INTRODUCING THE BOOK

BACKGROUND TO THE DEVELOPMENT OF THIS BOOK

Research in elementary and secondary school science shows that male and female students have similar interests and motivation, albeit, with those males interested in science tending to prefer physical sciences and females biological sciences. However, at the university level, gender differences appear when examining the intended majors of all first-year US college students: 15.1% of women and 29.3% men plan to major in engineering, and in the physical sciences 2.0% of women and 2.8% of men plan to major in the physical sciences (Hill, Corbett, & St. Rose, 2010). Gender differences continue throughout university as evidenced by the percentage of US undergraduate women graduating with various majors: women graduate with only 20.5% of the physics majors and 19.5% of the engineering majors in the US in 2006 (Hill et al., 2010). Women in 2006 were the majority (51.8%) of majors in undergraduate chemistry (Hill et al., 2010); in 2007, US colleges and universities enrolled 57.2% women overall (National Center for Educational Statistics, 2009). Doctoral degrees are awarded in the physical sciences to males and females in the US at a rate of 2.6 to 1, respectively (Chapter 1, in this volume, Chiu & Wang). Clearly much female academic potential is lost to science.

Not surprisingly, these gender differences have a long history. Female scientists and their contributions have long been downplayed and in some cases even ignored by both western and eastern science traditions. Female students, for a great part of history, were not considered of suitable constitution to be permitted even to study the sciences. Once this barrier began to come down, women who were passionate about the sciences found themselves delegated to the role of assistant to male mentors and teachers who were considered the true scientists. This underrepresentation and imbalance has left an incomplete picture of how the history of science and scientific discoveries should be portrayed. This book hopes to begin to rectify this perception.

Marie Curie’s receipt of her second Nobel Prize for her independent work in chemistry stands as a watershed moment in the history of science. Marie Curie has inspired many girls and women to study and pursue careers in science—and not just because she was a female scientist but also because she broke the rule that said women could not “do” good science. Having experienced firsthand the discrimination and obstacles that women encounter on the path to scientific careers, Marie Curie established the first Radium Institute (Institut du Radium, now the Institut Curie) in Paris in 1909 and also initiated the Radium Institute in Poland in 1923 during the celebration of the 25th anniversary of the discovery of radium. These institutes supported both female and male students in their pursuit of science education and science-related careers. Despite Marie Curie, along with a few other female scientists, being sparsely sprinkled throughout contemporary science.
textbooks and historical accounts, the manner in which the abilities and accomplishments of female scientists are portrayed differs from how these same elements are portrayed for male scientists. When mentioned, the female scientist is too often characterized as hard working and as achieving her results solely because of the sheer number of repeated trials she made, while male scientists are credited with being creative thinkers and systematic researchers. We hope this work will challenge these stereotypes and demonstrate that female scientists’ brilliance and creativity have advanced our understanding in a number of science domains.

In December 2008, the United Nations declared 2011 as the International Year of Chemistry (IYC) and placed the International Union of Pure and Applied Chemistry (IUPAC) and the United Nations Educational, Scientific, and Cultural Organization (UNESCO) at the helm of the event. The IYC-2011 aims to increase the public’s appreciation of chemistry, encourage young people’s interest in chemistry, generate enthusiasm for the creative future of chemistry, enhance international cooperation on information sources for activities in chemistry, and emphasize the importance of chemistry in sustaining natural resources throughout the world (IYC-2011, 2011). Marie Curie seemed a most fitting model for the book because 2011 marked the 100th anniversary of her Nobel Prize in Chemistry.

THREE BOOK SECTIONS AND CHAPTERS

This book is a companion to the IYC-2011 celebration. The eleven chapters are organized into three sections: Section 1: Marie Curie’s Impact on Science and Society, Section 2: Women Chemists in the Past Two Centuries, and Section 3: Policy Implications.

The authors invited to contribute to this book were asked to orient their chapter around a particular aspect of Marie Curie’s life such as the ethical aspects of her research, women’s role in research or her influence on the image of chemists. As a consequence we have 11 very different chapters celebrating Marie Curie’s life but, almost by necessity, there is overlap between chapters when referring to the same historical events. As editors, the authors had freedom to write as they wished and we did not attempt to prevent this overlap.

Section 1: Marie Curie’s Impact on Science and Society

In the first section, Marie Curie’s Impact on Science and Society, all four chapters shed light on Marie Curie’s life and discuss the impact of her research from a number of different perspectives. Chapter 1 concerns Marie Curie and science education, co-authored by Chiu and Wang. Their chapter draws upon the critical events of Marie Curie’s life describing her creative contributions to both research and her role in inspiring young women to pursue science careers. Chiu and Wang highlight Marie and Pierre Curie’s gift to the world of giving up their patent rights associated with the production of radium. This unselfish decision to abandon the patent rights captured the world’s attention and was received with high respect across the globe. The entire Curie family is unique and holds a special place in the
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history of science. However, the topic of Marie Curie as science educator or as subject of textbooks might offer an innovative angle for the Centennial. In Chapter 2, Gilmer provides insightful perspectives on Irène Joliot-Curie, the daughter of Nobel laureates in Physics—Marie and Pierre Curie, and of Nobel laureate in Chemistry—Marie Curie. In 1935 Irène also received the Nobel Prize in Chemistry, 24 years after her mother, and jointly with her husband, Frédéric Joliot-Curie. In this chapter, Gilmer describes Irène’s personal life, her scientific achievement, and also her political involvements during her life. From her earliest days, Irène’s parents and parental grandfather influenced her learning of science and her scientific orientation. In Chapter 3, Des Jardins elaborates on the visits of Madame Curie to the United States, via the help of Marie Mattingly Meloney (known as Missy Meloney). The public relations blitz surrounding Marie’s visit to America influenced both men and women’s perceptions of women scientists, even to this day. In the public relations surrounding her trip, Marie was painted in domestic terms whose science was maternally motivated to help rid the world of cancer. The ultimate paradox for a woman is she needs to look maternal, but then she looks incompetent in science—which Des Jardins dubs ‘the Marie Curie complex’. In Chapter 4, Catherine Milne delves into the ethics related to Marie Curie’s research findings, the role that ethics play in scientific research and the existing ideologies that frame ethics associated with the practice and outcomes of scientific research. Of particular importance was Curie’s desire, by not taking out patents, to ensure the longevity of research associated with the chemistry, physics, and biomedical applications of radium. With this decision, Curie’s research provides a context for considering the nature and role of ethics in scientific and chemical research.

Section 2: Women Chemists in the Past Two Centuries

The second section with four chapters takes readers on a journey through the life and times of significant female scientists. The first two chapters in this section attend more to the scientific work of women scientists while the second two chapters deal more with the influence on public education by women scientists and science educators. In Chapter 5, Ogilvie draws our attention to the barriers to women’s success in science, barriers that continued throughout the 19th and early 20th centuries. Ogilvie claimed that two strategies existed that were accepted by male scientists and were normally used by women scientists who hoped to pursue a scientific career. The first strategy was to become involved in those scientific fields—so-called women’s work—that men did not care to pursue—such as radioactivity. The second strategy was for women to collaborate with a spouse in order to enter the sciences. However, in the latter case, women scientists' contributions have been difficult or even impossible to ascertain and is contentious. In Chapter 6, Mamlok-Naaman, Blonder, and Dori examine the work of five women scientists (four with Nobel Prizes in Chemistry, with the fifth famous for developing a medical drug) and highlight their roles in changing the face of science over the last 100 years. They propose women could create social networking
groups in order to assist themselves with becoming accepted into the science community and forming an outlet for collaboration and informal mentorship. In Chapter 7, Gilbert focuses on the role of women chemists in the evolution of public education about chemistry and describes the nature of the contributions made by prominent women chemists and Nobel laureates in Chemistry—Marie Curie, Irène Joliot-Curie, and Dorothy Crowfoot Hodgkin—to ‘chemistry and the public’. Gilbert claims that the importance of equity demands that an access to careers in chemistry be gender-neutral. However, for women, the challenge is to draw a balance between the commitments of home and research as well as working in a male-dominated environment. Gilbert points out that avenues of promoting ‘green chemistry’ should attract positive engagement and awareness by a public that includes both women and men. Finally in Chapter 8, Palmer discusses some of the reasons why women scientists and science authors have been generally overlooked and provides a detailed account of the productivity and influences of an early, largely unrecognized science textbook author, Mary Amelia Swift. Palmer points out that Swift’s work should be given more recognition than it is in current biographies because of her books’ usefulness and popularity for younger children in understanding science.

Section 3: Policy Implications

The third and final section with three chapters examines how policies influence female students to enter the field of science. In Chapter 9, Husseinius and Scantlebury discuss how images of chemists have changed very slowly over time. They present a wide range of perceptions of chemists from witches, alchemists, poisoners, to scientists that showed an evolutionary path gradually moving toward a positive image of chemists/scientists. However, the images of chemists/scientists are still dominated by men, including the images and text in school chemistry books. Also, studies on students’ attitudes towards chemistry reveal significant differences in liking chemistry, with males preferring to study chemistry more often than females. Needless to say, this phenomenon is universal. In Chapter 10, Pnina Abir-Am raises the issue of how scientific societies often fail—intentionally or unintentionally—to celebrate women scientists’ accomplishments, particularly in this year of the centennial of Marie Curie’s Nobel Prize in Chemistry. Abir-Am points out that in the history of science, scientists and scholars often refer to the scientific work of Marie Curie with feminine qualities rather than her scientific accomplishments. In this manner, Marie Curie and other women scientists and their female topics are relegated to the margins of both science and its commemorative practices. Finally in Chapter 11, Southerland and Bahbah comment that while women have made tremendous progress in terms of their participation in science over the past century, their continued underrepresentation in science, technology, engineering, and mathematics fields is still perplexing. They suggest that an accountability system (i.e., alignment of standards, assessment and professional development) might provide useful information to inform instruction for supporting females in becoming scientists. These three chapters frame a wide
scope of actions that we, as science educators, could take to change the trend and stereotypes of female scientists and provide more opportunities for females in scientific practice.

OUR GOALS FOR THIS BOOK

Our hope is that this book will positively influence young women’s minds and decisions they make in learning of chemistry/science like Marie Curie’s biography. But we do hope this book opens an avenue for young women to explore the possibility of being a scientist, or at least to appreciate chemistry as a human enterprise that has its merit in contributing to sustainability in our world. Also we hope that both men and women will realize that women are fully competent and capable of conducting creative and fascinating scientific research.

In sum, we thank all of the authors who contributed to this work and supported the celebration of the 100th Anniversary of Madame Marie Skłodowska Curie’s Nobel Prize in Chemistry. We would also like to express our appreciation to Sense Publishers who joined us in marketing this book during the International Year of Chemistry-2011. In particular, Mei-Hung Chiu wants to express her appreciation to Penny Gilmer and David Treagust who have been supportive to serve as co-editors of this book with her.

Finally, we hope this book ignites people’s interest in chemistry across the globe, and begins in some small way to validate the significant scientific sacrifices and contributions of women who prove science is indeed women’s work.

REFERENCES


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