enjoy multidisciplinary and emotive scientific debates—which are rare in physics—then *The Science on Women and Science*, edited by Christina Hoff Sommers, will be of interest to you.

Also rare in physics is a single-topic volume whose editor doesn't agree with all the authors. *The Science on Women and Science* grew out of a conference sponsored by the politically conservative American Enterprise Institute as a reaction to findings reflected in the National Academies' 2007 report titled *Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering*. The report minimizes the role of biology and ventures that the root causes of gender bias in science are psychosocial and can be fully addressed by educational and workplace reforms. Those findings, as well as actions such as the efforts to enforce Title IX—the US law that prevents gender-based discrimination in educational programs—are generally inconsistent with fundamental, socioeconomic beliefs held by scholars who are for the free market and against government regulation. This book's bent is to

Amy Bug is a professor in the department of physics and astronomy at Swarthmore College in Pennsylvania. She conducts research in computational condensed-matter physics, teaches across the physics curriculum, and has taught a course called Gender and Physical Science.

“attribute the gender disparity to characteristic gender preferences grounded in biological differences,” says Sommers in the introduction.

For example, David Geary (chapter 7) claims that males have an evolutionary advantage both in spatial cognition and mathematical reasoning. But wait: Elizabeth Spelke and Katherine Ellison (chapter 2) counter that core systems for math emerge in human infants and in “no case have male infants or children been found to have a general advantage over females in any of these core domains.” But in older children they do, says Richard Haier (chapter 8), for there are “more boys than girls in the extraordinary range” of the SAT math test. However, chime in Jerre Levy and Doreen Kimura (chapter 9), some crucial abilities (reasoning) in mathematics favor males, while others (computation) favor females. Depending on your views on gender and science, a given chapter will offer either an infuriating refutation or a delightful confirmation. The mixture of evidence in this book might even change your mind . . . but probably not, speculates Joshua Aronson (chapter 5).

And so the debate continues: Simon Baron-Cohen (chapter 1) argues that thanks to “liberal and fair-minded” professors, academic misogyny is a thing of the past, but men dominate science because they tend to be natural “systemizers,” whereas women tend to be “empathizers.” In his chapter, Aronson discusses the stereotype-threat theory, which posits that negative stereotypes contribute to a particular group's poor performance. By not overinterpreting those findings, he goes a good way toward deflecting criticism in the following chapter, in which Amy Wax challenges his handling of stereotype-threat data and the degree to which they explain the gender gap in scientific achievement. Charles Murray's conclusion (chapter 10) goes where angels fear to tread and violates Sommers's dictum that comparing sexual brain dimorphism research with its racial analogue is inappropriate. If you want to read a view that compares the resignation of

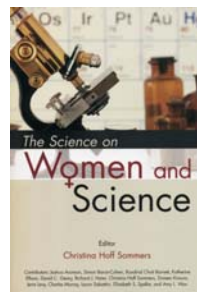
Lawrence Summers from Harvard University to the trial of Galileo, you will enjoy Murray's concluding chapter.

The political becomes personal for me in chapter 4, in which Sommers attacks both my alma mater, MIT, and the NSF ADVANCE program, which supports projects to enhance the participation of women in science and engineering. The gender reforms championed by MIT dean of

science Robert Birgeneau in the late 1990s clearly did not diminish the university's scientific reputation or power. And I've seen firsthand the resulting scientific progress and development of human capital from just one ADVANCE award, which benefited more than four dozen senior chemists and physicists. Another gripe with the book concerns a couple of simplistic graphs that are meant to be illustrative but are instead misleading because they either improperly characterize the data that are being discussed or conflict with the author's statements in the text.

Do these 10 chapters give a balanced representation of our current state of knowledge? It's a tough question and requires evenhanded searching of the extensive literature. *Why Aren't More Women in Science? Top Researchers Debate the Evidence* (American Psychological Association, 2006), edited by Stephen Ceci and Wendy Williams, may have achieved that remarkable balance. Also, mainstream views that question the significance and immutability of brain-based sex differences are not well represented in *The Science on Women and Science*. For those views, curious readers might want to peruse, for example, the forthcoming book on that subject by Rebecca Jordan-Young of Barnard College or works by Janet Hyde at the University of Wisconsin–Madison or Anne Fausto-Sterling of Brown University.

Though falling short of the synthetic excellence of Ceci and Williams's work, *The Science on Women and Science* is rich in data, descriptions of real-world reform efforts, and essays by acknowledged experts. However, a few otherwise strong chapters are weakened by



polemics. Scholars, whether on the right or the left of the political spectrum, do not serve their cause by preaching a loosely reasoned sermon to the choir. Although choir members will receive it with enthusiasm, guests in the congregation may not.

The Stability of Matter in Quantum Mechanics

Elliott H. Lieb and Robert Seiringer
Cambridge U. Press, New York, 2010. \$50.00 (293 pp.). ISBN 978-0-521-19118-0

Why is the matter around us stable? By “stability” I am not simply referring to the absolute limit on the amount of energy of an atom; every student who has taken a quantum mechanics course has solved the fundamental example of atomic hydrogen. Rather, I mean stability that makes the amount of energy proportional to the number of atomic particles and leads to the fact that two liters of fuel contain twice as much energy as one liter.

The stability of matter should primarily be an outcome of nonrelativistic quantum mechanics, since nuclear forces, radiative terms, and other non-Coulomb interactions contribute only tiny corrections to the binding energies of atoms and molecules. Quantum mechanics—given an appropriate formalism of the uncertainty principle—prevents an electron from falling into the nucleus. In addition, the distinction between fermions and bosons becomes important for systems with large numbers of particles. We now know that the binding energy would increase too rapidly with the number of negatively charged bosons and therefore violate the required energy bound, rendering bosons unsuitable for ordinary matter.

The rigorous proof showing that nonrelativistic quantum mechanics predicts stability of matter is a highlight of the application of modern mathematics to fundamental problems in physics. With their outstanding book, *The Stability of Matter in Quantum Mechanics*, mathematical physicists Elliott Lieb and Robert Seiringer provide a complete, self-contained summary of five decades of research, primarily by Lieb and his collaborators, into the stability

of matter in various physical situations. Both authors are leaders in that domain.

Going beyond the stability problem in nonrelativistic quantum mechanics, the authors also model the corresponding quantum mechanical systems with relativistic kinematics. Although only toy models, they are frequently used for calculations of atomic and molecular energies. In relativistic quantum mechanics, a new feature occurs: The product of the charge of the nucleus and the fine structure constant must be bounded to ensure the finiteness of the energy. The stability of large systems also implies a bound on the fine structure constant, which characterizes the strength of the electromagnetic interaction. The authors also take into account gravitational interactions, in which can be seen an even more spectacular result: Stars collapse under gravity, and their critical mass—above which they become unstable—depends on the gravitational constant.

The discussions of those and other topics make the book a rich source for research into related fields. However, *The Stability of Matter in Quantum Mechanics* is also for students of mathematics and physics, not just for researchers. Since deep and beautiful mathematical techniques and results are needed, the required mathematical level is certainly high. But students should not be discouraged because the book’s pedagogical style carefully guides them through the physical concepts and relevant mathematics before putting all the pieces together. Students and teachers alike will enjoy a marvelous experience as they learn from *The Stability of Matter in Quantum Mechanics*.

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Crafting the Quantum

Arnold Sommerfeld and the Practice of Theory, 1890–1926

Suman Seth
MIT Press, Cambridge, MA, 2010.
\$32.00 (378 pp.).
ISBN 978-0-262-01373-4

Arnold Sommerfeld (1868–1951) was appointed to the chair for theoretical physics at the University of Munich in 1906; he was recommended by his colleague Wilhelm Röntgen to fill that

post, which had been vacant since Ludwig Boltzmann moved back to his native Vienna in 1893. In the first quarter of the 20th century, Sommerfeld corresponded with the leading physicists of the day, including Max Planck, Woldemar Voigt, and Albert Einstein. He also corresponded with the younger contemporary mathematical physicists, as theoretical physicists were then usually called, including Max Born, Niels Bohr, and Erwin Schrödinger.

In writing *Crafting the Quantum: Arnold Sommerfeld and the Practice of Theory, 1890–1926*, Suman Seth has mined those correspondences extensively. A historian of 19th- and 20th-century physical science at Cornell University, Seth traces Sommerfeld’s roots in applied mathematics, which led to his rise in theoretical physics. After completing his dissertation under mathematician Ferdinand von Lindemann at Albertina University in Königsberg, East Prussia, Sommerfeld carried out his postdoctoral work as a member of the entourage of mathematicians David Hilbert and Felix Klein at the University of Göttingen; he collaborated with Klein on the four-volume, 966-page applied-mechanics treatise *Über die Theorie des Kreisels* (*On the Theory of the Gyroscope*).

Sommerfeld’s other early publications were on hydrodynamics and the theory of lubrication, wireless telegraphy, and oscillations in coupled AC circuits; one paper was entitled “Zur Theorie der Eisenbahnbremsen” (“On the Theory of Brakes on Railroad Cars”). He also taught applied mathematics to engineers at postsecondary technical institutions in western Germany before he was called to chair the Munich theoretical physics department. Too old to be drafted during World War I, Sommerfeld worked on problems of radio telegraphy and ballistics for the Kaiser Wilhelm Foundation for War Technology and Science (which disappeared after World War I). Indeed, the path of Sommerfeld’s career showcases the close link between pure and applied physics.

Seth argues that advances in theoretical physics are characterized by two contrasting approaches: applying general laws and principles to physical phenomena, as Einstein did with relativity and Planck did with thermodynamics, and using experiments,

