*A Chemical Passion*, Marelene Rayner-Canham and Geoff Rayner-Canham, UCL Institute of Education Press, London, 2017, 251+xxiv pp, ISBN 978-1-78277-1883, £26.99.

In the early twenty-first century, many forward-thinking institutions and individuals still struggle with discouragingly familiar patterns of underrepresentation and lack of diversity in their fields. The physical sciences in general, including chemistry and chemical engineering, continue to see large gender gaps especially in advanced degrees and professional positions.

The relatively low participation of women in these fields is certainly not a new phenomenon. Marelene and Geoff Rayner-Canham have long focused their attention on documenting the careers of women in chemistry, particularly in Britain. They have described in numerous books and articles—including one in this issue of this journal—both women's achievements and the barriers they faced. Their most recent book, *A Chemical Passion*, examines chemistry education for girls, particularly in England, in the second half of the nineteenth century and the first decades of the twentieth.

Their sources, primarily the in-house magazines of many independent girls' schools across England and their institutional archives, tell of and show girls actively learning chemistry from dedicated teachers (many of them women) in settings adapted to or built for the purpose. These sources, the authors assert, "have completely overturned the almost universally held view that chemistry was not for girls" (p xxi). Their story intersects larger trends of education for middle-class girls and women in Britain, debates in the philosophy of teaching chemistry in general and to girls in particular, and larger societal changes in roles of and opportunities for women during the period. Thus the book is of interest to scholars and readers in education, chemistry, and gender in the time and place the Rayner-Canhams treat.

The book begins in the middle of the nineteenth century with reforms in girls' education in England, including a greater emphasis on academic subjects and away from accomplishments in music and needlework. Chapter 1 treats government reports and changing social attitudes on the education of girls. It also describes a network of independent schools, the Girls' Public Day School Company (founded in 1872), to fund academic schools affordable for girls of middle-class families.

Chapter 2 takes a step back in time to the earliest chemistry education for girls in England. *Conversations on Chemistry*, by Jane Marcet, was ostensibly intended to teach girls about chemistry, albeit not in a scholastic setting. The earliest English schools that taught chemistry to girls were Quaker schools such as the Newington Academy for Girls and the Mount School, York, both of which taught chemistry before the middle of the nineteenth century.

Chapter 3 focuses on two schools that were models for the new academic girls' schools of the late nineteenth century. One, the North London Collegiate School for Ladies, was a day school; the other, Cheltenham Ladies' College, a boarding school. Their headmistresses for long periods of the later nineteenth century, Frances Buss and Dorothea Beale respectively, were highly influential in girls' education.

How chemistry was to be taught to girls is the subject of Chapter 4. As an academic subject and as a practical one for university or medical studies (pursued by a small but growing number of young women), chemistry as taught to girls was not different from chemistry as taught to boys. The debates in pedagogy, such as the virtues or deficiencies of Henry Armstrong's "heuristic" method, were current during this period throughout British chemistry education. But it was not taken for granted throughout the period that chemistry as an academic subject was suitable for girls: some advocated for chemistry as applied to the domestic spheres of cooking and cleaning. Most of the women who taught science to girls rejected domestic science and particularly domestic chemistry, and they successfully beat it back.

Who *were* these women who taught chemistry to girls? They and the institutions that educated them are the main subject of Chapter 5. Additional biographical information of additional pioneering women chemistry teachers is available in an online appendix (1). For the most part, the people who taught chemistry to girls were women, except for the very earliest classes. Many of these teachers were educated at women's colleges or teacher training schools.

Chapter 6 treats "practical" chemistry, and in particular on the laboratories in which chemical skills were practiced and taught. Often the spaces for practical work in chemistry were makeshift, sometimes attics or basements. Later, purpose-built labs were constructed, sometimes to provide an education in chemistry as good as the boys' schools and sometimes to keep up with the best girls' schools. Articles in school magazines that proudly described their institution's labs indicated a mistaken belief that such facilities were unique or rare in girls' schools.

The next two chapters focus on extracurricular activities related to chemistry: chemistry and science clubs (Chapter 7) and stories and poems about chemistry written by students (Chapter 8). Club activities included presentations by students, presentations by professionals to students, and field trips to industrial sites. Many excerpts from chemistry-themed poems and short stories are given in Chapter 8 (as well as a few in Chapter 3 from the "model schools"). These writings and occasionally drawings were typically published in school magazines. They illustrate students' enthusiasm for the subject as well as a playfulness often manifested in abysmal puns.

Having delineated the state of chemistry education in independent girls' schools in England from its beginnings through its apogee shortly after World War I, the authors briefly survey the subject in the rest of Great Britain. Chapter 9 describes some examples in Wales and Chapter 10 in Scotland. In both countries, the authors focus on a small number of schools, pointing out interesting similarities and differences compared to what they found in England and refraining from drawing general conclusions from more limited material.

What did British women do with the chemistry education they acquired as girls? Chapter 11 presents examples of women who worked in industrial and academic chemistry, in biochemistry, in medicine, and in pharmacy. (The online appendices contain additional biographical information on these women as well.) Not surprisingly, such positions were not plentiful. During World War I, however, they became comparatively more numerous.

The twelfth and final chapter describes "the end of an era" for girls' education in chemistry in the 1930s. The authors quote from an influential report in this respect, the 1923 Hadlow report on "whether greater differentiation is desirable in the curriculum for boys and girls respectively in Secondary Schools?" (p 209). This committee put great faith in scientific evidence that girls were physically weaker than boys. It even asserted that women were mentally inferior, noting that "in science, very few women have attained to the first rank" (p 211)! Societal expectations changed and career opportunities for women in science declined during the interwar years. Gradually, chemistry fell out of the curriculum and then out of the memory of many of the schools that had taught it.

This last chapter is the only one which left me disappointed: I would have liked the authors to draw some more general warnings or conclusions from this chapter on retrogression in the role of women in science. The lesson seems so clear to me that the clock can be turned back, and I would have liked the authors to say so. I am not sure, however, that such criticism is warranted. After all, the authors provide in the final chapter as in all of the preceding ones, an engaging and thoroughly documented narrative. The book as a whole, including the last chapter, gives its readers a well-grounded basis to draw their own conclusions.

## Reference

1. M. Rayner-Canham and G. Rayner-Canham, *A Chemical Passion*, appendices; http://www.ucl-ioe-press.com/ioe-content/uploads/2017/02/A-Chemical-Passion_Appendices.pdf (accessed Nov. 4, 2017).

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