Muslim Women and Science: 
The Search for the “Missing” Actors

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The only known scientific treatise dedicated to a woman in the premodern Islamic world is al-Bīrūnī’s Kitāb al-tafhīm li-awā’il ṣina’at al-tanjīm, or Book on the Understanding of the Elements of the Art of Astrology. Composed in the early eleventh century, the dedicatee was the princess Rayhana, daughter of al-Ḥasan of Khwarazm, a region of the Persian Empire. The life of Rayhana is shrouded in myth, as al-Bīrūnī’s dedication to her is the only evidence of her existence. The editor of the modern edition wrote in 1934, “she is marked out among oriental women by her craving for scientific knowledge and by the rare distinction of having a book dedicated to her.” Scholarship on women and science in the premodern Islamic world has advanced very little, if at all, beyond this assessment of Rayhana made almost eighty years ago. A handful of names have come to light in recent studies, but they all date to the tenth century. Sutayta al-Mahamali of Baghdad and Labona of Córdoba were known for their mathematical abilities. Mariam al-Ijliya and Fatimah al-Majrītiya were said to have built astrolabes.

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1 There is a modern edition and translation of the text, although it is not always reliable and is in much need of revision. See al-Bīrūnī, Abu Rayhān Muḥammad ibn Ahmad, The Book of Instruction on the Elements of the Art of Astrology, ed. Ramsay Wright (London: Luzac Halle, 1934).


3 I employ the term “science” throughout the essay, despite its nineteenth-century origin and anachronistic character for the early modern period. It is nonetheless useful as an umbrella term for all the various ways of making sense of the natural world during this time, including, but not limited to, natural philosophy, natural history, astronomy, astrology, alchemy, and geography.

While certain Western cultural prejudices and misunderstandings of women in the Islamic world exist for any period, the problem of women and science has been compounded by the fact that the prevailing view of Islamic science after the eleventh century was one of decline and stagnation. Several recent scholars have shown this estimation to be false or at least very questionable, despite its persistence among many historians and in popular culture.

Misperceptions have certainly contributed to a lack of scholarship in this field, but the sources are also difficult to track down, and there are no obvious starting points for research. No women are known to have authored scientific or philosophical texts for early modern times; no female names appear at all in the texts that have been subjected to historical examination. As most historians realize, however, women are there more often than not; it is just a matter of knowing which kinds of questions to ask and where to look. The goal of this essay is to lay out in more detail how we may go about asking these questions, identifying sources, and using extant historiographical work to guide our search. I begin by briefly surveying how historians of women and science in early modern European contexts have tackled similar challenges, and then evaluate whether these methods and questions may be similarly applied to the Islamic context. In turning to the Islamic world, I first address how the so-called “decline thesis” has undermined efforts to understand the nature, locales, duration, and general assessment of scientific practice. I then identify specific contexts of scientific activity where it would be useful to direct our inquiries regarding women. Finally, I survey some of the more general literature on women in the early modern Islamic world to form a framework within which we might approach women’s participation, patronage, or other links to science.

Historians of early modern science in European contexts have been faced with very similar challenges when attempting to reconstruct the circumstances in which women participated in or were patrons of scientific activities. These challenges have been mitigated by the fact that several women authored and pub-


lished their own writings, particularly in the seventeenth century. In attempting to include a broader spectrum of women than those who authored specific texts, historians have turned to a range of sources, as well as particular methodological approaches, to understand better how early modern European women participated in the scientific enterprise. These sources include images and paintings of women, private libraries, and especially correspondence. One particularly fruitful source has been the letters exchanged between women and famous scientific figures, such as Descartes or Galileo. Dedications have also been indicative of the interest of elite women in scientific or philosophical subjects, although this type of source has not yet been fully explored.

In addition to expanding the pool of potential sources, the scope of what historians now consider “science” has also broadened to include, among other things, alchemy and astrology. These new areas of inquiry have yielded much insight into women’s history. While historians have certainly made great strides in the past several decades in uncovering what we may call “women’s history of science” in the early modern period, this work is often overshadowed by publications that focus on gender and science. Without delving into the complicated reasons for this phenomenon, we may simply state that gender has also been conspicuously absent from studies on early modern Islamic science. That does not mean that gender would not be a useful category of analysis in this context; just that, as with women’s history more generally for the Islamic world, these questions have not yet been asked.

Within the Islamic world, we confront several issues when assessing whether similar source material might be found that could guide our research on women. Part of the problem has to do with differences between early modern

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7 See, for some examples, Maria Cunitz, *Urania Propitia* (Johann Seyffertus, 1650); Margaret Cavendish, *A Description of a New World Called A Blazing-World* (London: A. Maxwell, 1666); Maria Sibylla Merian, *Metamorphosis insectorum Surinamensium* (Amsterdam: Gerard Valck, 1705).


Europe and the Islamic world and their distinct scientific cultures, which are addressed in the next section. However, there are certainly some clear Islamic analogues to the sources listed above, such as the abundance of Ottoman and Persian miniatures portraying women, which could be mined for evidence of a relationship to science. Libraries and book lists also may well yield interesting results. The Topkapi Library in Istanbul, for example, includes the private libraries of three or four elite women in the Ottoman imperial court. Finally, there have been no general studies of correspondence between individuals engaged in scientific activities. One reason for this lack is that the task of tracking down collections of early modern letters in Middle Eastern archives is very difficult. There is evidence, of course, of intellectual correspondence involving women on various topics, but research projects dedicated to this study tend to focus on isolated individuals.

Scholarship on science in the early modern Islamic period, between roughly 1400 and 1700, has been hindered by the assertion that science and rational inquiry declined drastically after the eleventh century. In short, the argument goes something like this: the Mongol invasions, coupled with the popular rhetoric against the “foreign” sciences espoused by the theologian al-Ghazālī (1085–1111), and particularly Greek philosophy, caused a turn away from the scientific inquiry and innovation that characterized the medieval Islamic world, and stimulated a movement towards religious conservatism. Recently, Frank Griffel has argued that al-Ghazālī did not reject rational sciences entirely, but rather regarded them with caution because they could lead to disbelief; he urged others to do the same. The effect of the Mongol invasions is also not clear. For example, the establishment of an important and intellectually productive astro-

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11 Edited volumes of correspondence, such as *Letters of a Sufi Scholar: The Correspondence of 'Abd al-Ghanī al-Nābulusī (1647–1731)*, ed. Samer Akkach (Leiden: Brill, 2010), are quite rare.

12 The notion was first developed by early twentieth-century scholars such as Max Meyerhoff and George Sarton, but then left unchallenged by later historians of science. See David Lindberg, *The Beginnings of Western Science: The European Scientific Tradition in Philosophical, Religious, and Institutional Context, Prehistory to A.D. 1450* (Chicago: University of Chicago Press, 1992). Toby Huff shifts the date of decline to the thirteenth century, but presents a very similar narrative. *The Rise of Early Modern Science: Islam, China, and the West*, 2nd ed. (Cambridge: Cambridge University Press, 2003).

nomical observatory in the thirteenth century under the patronage of the Mongol Hulagu Khan at Maragha has helped debunk this myth. Other historians have suggested that the decline occurred much later, in the fifteenth century.\textsuperscript{14} Again, the Mongol invasion and the supposed Mongol tendency to destroy libraries and disrupt scholarly traditions, by displacing scholars from intellectual centers, are adduced as reasons for a pronounced decline in scientific endeavors. Furthermore, the division of the central Islamic world into three distinct empires, all of which were reputedly characterized by decadence and overindulgence, contributed to a disinterest in scientific inquiry.\textsuperscript{15} Many historians have accepted this later dating and argument as a more plausible appraisal, but it remains a contested issue. Certainly the lasting effects of the “decline thesis” are still felt in the lack of attention scholars have paid to early modern Islamic science.\textsuperscript{16}

Part of the problem lies in the fact that the Islamic empire during the early modern period was fragmented. Moreover, it spanned a huge geographical territory, stretching from India to North Africa. Different kinds of cultural and intellectual florescence occurred in different places at different times. While madrasas across the Islamic world were centers of learning, they are not analogous to European universities and differed significantly in curricula and levels of sophistication.

Broader generalizations about the practice of science remain problematic. Fazlur Rahman writes, for example, that the early modern era was characterized by “manuals, commentaries, and super-commentaries” that were mostly “unoriginal, pedantic, and superficial.”\textsuperscript{17} This estimation is only partly true. The Muslim world produced no scientific academies such as we find developing in Europe in the seventeenth century; rather, scientific activity tended to be centered at courts

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\textsuperscript{14} Muzaffar Iqbal, \textit{Islam and Science} (Aldershot: Ashgate, 2002).
\textsuperscript{15} Iqbal, \textit{Islam and Science}, 160–69.
\textsuperscript{16} This orientation toward Islamic science is slowly changing. Two major exceptions to a picture of decline and decadence are Ekmeleddin Ihsanoglu, \textit{Science, Technology, and Learning in the Ottoman Empire: Western Influence, Local Institutions, and the Transfer of Knowledge} (Aldershot: Ashgate, 2004); and Khaled El-Rouayheb, \textit{Islamic Intellectual History in the Seventeenth Century: Scholarly Currents in the Ottoman Empire and the Maghreb} (Cambridge, MA: Harvard University Press, 2015). Other scholars have long argued that Muslims were reluctant to adopt Western scientific ideas and methods. See Pervez Hoodbhoy, \textit{Muslims and Science: Religious Orthodoxy and the Struggle for Rationality} (Lahore: Vanguard, 1991), 147–48.
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or, in some cases, observatories. The nature, extent, and sophistication of the scientific output of these centers demand further contextualized studies. Finally, because the printing press was not fully exploited in the Islamic world until the eighteenth century, it is not clear how widely scientific ideas circulated.\textsuperscript{18} It is therefore difficult to provide anything like a concise general overview of early modern Islamic science, and so we must satisfy ourselves with looking more deeply at a few contexts where scientific activity was prominent.

One well-known example is the observatory established at Samarkand in 1420 by the Timurid ruler and astronomer Uleigh Beg. The observatory was supposedly demolished by an invading force in 1449, although astronomical activity continued at the observatory in the neighboring city of Bukhara.\textsuperscript{19} The Timurid dynasty is better known for Persian-inspired art and architecture, manuscript illumination, and book production, rather than for its patronage of science.\textsuperscript{20} In a culturally rich court environment, however, it is likely that men of letters and practicing astrologers sought patronage among the courtly elite, including women. Several prominent noblewomen are known to have sponsored architectural projects, including Saray Mulk Khanum, the wife of Timur himself, who was responsible for building the madrasa in Samarkand. Timurid women are also portrayed alongside courtiers in a miniature painting of an audience with Uleigh Beg. Many of these miniature paintings and manuscript illustrations were taken directly from historical sources, such as \textit{Zafarnama} (1436), composed by Sharaf al-Dīn Ali Yazdī about the life of Timur. The Timurids included accounts of women’s lives in their histories, and thus these may well at least provide evidence of female patronage of scientific activities during the late fourteenth and fifteenth centuries.\textsuperscript{21}

\textsuperscript{18} Elizabeth Eisenstein has famously argued that the printing press was one of the necessary conditions for the Scientific Revolution, because of its ability to standardize and reproduce scientific ideas and then spread them widely at a rapid pace. Eisenstein, \textit{The Printing Press as an Agent of Change} (Cambridge: Cambridge University Press, 1980).


\textsuperscript{20} Lisa Golombek and Maria Subtelny, eds., \textit{Timurid Art and Culture: Iran and Central Asia in the Fifteenth Century} (Leiden: Brill, 1992).

Towards the middle of the sixteenth century, the Mughal Empire in India evidenced an active interest in scientific activities.\textsuperscript{22} Scholars produced several astronomical works within the traditional medieval genre;\textsuperscript{23} and the late fifteenth and early sixteenth centuries saw a special focus on the founding and restoration of *madrasas*, particularly under the leadership of the ruler Akbar (1556–1605). Some evidence suggests that women were involved as patrons of these *madrasas*, although more work is necessary to establish their precise role.\textsuperscript{24} One woman, the Empress Nur Jahan, is said to have been the real power behind her husband, Jahangir, the Mughal emperor who reigned from 1605–27. Jahangir was supposedly a patron of learning and had a large library, raising the question of the extent to which Nur Jahan may have been involved in these patronage activities or book-collecting.\textsuperscript{25} The cases of both the Timurid and Mughal empires reveal evidence of at least some women as patrons of *madrasas*, although it is not clear how involved they were in the administration, and whether this involvement had anything to do with shifting the curriculum toward a more religious or scientific focus. The extant historiography of women in the early modern Islamic world may well yield further information about their education, involvement with *madrasas*, and possible relationship to science.\textsuperscript{26}

There are other instances of female patronage of architecture and *madrasas*, particularly in Mamluk Egypt (1250–1517).\textsuperscript{27} The Mamluk period extends into the fifteenth century, and it is then that sources mentioning women are


\textsuperscript{25} Jaffar, *Education*, 92–95.


\textsuperscript{27} Howayda al-Harithy, “Female Patronage of Mamluk Architecture in Cairo,” *Beyond the Exotic*, 321–35.
most abundant. The case of the Mamluk madrasas is particularly interesting. Jonathan Berkey has shown that women who endowed madrasas through a waqf charity sometimes continued as administrators within these institutions. Berkey also illustrates that while there is no evidence that women taught or studied at these institutions, several women achieved remarkably high levels of learning, likely through informal study groups and private tutoring. Berkey further argues that the education of women fits well within the religious paradigm of the importance of the acquisition of knowledge for all Muslims. As we have seen, some evidence indicates that women in the Timurid and Mughal empires, and possibly the Safavid as well, were patrons of madrasas. Through her patronage of a madrasa, it is certainly possible that a woman could have put into practice her own scientific interests by determining curriculum or selecting books for the library. However, no evidence yet suggests this possibility was a reality.

Instead, it appears that much of women’s education and their interest in founding schools centered on religion. For more learned women, the literature of the hadith, or the sayings of the Prophet, provided ample opportunity for participation in knowledge production and transmission. In recent years, scholars have devoted much attention to women who became experts in hadith literature. Asma Sayeed’s account is a masterful study of the social conditions of women that contributed to their opportunities for education or prohibited them from learning. Sayeed reminds us that the status of women in the premodern Islamic world shifted in different periods and locales. Therefore, it would perhaps be helpful to keep her work, and especially her timeline, in mind when searching for women’s participation in or patronage of science. Furthermore, the fact that women were capable of achieving these high standards of learning in some areas leads us to consider whether their expertise extended to other fields, especially science.

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28 One excellent primary source is the biographical dictionary by Shams al-Din Mohammad al-Sakhawi, which includes the names of 1,075 women. Of these, Berkey identifies 411 whose educational training was made explicit in the text, although he writes that the inclusion of the remaining women probably means that they also had some level of education. Jonathan Berkey, *The Transmission of Knowledge in Medieval Cairo: A Social History of Islamic Education* (Princeton: Princeton University Press, 1992), 167.

29 Ibid., 162–67.

30 Ibid., 167–75.

One of the most obvious areas of women’s involvement with science was in the field of medicine, and particularly in their role as midwives. As with research on women within the hadith tradition, these studies are promising in terms of elucidating how women were educated and thus linked to learned disciplines. Avner Giladi examines the social status of midwives in premodern Islamic societies, and finds that the practical knowledge associated with childbirth enabled women to occupy important positions outside their own homes, yet still remaining well within the sphere of family life and households. In general, women provided health care to their families, particularly to other women and children, and the biographical dictionaries of male doctors provide some evidence that women also were trained as physicians or nurses. However, as with scientific treatises more generally, there are no known medical treatises authored by Muslim women in the premodern period. Giladi concludes that although they were subordinate to male physicians, female midwives performed a unique role as mediators between the craft of birthing and the learned world of medicine. Again, looking more in depth at how women were able to negotiate their positions as learned individuals, whether through the craft of birthing or their knowledge of the hadith, can help us to approach the question of how women may have sought out and negotiated a similar relationship to the sciences.

To conclude, there are two general methods that seem promising to anyone interested in undertaking research on early modern Muslim women and science. One approach is to look more closely at contexts in which scientific activity occurred from the perspective of a historian of science, and attempt to identify women and their roles within those contexts. One might also examine the literature on women in the premodern Islamic world, particularly on their patronage of architecture and madrasas, but also on the role they played in the transmission of the hadith. It is clear from our brief consideration of the latter that, while there is some overlap with the kinds of sources we find useful in the European context,

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34 Peter Pormann and Emilie Savage-Smith, Medieval Islamic Medicine (Cairo: The American University in Cairo Press, 2007), 103.
other sources are specific to the Islamic context, such as biographical dictionaries, and these can be very worthwhile. Because biographical dictionaries focus mostly on men, sometimes it may seem that one is seeking a needle in the haystack. In broadening one’s search to include studies of women more generally, however, new leads may emerge, perhaps in the biographical sources in the bibliographies of other works.35 Neither method can guarantee success, but the underdeveloped state of research in this field demands concerted and deliberate efforts.