

Women of Science in Enlightenment France

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Introduction

A Sextet of Firsts, Variations on a Theme

FRENCHWOMEN ARE NOW KNOWN TO HAVE PLAYED A SIGNIFicant role in the eighteenth century, participating in and shaping the Enlightenment and the Revolution as salonnières, authors, and activists.¹ Still other women, those who daringly chose to do science, to expand our knowledge of the natural world in diverse disciplines and who are the subjects of this book, have been less recognized. Such intrepid females were scarce, for their path to science was strewn with obstacles. Referring to her own difficulties, the Newtonian physicist Mme Du Châtelet wrote, "I feel the full weight of the prejudice which universally excludes us from the sciences . . . there is no place where we are trained to think, . . . an abuse which cuts back, as it were, one half of humankind."² The great feminist Mary Wollstonecraft echoed this, lamenting more generally at the end of the century that the study of nature seemed closed to most women and wishing that more of them would undertake serious work on this "fair book of knowledge," would "attach themselves to a science with that steady eye that strengthens the mind." Instead, she found such women to be a wondrous rarity. "I have been led to imagine that the few extraordinary women who have rushed in eccentrical [sic] directions out of the orbit prescribed to their sex, were male spirited, confined by mistake in a female frame."3

Yet there were some "extraordinary women" of science nonetheless, a few even achieving stardom, for example, Italy's learned ladies—Laura Bassi, the first woman physics professor in Bologna, and her colleague the anatomical lecturer Anna Morandi—or the distinguished English astronomer Caroline Herschel.⁴ These three certainly escaped beyond their normally confining spheres. So did Mme Du Châtelet. But to find her French female contemporaries, also

working with courage and perseverance but less visible, we must adjust our lens. The pages that follow tell compelling stories about six of them.

Mme Du Châtelet herself is not among them, although she became a veritable scientific heroine of the period and deservedly so. But even she was overlooked for two centuries; as Voltaire's mistress she was mentioned by historians solely in that capacity, her own intellectual prowess not discussed, surely not celebrated. Finally, however, toward the end of the last century, she began to be studied in her own right, taken seriously as the *femme de science* that she was, brilliant, bold, and widely influential, her books on natural philosophy and physics appreciated and analyzed in depth and detail.⁵ Here was a woman driven to overcome the lack of education she decried above, procuring the private tutors necessary to learn and truly master mathematics and the hard sciences. Her numerous works, especially the 1740 Institutions de physique and her posthumous translation of and creative commentary on Newton's Principia, establish her as one of the most sophisticated writers on science of her day. There is now a copious literature on her and the many facets of her oeuvre, and she has attained a kind of visibility and luster that her female contemporaries do not enjoy.⁶ The six women discussed in this book, scientific peers of hers, were relegated to the shadows and are only slowly emerging into the light. Aware of Mme Du Châtelet's brilliance, Voltaire called her the "Minerva of France," invoking the Roman goddess of wisdom and the arts. He told Frederick of Prussia that she, the real brain behind his 1738 Élémens de la philosophie de Newton, truly deserved the authorial credit: "Minerva dictated, and I wrote."⁷ I have therefore called my less-known Enlightenment women of science "Minerva's sisters." Several of them were likened to her by their male contemporaries, and the chemist of my last chapter emblazoned her own name on Minerva's shield in her commissioned bookplate. So this deity was broadly seen as the patroness of science both pure and applied.

Lest the word "science" in this context appear anachronistic, it was used frequently in eighteenth-century Europe, as by Du Châtelet and Wollstonecraft above, in addition to the more common term "natural philosophy."⁸ The crowning intellectual achievement of the French Enlightenment, the multi-volume *Encyclopédie* of Diderot and d'Alembert, invoked "science" in the very subtitle, *Dictionnaire raisonné des sciences, des arts et des métiers,* and the term with its modern meaning occurred in its numerous entries concerning the study of nature. The long article in volume 8 on "Natural History," for example, remarked on

the "taste for this science in the general public" and sprinkled the word throughout as it compared "the different branches of science" that deal with the mineral, animal, and vegetable realms of nature: astronomy, anatomy, botany, chemistry, and experimental physics. "Blessed is the century in which the sciences are sufficiently perfected as to . . . contribute to the happiness of man."⁹ The august members of the Paris Académie des Sciences were, as the name implies, devoted to the study of the natural world, not other kinds of wisdom pursued in other academies. The men who knew the women in this book employed the term when referring to them, as did Benjamin Franklin in citing the anatomist's work and Jérôme Lalande the astronomer's. And the women themselves used the term, the chemist of my last chapter, for example, writing, "Chemistry, as well as all the sciences that have for their object the knowledge of nature, makes strides every day."¹⁰

It was a Cartesian, the great popularizer Fontenelle, who in 1686 first encouraged French women to participate in scientific learning, the marquise in his best-selling *Conversations on the Plurality of Worlds* refusing to be side-tracked by her teacher's repeated seductive maneuvers, instead insisting that they keep their eyes and ideas on the stars in the night sky they were discussing.¹¹ The Newtonians explicitly wooed women too, as did Algarotti's *Newtonianisme pour les dames* in 1738. But they did not all need such scientific simplifications. In fact Newton's 1704 *Opticks* had been translated in 1720 into French at the urging of a woman.¹² At its end this work included inviting "Queries"—"hints to be examin'd and improv'd by the farther Experiments and Observations of such as are inquisitive," speculations intended for "a farther search to be made by others."¹³ Newton's overtures in these Queries stimulated new ideas, approaches, and styles of investigation not only in mathematics, astronomy, mechanics, and the physics of light but beyond—in epistemology, natural history, botany, anatomy, and chemistry, the fields of the women in this book.¹⁴

Elisabeth Ferrand, the subject of chapter 1, was a mathematician, an early believer in the law of attraction, and an epistemologist who studied human cognition by analyzing separately what each of the five senses contributed to it. In a portrait by Quentin de La Tour she chose to be depicted "meditating on Newton." Astronomer Nicole Reine Lepaute of chapter 2 computed the accurate prediction of the return of Halley's Comet, a triumph widely considered to prove Newton's law of universal gravitation and which required the analysis of the component forces that determined the comet's orbit. Chapter 3 deals with

two enthusiastic contributors to botany. Field naturalist Jeanne Barret disguised herself as a man to work with botanist Philibert Commerson collecting flora during Bougainville's round-the-world voyage. When curating these harvests they sought order behind their great profusion, discovering previously unknown plant species and always searching for subspecies, varieties, to better clarify the overarching category. Madeleine Françoise Basseporte, botanical illustrator and the king's draftsperson at the Jardin du Roi, enriched the work of Buffon and of Bernard de Jussieu by analyzing and depicting the parts of plants to discover the patterns and organizing principles of that science. Chapter 4 concerns anatomist Marie-Marguerite Biheron, who analyzed the human body, taking it apart in countless dissections to elucidate the hidden internal structures and thus perfect the wax models that she displayed and taught with for decades. And chapter 5 introduces chemist Marie Geneviève Charlotte Thiroux d'Arconville, who studied organic decomposition, echoing Newton's view, in Query #30 of the Opticks, that decay was a natural breakdown process in which substances were reduced to their component elements. As Newton summed up, "Nature seems delighted with transmutations," and d'Arconville confirmed, "We must therefore look at putrefaction as the wish of nature."¹⁵

I set out almost two decades ago to revive the stories of these women, seeking their traces in the archives, finding what contemporaries said about them, and bit by bit uncovering information that had been dropped from the triumphalist narratives of science composed by men in charge. These women had been written out of history. Well-known in their day but subsequently erased from the record, they have only recently begun to resurface.¹⁶ Their lives are fascinating because their keen intelligence, curiosity about the workings of nature, extraordinary verve, and visionary courage led them to defy the gender conventions of their time and do the science they wanted to do. Driven to embark on what Carolyn Heilbrun has called a "quest plot," to hunt for something beyond the comfortable though stifling nest, they escaped from the traditional female script and, unafraid, became their own agents of rescue.¹⁷ Theirs was a choice much more difficult than conforming to the expectations of their day, but for them there simply was no other option.

I have called them "firsts" because unlike girls and women today who want to pursue science, these women had no female role models to follow, and so they themselves were the pioneers. Their very presence in these fields was rare, they were un-networked, unaffiliated in any official capacity with exclusively male

institutions, and not even connected with each other. Taking tentative steps on untrodden paths, then blazing the way forward as they gained confidence, Ferrand became the first woman—preceding Mme Du Châtelet—to champion Newtonianism in France, Lepaute the first Frenchwoman to be elected to a scientific academy, Barret the first woman to sail around the world, Basseporte the first (and only) woman to secure the coveted post of *dessinateur du roi* in the royal botanical gardens, Biheron the first person to teach general anatomy and sex education using models of her own invention, and d'Arconville the first person to suspect, over a century before Pasteur, that the cause of putrefaction was airborne. Theirs were full, rich lives of steely resolve, and they knew their contributions to science were worthwhile. Such women made it easier for those who followed in their footsteps, precisely because they paved the route. Love of learning about nature, perseverance in the face of obstacles, determination to be useful, will and energy to buck the norm, to break free of limits—all characteristics that distinguished them then and can be emulated today.

These are the qualities that they had in common, a shared, discernible pattern. But I want to emphasize their differences as well, for they were an eclectic mix, representing a wide range, an assortment of approaches to their scientific goals. There was no solidarity among them for they were unaware of each other except in one special instance where two of them were a couple. Overall, because their backgrounds and aspirations were so diverse, they illustrate an array of choices and trajectories that got them where they wished to go. There was not just one way to pursue science.

How did they do it? Very few possibilities existed in eighteenth-century France for women with serious intellectual curiosity to slake their thirst. Girls might at best be educated in a convent with catechism, music, needlework, some domestic skills, and if they were lucky, they might learn how to read. Then married off young to a stranger, they were immediately expected to produce children, as soon and as many as possible. Divorce was unheard of, and they were to be content with serving a husband and nurturing a family. To circumvent this, half of my six women chose female life companions and so remained unconstrained by the almost feudal marriage laws and customs that persisted in this period and denied wives any legal existence or social independence, no more rights than the criminal and the lunatic. But lesbian relations, considered a form of sodomy, were then punishable by death if "lewdness," "depravity," and "unnatural acts" could be documented; there was, for example, an execution of this

sentence on 5 June 1750 when two individuals were burned alive in the Place de Grève.¹⁸ Whether the intimacies shared by the women in this story were sexual as well as emotional and scholarly we cannot know; in any case their intense female friendships seemed respectable enough to not raise alarms.

The remaining three women did marry, but they did not compromise their work to do so; one delayed marriage until after her scientific activities ended, and the other two tolerated oddly decentered husbands who were far less significant than the male colleagues with whom they found fulfilling cerebral relationships and who assisted them in their work. These three thus managed, astonishingly, to carve out freedoms for themselves despite the confines of matrimony. One even arranged a sort of chaste ménage à trois, living for decades with both her complacent spouse and her male science colleague in an unusual configuration. The boldness of these women manifested itself in still more ways, one hiding a famous political fugitive for years at great personal risk, another masquerading as a man to achieve her purpose, another refusing to retire in her old age and preventing powerful men of science, and royal ministers, from forcing her to do so.

Tenacious, independent, and resolute, these six boundary-breaking women did not flare out, were not dilettantes, but instead dedicated researchers who kept at their work over many years, the shortest for about fifteen, the longest for more than half a century. We could reasonably argue that their commitment enhanced their longevity, that they exemplified creative aging, as their lifespans far exceeded the thirty-eight-year average for their day, the youngest dying at fifty-two, the others living exceptionally to be sixty-five, sixty-seven, seventysix, seventy-eight, and eighty-five. They were motivated not by fame, glory, or fortune-what Dorinda Outram has called "dirty" power-but by genuine thirst to satisfy their deep curiosity about the natural world and determination to make useful contributions to scientific knowledge. Fierce competition among men swirled all around them, priority disputes, intellectual meanness, plagiarism accusations, feuds of all kinds, grasping claims for entitlement to patrons, pensions, prizes. The Enlightenment was a time of burgeoning public appetite for science; there was a flourishing market for it and also the inevitable jockeying for position to enjoy the spoils. The women had to negotiate this without damage to themselves, find a way through it that would not seem threatening and so would not derail them from pursuing the science they loved. Spanning several fields, the women strengthened their century's understanding of the mind,

the cosmos, the wild plants of the wide world, the cultivated botanical garden, the human body, and the border between vitality and decay.

Were they feminists? The term "feminism" has evolved over the centuries, and even today when it sounds familiar and is used loosely it means many different things.¹⁹ In the eighteenth century the word did not exist. These women wanted to do science, which was not conventional, and they thus figured out how to prevail, but they did not necessarily picture other women doing the same. None of them believed they were inferior to their male colleagues, nor did they resent those men. They did not rail against inequity or voice grievances against male prerogatives.²⁰ Their actions, however, spoke louder than words. They made original life choices for themselves, and they maneuvered to accomplish exactly what they wanted yet without disruption to the fixed order.

While sensitivity to gender is of course central to my book, the sociologist Dianne Millen's work on female scientists has shown how tricky it is to "do feminist research on non-feminist women." Millen argues that "a concern for power relationships is the defining feature of feminist research," but my six women did not necessarily consider themselves downtrodden or oppressed, did not all have "full awareness of the systems which surround and constrain them." Mme Du Châtelet did and was vocal about it as we saw, but my six subjects were less outspoken and functioned differently. They never berated the establishment, never imagined that the world would change to accommodate them.²¹ Instead, without overt protest, they learned to work the system, to recognize and exploit opportunities, believing that their own efforts, and not external factors, would be responsible for successful outcomes. Inner drive propelled them to pursue their scientific plans. When encountering structural barriers they may have lacked the conceptual vocabulary, or the desire, to speak about them; instead they negotiated smart means to do what they wished without causing a stir. Nimble and purposeful, they navigated the male-dominated turf without leaving it.

These women deployed what Michel de Certeau pointedly calls *tactics* as opposed to *strategies*, coping mechanisms for operating in difficult imposed terrain, improvised measures to circumvent the established scheme, to encroach cleverly without being detected as transgressors. In fact, to do anything other than pairing and bearing in their day, women had to develop all manner of methods to steer through obstacles and get where they wanted to go. Certeau makes a meaningful distinction between *strategy*, which requires power and having one's own proper place from which to go out and master more places, and

tactics, which must be played by the less powerful on the existing field and which require maneuvering in uncongenial space, using the constraining order unconventionally, artfully. In his formulation, strategies are repressive, tactics are oppositional and involve the seizure of chances that arise to gain one's objectives, creative resistance, manipulation of prevailing rules, and the imagining of an alternative vision to attain desired ends.²² There is, as Certeau says, always some play in the machine, ways to map out room within constraints to make the situation habitable. The women in this book contrived idiosyncratic routes for their lives through and out of traditional expectations.

Although they had in common their unorthodox choice to do science, in many other respects they were dissimilar, hailing from different classes and backgrounds and working in unrelated fields. The first three were atheists, the last three were Jansenists, critical of official Catholicism but devout believers in pure biblical teachings and thus enemies of despotism, hierarchies, tyranny, and arbitrary powers of church and state.²³ The women were socially diverse as well. Barret was a domestic, Biheron the daughter of a pharmacist, d'Arconville a high society grande dame. Their motives and aspirations were not the same. Except for Basseporte and Biheron, who were partners, we cannot be sure the others were acquainted, although they should have been. They had no access to the scientific sociability enjoyed by their male contemporaries, who formed bonds through numerous institutional affiliations, academies, university faculties, observatories, the periodical press, and the joint effort of the magisterial Encyclopédie. All of these provided for men a sense of belonging to lofty, historically significant endeavors. There was no analogous arena for smart women to come and work together, no shared forum for discussing or exchanging ideas of mutual scientific interest. My six women had to craft their own stimulating communities, enlist teams of men who could give them the help they needed to get started. Once launched, however, they were pretty much on their own, outside of formal institutions, persevering in original ways in salons, studios, workshops, makeshift observatories, dissecting enclosures, on boats, in gardens and home laboratories, at dinner tables.²⁴ That they did this without learned female camaraderie is an object of wonder and an overarching point of my book. Each had to find her own path, and their stories illustrate the diversity and creativity of the choices they made in order to live scientific lives.

Known in their day, they were later deemed insignificant, rendered invisible, literally obscured. As biographical theorist Judy Long plainly puts it, such

socially produced "obscurity" accounts for the "shortage" of notable female subjects, for they are "caused to disappear" by later male gatekeepers in an active process of submersion.²⁵ And while my women have in recent years begun to attract some scattered attention, they have been discussed in isolation, never together, and so remain apparently singular. Treated separately, disconnected, they seem anomalous, exceptional and rare birds, *admired* in the old sense that, as Germaine Greer writes, "carries an undertone of amazement."²⁶ When they are set in context and discussed together in depth and breadth, however, a pattern emerges that illuminates a kind of female courage and investigative energy that ran throughout the Enlightenment. There were quite a few other scientific women in this period of whom I caught glimpses, but too much evidence had been lost to time. I concentrate here on the ones I was able to flesh out. And the taxonomic urge is strong, as historian Jenny Uglow says. Whereas their individual lives are interesting in and of themselves, their cumulative experience is fuller and more empowering.²⁷ "A collective biography," Alison Booth explains, "requires an additional rhetorical frame besides that of any biography: the definition of the category or principle of selection . . . and the *encouraging* view that noteworthy lives differ enough from each other to leave space for others to join them."28 Of course I believe that such examples of path-blazing women of science are "encouraging" for female scientists today, as Booth would hope them to be. Assembling their stories of fervor and stamina results in a picture and a message that is greater than the sum of the parts.

These six women, once their resolve and staying power became clear, found support from some male contemporaries. This fact reveals an important tolerance and even welcome among the men of science and philosophers that they selectively gathered around them, a surprising elasticity of mind in a world too easily dismissed as narrowly patriarchal. It enriches our current understanding of the French Enlightenment to observe how a considerable number of men wanted these women to succeed and be properly credited for their contributions. This approach reveals unexpected hospitalities in the scientific milieux from which the women were officially excluded yet with which they were so intimately involved. My more gender-inclusive narrative shows not only the content of these women's works and days but the fact that they were, due to their own efforts and tenacity, accepted rather than thwarted. To probe this dynamic meaningfully it does not suffice to concentrate on their male colleagues and then just "add women and stir." Such a technique does nothing to alter the

traditional picture.²⁹ Instead we must flip it around, adjust our lens, zoom in on the women at the center, and *then* consider the orbiting men who become visible in their lives as we pan out.³⁰

So the focus of this book is on the women's stories, with male supporting actors added as needed. Yet they are needed. Most of the letters, scientific papers, and artifacts of these women were not preserved by the custodians of culture and are lost, through neglect, unceremonious discarding, or deliberate material destruction—the net effect was erasure.³¹ We do have Basseporte's botanical illustrations and d'Arconville's manuscript memoirs dictated in her old age. But archivists, librarians, and museum curators failed to acknowledge the value of, and therefore did not keep, Ferrand's mathematical communications, or Lepaute's astronomical papers on the transit of Venus of 1761, or Biheron's anatomical models. And they did not attempt to distinguish, while they still might have been able to, Barret's herbarium labels from Commerson's. We know that all six women corresponded with savants, but we have a mere handful of letters by Ferrand, Lepaute, Biheron, and d'Arconville, one by Basseporte, and phantoms of a couple from Barret to which only the replies remain.

These women, therefore, are known to us mostly through the words of their famous male contemporaries, who luckily for me had a lot to say about them, so there is rich material here. I make extensive use of such sources—letters defending them, sometimes vehemently, ship logs, obituaries and eulogies (the men were particularly eloquent in mourning), newspapers, memoirs, dedications, portraits, homages, mini-biographical entries, chronicles, and gossip sheets. Diderot, d'Alembert, Rousseau, Buffon, Mercier, Bougainville, Lalande, Commerson, Condillac, Bachaumont, Clairaut, Jussieu, Grimm, Mentelle, the artists Quentin de La Tour and Voiriot in France, and foreigners such as Ben Franklin, John Pringle, John Wilkes, Linnaeus, members of the Bernoulli family, the monarchs of Sweden and Denmark, and various German princes, to name only some, make clear that the subjects of this book were forces to be reckoned with and scientifically significant in their day.

I write their stories with as much texture as possible. Determined to set their science in the context of their ways of life, in what Steven Shapin calls their *habitus*, I agree with him that science should be studied "as if it was produced by people with bodies, situated in time, space, culture and society."³² Their science bore the marks of where and when it was produced, of their quotidian situations. While mining the sources mentioned above, what others said about them,

I also test those reports, holding them up against the exertions of the women themselves, their behavior, what they actually *did*. Deeds do not lie. Kathleen Barry argues that "feminist-critical biography must assume a self that is knowable through its doing and actions, that is, through intentionality." Even for women who did not leave accounts of themselves, we can study the highly significant choices they made, their interactions, the empirical world of their experiences, and in this way we can retrieve some of their lost subjectivity.³³ These six women were not strident about their problems or the difficulties they encountered, but, as Barry reminds us, women who did not say much still had a battle to fight, suggesting that because women in all ages "usually know more about domination than they speak," we may assume such consciousness even as we recognize the reasons it might have been submerged.³⁴ These women were quietly but concertedly persistent and, while they surely encountered deterrents, took deliberate steps forward and stayed the course.

Although they did not leave much evidence of their private thoughts, we have a bit more in their works meant for public consumption, whether textual or figural: Lepaute's star charts, eclipse maps, and computational tables; Basseporte's hundreds of botanical illustrations, some drawn with pencil and pastels, others painted on vellum, these last still part of the well-preserved permanent collection called Les Vélins du Roi; Biheron's four-page pamphlet advertising her first Anatomie artificielle exhibit in 1761; and d'Arconville's (always anonymous) printed volumes of scientific translations plus of course her original work, a treatise on putrefaction. These are relatively meager traces, however, and the women seem almost mute compared to their contemporary Mme du Coudray, the "King's midwife" and subject of my last book. Because du Coudray's was an official royal mission to arrest infant mortality and she therefore a celebrity, I found hundreds of letters in numerous departmental archives by, to, or about her.³⁵ But such a paper trail was exceptional for a woman at that time. Moving from my sage-femme who enjoyed publicity to these much less conspicuous yet equally strong *femmes sages* has had its challenges.

These women refused to accept exclusion from the march of progress. The need to be useful was a trait they shared and absolutely central to their motivation, and they repeatedly articulated it as a moral imperative for all their work. Their life choices gave them purpose and self-fulfillment, taking control of their destinies, learning courage by being courageous. And they upheld the highest standards: intellectual precision and logical rigor, computational accuracy, dis-

ciplined collecting in the field, "truth-to-nature" botanical images and anatomical models, and scrupulously recorded laboratory experiments. They expressly considered it "criminal" to be careless when presenting scientific results.³⁶

The independence of these women resonated with some writing by their nonscientific contemporaries. Mme de Graffigny's 1747 novel, the best-selling *Lettres d'une Péruvienne*, featured the heroine Zilia who gains strength, resists marriage, finds and frees herself through learning and chooses a single life that satisfies her mental thirst and fulfills her. Graffigny's critics were constantly trying to change the ending of the novel, to marry off her heroine, but the author stood firm. Female journalists also proclaimed the Enlightenment the *Siècle des dames*, the Century of Women. Some of my six in this book were explicitly mentioned and lauded in the *Journal des Dames*, a periodical whose very existence signaled something new and whose first female editor, Mme de Beaumer, championed women adamantly.³⁷ There was excitement in the air, a sense of possibilities, of openness for women to accomplish things and to do it relatively unscathed if they knew how, as these did, to choreograph the requisite dance.

Subsequent historical accounts, however, damped down all this energy, reducing the players to silence. The erasure of women from the history of science in particular has been noted and rued by many scholars, historians, sociologists, and biography theorists. Margaret Rossiter early stressed their "systematic underrecognition" in previous centuries, and Naomi Oreskes their "invisibility," how they end up in the "ellipses" instead of the limelight because they do not buy into the male rhetoric of "heroism" and conquering the unknown. Hilary Rose explored the shared experience of oppression among women scientists.³⁸ To redress this imbalance it is necessary to highlight and foreground what women have accomplished, to embark on a new and different kind of recounting, a counterpoint narrative. The "objective" cradle-to-grave, womb-to-tomb presentation is, after all, a patriarchal invention that needs some unpacking. Here feminist biographers have chimed in: Phyllis Rose on the "deliciously wicked absence of impartiality"; Carolyn Heilbrun and Judy Long on telling women's lives in original ways based on connection with the subjects and the validating of empathy and affinity; Paula Backsheider on how feminism, through reciprocity, has brought the biographer back into the frame; and Amy Richlin on the need to argue with the archival silence that continues to engulf women and the importance of explaining the author's use of the personal voice, "not everyone's cup of tea" but honestly imperative for social change.³⁹ It is not only feminists

who uphold innovation and making the teller part of the tale. James Clifford has criticized the traditional approaches by old-school omniscient biographers bent on making lives seem tidy, what he calls the "myth of personal coherence," Robert Rosenstone has promoted unorthodox historical writing of all kinds, and Thomas Söderqvist has argued for risk-taking, including specifically "open collaboration" between biographer and scientific subject.⁴⁰

Such scholars have inspired me to experiment with both storytelling and structure in this book. Thus it has a hybrid format, combining the age-old yet newly relevant genre of scientific biography with more personal elements.⁴¹ The tales of these six women are told in separate chapters, excepting a central fulcrum chapter that combines two dedicated but very different contributors to botany, which provides a certain symmetry. While the chapters incorporate the women's geographies of inquiry and various theoretical lenses through which they can be viewed, they are biographies, tales of lives lived whole. In addition, these discrete sections are braided together through short links, interludes in a different voice that bridge the individual acts and join them. The chapters cover, the links uncover, investigate, try things-in the spirit of the original meaning of the "essay."42 There is much about the lives of these women that we cannot know. In the interludes I meander through the neighborhoods where they lived and died, allowing myself to pry, to entertain possibilities, even probabilities for which no evidence remains. For historians, hard facts are not all we need. We also wonder, wander, ponder, speculate, and my links reveal such processes; they are more musing and playful. Increasingly, historians have been using an active rather than a neutral voice, showing their unique relationships with their subjects, their involvement, borrowing devices from other genres, including fiction.43 My interludes take the form of imaginary letters from me to my protagonists, and for a reason. Enlightenment archives are full of correspondence between men, much of it entirely inconsequential, but far fewer exchanges between women have been preserved. After close to twenty years of living with this project and thinking of these people as "my" women I take the liberty of writing to them, asking questions, probing what might have caused their awakening. Because of course they do not answer, readers get a chance to pause, to pose their own questions, and to contemplate what those replies might have been. Most importantly, I try to inform my six women of their modern relevance, bringing them up to date on things I think they have a right to know.

In stressing the individual agency of these women I have tried to make theirs

a "usable past" for us in the twenty-first century.⁴⁴ Women have been deleted from histories of literature and art as well, but the effect of their absence from the scientific record is especially damaging.⁴⁵ There is still nothing close to parity for women in science today; their numbers in the STEM fields remain distressingly low. Many decry this situation and seek persuasive ways to attract women.⁴⁶ I believe that inspiring examples of females in science from the past are much more than interesting; they encourage girls to enter and women to *stay in* this field. Such accounts of female perseverance do advocacy and crucial social work.

My object is not to lionize or make exaggerated claims for the scientific contributions of the six women in this book, although they were certainly knowledge producers, enriching epistemology, astronomy, field exploration, botany, anatomy, and chemistry. Men respected them, made room for them and relied on them in their day. Combining and juxtaposing their surprising lives reveals a vital though unsung female presence in eighteenth-century French science. They are not broadly known, even less so in the English-speaking world, and their stories have not been told together. It will be enough to give credit where it is (over)due.