A Classic Continued Up to the Present

Georgina M. Montgomery

As the old adage goes, well-behaved women don’t make history. This saying certainly holds true for the small number of “clever, astute, hardworking, and determined” women who harnessed their individual and collective frustration about pervasive prejudice in the sciences to demand recruitment, recognition, representation, and promotion of women scientists. In *Women Scientists in America: Forging a New World Since 1972*, Margaret Rossiter guides us from the “rather quiet, mundane, even ladylike” emergence of female researchers’ first interest groups to the direct confrontations they would take on in pursuit of equity in the sciences.

Rossiter (a historian of science at Cornell University) introduces dozens of women whose activism evokes a sense of admiration. Mary Gray, a founding member of the Association for Women in Mathematics, emerged as the voice of math anxiety. Margaret Rossiter, a biochemist at the University of Pittsburgh, described how she established opportunities for women in science, particularly in universities, through lawsuits made possible in the United States by the Equal Employment Act of 1972. Specific cases of discrimination in professional associations and universities combined with status-of-women reports by women don’t make history. This saying certainly holds true for the small number of “clever, astute, hardworking, and determined” women who harnessed their individual and collective frustration about pervasive prejudice in the sciences to demand recruitment, recognition, representation, and promotion of women scientists. In *Women Scientists in America: Forging a New World Since 1972*, Margaret Rossiter guides us from the “rather quiet, mundane, even ladylike” emergence of female researchers’ first interest groups to the direct confrontations they would take on in pursuit of equity in the sciences.

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Rossiter sketches the biographies of women scientists who fought prejudice in the sciences, and particularly in universities, through lawsuits made possible in the United States by the Equal Employment Opportunity Act of 1972. Specific cases of discrimination combined with status-of-women reports by professional associations and universities demonstrated widespread inequality in the hiring and promoting of women and minorities. Individuals such as Sharon L. Johnson, a biochemist at the University of Pittsburgh Medical School, and Shyamala Rajender, a chemist and instructor at the University of Minnesota, took on their respective institutions in the courts. Such actions were important as these women fought “for themselves, for their ‘class’ of fellow female academicians … for colleagues in their fields across the nation, and for future women scientists.” All too often their own careers were derailed even as they established opportunities for others.

At the same time, multiple local programs began to warm the “chilly climate” that had greeted older women scientists at the start of their careers and had far too frequently persisted well beyond tenure. Between 1970 and 1980, the annual number of U.S. female undergraduates attaining bachelor’s degrees in the sciences increased from 80,000 to 200,000. Engineering schools hired consultants to create mechanisms for mentoring their growing numbers of female undergraduates, as issues of equity emerged in laboratories and other facilities and led to retention problems. Male-only schools responded by going co-ed. It quickly became apparent that it was essential to create programs to offset circumstances that the first arrivals at Princeton University, for example, described as lonely and isolating.

In the last decades of the 20th century, as numbers increased in some but not all fields, recruiting became a priority. Powered by “the largely volunteer zeal of thousands of individuals,” a range of programs showed girls the new opportunities emerging for women in science, technology, engineering, and mathematics (STEM) fields. The Women and Mathematics initiative, started in 1974, involved college educators visiting secondary schools. A year later, with modest corporate funding thanks to a proposal written by Gray, speakers targeted tenth-grade girls in order to help them acquire the requisite skills for advanced work in science and engineering. Many of the feminist mathematicians became self-appointed “watchdogs” who spoke out when girls’ apparent “underperformance” in mathematics was identified as genetic rather than the result of such factors as math anxiety.

During the 1980s, data revealed that the growing numbers of female science undergraduates had not led to proportionate increases in career opportunities in academia or corporations. Looking around at their departments and professional associations, individuals and groups “created a recurring drumbeat, Why so few?” Individuals responded to this sense of isolation by seeking mentors and forming support groups. A group of San Francisco Bay Area women scientists, for example, gathered biweekly to exchange experiences and advice, ultimately sharing their approach to collective mentoring at the 1994 meeting of the American Society for Cell Biology.

As the 20th century drew to a close, the responsibility of making STEM disciplines more inclusive increasingly fell on university administrators. A 1999 Massachusetts Insti-
tute of Technology report (3) revealed that tenured women scientists had “been treated unequally for years. … At the peak of their careers they were isolated, powerless, and almost invisible.” In response, President Bill Clinton invited Nancy Hopkins (a molecular biologist at MIT who led the report) to speak at the 1999 celebration of Equal Pay Day. Hopkins soon was touring the country, electrifying fellow female scientists and opening the eyes of some skeptical males.

Like Hopkins’s talks, Women Scientists in America: Forging a New World Since 1972 may send readers on an emotional journey. Rossiter’s extraordinarily detailed account offers compelling data alongside the multiple stories of individual women, both those thwarted by discrimination and those who emerged as outstanding success stories. The inequities are all too evident and persistent, this book should be read by skeptics who don’t believe that there is persisting prejudice. It also provides inspiration and ideas for those who relish the stories of women who now deservedly do make history.

References

HISTORY AND PHILOSOPHY OF SCIENCE

A Revolution of Its Own

Daryn Lehoux1 and Jay Foster2

No one can deny that science has been successful, but why has science been so successful? Surely it’s not an accident, not just a long run of good luck. The reason why, or so most of us learn from our science classes and textbooks, is that the sciences have a distinctive method. In The Structure of Scientific Revolutions (1),

1Department of Classics, Queen’s University, Kingston, ON K7L 3N6, Canada. E-mail: lehoux@queensu.ca. 2Department of Philosophy, Memorial University of Newfoundland, St. John’s, NF A1C 5S7, Canada. E-mail: jfoster@mun.ca

The patchiness of scientific practice. Apparatus for producing Bose-Einstein condensate.

Thomas Kuhn argued that the sciences do not share anything quite so rigorous as a method. The success of science, he argued, is a consequence of a more general structure of scientific inquiry.

Since Structure was first published in 1962, it has sold over one million copies and has been translated into 16 languages. This book is the rarest of things, an academic bestseller. Pick any list of the top 100 most influential books of the 20th century—or even the most influential books of all time—and it’s very probable that Structure will appear on that list. Philosopher of science Ian Hacking, who introduces this 50th-anniversary edition of the book, tells us: ‘‘Great books are rare. This one. Read it and you will see.’’ He is right on the mark.

What made Kuhn’s view of science so different and so attractive? Before Kuhn, philosophers had been focused on trying to state what the scientific method should be. But he suggested that we should pay attention to how science is done—how scientists actually work—rather than to how philosophers think it ought to work. If you want to know how science is carried out, then in one way or another, you are going to have to look at the history of science. It’s this history that shows us how the sciences work in action.

The opening line of Structure is thus a powerfully subversive statement: ‘‘History, if viewed as a repository for more than anecdote or chronology, could produce a decisive transformation in the image of science by which we are now possessed.’’ If you want to understand the sciences, says Kuhn, examine how scientists work and how their work has changed over time. Over the past half-century, this approach to studying the sciences has given us a radically different perspective on scientific practice and progress.

Most accounts of scientific method describe it as being empirical and logical. Past this very superficial consensus, there is often little agreement. Different scientists working in different scientific disciplines will likely disagree about anything more specific. To answer more specific questions, many still lean heavily on the ideas of Karl Popper (who, Hacking observes, was ‘‘[b]efore Kuhn … the most influential philosopher of science— … the most widely read, and to some extent believed, by practicing scientists’’). Popper’s familiar view, very roughly, is that scientists should formulate empirically falsifiable hypotheses, devise empirical tests for the hypotheses, and then conduct these tests (2). If, in any instance, the empirical test fails, then logic demands that the hypothesis must be rejected. This method, usually simply called falsification, has its roots in deductive logic, specifically the modus tollens (literally, ‘‘the mode that denies by destroying’’).

Despite all of its merits, the Popperian method isn’t entirely satisfying. It leaves even the best scientific hypotheses with the status of being not so much true as ‘‘not yet falsified’’ or, at the very best, ‘‘approximately true.’’ Even Popper’s famous detractor, Carl Hempel, agreed that science did not attain truth but only ‘‘high probability’’ (3). Surely our most-established scientific ideas—for example, that a hydrogen atom has one electron and one proton—are something more than approxi-