Ten Women Who Changed Science and the World

By Catherine Whitlock, Ph.D., and Rhodri Evans, Ph.D. New York, Diversion Books, 2019. Pages: 288. ISBN 978-1-63576-610-3 (hardcover), ISBN 978-1682306277 (paperback), ISBN 978-1-63576-609-7 (ebook). Price: $26.99 (hardcover), $18.99 (paperback), $8.99 (ebook).

Reading about the childhood and later-life experiences of eminent scientists is always fascinating, allowing the reader to gain insight into the forces—including serendipity—that led to transformative accomplishments. Arguably, these influences may be particularly intriguing when the protagonists are women who ascended to the pinnacle of their profession despite systemic inequity.

Coauthored by an immunologist, Dr. Catherine Whitlock, and an astrophysicist, Dr. Rhodri Evans, *Ten Women Who Changed Science and the World* chronicles in telling detail the resistance that most, if not all, of the women scientists encountered in forging their career path. Although these extraordinary women shared the commonalities of brilliance, insatiable curiosity, resilience, and grit, their experiences differed to a certain extent. They came from assorted cultures and backgrounds, with their sagas representing American, Chinese, and diverse European vagaries. Some were blessed with parents and teachers who encouraged their professional pursuits, while others were dissuaded by these same authority figures. Only three of the women married and bore children. Tragically, a few of the protagonists endured religious persecution in addition to sex discrimination.

The book highlights the lives and careers of physicist and chemist Marie Curie (1867–1934), astronomer Henrietta Swan Leavitt (1868–1921), nutritionist Elsie Widdowson (1906–2000), biologist and environmental conservationist Rachel Carson (1907–1964), physicists Lise Meitner (1878–1968) and Chien-Shiung Wu (1912–1997), and chemists Dorothy Crowfoot Hodgkin (1910–1994) and Gertrude Elion (1918–1999). Two physicians, Drs. Virginia Apgar (1909–1974) and Rita Levi-Montalcini (1909–2012), complete the illustrious group of featured women.

Gertrude Elion, Rita Levi-Montalcini, Marie Curie, and Dorothy Hodgkin received international renown and recognition for their work when they were awarded the Nobel Prize in their respective disciplines. Not only was Marie Curie the first woman to be awarded the Nobel Prize, she also is the only person to win the Nobel Prize in two scientific fields (physics in 1903 and chemistry in 1911). However, other deserving women were robbed of that honor. Specifically, the brilliant efforts of nuclear physicist Dr. Lise Meitner, who codiscovered nuclear fission, were expunged from the record after she was exiled from Germany in 1938 because she was an Austrian Jew. Subsequently, her collaborator, Otto Hahn, received the 1944 Nobel Prize in Chemistry for their discovery, without mention of Meitner's involvement. Similarly, one of the finest experimental physicists of her generation, Chien-Shiung Wu, determined in an extremely complex experiment in 1956 that an accepted "law" of physics, the law of parity, was incorrect. The idea that left-spinning and right-spinning subatomic particles would behave identically was wrong. In an egregious oversight, when the Nobel Prize was awarded the following year for this major discovery, it went to the two male theoreticians who explained how parity may be violated.

Dr. Virginia Apgar is well known to anesthesiologists for her development of the Apgar score, an acronym that constituted the first clinical method to recognize the newborn's needs as a patient, which subsequently markedly improved neonatal survival rates. Apgar was an ebullient, charismatic, force of nature who not only revolutionized neonatology but also developed the nascent subspecialty of obstetric anesthesia. She observed that cyclopropane, commonly administered as a general anesthetic for Caesarean delivery, caused neonatal depression, and she determined that regional anesthesia provided superior maternal and newborn outcomes. Contrary to popular belief at the time, she recognized that neonatal acidosis and hypoxia were abnormal, and she emphasized the need for immediate and effective resuscitation of depressed babies with lung expansion rather than by administration of intragastric oxygen. Later in her career, Dr. Apgar joined the March of Dimes, focusing on prevention of birth defects, and advanced the emerging field of teratology.

Dr. Apgar, however, was not exempt from experiencing rampant sexism during her storied career. During her time as a surgical house officer at Columbia Presbyterian Hospital, she was mentored by the distinguished surgeon, Dr. Allen Whipple, who recognized her obvious intellect, work ethic, energy, and leadership potential. Whipple advised Apgar, despite her surgical skills, to transfer her specialty to anesthesiology if she hoped to be able to support herself; he feared that prevailing sex discrimination would prevent her from being successful in the competitive world of New York surgery. After completing residency training in anesthesiology, during which she was subjected to housing shortages for women, Dr. Apgar returned to Columbia in 1938 to become Director of the Division of Anesthesia and

 Anesthesiology 2022; 137:658–9. DOI: 10.1097/ALN.0000000000004322

gradually built a residency training program. In 1949, when she was passed over for the Chairmanship of the Division of Anesthesiology, Dr. Apgar pivoted once again and devoted her considerable abilities to neonatology and obstetric anesthesiology. The rest is history. (I would be remiss if I did not mention how disappointed I was when the coauthors referred, incorrectly, to Dr. Apgar as "one of the first prominent female obstetricians in the United States.")

The other physician profiled in *Ten Women Who Changed Science and the World*, Rita Levi-Montalcini, won the Nobel Prize for Physiology or Medicine in 1986 for her discovery in 1954 of nerve growth factor. We now know that nerve growth factor, which has an important role in neuroplasticity, has a wide repertoire, functioning as a key link between the nervous system, the endocrine system, and the immune system. Dr. Levi-Montalcini shared the award with Stanley Cohen, who discovered epidermal growth factor, which is now used routinely in wound healing for burns and in corneal transplantation.

Apparently, Levi-Montalcini had a redoubtable personality; yet even her formidable demeanor did not render her impervious to the horrific discrimination, based on religion and sex, that characterized fascist Italy during the 1930s and early 1940s. In 1938, Mussolini's government issued "Laws for the Defense of the Race" that forbade marriage between Aryans and other races and banned Jews from academia and many other professions. Since Levi-Montalcini could no longer be employed by Turin University, she relied on her steely determination and strength of character to establish her own home laboratory, where she secretly conducted the crucial experiments that laid the foundation for her discovery of nerve growth factor. Living a vibrant life until her death at 103 yr of age, Levi-Montalcini and her fraternal twin sister established, at age 83, a charitable foundation that funded hundreds of girls through their studies. The charity's website underscores the importance of giving girls the tools necessary to develop their full potential, emphasizing that the ramifications of this empowerment will have an advantageous effect on the economic, social, and cultural development of society as a whole.

Spatial constraints do not permit even a cursory summary of the eight remarkable nonphysician trailblazers included in this interesting and informative volume. I recommend *Ten Women Who Changed Science and the World* to readers who are interested in science, history, gender issues, and other societal phenomena. The book, which includes a helpful glossary and is accessible for those lacking scientific sophistication, may be especially enlightening and motivating for young girls who are considering a career in the sciences. Finally, I hope parents and educators will read these instructive stories and reflect on the importance of encouraging and enabling dreams, rather than crushing them. As William Butler Yeats wrote so affectingly in his beautiful poem titled "He Wishes for the Cloths of Heaven": "But I, being poor, have only my dreams; I have spread my dreams under your feet; Tread softly because you tread on my dreams."[1]

Kathryn Elizabeth McGoldrick, M.D., F.C.A.I. (Hon). New York Medical College, Valhalla, New York. kathryn_mcgoldrick@nymc.edu

Reference

1. Yeats WB: He wishes for the cloths of heaven, The Collected Poems of W.B. Yeats. Ware, Hertfordshire, UK, Wordsworth Editions, Ltd., 1994, p. 59

(Accepted for publication July 11, 2022. Published online first on August 2, 2022.)