

**ENLIGHTENED FEMALE NETWORKS:
GENDERED WAYS OF PRODUCING KNOWLEDGE (1720-1830)**

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Abstract

This special issue investigates women's scientific networks in Europe roughly between 1720 and 1830, an interesting period from a gender point of view. The articles analyse the role that networks played in enabling, shaping, and circumscribing women in their intellectual pursuits, social aspirations, and ideals. They also focus on how was the nature of the member's relationships, how women negotiated their scientific identities, and how often women could use their femininity to create new social spaces for themselves and their families. We traced different types of networks such as "paper networks", "technical", "distant" (in its special and temporal sense), "moral" and "mixed", as well as how many of these networks were characterised by broad intellectual engagement which was never exclusively scientific, but also literary, poetic, educational and philosophical.

Introduction

"The ability to connect with people can completely change your life." Such is the claim of a blog offering online classes on how to start and nurture an effective, emotionally rewarding professional

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network — the glossy promise of thousands of online courses, YouTube videos, and self-help books. Networking is now considered an essential skill in business and academia, and the study of social networking has exponentially increased in recent years in areas such as economics, psychology, and sociology.² Gender is a key factor in modern perceptions of networks: it is hotly debated, for instance, whether the difference in earnings and promotions between men and women may be affected by gender differences in networking.³ Meanwhile universities and female professional societies coach women in networking and provide them with female mentorship.⁴

Nevertheless, female networks are hardly new. Academic women after World War I purposely organised an international web of women scholars across the Atlantic, which still holds today in some countries, to add weight to their opinions in political and scholarly matters.⁵ As Londa Schiebinger recognized in her influential 1989 book *The Mind Has No Sex*, networks of noblewomen played a crucial role in providing mechanisms for women to enter intellectual circles

² Quotation from <https://blog.coursesity.com/best-personal-networking-classes/>, accessed 7 October 2021. A WorldCat search (network*) gave 10,936,371 results. On contemporary networking advice see e.g. *The Guardian*, <https://www.theguardian.com/small-business-network/2017/jan/23/psychologists-guide-networking-events-advice>. See also Paula Govoni's "Feminist Networks beyond the Science Wars: The 'Female Brain' in the 1790s and the 1990s" in this issue. An insightful introduction to social network analysis in: Stephen P. Borgatti, Daniel J. Brass and Daniel S. Halgin, "Social Network Research: Confusions, Criticisms, and Controversies" in Daniel J. Brass, Giuseppe (joe) Labianca, Ajay Mehra, Daniel S. Halgin, Stephen P. Borgatti (eds.), *Contemporary Perspectives on Organizational Social Networks* (Bingley, U.K: Emerald, 2014), 1-32.

³ Elena Greguletz, Marjo-Riitta Diehl, Karin Kreutzer, "Why women build less effective networks than men: The role of structural exclusion and personal hesitation," *Human Relations*, Volume 72 issue 7, (2018): 1234-1261; Laura Weis and Alixe Lay "Gender-specific networking: mind the gap," in Alexander-Stamatios Antoniou, Cary Cooper and Caroline Gatrell (eds), *Women, Business and Leadership. Gender and Organisations* (Edward Elgar Publishing, 2019), 174–198. Brian Uzzi, "Men and Women Need Different Kinds of Networks to Succeed", in *Harvard Business Review* February 25, 2019: <https://hbr.org/2019/02/research-men-and-women-need-different-kinds-of-networks-to-succeed>. But see Friederike Mengel, "Gender differences in networking," *The Economic Journal*, volume 130, issue 630, (2020): 1842–1873: "Earnings and promotion gaps appear partly because male decision makers are more likely to reward their (predominantly male) network neighbours with increased earnings as well as promotion." <https://academic.oup.com/ej/article-abstract/130/630/1842/5810657>

⁴ On women's mentoring: http://www.minerva-femmenet.mpg.de/pdf_biospektrum_legrumundhaas_engl.pdf.

⁵ Christine von Oertzen, *Science, Gender, and Internationalism: Women's Academic Networks, 1917–1955* (Palgrave Macmillan, 2012); Patricia Fara, *A lab of one's own. Science and suffrage in the first world war* (Oxford-New York: Oxford University Press, 2018). For present-day networks of female academics see e.g. <https://www.dab-ev.org/de/netzwerke/Netzwerke.php>

in the seventeenth and eighteenth centuries, as these women's elevated social rank could offset their supposed intellectual inferiority as women.⁶ Women participated in global commercial and scientific networks that brought together scholars, merchants and explorers with whom they corresponded, collecting and swapping shells, plants, insects and other natural specimens.⁷ The exchange of knowledge and scientific objects was a common way of joining communities and strengthening bonds. For instance, early modern gentlewomen enthusiastically nurtured their networks of influence by exchanging medical recipes, herbals books, and remedies.⁸

We contend here that exploring historical scientific networks can illuminate further the role that networks play in enabling and legitimising women in their intellectual pursuits, social aspirations, and ideals. We investigate women's strategies for entering networks, the nature of their relationships, how they negotiated their scientific identities, and how networks enabled, shaped and circumscribed female contributions to science. We focus on a particular moment in European history, the period roughly between 1720 and 1830, which is especially interesting from a gender perspective. Ways of knowing, institutional settings, and practitioners' social identities were changing in favour of courts, academies and households rather than monasteries and universities, generating new forms of sociability that destabilized traditional intellectual gender hierarchies.⁹ Contemporaries perceived, often with anxiety, that the modern commerce between the sexes was

⁶ Londa Schiebinger, *The mind has no sex? Women in the origins of modern science* (Harvard University Press, 1989).

⁷ For such exchanges see e.g. Arlene Leis and Kacie L. Wills (eds.), *Women and the art and science of collecting in eighteenth-century Europe* (London & New York: Routledge, 2021); also the contributions in "Rethinking Banks", special issue of *Notes and Records*, Volume 73, Issue 4 (20 December 2019), ed. Simon Werrett. On women in the republic of letters, see the pioneer work of Dena Goodman, *The republic of letters: A cultural history of the French Enlightenment* (Ithaca: Cornell University Press, 1994) and Clarissa Campbell Orr, "Aristocratic feminism, the learned governess, and the republic of letters", in *Women, gender and Enlightenment*, ed. Sara Knott and Barbara Taylor (Basingstoke: Palgrave Macmillan, 2005), 306–325.

⁸ Elaine Leong, *Recipes and everyday knowledge. Medicine, science, and the household in Early Modern England* (Chicago: Chicago University Press, 2018); Alisha Rankin, *Panacea's daughters: Noblewomen as healers in Early Modern Germany* (Chicago: Chicago University Press, 2013); Sharon T. Strocchia, ed., "Special Issue: Women and healthcare in Early Modern Europe", *Journal of the Society for Renaissance Studies*, Volume 28, 4 (September 2014): 496-638.

⁹ See for instance the essays in Lorraine Daston and Katharine Park (eds.), *The Cambridge History of Early Modern Science* (New York: Cambridge University Press, 2006); and in W. Clark, J. Golinski, and S. Schaffer (eds.), *The Sciences in Enlightened Europe* (Chicago: University of Chicago Press, 1999). On the transitions from the old scholarly values to the Enlightenment ones, see: Anne Goldgar, *Impolite Learning: Conduct and Community in the Republic of Letters, 1680-1750* (Yale University Press, 1995).

effacing the differences between a supposed “manly mind” and a “feminine” one. “Polite” or “gallant” conversation with educated women in salons and parlours became a site where men demonstrated the acuity of their intellects in witty conversation. These changes opened, in the words of Anthony J. Lavopa, “lacunae free of the gender binaries, and spaces to slip by them,” which women profited from.¹⁰ In a dynamic relation, the new sociability fostered scientific languages and literary genres close to the polite conversation between men and women — the instructive dialogue, the didactic letter, the witty short essay, the scientific poem— arguably addressing an imagined network of readers of both sexes with a shared enthusiasm for experiment and natural philosophy.¹¹ A constellation of socio-material circumstances and new gender dynamics, supported by the pervasive ideal that sciences had to be conversant with the world, and that knowledge had to be “useful” (with all the ambiguities that the term possessed) fostered networks of practitioners devoted to the improvement of their fellow men and women and themselves.¹²

1. *What is a network?*

“Networks” is an analyst’s category and a useful one as it can embrace a variety of more specific terms used by historical actors. In the eighteenth-century other categories described social bonds and intellectual communities. Georgian elite women might refer to themselves as “women of quality,” while Parisian high society (which included non-aristocratic men of letters) would consider themselves *le monde, le honnête société*.¹³ High-ranking women often ran “sociétés” (which

¹⁰ Anthony J. Lavopa, *The Labor of the Mind. Intellect and Gender in Enlightenment Cultures* (Philadelphia: University of Pennsylvania Press, 2017), 13. See also: Anne C. Vila, “‘Ambiguous Beings’: Marginality, Melancholy, and the Femme Savante”, in Sarah Knott and Barbara Taylor (eds.), *Women, Gender and Enlightenment* (Houndmills, Basingstoke, Hampshire, New York: Palgrave Macmillan, 2005), 53-70; G. J. Barker-Benfield, *The Culture of Sensibility: Sex and Society in Eighteenth-Century Britain* (Chicago: Chicago University Press, 1992); Catherine M. Jaffe and Elizabeth Franklin Lewis, *Eve's Enlightenment: Women's Experience in Spain and Spanish America, 1726-1839* (Baton Rouge: Louisiana State University Press, 2009).

¹¹ Mary Terrall, “Natural Philosophy for Fashionable Readers,” in Marina Frasca-Spada and Nick Jardine eds., *Books and the Sciences in History* (Cambridge, UK: Cambridge University Press, 2000), 239–253; Mary Terrall, “Masculine Knowledge, the Public Good, and the Scientific Household of Réaumur.” *Osiris* 30 (2015): 182–202.

¹² Lorraine Daston, “Afterwards: The Ethos of Enlightenment” In W. Clark, J. Golinski, and S. Schaffer, *The Sciences in Enlightened Europe* (Chicago: University of Chicago Press, 1999), 495–504; Koen Stapelbroek and Jani Marjanen (eds.), *The Rise of Economic Societies in the Eighteenth Century: Patriotic Reform in Europe and North America* (Palgrave: Basingstoke, 2012).

¹³ Ingrid Tague, *Women of Quality: Power and Subordination in England, 1690-1760* (Woodbridge, 2002).

would later would be known as “salons”) and “tertulias” (in Spain), whose guests regularly attended to discuss literary and philosophical matters.¹⁴ A “circle” of friends often shared hobbies and intellectual amusements, for instance, the circle of ladies who frequented the lectures of the Royal Institution of Great Britain.¹⁵ Women could also socialize in “campaigns” and establish lasting bonds, as did for example the volunteers who propagated inoculation and vaccination against smallpox in eighteenth-century Britain, or societies dedicated to the care for foundlings. Women whose efforts were directed to serving the nation (by decreasing the mortality of children, for instance, or promoting textile work among poor urban women) called themselves “improvers” or “patriots.” Women might even come together as “mothers.” But for all their nuances, which the essays here keep in mind, these communities may be considered collectively as networks, because their members felt themselves to be part of a group that shared interests, values, pleasure, and time. The term ‘network’ serves as an umbrella term to capture these communal connections.¹⁶

The reach of the networks analysed here was shaped by the reach of European women – within, and occasionally beyond the boundaries of Europe. In Britain, Queen Charlotte’s collecting activities had a global reach through British overseas trade and territorial expansion, but that was quite exceptional. What counted as “global” was different for different women. The ‘world’ for some women was a virtual one, created through imaginative reading, and was brought home through correspondence, conversations and publications. Paper technologies were vital for maintaining enlightened women’s networks, as the essays in this issue testify.¹⁷ For instance, as Francesca Antonelli and Palmira Fontes da Costa demonstrate in this special issue, the French women Madame Paulze-Lavoisier (1758-1836) and Madame Picardet (1735-1820) and in Portugal

¹⁴ Dena Goodman, *The Republic of Letters. A Cultural History of the French Enlightenment* (Cornell University Press, Ithaca and London, 1994). For an updated discussion of the bibliography in the French context, see in this issue: Loïc Charles and Christine Théré, “*Les femmes économistes: The Place of Women in the Physiocratic Community.*” On gender dynamics and the Enlightenment, see Sarah Knott and Barbara Taylor (eds.), *Women, Gender and Enlightenment* (Houndmills, Basingstoke, Hampshire, New York: Palgrave Macmillan, 2005).

¹⁵ Harriet Olivia Lloyd, *Rulers of Opinion: Women at the Royal Institution of Great Britain, 1799-1812* (PhD dissertation, University College London 2019).

¹⁶ Benedict Anderson, *Imagined Communities: Reflections on the Origin and Spread of Nationalism* (London: Verso, 1983); Lissa Roberts, “Practicing Oeconomy during the Second Half of the Long Eighteenth Century: An Introduction,” *History and Technology* 30, no. 3 (3 July 2014): 133–48; Peter Clark, *British Clubs and Societies 1580-1800. The origins of an Associational World* (Oxford: Oxford University Press, 2002).

¹⁷ For a broader scope on paper technologies see Carla Bittel, Elaine Leong, Christine von Oertzen (eds.), *Working and Knowing with Paper: Towards a Gendered History of Knowledge* (Pittsburgh: University of Pittsburgh Press, 2019).

the Marquise of Alorna (1750-1839) all depended on correspondence, publications and secretarial work to maintain networks of friends and collaborators.¹⁸

The essays in this issue reveal a variety of networks, focused on different elements of science, technology and medicine. In addition to tracing “**paper networks**” supported by correspondence and writing, the contributors explore “**technical networks**,” which entailed the exchange of artefacts. Mónica Bolufer and Elena Serrano discuss, for example, the Tenerife aristocrat María del Carmen Betancourt y Molina (1758-1824) who sent a twisting machine and textile samples to the Real Sociedad Económica de Tenerife de Amigos del País. Women also participated in what might be called “**distant networks**.” According to Bolufer and Serrano, books provided enlightened vistas of nature to those who did not travel, for instance, Joana de Vigo i Esquella (1779-1855) in Menorca, who could not visit the natural cabinets of Europe’s northern capitals or China, Egypt and Rome. Books enabled imaginary bonds with real persons, thus creating intellectual and affective bonds.¹⁹ Distant networks could also be “**diachronic**,” that is, between figures of the past and present, across different generations, genealogies and lineages. Paola Govoni shows how the network imagined by Clotilde Tambroni (1758-1817), professor of Greek at the University of Bologna, went back to Hypatia. Genealogies or lists of historical women known for remarkable achievements were often used in debates on women’s intellectual capacities, the so-called *querelle des femmes*.²⁰ Here we propose to think of these genealogies as networks in which the women that invoked them situated themselves, seeking legitimacy and giving themselves a differentiated identity, as real networks did. We also address what we could call “**moral networks**” – communities of like-minded women who shared values and used those values to manage a community and its interests. Such networks protected women, but could also hinder them, as the case of Lady Mary Wortley Montagu (1689-1762) discussed by Helen Esfandiary makes apparent. Finally, we discuss new “**mixed networks**” which purposefully brought together

¹⁸ Francesca Antonelli, “Madame Lavoisier and the Others. Women in Marie-Anne Paulze-Lavoisier’s Network (1771-1836)”;
Palmira Fontes da Costa, “Gender and botany in early nineteenth-century Portugal: the circle of the Marquise of Alorna.”

¹⁹ Mónica Bolufer and Elena Serrano, “Maritime crossroads: the knowledge pursuits of María de Betancourt (Tenerife, 1758–1824) and Joana de Vigo (Menorca, 1779–1855).”

²⁰ Govoni, “Feminist networks beyond the Science Wars”. On the *querelle des femmes*, see Mónica Bolufer Peruga, “Women of Letters in eighteenth-century Spain. Between Tradition and Modernity,” in Catherine M. Jaffe and Elizabeth Franklin Lewis (eds.), *Eve’s Enlightenment: Women’s Experience in Spain and Spanish America, 1726-1839* (Louisiana State University Press, 2009), 36-62.

men and women, as in the case of the new science of the physiocrats according to Loïc Charles and Christine Théré.²¹

2. Possibilities and constraints

Women, evidently, were restricted in their capacity to belong to and use the networks in the same way as men. The case studies collected in this volume indicate a wide variety of networks, and highlight how they were shaped by a range of factors including gender and social status. Expectations of female duties and virtues and ideas about the limitations of female minds and bodies frequently limited women's ability to contribute to knowledge-making – or at least to be seen to do so in public. Conventions of female modesty could prevent women from direct interactions with male intellectuals, as in the case of the physiocratic network explored by Charles and Théré, and from public authorship. Women avoided the ostentation of print, considered inappropriate for the female sex, but found other ways of producing and circulating knowledge. Bolufer and Serrano explore how women negotiated the fluid boundaries between intellectual modesty and ignorance, and tried to engage with male scientific networks while maintaining an appropriate distance. This positioning frequently required women to subsume their own accomplishments under the names of male relatives. María del Carmen Betancourt y Molina, for instance, publicly introduced new techniques as her father's initiatives. This anonymity was far removed from the ostensible 'modest witnessing' practiced by male natural philosophers and experimenters to enhance the authority of their claims. Conventions of modesty continue to challenge scholarship to the present day, as women are less visible in archives, or subsumed under the intellectual legacy of their husbands. The documents of Marie-Anne Paulze-Lavoisier, for instance, are still frequently attributed to her husband Antoine, as Antonelli notes. The contributions of King George III and his wife Queen Charlotte are similarly entangled in the case of the British royal collection of natural philosophical and natural historical objects.²²

The limitations imposed on early modern women shaped not only their ability to participate in public debates and to claim authorship, but also potentially curtailed women's choice of subjects.

²¹ Helen Esfandiary, "A thankless enterprise": lady Mary Wortley Montagu's campaign to establish medical unorthodoxy amongst her female network"; Loïc Charles and Christine Théré "*Les femmes économistes*: The place of women in the physiocratic community."

²² Mascha Hansen, "Queen Charlotte's scientific collections and natural history networks."

For instance, tutors to Queen Charlotte were reluctant to discuss plant reproduction which might offend the queen's 'female sensibilities'.²³ Similarly, while translation was generally considered an appropriate intellectual activity for women, women had to be careful in the selection of texts – Buffon's works on natural history, for instance, might be seen as salacious (Bolufer and Serrano). Some women legitimised their engagement with insalubrious subjects by pointing to the physicality of female experience. The anatomical wax modeller Anna Morandi claimed superior skills and understanding on the basis of her own experience of pregnancy and childbirth.²⁴ Others joined all-female societies, publicly justifying their commitment to science as a means to be better mothers, better Christians, and useful to their communities.²⁵

While the restrictions on women's engagement with science were pervasive, the case studies presented here also highlight how women could use their femininity to create new social spaces and families for themselves.²⁶ This could include the use of femininity to claim authority in particular fields, or to use their skills and experiences to organise activities central to knowledge exchange. Some women had the confidence to argue that they were no less capable intellectually than men, even if their physiology was different – as Clotilde Tambroni wrote, "although the fibers of our brains are more delicate, they have a much greater elasticity and a much more acute sense [than men's]" (Govoni). Experiences of motherhood and household management, in particular, could offer support for women's claims to expertise, for instance when it came to decisions about family health (Esfandiary) and estate management (Charles/Théré).

Despite the limitations placed upon them, many of the women investigated here were central to the creation and maintenance of scientific networks through 'feminine' activities. Madame Lavoisier's domesticity enabled her to manage socializing in support of science. Networks emerged through cultural encounters of high society's circuits, in the form of musical and theatre

²³ For the anxieties provoked by Linnaeus sexual classification of plants in women's education, see Samantha George, *Botany, sexuality and women's writing, 1760–1830: From modest shoot to forward plant* (Manchester University Press, 2017).

²⁴ Lucia Dacome, *Malleable Anatomies: Models, Makers, and Material Culture in Eighteenth-Century Italy* (Oxford: Oxford University Press, 2017).

²⁵ Margaret Jacobs and Dorothee Sturkenboom, "A women's scientific society in the west. The late eighteenth-century assimilation of science," *Isis* 94, 2 (June, 2003):217-52; Elena Serrano, *Ladies of Honor and Merit: Gender, Useful Knowledge and Politics in Enlightened Spain* (Pittsburgh: University of Pittsburgh Press, 2022).

²⁶ See also Meghan Roberts, *Sentimental Savants: Philosophical Families in Enlightenment France* (Chicago: University of Chicago Press, 2016).

performances, but also laboratories. Thus, Madame Paulze-Lavoisier first met Claudine Picardet in Guyton de Morveau's laboratory in Dijon in 1787. Many networks were characterised by broad intellectual engagement which was never exclusively scientific, but also literary, poetic, educational and philosophical.²⁷ Indeed, there was frequently a close link between letters and science, as employed by the Marquise of Alorna and the Count of Barca, as well as by female supporters of physiocracy who used poetry to make economics more palatable. Rumford and Paulze-Lavoisier's gatherings in Paris included experimental demonstrations and musical performances. Such examples suggest that salons and laboratories were an alternative means of knowledge dissemination where publishing might be inappropriate.²⁸

Taking this intellectual work seriously highlights the fact that in some respects the newly emerging academies of the eighteenth century followed domestic models of collaboration and knowledge production, and that male networks were enabled by the labours and skills of women - as *secretaires*, managers of households and events, editors and translators. Like networks themselves, correspondence engaged in diverse issues which have often been dismissed as merely domestic, but which contributed centrally to the creation and maintenance of knowledge networks, as for instance in the case of Joana de Vigo i Esquella, who wrote to family and friends of "news and gossip, gifts, food delicacies, orders of garments and medicines to be bought and shipped, moral warnings... and practical instructions."²⁹ The recent turn of historians of science to the paper-work of knowledge production reminds us that work which has often been dismissed as unoriginal, routine and administrative is crucial for knowledge production.³⁰ In the same manner, the *album amicorum* of upper-class women, notebooks in which visitors wrote witty notes to their hostesses, showed ways in which women participate in and contribute to the creation of particular networks that appreciate certain literary genres, moral values and ways of doing.³¹ The same can be said of

²⁷ Derya Gurses, "Exercises in Women's Intellectual Sociability in the Eighteenth Century: The Fair Intellectual Club," *History of European Ideas* 41, no. 3 (3 April 2015): 375–86.

²⁸ Francesca Antonelli, "Becoming Visible. Marie-Anne Paulze-Lavoisier and the Campaign for the "New Chemistry" (1770s-1790s)," in Annette Lykknes, Joris Mercelis, and Elena Serrano (eds), *Women, Gender and Chemistry: Identities, Opportunities, Barriers. Ambix Special Issue* (Forthcoming, August 2022).

²⁹ Bolufer and Serrano, "Maritime Crossroads," p. X.

³⁰ Carla Bittel, Elaine Leong, Christine von Oertzen (eds.), *Working and Knowing with Paper: Towards a Gendered History of Knowledge* (Pittsburgh: University of Pittsburgh Press, 2019).

³¹ See for instance the contributions of Sophie Reinders, "Social networking is in our DNA": Women's *Alba amicorum* as places to build and affirm group Identities," and Clara Strijbosch, "The many shades of love: Possessors and

women's "accomplishments," material creations that circulated among circles of friends and kinship, until recently belittled as ladylike pastimes, and today recognised as testimonies of women material literacy and active engagement in contemporaneous scientific debates.³²

Which aspects of a woman's identity enabled or hindered her from participation in networks? Most women investigated in this volume were of high social standing, members of the nobility (Marquise of Alorna; Albertine Adrienne Necker de Saussure), or "women of quality" (Wortley Montagu and her circle), and we need to be careful not to generalise their situation. Elite status offered improved women's access to education, resources and connections. Even among the elite, women were generally not educated to the same standard as their male relatives; as Hansen notes, Queen Charlotte was restricted in her study of natural history by her lack of Latin. Nevertheless, the women explored in this volume engaged with epistolary genres, and with influential philosophical works as in the case of the Marquise of Alorna and the work of Rousseau.

Material wealth supported the creation of networks in many ways. Large apartments, *hôtels* and gardens allowed gatherings (such as Rumford and Paulze-Lavoisier's residence in rue d'Anjou, Paris) while libraries help the circulation of knowledge. Similarly, the ability to travel enabled the formation of connections, whether between the exiled Russian Princess Ekaterina Dashkova and Maria Edgeworth in Paris in 1802, Madame Paulze-Lavoisier's meetings with Charles Blagden, Humfry Davy, and James Watt when she travelled to England and Scotland in 1817, or Lady Wortley Montague's travels abroad with her diplomat husband. Other elite women were less mobile, such as Joana de Vigo, Maria Betancourt, and Queen Charlotte. They used their considerable resources to bring the world to them instead, and engaged male tutors and botanizers to do work they could not be seen to be doing themselves. As Govoni points out, in Tambroni's case, her religious and political connections enabled her to frequent public spaces while respecting female decorum. Family was a key resource for female networks. Relatives' travels could broaden women's intellectual reach, as in the case of Agustín Betancourt whose sister never left Tenerife. Family ties offered access to scientific discourse - Albertine de Saussure was the daughter of

inscribers of sixteenth-Century Women's" in Dieuwke Van Der Poel, Louis P. Grijp, und Wim van Anrooij (eds.), *Identity, Intertextuality, and Performance in Early Modern Song Culture* (E-book: Brill, 2016).

³² Dorota Babilas, "From female accomplishment to botanical science: Mary Delany's "Paper mosaicks," *Literature Compass* 10, n° 2, (August 2013), 613-42; Serena Dyer, *Material Lives. Women Makers and Consumer Culture in the 18th Century* (London, New York: Bloomsbury Visual Art, 2020).

Horace Benedict and wife of Jacques Necker; Diodata Saluzzo Roero, a correspondent of Tambroni's, was the daughter of a chemist and artilleryman and became the first female member of the Turin Academy of Sciences founded by her father. María Betancourt's father was a founding member of the Economic Society of Tenerife to which she sent her twisting machine.

Conversely, while women used their male connections to increase their own intellectual activities, men made use of elite women to gain access and influence. The physiocrats discussed by Charles and Théré deliberately developed a hybrid form of intellectual sociability with elements of both the salon and the scientific academy, using the inclusion of women as a strategically important move to gain access to members of the Court. Religious communities similarly drew on influential women to pursue their interests and activities.

3. Female Networks and the Sciences

The networks under scrutiny here were not just social communities but scientific endeavours. If they were excluded, for the most part, from the formal careers that were available to male natural philosophers, then what did science offer enlightened women in the eighteenth century? As da Costa shows, for the Marquise of Alorna, botanical writing was a form of consolation and healing, a means to deal with grief: pursued in exile, but enabling an engagement with others. As for many natural philosophers of the period, the study of nature was a path to God. Queen Charlotte's library contained numerous works on natural theology and religion by William Paley and William Derham among others. Charlotte admired her appointed reader André Deluc because "all of his research is filled with admiration for the Supreme Being."³³ Natural history complemented civil and religious history for female authors, who grappled with contemporary debates over the biblical account of creation and the history of the Earth. For other women, the sciences offered a degree of recognition of their role as patriots and contributors to the wellbeing of the nation. As Bolufer and Serrano note, María de Betancourt enthusiastically appealed to the economic society of Tenerife seeking to become a "friend of the nation" (*Amigo del País*) through communications of useful inventions. Women undertook charitable actions in the search for salvation or sought out fame through enterprises such as Joana de Vigo's translations. To desire fame might be considered vanity (for some glory was the very opposite of femininity), so women exhibited skilful agency in cultivating recognition among select audiences of their peers rather than universal acclaim. Men

³³ Hansen (this volume), "toute ses recherches sont remplies d'admiration pour l'Être suprême."

imposed constraints on such efforts. Hansen highlights the views of Lichtenberg, who visited Queen Charlotte and reckoned a woman's fame should be no more than that acquired in keeping her husband attached to her. For other enlightened women, scholarship was a means to make a living, or belonged to the kinship culture of seeking and securing alliances with other families through marriage. Marie Le Dée de Rocourt devoted herself to supporting her husband, the physiocrat Pierre Samuel Du Pont. With her help, he wrote, he was "capable of high thoughts and great actions."³⁴ Female ambitions might be tempered or encouraged by their wider family networks – parents and siblings in particular. Women also followed their own interests independently, pursuing them against terrific resistance or by forging alliances with the interests of others. As Govoni argues, in Bologna women such as Clotilde Tambroni took advantage of the enlightening ambitions of local authorities and dignitaries to gain a distinctive position at the university.

Female networks had a significant impact on the sciences and medicine in the enlightened era. Networks altered the reception of Linnaeus binomial nomenclature. For example, the Marquise of Alorna's *Botanical Recreations* communicated a distinctive form of Linnean botany cast through the lens of her Portuguese contemporaries Félix Brotero and Correia da Serra. English women played a key role in fostering public acceptance of vaccination, reworking Lady Mary Wortley Montagu's adoption of the Turkish method of smallpox inoculation to make it amenable to English households where diverse techniques were in play. Many women, such as Clotilde Tambroni and the Marquise of Alorna, forged new connections between literature and science, so that networks integrated otherwise distinct enterprises. Salons provided critical spaces for natural philosophical debate and innovation, offering a degree of freedom that more formal institutions such as the academies could not. Physiocratic experiments in land management benefitted from the patronage of noblewomen whose wealth outstripped the all-male academies. Men also learned directly from women's skills, knowledge and experience. Bolufer and Serrano note how the Spanish engineer Agustín de Betancourt recalled how he learned with his sister María that formed the basis of his future engineering career: "Of all I have learnt in my life, he writes, "nothing has been more useful" than the tasks of "spinning, weaving, dyeing and all the things that we did as pastime: all this knowledge that I acquired playing has been the origin of my passion for the mechanical arts and of all my happiness."³⁵ Men placed limitations on female participation in science, but encouraged

³⁴ Charles and Théré (this volume), p. x.

³⁵ Bolufer and Serrano, "Maritime Crossroads", p. x.

efforts that supported their own research. Antonelli shows how Antoine Lavoisier's campaign to promote his new chemistry was unthinkable without the efforts of his wife Madame Paulze-Lavoisier, whose secretarial skills and socializing underwrote her husband's revolutionary chemistry.

The essays assembled here are only a first step to appreciating the rich history of female networks in the sciences, and much remains to be done. While networks were no doubt diverse and widespread in the nineteenth century, many of those explored in this volume seem to have declined around 1800, witnessing the end of the remarkable tradition of employing female professors in Bologna at this time. Antonelli asks if a "masculinization" of science and culture in the early nineteenth century lead to reduction in female collaboration and more reliance on male networks. The era of the Napoleonic wars certainly encouraged a new aggressive masculinity, but no clear pattern emerges.³⁶ As Harriet Lloyd has shown, the Royal Institution under Humphry Davy became the centre of a thriving network of gentlewomen in the early nineteenth century.³⁷ And as Hannah Wills highlights, Joseph Banks's secretary Charles Blagden acted as a go-between for a substantial circle of erudite women in London at this time.³⁸

Certainly, female networks have arisen in numerous times and places since then. This volume has focused on Europe, but networks no doubt spanned the globe. Govoni addresses recent female networks, in this case aimed at deconstructing the gendered assumptions of Darwinian evolution and biology. Govoni argues that they bear comparison with networks of the past, overturning unscientific evidence used to bolster scientific claims and seeing their work as in continuity with older traditions. Our focus on female networks thus highlights the interconnectedness of women in science, moving away from individuals to communities which integrated diverse identities, geographies, and knowledges, bringing people together, and spanning both the past and the present.

³⁶ Norman Bryson, "Géricault and Masculinity," in Norman Bryson, Michael Ann Holly, and Keith Moxey (eds.), *Visual Culture: Images and Interpretations* (Hanover, NH: Wesleyan University Press, 1994), pp. 228-259.

³⁷ Harriet Lloyd, *Rulers of Opinion: Women at the Royal Institution of Great Britain, 1799-1812* (PhD dissertation, University College London, 2019).

³⁸ Hannah Wills, "Joseph Banks and Charles Blagden: cultures of advancement in the scientific worlds of late eighteenth-century London and Paris," *Notes and Records* 73 (2019), 477-497.

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