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Women and Science, 1988

This selection from a history of European women shows how some women, especially the better educated, could participate in the scientific revolution of the seventeenth and eighteenth centuries. But Anderson and Zinsser also demonstrate how much of the scientific revolution endowed male prejudices with false scientific respectability. What factors seem to have enabled women to participate in the scientific revolution? In what ways was the scientific revolution a new bondage for women?

THINKING HISTORICALLY

What do the authors mean when they say that for women "there was no Scientific Revolution"? In what ways were women's lives different after the scientific revolution? In what ways were they the same? Were the differences caused by the scientific revolution?

Women Scientists

In the same way that women responded to and participated in Humanism,[1] so they were drawn to the intellectual movement known as the Scientific Revolution. The excitement of the new discoveries of the seventeenth and eighteenth centuries, in particular, inspired a few gifted women scientists to formulate their own theories about the natural world, to perform their own experiments, and to publish their findings. In contrast to those educated strictly and formally according to Humanist precepts, these women had little formal training, and chose for themselves what they read and studied. Rather than encouraging them, their families at best left them to their excitement with the wonders of the "Scientific Revolution"; at worst, parents criticized their daughters' absorption in such inappropriate, inelegant, and unfeminine endeavors.

All across Europe from the sixteenth to the eighteenth centuries these women found fascination in the natural sciences. They corresponded and studied with the male scientists of their day. They observed,

[1] A faith in the capacities of humans that reached religious dimensions in the sixteenth century. Renaissance humanism valued reason, classical culture and literature, and civic engagement. [Ed.]

Source: Bonnie S. Anderson and Judith P. Zinsser, *A History of Their Own: Women in Europe from Prehistory to the Present* (New York: Harper & Row, 1988) 2:87–89, 96–99.

and they formulated practical applications from their new knowledge of botany, horticulture, and chemistry. The Countess of Chinchon, wife of the Viceroy to Peru, brought quinine bark to Spain from Latin America because it had cured her malaria. Some noblewomen, like the German Anna of Saxony (1532–1582), found medical uses for the plants they studied. The most gifted of these early naturalists is remembered not as a scientist but as an artist. Maria Sibylla Merian (1647–1717) learned drawing and probably acquired her interest in plants and insects from her stepfather, a Flemish still-life artist. As a little girl she went with him into the fields to collect specimens. Though she married, bore two daughters, and ran a household, between 1679 and her death in 1717 she also managed to complete and have published six collections of engravings of European flowers and insects. These were more than artist's renderings. For example, her study of caterpillars was unique for the day. Unlike the still life done by her contemporaries, the drawings show the insect at every stage of development as observed from the specimens that she collected and nursed to maturity. She explained:

> From my youth I have been interested in insects, first I started with silkworms in my native Frankfurt-am-Main. After that . . . I started to collect all the caterpillars I could find to observe their changes.

Merian's enthusiasm, patience, and skill brought her to the attention of the director of the Amsterdam Botanical Gardens and other male collectors. When her daughter married and moved to the Dutch colony of Surinam, their support was important when she wanted to raise the money for a new scientific project. In 1699, at the age of fifty-two, Maria Sibylla Merian set off on what became a two-year expedition into the interior of South America. She collected, made notations and sketches. Only yellow fever finally forced her to return to Amsterdam in 1701. The resulting book of sixty engravings established her contemporary reputation as a naturalist.

Mathematics, astronomy, and studies of the universe also interested these self-taught women scientists. In 1566 in Paris Marie de Coste Blanche published *The Nature of the Sun and Earth*. Margaret Cavendish (1617–1673), the seventeenth-century Duchess of Newcastle, though haphazard in her approach to science, produced fourteen books on everything from natural history to atomic physics.

Even more exceptional in the eighteenth century was the French noblewoman and courtier, Emilie du Châtelet (1706–1749). She gained admission to the discussions of the foremost mathematicians and scientists of Paris, earned a reputation as a physicist and as an interpreter of the theories of Leibnitz and Newton. Emilie du Châtelet showed unusual intellectual abilities even as a child. By the age of ten she had read Cicero, studied mathematics and metaphysics. At twelve she could speak English, Italian, Spanish, and German and translated Greek and Latin texts like

Aristotle and Virgil. Presentation at court and life as a courtier changed none of her scientific interests and hardly modified her studious habits. She seemed to need no sleep, read incredibly fast, and was said to appear in public with ink stains on her fingers from her notetaking and writing. When she took up the study of Descartes, her father complained to her uncle: "I argued with her in vain; she would not understand that no great lord will marry a woman who is seen reading every day." Her mother despaired of a proper future for such a daughter who "flaunts her mind, and frightens away the suitors her other excesses have not driven off." It was her lover and lifelong friend, the Duke de Richelieu, who encouraged her to continue and to formalize her studies by hiring professors in mathematics and physics from the Sorbonne to tutor her. In 1733 she stormed her way into the Café Gradot, the Parisian coffee-house where the scientists, mathematicians, and philosophers regularly met. Barred because she was a woman, she simply had a suit of men's clothes made for herself and reappeared, her long legs now in breeches and hose, to the delight of cheering colleagues and the consternation of the management. . . .

Châtelet made her reputation as a scientist with her three-volume work on the German mathematician and philosopher Leibnitz, *The Institutions of Physics,* published in 1740. Contemporaries also knew of her work from her translation of Newton's *Principles of Mathematics,* her book on algebra, and her collaboration with Voltaire on his treatise about Newton.

From the fifteenth to the eighteenth centuries privileged women participated in the new intellectual movements. Like the men of their class, they became humanist scholars, naturalists, and scientists. Unfortunately, many of these women found themselves in conflict with their families and their society. A life devoted to scholarship conflicted with the roles that women, however learned, were still expected to fulfill.

Science Affirms Tradition

In the sixteenth and seventeenth centuries Europe's learned men questioned, altered, and dismissed some of the most hallowed precepts of Europe's inherited wisdom. The intellectual upheaval of the Scientific Revolution caused them to examine and describe anew the nature of the universe and its forces, the nature of the human body and its functions. Men used telescopes and rejected the traditional insistence on the smooth surface of the moon. Galileo, Leibnitz, and Newton studied and charted the movement of the planets, discovered gravity and the true relationship between the earth and the sun. Fallopio dissected the human body, Harvey discovered the circulation of the blood, and Leeuwenhoek found spermatozoa with his microscope.

For women, however, there was no Scientific Revolution. When men studied female anatomy, when they spoke of female physiology, of women's reproductive organs, of the female role in procreation, they ceased to be scientific. They suspended reason and did not accept the evidence of their senses. Tradition, prejudice, and imagination, not scientific observation, governed their conclusions about women. The writings of the classical authors like Aristotle and Galen continued to carry the same authority as they had when first written, long after they had been discarded in other areas. Men spoke in the name of the new "science" but mouthed words and phrases from the old misogyny. In the name of "science" they gave a supposed physiological basis to the traditional views of women's nature, function, and role. Science affirmed what men had always known, what custom, law, and religion had postulated and justified. With the authority of their "objective," "rational" inquiry they restated ancient premises and arrived at the same traditional conclusions: the innate superiority of the male and the justifiable subordination of the female.

In the face of such certainty, the challenges of women like Lucrezia Marinella and María de Zayas had little effect. As Marie de Gournay, the French essayist, had discovered at the beginning of the seventeenth century, those engaged in the scientific study of humanity viewed the female as if she were of a different species—less than human, at best; nature's mistake, fit only to "play the fool and serve [the male]."

The standard medical reference work, *Gynaecea,* reprinted throughout the last decades of the sixteenth century, included the old authorities like Aristotle and Galen, and thus the old premises about women's innate physical inferiority. A seventeenth-century examination for a doctor in Paris asked the rhetorical question "Is woman an imperfect work of nature?" All of the Aristotelian ideals about the different "humors" of the female and male survived in the popular press even after they had been rejected by the medical elite. The colder and moister humors of the female meant that women had a passive nature and thus took longer to develop in the womb. Once grown to maturity, they were better able to withstand the pain of childbirth.

Even without reference to the humors, medical and scientific texts supported the limited domestic role for women. Malebranche, a French seventeenth-century philosopher, noted that the delicate fibers of the woman's brain made her overly sensitive to all that came to it; thus she could not deal with ideas or form abstractions. Her body and mind were so relatively weak that she must stay within the protective confines of the home to be safe.

No amount of anatomical dissection dispelled old bits of misinformation or changed the old misconceptions about women's reproductive organs. Illustrations continued to show the uterus shaped like a flask with two horns, and guides for midwives gave the principal role in labor

to the fetus. As in Greek and Roman medical texts these new "scientific" works assumed that women's bodies dictated their principal function, procreation. Yet even this role was devalued. All of the evidence of dissection and deductive reasoning reaffirmed the superiority of the male's role in reproduction. Men discovered the spermatazoon, but not the ovum. They believed that semen was the single active agent. Much as Aristotle had done almost two millennia earlier, seventeenth-century scientific study hypothesized that the female supplied the "matter," while the life and essence of the embryo came from the sperm alone.

These denigrating and erroneous conclusions were reaffirmed by the work of the seventeenth-century English scientist William Harvey. Having discovered the circulation of the blood, Harvey turned his considerable talents to the study of human reproduction and published his conclusions in 1651. He dissected female deer at all stages of their cycle, when pregnant and when not. He studied chickens and roosters. With all of this dissection and all of this observation he hypothesized an explanation for procreation and a rhapsody to male semen far more extreme than anything Aristotle had reasoned. The woman, like the hen with her unfertilized egg, supplies the matter, the man gives it form and life. The semen, he explained, had almost magical power to "elaborate, concoct"; it was "vivifying" . . . endowed with force and spirit and generative influence," coming as it did from "vessels so elaborate, and endowed with such vital energy." So powerful was this fluid that it did not even have to reach the woman's uterus or remain in the vagina. Rather he believed it gave off a "fecundating power," leaving the woman's body to play a passive, or secondary, role. Simple contact with this magical elixir of life worked like lightning, or—drawing on another set of his experiments—"in the same way as iron touched by the magnet is endowed with its powers and can attract other iron to it." The woman was but the receiver and the receptacle.

Anatomy and physiology confirmed the innate inferiority of woman and her limited reproductive function. They also proved as "scientific truth" all of the traditional negative images of the female nature. A sixteenth-century Italian anatomist accepted Galen's view and believed the ovaries to be internal testicles. He explained their strange placement so "as to keep her from perceiving and ascertaining her sufficient perfection," and to humble her "continual desire to dominate." An early-seventeenth-century French book on childbirth instructed the midwife to tie the umbilical cord far from the body to assure a long penis and a well-spoken young man for a male child and close to the body to give the female a straighter form and to ensure that she would talk less.

No one questioned the equally ancient and traditional connection between physiology and nature: the role of the uterus in determining a woman's behavior. The organ's potential influence confirmed the female's irrationality and her need to accept a subordinate role to the

male. The sixteenth-century Italian anatomist Fallopio repeated Aristotle's idea that the womb lusted for the male in its desire to procreate. The French sixteenth-century doctor and writer Rabelais took Plato's view of the womb as insatiable, like an animal out of control when denied sexual intercourse, the cause of that singularly female ailment, "hysteria." Other sixteenth- and seventeenth-century writers on women and their health adopted all of the most misogynistic explanations of the traditional Greek and Roman authorities. No menstruation meant a diseased womb, an organ suffocating in a kind of female excrement. Only intercourse with a man could prevent or cure the condition. Left untreated the uterus would put pressure on other organs, cause convulsions, or drive the woman crazy. Thus, the male remained the key agent in the woman's life. She was innately inferior, potentially irrational, and lost to ill-health and madness without his timely intervention.

So much changed from the fifteenth to the eighteenth centuries in the ways in which women and men perceived their world, its institutions and attitudes. The Renaissance offered the exhilaration of a society in which the individual could be freed from traditional limitations. In the spirit of Humanistic and scientific inquiry men questioned and reformulated assumptions about the mind's capabilities and the description of the natural universe. New methods of reasoning and discourse, of observation and experimentation, evolved and led to the reorientation of the natural universe and more accurate descriptions of the physical world, including man's own body. Yet when it came to questions and assumptions about women's function and role and to descriptions of her nature and her body, no new answers were formulated. Instead, inspired by the intellectual excitement of the times and the increasing confidence in their own perceptions of the spiritual and material world, men argued even more strongly from traditional premises, embellishing and revitalizing the ancient beliefs. Instead of breaking with tradition, descriptions of the female accumulated traditions: the classical, the religious, the literary, the customary, and the legal—all stated afresh in the secular language of the new age. Instead of being freed, women were ringed with yet more binding and seemingly incontrovertible versions of the traditional attitudes about their inferior nature, their proper function and role, and their subordinate relationship to men.

With the advent of printing, men were able to disseminate these negative conclusions about women as they never could before. From the sixteenth century on the printing presses brought the new tracts, pamphlets, treatises, broadsides, and engravings to increasing numbers of Europeans: pictures of the sperm as a tiny, fully formed infant; works by scholars and jurists explaining the female's "natural" physical and legal incapacity; romances and ballads telling of unchaste damsels and vengeful wives set to plague man.

Although these misogynistic attitudes about women flourished and spread, the defense of women had also begun. In her *Book of the City of Ladies* Christine de Pizan, the fifteenth-century writer, asks why no one had spoken on their behalf before, why the "accusations and slanders" had gone uncontradicted for so long? Her allegorical mentor, "Rectitude," replies, "Let me tell you that in the long run, everything comes to a head at the right time."

The world of the courts had widened the perimeters of women's expectations and given some women increased opportunities. However, for the vast majority of women, still not conscious of their disadvantaged and subordinate status, changes in material circumstances had a far greater impact. From the seventeenth to the twentieth centuries more women were able to live the life restricted in previous ages to the few. In Europe's salons and parlors they found increased comfort, greater security, and new ways to value their traditional roles and functions. For these women, "the right time"—the moment for questioning and rejecting the ancient premises of European society—lay in the future.

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LADY MARY WORTLEY MONTAGUE

Letter on Turkish Smallpox Inoculation, 1717

Lady Mary Wortley Montague, an English aristocrat, came down with smallpox in 1715. She survived, but was badly scarred by the rash that accompanied the often-fatal disease. Her younger brother died from smallpox, one of the tens of thousands who succumbed in epidemics across Europe and around the world in the eighteenth and nineteenth centuries. Two years after her recovery Montague traveled to Istanbul with her husband, who was the British ambassador to the Ottoman Empire. There, she witnessed a new approach to warding off smallpox infections, as she described in the following letter to a friend in England. What process does Montague describe in her letter? What was her response to the events she witnessed in Turkey?

Source: *Letters of Lady Mary Wortley Montague, written during her travels in Europe, Asia, and Africa, to which are added poems by the same author* (Bordeaux: J. Pinard, 1805). The UCLA Louis M. Darling Biomedical Library, History and Special Collections Division. Also available from Gutenberg E-Books at Lady Mary Wortley Montague, Her Life and Letters (1689–1762). Author: Lewis Melville. Release Date: January 4, 2004 [EBook #10590].