Special Issue: Volume 69, AUGUST 2022 - issue 3: "I am not a lady, i am a scientist." **Accepted Manuscript!**
Printed version in: https://www.tandfonline.com/doi/full/10.1080/00026980.2022.2100954

"I am not a lady, I am a scientist." Chemistry, Women, and Gender in the Enlightenment and the Era of Professional Science. Introduction.

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ABSTRACT This article introduces a collection of papers on women, gender, and chemistry in eighteenth- and twentieth-century Europe and the United States. After briefly surveying previous research on women and gender in science and outlining the long history of women in chemistry, we present this special issue's main findings concerning several key themes, including the identities and strategies of women engaged in chemical activities and the enabling circumstances and networks that helped these women gain entry into male-dominated institutions and fields of study. We suggest that these overarching themes are equally relevant to the Enlightenment era and the late nineteenth- and early to mid-twentieth-century age of professional science, thus illustrating the benefits of jointly treating cases that might otherwise seem to have little in common.

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Building on seminal investigations carried out in the final decades of the twentieth century, the historical study of women and gender in science, technology, and medicine has developed into a firmly established research field in more recent years. This historiography has covered disciplines ranging from anatomy and aeronautical engineering to zoology, as well as interdisciplinary and "amateur" projects and a broad variety of technologies. The reasons why women have been drawn to—or excluded from—specific fields of science, technology, and medicine is one major theme that rightfully continues to attract scholarly attention. Other important topics of ongoing interest include the feminisation and masculinisation of different areas within STEM and the role of educational and other institutions, as well as of networks, mentors, and role models, in fostering women's careers. Scholars have also focused on how notions of masculinity and femininity shaped the identities of different groups of scientists, engineers, and medical workers, and on the ways in which gender issues and the presence or absence of women have affected the development of these fields—and vice versa.[1] As a

[1] Useful literature surveys and/or reference works include Claire G. Jones, Alison E. Martin, and Alexis Wolf, eds., *The Palgrave Handbook of Women and Science since 1660* (Cham: Palgrave MacMillan, 2022); Sally Gregory Kohlstedt, "Sustaining

case in point, historians of science have shown how a certain image of science as a heroic and dangerous adventure—an emphasis on its "physicality," to use Naomi Oreskes's words, corresponding to a certain ideal of masculinity—made women's scientific work seem mundane and routine, effacing women from historical accounts and archival records.[2]

The words "I am not a lady, I am scientist" quoted in our title provide one useful introductory example illustrating the potential of the history of chemistry as a rich field for further exploring many such themes through a long-term perspective attentive to larger trends in the realms of science and gender. This statement was made by Gertrud Kornfeld (1891–1955), a physical and photochemist who appears in Joris Mercelis's contribution to this special issue as the first female laboratory researcher promoted to a senior staff position at the Kodak Research Laboratories in Rochester, New York. Kornfeld was proud to have obtained what other historians have aptly described as "a lab of one's own" at the photographic company.[3] Like other women scientists at Kodak, however, she was not allowed to enter her laboratory building on evenings or weekends for reasons of social propriety, and a security guard reportedly once exclaimed "No ladies after working hours!" when enforcing this policy.[4] When Kornfeld joined Kodak in the late 1930s, discriminatory restrictions like this had long been common

Gains: Reflections on Women in Science and Technology in the Twentieth-Century United States," in *Removing Barriers: Women in Academic Science, Technology, Engineering, and Mathematics*, ed. Jill M. Bystydzienski and Sharon R. Bird (Bloomington: Indiana University Press, 2006), 23–45; Nina E. Lerman, Ruth Oldenziel, and Arwen P. Mohun, eds., *Gender & Technology: A Reader* (Baltimore: JHU Press, 2003); Lynette Hunter and Sarah Hutton, eds., *Women, Science and Medicine 1500–1700* (London: Sutton Publishing, 1997); Katharine Park, *Secrets of Women: Gender, Generation, and the Origins of Human Dissection* (New York: Zone Books, 2010); Angela N. H. Creager et al., eds. *Feminism in Twentieth-Century Science, Technology, and Medicine* (Chicago: University of Chicago Press, 2001); and Jenna Tonn, "Gender," *Encyclopedia of the History of Science* (March 2019), doi: 10.1184/LPS/J1/11 (accessed 30 June 2022). For a recent bibliography on gender and science with emphasis on masculinities, see Erika Lorraine Milam and Robert A. Nye, "An Introduction to *Scientific Masculinities*," *Osiris* 30, no. 1 (2015): 1–14. On early female networks, see Anna Maerker, Elena Serrano, and Simon Werrett, eds., "Enlightened Female Networks: Gendered Ways of Producing Knowledge," special issue of *Notes and Records: The Royal Society Journal of the History of Science,* forthcoming. For the uses of gender in science innovation, see http://genderedinnovations.stanford.edu/what-is-gendered-innovations.html (accessed 3 July 2022).

[2] Naomi Oreskes, "Objectivity or Heroism? On the Invisibility of Women in Science," *Osiris* 11 (1996): 87–116, on 102. On masculinity and physicality in STEM, see also, e.g., Boel Berner, "The Worker's Dream of Becoming an Engineer," *History and technology* 15 (1999): 345-372;; Andrew Warwick, *Masters of Theory: Cambridge and the Rise of Mathematical Physics* (Cambridge: University of Chicago Press, 2003); Gabriella Szala "Paper Trials, Multiple Masculinities, and the Oeconomy of Honor," in Carla Bittel, Elaine Leong, and Christine von Oertzen, eds., *Working with Paper: Gendered Practices in the History of Knowledge* (Pittsburgh: University of Pittsburgh Press, 2019), 60–74.

[3] Marsha L. Richmond, "'A Lab of One's Own': The Balfour Biological Laboratory for Women at Cambridge University, 1884–1914," *Isis* 88 (1997): 422–55; Patricia Fara, *A Lab of One's Own: Science and Suffrage in the First World War* (Oxford: Oxford University Press, 2018).

[4] Eastman Kodak Co., *Journey: 75 Years of Kodak Research* (Rochester: Kodak, 1989), 71. See also Joris Mercelis's article in this special issue.

in science-related work and professional environments.[5] Kornfeld must have realised that her challenge to Kodak's policy was unlikely to be successful, but her explicit self-identification as a scientist rather than a "lady"—"a woman of educated manners"—is nevertheless powerful in that it seems to convey an idealistic, universalist view of a scientific enterprise free of gender and class biases. That, at least, is one way of interpreting her comment; as Annette Lykknes's contribution to this special issue illustrates, another possibility might be that Kornfeld shared some early female engineering students' eagerness to be accepted as "one of the guys."[6]

And yet, why could scientists not be ladies as well? This, in fact, was the claim of the eighteenth-century women protagonists in Francesca Antonelli's and Elena Serrano's articles in this special issue: that ladies, precisely because of their societal position, could (and even should) serve their communities through their inquiries and inventions.[7] Undoubtedly, eighteenth-century scientific personae (and the persona of the lady), as they might have been understood by, for example, the contemporaries of Marie-Anne Paulze-Lavosier (1758–1836), were very different from their twentieth-century counterparts.[8] In this regard, Kornfeld's objection raises broader questions about historical shifts in scientific identities, strategies, feelings, and frustrations, as well as the opportunities and barriers that women faced when they joined mostly male realms pictured as "new adventures."

This special issue focuses on four stories: Marie-Anne Paulze-Lavoisier and the ways she made herself visible as a contributor to the "new chemistry" promoted by her husband; the daughters of the enlightened families in Tenerife and Madrid—the Betancourts, the Luzuriagas, and the Gutiérrez Bueno—and the nuns of a female convent who felt part of the reformist movement that would bring prosperity to Spain; the first sixteen female graduates from the Norwegian Institute of Technology,

[5] For a nineteenth-century example, see Kara W. Swanson, "Rubbing Elbows and Blowing Smoke: Gender, Class, and Science in the Nineteenth-Century Patent Office," *Isis* 108 (2017): 40–61.
[6] Quote from Amy Sue Bix, *Girls Coming to Tech! A History of American Engineering Education for Women* (Cambridge, MA: MIT Press, 2014), 24.
[7] The expression "inquire and invention" for designing science is borrowed from Lissa Roberts, Simon Schaffer, and Peter Dear, eds., *The Mindful Hand: Inquiry and Invention from the Late Renaissance to Early Industrialisation* (Amsterdam: Koninklijke Nederlandse Akademie van Wetenschappen, 2007).
[8] We understand the concept of persona as it was defined by Lorraine Daston and H. Otto Sibum in their seminal article, namely as a "cultural identity that simultaneously shapes the individual in body and mind with a shared and recognizable physiognomy." Lorraine Daston and H. Otto Sibum, "Introduction: Scientific Personae and Their Histories," *Science in Context* 16, no. 1/2 (2003): 1–8. See also the essays in that special issue dealing with changes in the scientific persona from sixteenth to twentieth-century.

who were to help boost the industry of an independent and self-supporting country; and finally, the first women chemists who conducted laboratory work in an expanding photographic manufacturing industry that extended its branches from the United States to Western Europe and Australia.

When considered together, the articles cast light on questions of chemistry, women, and gender from a longer-term comparative perspective, focused on the times of Paulze-Lavoisier and Kornfeld, respectively. Both the Enlightenment era and the first half of the twentieth century have previously received substantial attention from historians of science, technology, and medicine. Yet, by presenting case studies on women, gender, and chemistry in both of these periods, we aim to further explore what insights can be gained by treating these eras together, rather than in distinct, specialised historiographies.

Our emphasis on the second half of the eighteenth century and the early to mid-twentieth century should not be taken to imply that no important developments happened in the intervening years or before the mid-1700s. The next section of this introduction, in fact, highlights the longstanding participation of women in chemistry-related pursuits, from early modern times up to the present, while also acknowledging barriers that these women faced in different times and contexts. Building on that necessarily selective historiographical survey, we then turn to key themes pertinent to several of the articles and some of the main findings emerging from both individual contributions and the issue in its entirety.

The Long History of Women in Chemistry

In the United States, chemistry today is the physical science where women earn the highest share of bachelor's or graduate degrees—slightly above 50 per cent of all chemistry BS degrees and almost 40 per cent of all doctorates.[9] Both in the United States and Europe, however, women chemists tend to face the most significant obstacles and/or gender inequities after entering the academic or industrial workforce, particularly if they have family members to care for.[10] Aggregate numbers, moreover, hide

[9] National Center for Science and Engineering Statistics, NSF, "Women, Minorities, and Persons with Disabilities in Science and Engineering," 2021, https://ncses.nsf.gov/pubs/nsf21321/report (accessed 4 May 2022), 18.
[10] In this respect, women chemists are similar to other female college graduates; see, e.g., Claudia Goldin, *Career and Family: Women's Century-Long Journey toward Equity* (Princeton, NJ: Princeton University Press, 2021). For non-US data and

notable differences between chemical subdisciplines; according to the Society of German Chemists, for instance, the share of women in German bachelor's programs in food and biochemistry is above 60 per cent, whereas their total representation in chemistry bachelor's degrees in Germany remains below 50 per cent.[11]

As we will illustrate in this section, it is hard, if not impossible, to fully understand such differences between different areas within chemistry and between educational and occupational settings without considering women's long-standing participation in—and partial exclusion from—chemistry. In the early modern period, alchemy and chymistry were fields to which many women were drawn and for reasons that have started being explored more systematically recently.[12] Engagement in chemical practices was sometimes consubstantial to women's social identities and expectations. For instance, in sixteenth-century German-speaking lands, gentlewomen were expected to practice charity—precisely because of their social identity as noblewomen—and in particular to develop remedies for the poor, which implied a familiarity with substances and their transformation by alembics, sieves, melting pots, and other devices. In seventeenth-century England, the good gentry wife was expected to take care of family members and their possessions through chemical practices: she was expected to know, for instance, how to make medicines and cosmetics (elixirs, syrups, ointments, perfumes and scents, and skin creams, to name but a few); or how to prepare all kind of preserves, varnishes for the furniture, and poisons for getting rid of cheese-eating mice, as attested by the thousands of recipes that have been passed on from one generation to the next in handbooks, correspondence, and recipe notebooks (a practice also evidenced by poems and other literary genres). As Elaine Leong and others have shown, drugs and cures were extensively tested on relatives and friends. Trying and testing involved

perspectives, see, e.g., Claire D'Andola, "Women in Chemistry—Where We Are Today," *Chemistry: A European Journal* 22, no. 11 (2016): 3523–8.

[11]Gesellschaft Deutscher Chemiker, "Statistik der Chemiestudiengaenge," 2021, https://www.gdch.de/fileadmin/blaetterkatalog/catalogs/statistik_2021/pdf/complete.pdf (accessed 30 June 2022).

[12] Penny Bayer, "From Kitchen Hearth to Learned Paracelsianism: Women and Alchemy in the Renaissance," in J. Linden, *Mystical Metal of Gold* (Brooklyn, NY: AMS Press, 2007): 365–86; and Meredith K. Ray, *Daughters of Alchemy* (Cambridge, MA: Harvard University Press, 2015). On women and alchemy, see, e.g., the recent special issue introduced in Sajed Chowdhury, "Introducing Women's Alchemical Cultures," *Early Modern Women: An Interdisciplinary Journal* 15, no. 2 (2021): 89–92; Antonio Clericuzio, "'Sooty Empiricks' and Natural Philosophers: The Status of Chemistry in the Seventeenth Century," *Science in Context* 23 (2010): 337–8; Margaret E. Boyle, "Scents and Celestinas: Alchemical Women in Early Modern Spain," *Early Modern Women* 15, no. 2 (2021): 113–20.

not only the substitution of ingredients but also the determination of doses, methods of application, and techniques of production and preservation. It required observing, recording, and exchanging information with other practitioners.[13] This rich culture of experimentation was often sustained by a deep understanding of alchemical processes.[14] Moreover, recent historiography emphasizing the circulation of material practices rather than unembodied ideas has demonstrated how the work of minds and hands is often inseparable, thus requiring a consideration of "mindful hands and handy minds."[15] All of this should not be taken to mean that the populated kitchen hearth was free of gender-related conflicts. For instance, as Simon Werrett and others have noted, natural philosophers' extensive use of kitchenware and domestic resources in their experiments became a source of anxiety and caused some male natural philosophers to distance themselves and their activities from what they considered mere cookery and female practices.[16]

It was not only the early modern kitchen that was buzzing with scientific activity. In drawing rooms, backyards, cellars, and attics of self-styled philosophical families, collections were assembled, foreign scientific books translated, results discussed, and manuscripts prepared for printing. Women participated in all these tasks. They gathered, classified, and curated collections and instruments; they translated scientific books; and they mastered "paper technologies," in taking notes, editing and preparing manuscripts, drawing illustrations, and nurturing scientific networks.[17] During the

[13] Elaine Leong and Alisha Rankin, "Testing Drugs and Trying Cures: Experiment and Medicine in Medieval and Early Modern Europe," *Bulletin of the History of Medicine* 91, no. 2 (2017): 157–82; Elaine Leong, *Recipes and Everyday Knowledge: Medicine, Science and the Household in Early Modern England* (Chicago and London: University of Chicago Press, 2018). Alisha Rankin, *Panaceia's Daughters.* On the wealth of the early modern recipe world, see the blog *The Recipes Project: Food, Magic, Art, Science, and Medicine*, and the blog: https://recipes.hypotheses.org/. Accessed 1 Julio 2022.
[14] Sarah Hutton "Alchemy and Cultures of Knowledge among Early Modern Women," *Early Modern Women* 15, no. 2 (2021): 93–102.
[15] Roberts, Schaffer, Dear, *The Mindful Hand*; Pamela H. Smith, *The Body of the Artisan: Art and Experience in the Scientific Revolution* (Chicago: University of Chicago Press, 2004). See also the project: "The Making and Knowing Project: Intersections of Craft Making and Scientific Knowledge," https://www.makingandknowing.org/ (Accessed 1 July 2022).
[16] Simon Werrett, "Household Oeconomy and Chemical Inquiry," in *Compound Histories: Materials, Governance and Production, 1760–1840*, ed. Lissa Roberts and Simon Werrett (Leiden and Boston: Brill Publishing, 2017), 35. See also Graeme Gooday, "Placing or Replacing the Laboratory in the History of Science," *Isis* 99 (2008): 795. On the issue of the uses of everyday utensils in early modern science, see Simon Werrett, *Thrifty Science* (Chicago: University of Chicago Press, 2019) and Lucy J. Havard (2022), "'Almost to Candy Height:' Knowledge-Making in the Early Modern Kitchen, 1700–1850," *Cultural and Social History* 19, no. 2 (2022): 119–39.
[17] A recent survey of paper technologies can be found in Carla Bittel, Elaine Leong, and Christine von Oertzen, "Introduction: Paper, Gender, and the History of Knowledge," in Bittel, Leong, and von Oertzen, *Working with Paper.* In the same volume, see Elizabeth Yale, "A Letter Is a *Paper House*: Home, Family, and Natural Knowledge," 145–59. See also Anke te Heesen, "The Notebook: A Paper-Technology," in *Making Things Public: Atmospheres of Democracy*, ed. Bruno Latour and Peter Weibel (Cambridge, MA: MIT Press, 2005), 582–9. On scientific practices in households, see Alix

eighteenth century, the still close links between scientific academies and the academicians' households permitted women to collaborate with learned men.[18] Scholars have also highlighted the important role of popularisers such as Jane Marcet (1769–1858), whose *Conversations on Chemistry* (1805) addressed to young women contributed to the public visibility of chemistry.[19]

Indeed, when defined broadly as the field of practice of those engaged with materials and their transformations, chemistry was a key element of the epochal changes that took place between the 1760s and the 1840s. Understood in this sense, chemistry was closely intertwined with matters of mining, agriculture and food production, and pharmacology; and as Lissa Roberts and Simon Werrett have argued, it decisively shaped the global circulation of materials and people and, therefore, the socio-material world.[20] Instead of a revolutionary break in the late eighteenth century, Roberts and Werrett highlight the "continuities and accumulations" that framed the historical development in the different ambits in which chemistry and chemists operated: from the academic world to the realms of manufacturing, health and medicine, and governmental administration. This emphasis on continuity, and on gradual rather than revolutionary change, remains relevant with respect to the second half of

Copper, "Homes and Households," in the *Cambridge History of Science*, *vol. 3. Early Modern Science,* ed. Katherine Park and Lorraine Daston (Cambridge: Cambridge University Press, 2006), 224–37.

[18] Mary Terrall, *Catched Nature in the Act: Réaumur and the Practice of Natural History in the Eighteenth Century* (Chicago: University of Chicago Press, 2014) and Mary Terrall, "Masculine Knowledge, the Public Good, and the Scientific Household of Réaumur," *Osiris* 30, no. 1, *Scientific Masculinities* (January 2015): 182–201.

[19] Jane Marcet, *Conversations on Chemistry, in which the Elements of that Science are Familiarly Explained and Illustrated by Experiments* (London: Longman, Hurst, Rees and Orme, 1806). Although the book targeted women, Michael Faraday (1791–1867) read it while he was still a bookbinder's apprentice, which seeded an interest in chemistry. See Peter E. Childs, "Elementary Chemistry: Mrs Jane Marcet and the Popularisation of Chemistry," in *Women in Their Element: Selected Women's Contributions to the Periodic System*, ed. Annette Lykknes and Brigitte Van Tiggelen (New Jersey: World Scientific, 2019), 101–11. See also Jean-Jacques Dreifuss and Natalia Tikhonov Sigrist, "The Making of a Bestseller: Alexander and Jane Marcet's *Conversations on Chemistry*," in *For Better or For Worse? Collaborative Couples in the Sciences*, ed. Annette Lykknes, Donald L. Opitz, and Brigitte Van Tiggelen (Basel: Birkhäuser, 2012), 19–32.

[20] Robers and Werrett, *Compound Histories*. On chemistry and mining, see, e.g., Hjalmar Fors, *The Limits of Matter* (Chicago: University of Chicago Press, 2015). On food, see Emma Spary, *Eating the Enlightenment: Food and the Sciences in Paris, 1670–1760* (Chicago: University of Chicago Press, 2012). On chemistry and agriculture, see, e.g., Peter M. Jones, *Agricultural Enlightenment: Knowledge, Technology, and Nature, 1750–1840* (Oxford: Oxford University Press, 2016); Jones, "Making Chemistry the 'Science' of Agriculture, c. 1760–1840," *History of Science* 54 (2016): 169–94. On chemical experts, see Ursula Klein and Emma Spary, eds., *Materials and Expertise in Early Modern Europe: Between Market and Laboratory* (Chicago: University of Chicago Press, 2010), and Ursula Klein, ed., special issue "Artisanal-Scientific Experts in Eighteenth-Century France and Germany," *Annals of Science* 69 (2012): 303–433.

the nineteenth century and the first half of the twentieth century, the period we have referred to in the title of this special issue as the era of professional science.[21]

The era of professional science continued to show an extensive participation of women in chemistry-related activities.[22] In this period as well, kitchen and other domestic settings continued to be important sites of chemistry for women; it has even been argued that connections with kitchen work can help explain why it was relatively common for women to work as chemical analysts in the nineteenth and early twentieth centuries.[23] Yet the proliferation of scientific societies, the rise of the specialised scientific journal, the expansion of higher scientific and technical education, and related efforts to separate "professional" from "amateur" practitioners in the decades around 1900 also created new dynamics, hopes, and disappointments.[24] Although commonly excluded, women were not solely a victim of the so-called professionalisation of the sciences; among other things, they also exploited a demand for more popular types of scientific publishing and writing; created scientific societies of their own (e.g., the German Association of Female Chemists); started being more commonly accepted into co-educational institutions of higher education from the first decades of the twentieth century onward; and gradually gained access to new types of paid jobs in science that could serve as alternatives to work as (secondary school) teachers in particular.[25]

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[21] For instance, as Erst Homburg has argued, it is important not to overstate the start of the "second industrial revolution" around the 1870s as a turning point in the history of chemistry; see, e.g., Homburg, "Chemistry and Industry: A Tale of Two Moving Targets," *Isis* 109 (2018): 565–76.

[22] See, e.g., the many women who contributed to the discovery of chemical elements, as discussed in Lykknes and Van Tiggelen *Women in Their Element*.

[23] See, e.g., Anders Lundgren, "Women and Analytical Chemistry: Reflection on the Chemical Skill Needed for Investigating the Elements," in Lykknes and Van Tiggelen, *Women in Their Element*, 124–33.

[24] On the proliferation of specialised scientific communities from the mid-nineteenth century onwards, see, e.g., David Cahan, "Institutions and Communities," in *From Natural Philosophy to the Sciences: Writing the History of Nineteenth-Century Science*, ed. David Cahan (Chicago: University of Chicago Press, 2003), 291–328. On the rise of the specialised scientific journal, see, e.g., Melinda Baldwin, "The Shifting Ground of *Nature*: Establishing an Organ of Scientific Communication in Britain, 1869–1900," *History of Science* 50 (2012): 125–54; Alex Csiszar, *The Scientific Journal: Authorship and the Politics of Knowledge in the Nineteenth Century* (Chicago: University of Chicago Press, 2018). On the expansion of higher technical and scientific education, see, e.g., Robert Fox and Anna Guagnini, eds., *Education, Technology and Industrial Performance in Europe, 1850–1939* (Cambridge: Cambridge University Press, 1993).

[25] See, e.g., Bernard Lightman, "Marketing Knowledge for the General Reader: Victorian Popularizers of Science," *Endeavour* 24 (2000): 100–106;Rebecca Rogers, "Learning to Be Good Girls and Women: Education, Training and Schools," in *The Routledge History of Women in Europe since 1700,* ed. Deborah Simonton (London/New York: Routledge, 2006), 93–133; Ruth Watts, *Women in Science: A Social and Cultural History* (London/New York: Routledge, 2007); Amy Bix, "From 'Engineereeses' to 'Girl Engineers' to 'Good Engineers': A History of Women's U.S. Engineering Education," in Bystydzienski and Bird, *Removing Barriers*, 46–65; Rayner-Canham and Geoffrey Rayner-Canham, *Chemistry Was Their Life: Pioneer British Women Chemists, 1880–1949* (London: Imperial College Press, 2008); Renate Tobies and Annette B. Vogt, eds., *Women in Industrial Research* (Stuttgart: Franz Steiner, 2014).

As with the early modern examples discussed above, the opportunities available to women chemists in the era of professional science tended to be concentrated in particular fields. Not only today but also in the first half of the twentieth century, for instance, biochemistry was one science in which the presence of women was strong.[26] This was not least due to the rapid expansion of this discipline in the early 1900s, in combination with the relatively limited academic prestige that it enjoyed in this period and the role of supportive mentors.[27] Radioactivity research and crystallography were other areas that attracted a comparatively high share of women chemists. For radioactivity, too, the newness of the field made it easier for women to find a foothold and take up positions, as male hierarchies had not yet been established. The field probably also attracted ambitious women (and men) because of the opportunities that lay in such an unexplored territory—but choosing this path also entailed risk not to succeed, a risk many women were willing to take.[28]

In other fields and in their broader professional environments, women chemists faced multiple barriers and direct or indirect attempts at exclusion. One notorious example of sexism concerns the American Chemical Society's (ACS) self-described "misogynist dinner" in the summer of 1880—four years after the ACS's creation—which is said to have prompted the resignation of the society's only female member.[29] Many other new scientific associations established in the age of professional science also largely or completely excluded women scientists, and the situation at older learned societies could be even worse: the Royal Society of London (founded in 1660), for instance, did not elect its first female member until 1945, the French Academy as late as 1979.

In some instances, the entry of academically trained female chemists and other women into chemistry jobs other than teaching led to status anxieties among male professional chemists; in Germany in the

[26] As Annette Lykknes shows in her contribution to this special issue, the related foodstuff industry attracted many women from the Norwegian Institute of Technology in the first half of the twentieth century.
[27] Rayner-Canham and Rayner-Canham, *Chemistry Was Their Life*, 309–310. For some of the same reasons, émigré scientists were also well represented in biochemistry; see, e.g., Ute Deichmann, *Flüchten, Mitmachen, Vergessen* (Weinheim: Wiley-VCH, 2001), 173.
[28] On the contributions of women to radioactivity research and crystallography, see, e.g., Marelene G. Rayner-Canham and Geoffrey W. Rayner-Canham, eds., *A Devotion to Their Science: Pioneer Women of Radioactivity* (Montreal: McGill-Queen's University Press; and Philadelphia, PA: Chemical Heritage Foundation, 1997); Maria Rentetzi, *Trafficking Materials and Gendered Experimental Practices: Radium Research in Early 20th Century Vienna* (New York: Columbia University Press, 2008); Lykknes and Van Tiggelen, *Women in Their Element*.
[29] George B. Kaufmann, "The Misogynist Dinner of the American Chemical Society," *Journal of College Science Teaching* 12 (1983): 381–3.

decade before World War I, for instance, the Association of German Chemists actively discouraged chemical trade journals from helping female chemists find positions.[30] For similar reasons and in the same period, a group of male industrial chemists in the United States sought to set themselves apart from relatively lowly paid chemical analysts, including some female chemists. These aspiring chemical engineers pejoratively referred to the scientific manuals on which analysts relied as "cookbooks"—a complaint with early modern precedents, as we have seen—and set professional membership criteria that de facto precluded women from joining the American Institute of Chemical Engineers (founded in 1908).[31] Such acts of resistance created major barriers for women, yet the perceived need for such measures also illustrates that employers were in fact willing to hire female chemists, and the range of occupations open to them gradually increased in the following decades.[32]

In the United States and elsewhere, the imposition of restrictive professional standards was part of a much broader masculinisation of the realm of "technology," a previously more inclusive sphere to which white middle-class male engineers and scientists laid claim in the early to mid-twentieth-century.[33] Specific cultures of masculinity can also help explain why chemist Robert Burns Woodward (1917-1979) presented the creation of new organic compounds as an artistic, almost heroic adventure and, as recently as the early 1970s, uncritically repeated a joke about synthetizing "bigboobsenone" in an high-profile award lecture.[34] Still, even in explicitly sexist professional environments, a substantial

[30] Jeffrey A. Johnson, "German Women in Chemistry, 1895–1925 (Part I)," *NTM International Journal of History & Ethics of Natural Sciences, Technology & Medicine* 6 (1998): 1–21, on 5–7.
[31] See Joanna Behrman, "Manuals, Handbooks, and Recipes," in *Between Making and Knowing: Tools in the History of Materials Research*, ed. Joseph D. Martin and Cyrus C. M. Mody (Singapore: World Scientific, 2020), 73–82, on 75–79; and Terry S. Reynolds, "Defining Professional Boundaries: Chemical Engineering in the Early 20th Century," *Technology and Culture* 27.4 (1986): 694–716. On masculinity and professionalisation, see also, e.g., Robert A. Nye, "Medicine and Science as Masculine 'Fields of Honor,'" *Osiris* 12 (1997): 60–79.
[32] E.g., Jeffrey A. Johnson, "Women in the Chemical Industry in the First Half of the 20th Century," in *Women in Industrial Research*, ed. Renate Tobies and Annette Vogt (Stuttgart: Franz Steiner, 2014), 119–58; Ruth Oldenziel, "Multiple-entry Visas: Gender and Engineering in the US, 1870–1945," in *Crossing Boundaries, Building Bridges: Comparing the History of Women Engineers, 1870s-1990s*, ed. Oldenziel, Karin Zachmann, and Annie Canel (Amsterdam: Harwood, 2000), 11-49, on 33-6.
[33] Oldenziel, *Making Technology Masculine*. On the historical meanings of "technology," see also, e.g., Eric Schatzberg, *Technology: Critical History of a Concept* (Chicago: University of Chicago Press, 2018).
[34] Robert B. Woodward, "Art and Science in the Synthesis of Organic Compounds: Retrospectand Prospect," in Pointers and Pathways in Research: Six Lectures in the Fields of Organic Chemistry and Medicine, ed. Maeve O'Connor (Bombay: CIBA of India Ltd., 1963), 22–41, on 41; and.Otto T. Benfey and Peter J.T. Morris, eds., *Robert Burns Woodward; Architect and Artist in the World of Molecules* (Philadelphia: Chemical Heritage Foundation, 2001), 430 and 448 (n.35). See also Anne M. Wilson, "Harry S. Mosher and Arthur C. Cope, Early Organic Chemists Who Mentored Women," *Bulletin for the History of Chemistry* 34, no. 1 (2009): 21–9; and Evan Hepler-Smith, "'A Way of Thinking Backwards': Computing and Method in Synthetic Organic Chemistry," *Historical Studies in the Natural Sciences* 48, no. 3 (2018): 300–37, on 310.

number of women chemists were able to carve out successful careers.[35] The history of chemistry, therefore, provides plenty of material for examining not only the discrimination that women experienced but also their accomplishments and strategies for overcoming barriers.[36]

Central Themes and Findings

What insights can the different articles in this special issue provide into this tension? While the eighteenth-century women discussed in Francesca Antonelli's and Elena Serrano's contributions might seem to have little in common with the twentieth-century female chemical engineers and corporate scientists examined, respectively, by Annette Lykknes and Joris Mercelis, we would like to suggest that it can nevertheless be fruitful to analyse these cases through similar perspectives.

For instance, as we discuss in more detail below, historian Lisbeth Koerner's interest in uncovering specific historical circumstances that enabled women's participation in the sciences is highly relevant to the twentieth-century cases presented in this issue, even though Koerner's reflections primarily concerned Enlightenment science. Both in the Enlightenment and in the era of professional science, two sets of enabling circumstances concerned the (anticipated) utility of chemical knowledge and the sites and spaces in which women could productively engage in chemical activities. Networks and mentorships could play a similar role, again in both periods.

Or let us return to Gertrud Kornfeld's words: "I am not a lady, I am scientist." As our earlier comments on this declaration illustrate, the identities and self-representations of women engaged in chemistry-related activities are also worth exploring through a longer-term, comparative lens. The same applies to the occupational roles and strategies taken by such women, as well as to the research methods and sources that historians can and have used to uncover and analyse female chemistry-related activities.

Enabling Circumstances

This special issue was inspired by the call of Lisbet Koerner, who in 1995 urged feminist historians to explain not only how women were excluded from making public science, but how in fact did they

[35] For example: Oldenziel, *Making Technology Masculine*, 170–3; Wilson, "Mosher and Cope."
[36] On the need for such histories of women in science and technology, see, e.g., Kohlstedt, "Sustaining Gains," 23.

manage to make it. How, she asked, could today's presence of women in scientific careers otherwise be explained? Writing in a special issue that reflected on the achievements of gender history and women's history, she suggested focusing on "enabling circumstances." Her article aimed to contribute to a new sort of history of women in science which could explain the formation of our present era—one that would show how women were able to succeed and take part in modern society, rather than just explaining gaps, exclusions, and struggles of the past.[37] Koerner described for instance, how in Sweden, within the enlightened state-building efforts and the promotion of a utilitarian science, women were accepted as knowledge-makers.[38]

⇒ Utility and Nation Building

Central to Koerner's argument are the notions of utility and nation building.[39] The papers of Lykknes and Serrano in this issue also note how social imaginaries of progress might create the conditions for women to "join forces." Often, the way women participated was presented as the "feminine way" to contribute to nation-building efforts.

This was the case with the eighteenth-century women that Serrano studied. They came from enlightened families, whose male members were eagerly engaged in reformists activities. They were sisters and daughters of doctors and apothecaries who campaigned for public health issues, or of fellows of patriotic societies who were involved in promoting local industries. Women's trials on developing silk dyes with local resources, their advice on how to reuse wasted organic materials, and their translations of chemical and medical works were pictured as the feminine way of contributing to local prosperity and "public happiness."[40]

The women on which Lykknes focuses—the first to graduate from the Norwegian Institute of Technology, in chemical engineering—also felt like they were part of a national enterprise: the building of an independent and self-supporting nation-state. They were conscious of their privileged status as

[37] In fact, Koerner calls this new approach to studies of women in science "a new Whig history of our discipline," because it deals with the formation of the present. Lisbeth Koerner, "Women and Utility in Enlightenment Science," *Configurations* 3 (1995): 233–54.
[38] See also the recent article by Paola Govoni, "Feminist Networks beyond the Science Wars: The 'Female Brain' in the 1790s and the 1990s," *Notes and Records: The Royal Society Journal of the History of Science*, published online 15 June 2022, https://doi.org/10.1098/rsnr.2021.0075.
[39] Lisbet Koerner, *Linnaeus: Nature and Nation* (Cambridge, MA: Harvard University Press, 1999).
[40] See also Elena Serrano, *Ladies of Honor and Merit: Gender, Useful Knowledge and Politics in Enlightened Spain* (Pittsburgh: University of Pittsburgh Press, 2022).

members of an elite who would participate in nation-building by helping create new industries. As is well known, science has been central to creating national identity.[41] Norway, which had gained independence from Denmark in the early nineteenth century and was gradually building an identity as an independent nation-state, already had national heroes, such as the polar explorer and zoologist Fridtjof Nansen (1861–1930), who returned from his Arctic expedition in 1896 to become a symbol of what Norway could achieve as an independent nation.[42] Large-scale hydropower plants were set up and high hopes were placed in knowledge production and industrial development.[43] The institute, the first of its kind in Norway, may have raised strong expectations of the women who joined it. Lykknes suggests that the prospect of becoming part of something bigger, of gaining status and positions, might have attracted ambitious women, often with the strong support of their families, such that they overcame barriers otherwise experienced by women entering male-dominated fields in education or professional life in Norwegian society.

⇒ **Sites**

As discussed in our survey of women's long history in chemistry, a focus on sites of knowledge production beyond the academy has been crucial to unveiling many women's scientific roles.[44] The family manor by the seaside where María de Betancourt and her brothers engaged in textile inquiry and inventions is one example (see Serrano's article). The detailed analysis of the social activity that took place in the household of the Lavoisiers in the Arsenal (ranging from evening dinners to theatrical performances and the showcasing of instruments) revealed, Antonelli argues, a new and more

[41] Carol E. Harrison and Ann Johnson, eds., "National Identity: The Role of Science and Technology," *Osiris* 24 (2009); Claire G. Jones, *Feminitity, Mathematics and Science, 1880–1914* (New York: Palgrave MacMillan, 2009), 5. See also Martin Kohlrausch and Helmuth Trischler, *Building Europe on Expertise: Innovators, Organizers, Networkers* (New York: Palgrave MacMillan, 2014), esp. chapter 2.
[42] The dissolution of the union with Sweden did not take place until 1905. On Nansen as a national hero, see Robert Marc Friedman, "Nansen, National Honour and the Rise of Norwegian Polar Geophysics," in *Perspectives on Scandinavian Science in the Early Twentieth Century,* ed. Reinhard Siegmund-Schultze and Henrik Kragh Sorensen (Oslo: The Norwegian Academy of Science and Letters, 2006), 85–110.
[43] Annette Lykknes, "The Chemistry Professor as Consultant at the Norwegian Institute of Technology, 1910–1930," *Ambix* 67 (2020): 271–88.
[44] Christine von Oertzen, Maria Rentetzi, and Elizabeth S. Watkins, "Finding Science in Surprising Places: Gender and the Geography of Scientific Knowledge," introduction to special issue "Beyond the Academy: Histories of Gender and Knowledge," *Centaurus* 55, no. 2 (2013): 73–80; See also the special issues published in *Ambix*: "Sites of Chemistry in the Eighteenth Century," *Ambix* 60, no. 2 (2013); "Sites of Chemistry in the Nineteenth Century," *Ambix* 61, no. 2 (2014); and "Sites of Chemistry in the Twentieth Century," *Ambix* 62, no. 2 (2015). These publications were one of the outputs from the international project "Situating Material and Knowledge Production in the History of Chemistry: Sites and Networks of Discipline Formation and Industrial Practice, 1760–1840" co-directed by Lissa Robers and John Perkings.

ambitious facet of Marie-Anne Paulze-Lavoisier. The experiences of early women chemists in the photographic film and paper industry suggests that even the establishment of exclusively female, segregated corporate research labs can be considered an enabling circumstance. In the United States and elsewhere, a preoccupation with leadership had been an important feature of manliness in the nineteenth and early twentieth centuries, and the need for teamwork was frequently stressed in the early to mid-twentieth-century literature on industrial research and development (R&D).[45] Although it was mostly considered out of the question that women scientists would exert authority over men, in all-female laboratories they could become team leaders and, as Mercelis's article illustrates, even end up occupying a more senior position in their R&D facilities than many of the male scientists in their organisation.

⇒ **Networks**

For obvious reasons, having access to scientific networks of power was another enabling circumstance.[46] That becomes clear in all of the articles in this special issue. During the Enlightenment, households could be sites of knowledge production as well as sites for networking, as we have seen in the articles by Antonelli and Serrano. In the house of her father, a public figure, the young María Antonia Gutiérrez Bueno familiarised herself not only with the new empirical sciences, with chemical theories and laboratory practices, but also with the wider circles of enlightened sociability. This may have made it possible for her to later publish her chemical translations in a widely known journal, among other things.

In the professional era, women often found jobs through their contacts. For instance, the first two women chemical engineers who graduated from the Norwegian Institute of Technology (in 1919), Margot Dorenfeldt (1895–1986) and Randi Holwech (1890–1967), were sponsored by associate professor Ellen Gleditsch (1879–1968), who had worked with Marie Curie (1867–1934) for many years. Dorenfeldt was employed at the University where Gleditsch worked, while Holwech secured a

[45] On leadership and masculinity, see, e.g., Angel Kwolek-Folland, *Engendering Business: Men and Women in the Corporate Office, 1870–1930* (Baltimore: JHU Press, 1994); Sharon H. Strom, *Beyond the Typewriter: Gender, Class, and the Origins of Modern American Office Work, 1900–1930* (Urbana: University of Illinois Press, 1994), 50; Scott A. Sandage, *Born Losers: A History of Failure in America* (Cambridge, MA: Harvard University Press, 2005).
[46] See Anna Maerker, Simon Werrett, and Elena Serrano, "Enlightened Female Networks: Gendered Ways of Making Knowledge," *Notes and Records: The Royal Society Journal of the History of Science* (forthcoming). Several articles from the special issue are already online.

place in Curie's lab. Gleditsch was also very active in both the International Federation of University Women and in informal networks of women working on radioactivity across Europe.[47] It was precisely the sponsorship from Marie Curie that helped her when she struggled to get a full professorship at her alma mater.[48]

In the early twentieth century the concept of collegial friendships was unknown to many academic women. Yet this would change with the establishment of a formal organisation, The International Federation of University Women (IFUW), as a global network of female academics in 1919.[49] Educational institutions and all-female labs also served as nodes for networking and offered support and contacts to women. Some of the women who studied chemical engineering at the Norwegian Institute of Technology, for example, benefited from support and contacts that their male professor provided. However, historians must be careful to rely too much on the importance of male mentors in explaining women's careers, without considering a much wider field of networks and contacts, as this may erase the ways in which women in science and engineering had agency.[50]

Male kinship—of fathers, brothers, and husbands—also played a crucial role in many women's scientific careers.[51] Fathers were also strong supporters of some of the first women who were enrolled at the institute in Trondheim, and brothers circulated the works of their sisters within the male societies in Spain that Serrano investigates. As members of these societies, the brothers were in the position to propose their sisters as honorific members. Marriage could help or hinder women's careers. We have several examples of both in our collection of articles. Some women engineers were recruited

[47] On the role of the networks of women working on radioactivity, see for instance Rayner-Canham and Rayner-Canham, *A Devotion to Their Science*.
[48] Annette Lykknes, Lise Kvittingen, and Anne Kristine Børresen, "Appreciated Abroad, Depreciated at Home: The Career of a Radiochemist in Norway: Ellen Gleditsch (1879–1968)," *Isis 95* (2004): 576–609.
[49] Pycior et al., *Creative Couples*. On the history of the IFUW, see Christine von Oertzen, *Science, Gender and Internationalism: Women's Academic Networks, 1917–1955* (New York: Palgrave MacMillan, 2014). For an example of how female geologists capitalised on both the International Federation of University Women and international and national geological societies, see Cynthia B. Burek, "Early Female Geologists: The Importance of Professional and Educational Societies during the Late Nineteenth and Early Twentieth Centuries," in Jones et al., *Palgrave Handbook of Women and Science*, 101–25.
[50] Jones et al., *Palgrave Handbook of Women and Science*, 7.
[51] Pnina G. Abir-Am and Dorinda Outram, eds., *Uneasy Careers and Intimate Lives: Women in Science 1789–1979* (New Brunswick/London: Rutgers University Press, 1987).

in the same business or research group as their partners, although most of the women who remained longest in industry were unmarried or never had children.[52]

Identities, Motivations, and Strategies

Whereas the study of enabling circumstances requires careful attention to the historical contexts and networks in which female chemists operated, it is also important to closely consider the motives, identities, and strategies of these women themselves. Identities and strategies, to be sure, were never formed in a vacuum, and could indeed be closely related to the themes that we have discussed in the previous paragraphs. The creation and/or cultivation of a support network, for instance, could have important strategic components and might also cast valuable light on women's motives and identity.[53] Yet, at the same time, the articles in this special issue illustrate that there is much to be gained from taking seriously the motivations and self-images of women engaged in chemical activities, along with these women's assessments of the opportunities available to them and their strategies for pursuing their interests and ambitions. Unfortunately, it can be hard to determine whether women engaged in chemical work were pursuing any deliberate strategies, and there is certainly a risk of retrospectively reconstructing their goals and approaches from a primary source basis that is sometimes very limited. Still, despite such risks and limitations, there are clearly benefits to exploring the strategies, motives, and identities of women in chemistry through a longer-term comparative lens, as different contributions to this special issue make clear.

One way of doing this is looking at women's material productions. Take, for instance, the strategies employed by eighteenth-century women to gain public recognition as "improvers" or "friends of the country." These included presenting, to their social circles, their innovations in producing goods or

[52] Lykknes, Opitz, and Van Tiggelen, *For Better or For Worse?* Scientific families, collaborative couples, and the relevance of the domestic space for women in science have been discussed in several volumes over the last twenty-five years: Abir-Am and Outram, *Uneasy Careers and Intimate Lives;* Helena M. Pycior, Nancy G. Slack, and Pnina G. Abir-Am, eds., *Creative Couples in the Sciences* (New Brunswick/New Jersey: Rutgers University Press, 1996); Donald L. Opitz, Staffan Bergwik, and Brigitte Van Tiggelen, eds., *Domesticity in the Making of Science* (London: Palgrave MacMillan, 2016); and several articles in Annette Lykknes and Brigitte Van Tiggelen, *Women in Their Element*. For the example of an engineer couple in the late nineteenth and early twentieth centuries, namely Hertha Ayrton and William Ayrton, see Jones, *Feminity, Mathematics and Science.*

[53] Marriage, seeking the support of male mentors, and networking with other women are strategies highlighted in previous studies; see, e.g., Claire G. Jones, Alison E. Martin, and Alexis Wolf, "Women in the History of Science: Frameworks, Themes and Contested Perspectives," in *Palgrave Handbook of Women and Science*, ed. Jones et al., 3–24; Kohlstedt, "Sustaining Gains."

substances of economic value, as we find evidenced in women's trials with different dyes in silk clothes and threads that were glued to the notebooks of the Economic Society of Tenerife. Sending samples to patriotic societies and presenting oneself as a candidate for the prizes these societies awarded could be considered "strategies" in the sense that such actions served to balance the feminine modesty required of women, while also making these women visible (Serrano's article).

Secretarial, editorial, and translation work can also provide a useful starting point for analysing the identities, strategies, and self-representations of women in chemistry—not only of the likes of Paulze-Lavoisier but also of women chemists employed in early to mid-twentieth-century corporate laboratories. As Antonelli argues in her paper, Paulze-Lavoisier's well-known roles as scientific translator and notetaker (*secrétaire*) for her husband need to be considered in relation to her activities and self-representations as *maîtresse de maison* and author of letters and illustrations, since it was the strategic combination of these roles that allowed her to gain more visibility and recognition for her scientific contributions. More specifically, Antonelli demonstrates how Paulze-Lavoisier appropriated her husband's promotional campaign for a "new chemistry" to make herself more visible in scientific circles. Domestic sociability and hosting visiting scientists were part of this, but it also entailed actions that were much bolder when measured against the gender conventions of the time, such as drawing herself as participating in scientific practice—as the woman taking notes and interacting with some of the male scientists.

In the seventeenth and eighteenth centuries, the role of secrétaire was prestigious and powerful; individuals such as Bernard le Bovier de Fontenelle (1657–1757), the permanent secrétaire at the French Royal Academy, come to mind. At the eve of World War I, private secretaries commonly continued to be men, but the occupation was about to be feminised to a significant extent.[54] Female scientists and other college-educated women were among those working as secretaries in the interwar years, and women chemists also conducted paperwork as librarians, patent professionals, and literature chemists. Such positions have been identified as dead-end jobs where female scientists had to put

[54] See, e.g., Kwolek-Folland, *Engendering Business,* 57–62; Anna Horstmann, "Zwischen 'bravem Mädchen' und 'gebildeter Dame': Die Konstruktion von Weiblichkeit in den Büros der chemischen Industrie während des Ersten Weltkrieges," *GENDER–Zeitschrift für Geschlecht, Kultur und Gesellschaft* 11, no. 2 (2019): 86–102.

written material "into the hands of the men who should know about it."[55] Yet women chemists could have good strategic reasons for pursuing careers as office workers or librarians rather than laboratory researchers, and, much like Paulze-Lavoisier, could seek to define and/or combine their occupational roles in such a way as to gain more visibility and/or recognition. As Mercelis's article illustrates, for instance, at least some female librarians and literature chemists were recognised and rewarded for their distinct expertise in (among other things) reviewing and evaluating scientific publications in different languages.

According to chemist James W. Perry (1907–1971), a central figure in Evan Hepler-Smith's work in progress on the history of literature chemistry, the "ability to work harmoniously with the 'boys in the laboratory'" was "one of the important qualifications that a literature chemist must have."[56] It is a comment that may well have resonated with the female chemical engineering students analysed in Lykknes's article, the first one of whom was the only woman in a cohort of 103 incoming students at the Norwegian Institute of Technology. Lykkness suggests that in developing identities as engineers—and in becoming interested in studying technical and scientific subjects in the first place—several of the women in her prosopographical sample may have been strongly influenced by their fathers and/or brothers. Other women examined in her paper appear to have deliberately tried to blend into their male-dominated class and student environment. By positioning themselves as one of the men (or "guys"), women chemists and engineers may have avoided the effects of being too visible in their group, as symbols or "tokens" of womanhood, to borrow Rosabeth Moss Kanter's descriptions.[57] Specific strategies and motives, in other words, may have ended up affecting the identities of these women. And conversely, women's identities as "learned women" in the case of the Enlightenment, or of "scientists" or "engineers" in the case of the professional era, influenced the image of the groups and other institutions to whom women belonged. According to the gender conventions of the eighteenth century, for instance, women learned behaviour that could be beneficial for the whole

[55] Mildred Bond, "Along the Promenade," *Democrat and Chronicle* (13 October 1935). For a critical assessment of library work, see, e.g., Margaret W. Rossiter, "Chemical Librarianship: A Kind of 'Women's Work 'in America," *Ambix* 43 (1996): 46–58.
[56] James W. Perry, "The Literature Chemist," *Chemical and Engineering News* 28 (1950): 4530–2, on 4531; and Evan Hepler-Smith, "Compound Words: Chemical Information and the Molecular World" (unpublished book manuscript, 2021). We are most grateful to Hepler-Smith for allowing us to draw on his work-in-progress.
[57] Rosabeth Moss Kanter, "Some Effects of Proportions on Group Life; Skewed Sex Rations and Responses to Token Women," *The American Journal of Sociology* 82 (1977): 965–90, reproduced in *Small Groups: Key Readings in Social Psychology,* ed. John M. Levine and Richard L. Moreland (New York/Hove: Psychology Press, 2006), 37–54.

family, projecting an image of modernity. Yet we also find cases of women who highlighted their gender identities and made their traditionally feminine roles work in their favour. "Being a woman is no impediment to work for the benefit of the fatherland," declared María de Betancourt, as a way to justify her involvement in experimenting with dyes.

Rendering Women Visible

Finally, the articles in this special issue support Paula Findlen's argument that women who have disappeared from history were not necessarily invisible in their own time, but have become so due to a selection process.[58] This again applies to both the eighteenth-century and the twentieth-century cases. The female chemists and laboratory assistants employed at Eastman Kodak's synthetic chemistry department around the end of World War I, for instance, received relatively extensive media coverage at the time yet are almost completely absent from Kodak's corporate archives. Somewhat similarly, although records of Paulze-Lavoisier have been preserved, even today they are kept under the name of her more famous husband.

The articles in this issue draw on a variety of sources and methods to counter the common underrepresentation of women in archival and other collections. The sources used include minutes, reports, correspondence, and laboratory notebooks; oral histories transcribed and included in public and corporate archives; illustrations, portraits, and photographs; newspaper articles, women's contributions in bulletins, and short biographical entries in commemorative volumes. In terms of methods, our approaches vary from single-case studies in the form of biographies to multi-case studies, either in the form of prosopography or of studies of groups of women in specific labs or societies. Each of these methods naturally has its own strengths and limitations.[59] Taken together, they

[58] Paula Findlen, "Listening to the Archives: Searching for the Eighteenth-Century Women of Science," in *Writing about Lives in Science: (Auto)Biography, Gender, and Genre*, ed. Paola Govoni and Zelda Alice Francheschi (Göttingen: V&R unipress, 2014), 87–116.
[59] The literature on biography is especially rich; see, e.g., Michael Shortland and Richard Yeo, eds., *Telling Lives in Science: Essays on Scientific Biography* (Cambridge: Cambridge University Press, 1996). An updated bibliography on the uses of women's biography in the history of science, which, according to the authors, "have contributed to an historiographical transformation of the history of science from a women's perspective" in María Jesús Santesmases, Montserrat Cabré i Pairet and Teresa Ortiz Gómez, "Feminismos biográficos: aportaciones desde la historia de la ciencia," *Arenal,* 24:2 (2017): 379-404.

are meant to illustrate a range of rewarding options available to those interested in determining whether and why ladies could or could not be scientists as well.