SCIENCE AND ISLAM IN MODERNITY

Daniel A. Stolz – *University of Wisconsin, Madison*

Suggested Citation: Daniel A. Stolz, "Science and Islam in Modernity," *Encyclopedia of the History of Science* (November 2022) doi: 10.34758/sj2f-d525

At the beginning of the twenty-first century, one of the most sensational court cases in the Islamic Republic of Iran concerned the fate of Mohammed 'Ali Taheri. An engineer by training, Taheri was the founder of a therapeutic movement called Interuniversalism, also known as Cosmic Mysticism. Trained practitioners of Interuniversalism connect to the Universal Unconscious and apply "defensive radiation" to expel "inorganic beings" or "viruses" from bodies that need healing, particularly from undesired thoughts and behaviors. The system has roots in both Islamic and esoteric knowledge traditions, while employing a technoscientific vocabulary. The criminal charges against Taheri ranged from blasphemy to medical charlatanism: in other words, his movement violated the established lines of both religious and scientific authority in Iran. Of course, Cosmic Mysticism would not have attracted such scrutiny if it did not enjoy broad appeal, with tens of thousands of books sold and practitioners to be found in well-nigh every Iranian city, and across the Iranian diaspora.

As the anthropologist Alireza Doostdar has shown, the popularity of Cosmic Mysticism points to a late modern appetite for practices that are understood in terms both metaphysical and empirical.[1] In what sense was Cosmic Mysticism, whose closest relatives are arguably to be found in movements such as Theosophy and Spiritism, an Islamic practice? Clearly, the official interpreters of Islam in Iran regarded it as nothing of the sort. Yet the movement undeniably tapped into Sufi ways of knowing that run powerfully through Iranian Shiism. At the same time, while much of Iran's medical establishment might regard the movement's practitioners as quacks, it is impossible to account for the success of Cosmic Mysticism absent the prestige of biomedicine in Iranian society.

The case of Cosmic Mysticism is a useful point of departure for this essay, because it points to the fact that modern science and modern Islam have been mutually constitutive. Even as Islamic debate has guided the interpretation and practice of science, new sciences have played a crucial role in defining modern Islam for many of its adherents. Given such constant

---

[1] Doostdar, *The Iranian Metaphysicals*, 145-54.

interplay between science and Islam, it would be futile to ask simply how Islam has adapted to modern science, or vice versa. The very categories—what is considered Islam, and what is science—are precisely what have changed, most radically, in recent centuries.[2] This essay therefore seeks to show how modern science and modern Islam have emerged in conversation with each other.

The essay comprises three thematic sections, followed by two sections that develop these themes through more-detailed investigation of specific controversies. The first thematic section introduces transformations in governance as a key context for the emergence of new debates about Islam and science in the nineteenth century. The second section explores technology and the changing materiality of Islamic life in modernity. The third thematic section considers new relations of authority that arose from efforts to craft Islam as a "scientific" religion. The discussion of specific controversies surveys Islamic debates on creation and evolution, and briefly introduces the emergence of Islamic bioethics with reference to transplant medicine and assisted reproductive technology.

Throughout, the essay's focus is on the Middle East and South Asia in the nineteenth and twentieth centuries. The essay begins in the nineteenth century because it was then that the relationship of science to Islam began to constitute a defining problematic of modernity for many Muslims. Three developments brought the relation of Islam and science to the fore in new ways in the nineteenth century: an intensifying linkage of science to governance; an increasingly globalized material culture; and new relations of authority, as growing middle classes—not only scholars—participated heavily in an emerging public sphere. Together, these transformations made Islam and science a topic of debate that was broadly understood to be central to the future of society.

To begin in the nineteenth century does not mean that earlier centuries witnessed no transformation of the sciences in Islamic societies or debate over the relationship of Islam to natural inquiry. In fact, modern debates have often revived vocabulary and concepts that emerged in the ninth through twelfth centuries, when Muslim scholars first sought to justify (or contest) the Islamic appropriation of Hellenic sciences. The early modern period, too, was crucial for the emergence of new kinds of knowledge in many Islamic societies. In the seventeenth and eighteenth centuries, Ottoman society (to take one example) experienced novel forms of literacy and authorship, as well as innovation in fields including logic, timekeeping, and the adaptation of Paracelsian medicine and post-Copernican cosmology.[3] In the early eighteenth century, the Mughal ruler Muhammad Shah patronized a renaissance of astronomy at the court of Jai Singh II, who built a network of observatories centered on

[2] Harrison, "'Science' and 'Religion': Constructing the Boundaries," 81-106.

[3] Sajdi, *The Barber of Damascus*; El-Rouayheb, *Relational Syllogisms and the History of Arabic Logic*; El-Rouayheb, "Opening the Gate of Verification"; Brentjes, *Travellers from Europe in the Ottoman and Safavid Empires*; Ben- Zaken, "The Heavens of the Sky and the Heavens of the Heart"; Stolz, "Positioning the Watch Hand"; Küçük, *Science without Leisure*, 143-48.

his capital at Jaipur.[4] To understand the origin of modern sciences in the Islamic world would require a longer chronological scope than this essay offers. Instead, this essay seeks to explain some of the major debates and contexts in which Muslims have defined modern Islam and science in relation to each other.

The world of Islam is vast, of course, and it is not possible to do justice to its breadth and diversity. This essay's emphasis on the Middle East and South Asia reflects the focus of existing scholarship, but it is not to say that modern science has been of less interest to Muslim communities in other regions. However, the themes identified below, though derived from Middle East and South Asian history, should prove useful as a framework for analyzing other regions. Transformations in governance, material culture, and authority are essential to consider anywhere in the nineteenth- or twentieth-century world, even if the way in which these processes played out differed by region as well as within regions.

Islam has long occupied an important space in the historiography of science. George Sarton, who helped to found the discipline of history of science, devoted a significant part of his career to the great flourishing of scientific activity under the early Islamic empires.[5] Over the course of the twentieth century, scholars such as A.I. Sabra helped to establish a narrative in which medieval Muslim scholars (along with Jewish and Christian scholars working under the patronage of Muslim rulers) translated, extended, and revamped the sciences of antiquity, preparing the way for the European Renaissance.[6] Until quite recently, however, scholarly interest in Islam and science has mostly been limited to this early period of Islamic history, after which—according to a conventional view—Muslims neglected the sciences as part of a broader, post-twelfth-century decline. On this view, the modern history of science in Islamic lands was scarcely worth attention. If it was not a history of neglect or outright opposition, it was at best a history of the reception of "western" disciplines.

This view, which confined Islam's significance in the history of science to a kind of bridge between antiquity and the Renaissance, has recently been revised by two veins of scholarship. In one vein, historical studies have convincingly shown—often through highly technical analysis—how both the Persianate and Ottoman worlds of post-twelfth-century Islam continued to witness innovative work, particularly in mathematical astronomy and instrumentation.[7] In a different vein, scholars working on modern contexts have used

---

[4] Raina, "Circulation and Cosmopolitanism in 18th Century Jaipur," 23-26.

[5] See the first two volumes of Sarton's magnum opus, *Introduction to the History of Science.*

[6] For a concise synthesis, see Sabra, "Appropriation and Subsequent Naturalization."

[7] F.J. Ragep and Sally P. Ragep, *Tradition, Transmission, Transformation*; Saliba, *Islamic Science and the Making of the European Renaissance*; Brentjes, *Teaching and Learning the Sciences in Islamicate Societies*; Morrison, *Islam and Science*; Şen, "Reading the Stars at the Ottoman Court"; Umut, "Theoretical Astronomy in the Early Modern Ottoman Empire." For a recent and reliable overview of the state of this field, see the first three chapters in Dallal, *Islam, Science, and the Challenge of History*.

methods from science and technology studies (STS) to reveal the great diversity of ways in which Muslims have incorporated science, technology, and medicine into their lives over the last two centuries.[8] It remains difficult to connect the dots between these two bodies of scholarship, in part because the latter literature has yet to take up questions of scientific practice in a systematic way. The overall trend, however, is toward a view of Islamic history in which science was a continuous, dynamic phenomenon, rather than a distinctive feature of a limited "golden age." Of course, continuity does not mean that the sciences were understood or practiced similarly in every period. The meaning of "science" in Islam changed with social and political circumstances, and with the emergence and evolution of new disciplines.[9]

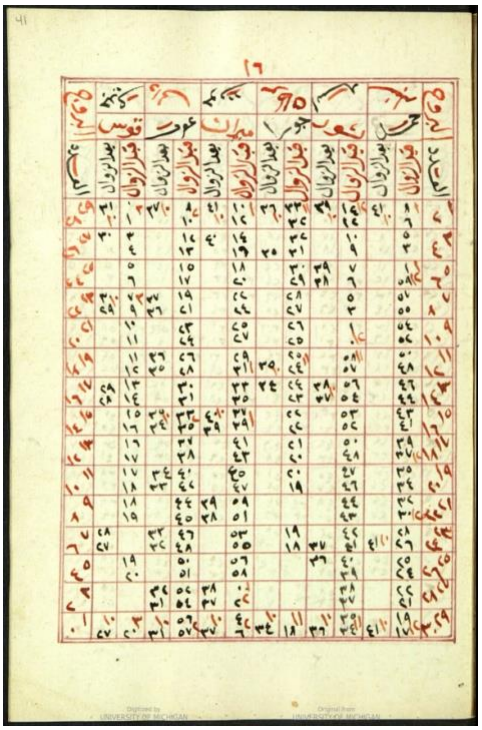

Figure 1: A table for the correction of mechanical timepieces, composed by a Muslim scholar in eighteenth-century Cairo. Source: Ramadan ibn Salih al-Khawaniki, *Kitab al-Manhaj al-Aqrab li-Tashih Mawdi' al-'Aqrab*, Isl. Ms. 808,1, p. 43, University of Michigan Library (Special Collections Research Center), Ann Arbor, http://hdl.handle.net/2027/mdp.39015078570259

[8] Many of these studies are cited below, but for a concise entry into this literature, see the essay by Noah Salomon, "Science and the Soul—An Introduction," *The Immanent Frame*, https://tif.ssrc.org/2018/09/27/science-and-the-soul-introduction/, published online September 27, 2018. Accessed July 22, 2022.

[9] For a reliable overview of the development of scientific disciplines in Islam through the early modern period, see Brentjes and Morrison, "The Sciences in Islamic Societies."

ISLAM, EMPIRES, AND KNOWLEDGE CIRCULATION IN THE NINETEENTH CENTURY

The nineteenth century was a crucial period for the emergence of many new scientific disciplines and institutions. Not coincidentally, it was also a time when colonial powers and modernizing empires—including those with Muslim rulers and majorities—waged a global contest for land and markets. Islamic empires had come into conflict with European rivals for centuries, from the Catholic conquest of Iberia to the Ottoman-Portuguese struggle for the Indian Ocean.[10] In the nineteenth century, however, the acceleration of European colonization and Russian imperial expansion, coupled with intensifying efforts by Muslim rulers to respond, meant that this struggle affected more and more of the world's Muslims. Moreover, imperial rivalry increasingly turned on new technical capacities, in fields ranging from irrigation to navigation and from medicine to metallurgy. In this context, science was often linked with new efforts to manage population, extract value, and wage war.

The growing importance of the sciences to political domination was certainly visible to Muslims who came under European colonial rule in the nineteenth century, whether in French Algeria (beginning in 1830), British India (formally governed by the Crown after 1857), or British Egypt (occupied in 1882). Colonial powers often pointed to science and technology as proof of their civilizational superiority, and of the salutary consequences of their rule.[11]

Yet the linkage of science and political power was also intensifying in the large regions that remained outside European colonization. In the Ottoman Empire, proponents of the New Order reforms at the end of the eighteenth century renewed the Empire's investment in nautical sciences and military engineering, sponsoring new technical schools and translations which they saw as crucial to the Empire's defense.[12] In the nineteenth century, the Ottomans deployed the telegraph and railroad to consolidate Istanbul's rule in its provinces, and to participate in African colonization.[13] Meanwhile, anxiety over population loss in the Empire's costly wars led pronatalist bureaucrats in Istanbul to promote new standards and schools for licensing midwives, working to bring reproduction under the eye of the state.[14] Such efforts were significant, in part, because they brought new techniques into the lives of ordinary people, who began to refer to the new sciences to articulate new

[10] Casale, *Age of Exploration*, especially 53-83.

[11] Adas, *Machines as the Measure of Men*.

[12] Yaycioglu, "Guarding Traditions and Laws."

[13] Minawi, "Telegraphs and Temporality in Ottoman Africa and Arabia during the Age of High Imperialism": 567-87.

[14] Balsoy, *Politics of Reproduction*.

conceptions of justice and rights—such as the idea that postmortem dissection could be demanded in cases of suspected homicide.[15]

The linkage of science to state power was also significant because it engendered new kinds of resistance. In Egypt, the Ottoman governor Mehmed Ali Pasha faced backlash for imposing quarantines in response to bubonic plague outbreaks in the 1830s. The confinement of plague-stricken individuals, and the forced removal of the dead, prompted protest from the urban population, including Muslim scholars (ulama). These protests expressed concerns about removing the sick from the care of family, and for the ability of quarantined families to maintain their livelihood.[16] Resistance to quarantine was not, as it was sometimes portrayed by authorities at the time (and since), the result of a timeless, "fatalistic" opposition to public health measures by Muslim scholars, who in fact had a long and complex history of debating the proper response to epidemic disease.[17]

Though Muslim rulers were as eager as any to deploy the new sciences and technology, the dominant position of Russia and the western European powers in the nineteenth century bore heavily on the political implications of debating science publicly. Consider, for example, the most commonly cited Islamic discussion of science from the nineteenth century, the *Refutation of the Materialists*, by Sayyid Jamal al-Din "al-Afghani" (d. 1897).[18] Afghani was a Persian-born intellectual and activist. During an itinerant career that took him through Ottoman and British-Indian lands, he sought to rally Muslims against British imperialism. In the *Refutation*, Afghani critiqued evolutionary thinking as the latest iteration of the ancient materialist philosophy that was well known to Islamic philosophy (*falsafa*). However, in a later exchange with the French orientalist Ernst Renan, Afghani deployed an evolutionary argument of his own: Islam, being relatively young, simply had yet to reach the stage of development that Christianity had attained in its relationship to science.[19] This exchange with Renan came in an argument with European intellectuals on the status of Islam in modernity. By contrast, the *Refutation* had expressed Afghani's views on a debate among Muslims in British India on how to proceed after the brutal suppression of the 1857 rebellion. In this latter context, the alleged "materialists" whom Afghani denounced were the followers of Sayyid Ahmad Khan, an Indian Muslim reformist whose program closely linked new sciences with an accommodating stance toward the British Empire.[20] In earlier centuries, Muslims had

---

[15] Fahmy, *In Quest of Justice*, 74-77.

[16] Fahmy, *In Quest of Justice*, 57-62.

[17] Stearns, *Infectious Ideas*.

[18] Keddie, *An Islamic Response to Imperialism*, 73.

[19] Keddie, *An Islamic Response to Imperialism*, 87.

[20] Qidwai, "Reexamining Complexity."

debated how to adopt the knowledge of cultures that Islam had absorbed. In modern times, the relationship of Islam and science has more often been wrapped up in the politics of how Muslims should respond to the ascent of non-Muslims powers.

The imperial and colonial contexts also shaped a rapidly changing landscape of schooling. Beginning in the middle of the nineteenth century, many Muslim societies saw the growth of new sites of learning. These included new imperial military and civil academies, such as in the Ottoman and Russian Empires; colonial schools, such as in British India; and the schools of foreign religious organizations, including Jesuits, Protestant missionaries, and the French-Jewish Alliance Israélite Universelle. Such schools were training grounds for a new class of people—mostly male—who not only could read, but could do so in multiple languages, often including French or English. Many went on to new technical careers in the military, agriculture, or medicine, and they contributed to the growth of Islamic print culture as both producers and consumers.

In this context, the school became an important site for developing—and contesting—new visions for what constituted Islamic knowledge.[21] Some religious reformists believed a new educational model was necessary to reinvigorate Islamic learning and equip the community to meet the challenges of the nineteenth century. In India, Sayyid Ahmad Khan founded the Anglo-Mohammedan College, which aimed "to form a class of persons, Muhammedan in religion, Indian in blood and colour, but English in tastes, in opinions, and in intellect."[22] (The school is now called Aligarh Muslim University.) To be sure, not all reformists shared Sayyid Ahmad's belief that his community stood to learn and benefit from their British colonizers. But the idea that Islamic learning should conform to modern norms, including standardized curricula, accreditation by exam, and a greater emphasis on topics such as mathematics and geography, gained wide purchase. In the Ottoman Empire, prominent early examples included the Dar'ul-Fünun in Istanbul, Husayn al-Jisr's patriotic school (*al-Madrasa al-Waṭaniyya*) in Syria, and repeated efforts to introduce exams and new curricula at Cairo's al-Azhar mosque, one of the great hubs of Sunni Islamic learning.[23]

Although the new literate class was still a small and overwhelmingly male minority in most societies, it wielded political and cultural influence in a burgeoning sphere of print publishing. This was the audience to which Muslim thinkers began to preach the compatibility of Islam with modern science. Often, they framed this effort in terms of revival. Thus, both Sayyid Ahmad Khan and the late Ottoman thinker and journalist İzmirli İsmail

---

[21] Hefner, "Introduction," in Hefner and Zaman, *Schooling Islam*, especially 14-17; see also Fortna, *Imperial Classroom*.

[22] Sayyid Ahmad was invoking Lord Macaulay's 1835 argument in favor of providing English-language education in India. Quoted in Lelyveld, *Aligarh's First Generation*, 207.

[23] Yalçınkaya, *Learned Patriots*; 141-44; Elshakry, *Reading Darwin in Arabic*; 134-35; Gesink, *Islamic Conservatism and Revival*.

Hakkı called for a "new theology" (*yeni ilm-i kalam*), citing classical Muslim theologians as authority for the principle that Islamic belief should adapt to the knowledge of the age.[24] For thinkers such as Sayyid Ahmad Khan and İsmail Hakkı, science was to be contrasted not with Islam proper, but rather with a mass of beliefs (now "superstitions") which had crept into Islam over the centuries. On this view, to be scientifically educated was also to be properly Muslim.[25]

Despite their overlapping rhetoric, however, the purpose of such "new theology" in British India differed from its aim in an Ottoman context. For Sayyid Ahmad, a new theology was necessary because it would fortify the faith of Muslims demoralized by the scientific prowess of their colonial rulers. For İsmail Hakkı, the new theology would serve as an alternative to the radical materialism espoused by a small but influential coterie of late Ottoman intellectuals.[26]

The political circumstances of the nineteenth century also shaped crucial debates over the language of science. Many modern sciences entered Islamic debate via translation. But translation raised thorny questions: for example, did Arabic (or Turkish, Persian, Urdu, etc.) already have words for modern scientific concepts? And if not, should translators use neologisms to capture the *meaning* of new terms, or simply transliterate foreign words?

Typically, translation efforts began with the premise that existing vocabulary, often in Arabic, provided ample resources to adapt new theories and techniques. In the late Ottoman Empire, eighteenth-century translators treated French astronomical texts as simply the latest examples of the kind of astronomical handbooks that had been developed for centuries in Arabic and Persian.[27] This tendency reflected the fact that such early translators often belonged to the old scholarly class of ulama, or, in the Ottoman case, to existing imperial "offices" such as the *müneccimbaşı* (chief astronomer-astrologer).

In many languages, however, a shift occurred around the early twentieth century, such that transliteration of European terms—or outright use of European languages—became the norm in scientific writing and pedagogy. The timing and nuances of this shift varied by place. In Egypt, for example, a move toward transliterated French and English terms occurred during the British occupation (1882-1923).[28] In the Turkish Republic, by contrast, state-led language reform was part of the promotion of Turkish nationalism in the 1920s and 1930s.

---

[24] Sayyid Ahmad Khan, "Lecture on Islam," in Kurzman, *Modernist Islam*, 291-96. Özervarlı, "Alternative Approaches to Modernization in the Late Ottoman Period," 87.

[25] Yalçınkaya, *Learned Patriots*, 119.

[26] Özervarlı, "Alternative Approaches to Modernization in the Late Ottoman Period," 87-88.

[27] Stolz, *The Lighthouse and the Observatory*, 151.

[28] Crozet, *Sciences modernes*, 368-70.

In the latter context, Arabic and Persian roots were replaced with Turkish equivalents as much as possible, but an increasing number of western terms entered the language as well, especially in scientific terminology.[29] In the long term, such national trends converged with a global shift toward English as the dominant language of scientific communication after the world wars.[30]

Scholars of translation have long recognized that the process of "carrying over" meaning from one language into another is creative, rather than simply mimetic. Thus, to translate Freud's "unconscious" into Arabic as *al-lā shu'ūr* invoked a history of Sufi Islamic discourses on subjectivity and the soul.[31] More than simply referencing such discourses, the project of translation itself gave rise to intense debate over the relationship between Islamic disciplines and contemporary knowledge. For example, in the controversy over whether the theory of evolution constituted a form of "materialism," Muslim authors sometimes used *māddiyya* (from the Arabic *mādda,* matter) as a direct rendering of the English term, or of the German *materialismus*. But another option was *dahriyya*, a term borrowed from a thousand-year-old debate in Islamic philosophy over Aristotelian causality. The latter translation implied that the "new" science was already well known within an existing, Islamic discursive tradition. Similarly, despite relying on a neologism, the late nineteenth-century coinage *taṭawwur* for "evolution" invoked the Qur'an: "we have created the human being in stages" (*aṭwār*^{an}).[32] Translators thus helped define the degree to which science was understood to be continuous or discontinuous with existing Islamic vocabulary and discourse. But in most places, translators made their choices under political circumstances that tended, over time, to favor the use of transliterated terms from European languages.

Most scholarship on modern Islam and science has focused on Islamic appropriations and debates about new sciences. Emerging literature, however, has begun to show how the globalization of modern sciences was itself shaped by the longstanding cultivation of knowledge among Muslim scholars, healers, prognosticators, midwives, market inspectors, and more—in fields from the astral to the alchemical. To take just one example, this was the era when state observatories proliferated and began to participate in global observational programs. In many Muslim societies, from North Africa to India, the establishment of such specialized sites was understood as part of a thousand-year tradition of astral knowledge.[33] Scholars trained in the Islamic discipline of astronomical timekeeping (*mīqāt*) became crucial translators and teachers of new mathematical models and instruments. The practices of

---

[29] Karaman, "Ataturk and the Turkish terminology reform."

[30] Gordin, *Scientific Babel*.

[31] El Shakry, *The Arabic Freud*, especially chapter 2.

[32] Elshakry, "Knowedge in Motion," 715.

[33] Stolz, *The Lighthouse and the Observatory*; Schaffer, "Asiatic Enlightenments."

these scholars, such as studying the sun's position for knowing the times of prayer, retained an important place in the new observatories and in the broader society.[34]

It is sometimes claimed that the association of science and technology with European military might in the nineteenth century inspired Muslim intellectuals to deem their scholarly traditions obsolete. As this section has shown, however, an enthusiasm for new ideas did not at all imply a lack of regard for the old. In fact, interest in new sciences stimulated novel engagement with historical Islamic discourses ranging from philosophy and theology to the study of health and illness, the nature of the soul, and the theory of language. A similar dynamic can be seen in the relationship between technology and the changing material culture of Islamic life.

ISLAMIC THINGS: TECHNOLOGY AND THE MATERIALITY OF RELIGIOUS LIFE

The rise of industrialized production and the reduction of trade duties transformed the material culture of daily life for much of the nineteenth-century world. A flood of new products opened new possibilities for dress, travel, communication, consumption, and leisure.[35] Muslim societies were as engaged as any in the onset of modern globalization. While forging specifically Islamic uses for the new technologies and goods, they also changed the way that Islam itself was practiced, materially, in the world.

With the advent of modern globalization, Muslims had to decide whether and how to incorporate a raft of new consumer products into their everyday lives. The pages of the Islamic press in the early twentieth century were awash in conversations about new objects, from the gramophone to the synthetic toothbrush. In general, the most vocal Muslim authorities tended to approve the use of such novelties, on the logic that the Muslim community should make use of beneficial technologies unless there was a specific reason for prohibition. One scholar has described this tendency as "laissez-faire Salafism," referring to the tendency of such thinkers to appeal to the earliest sources of Islam (*al-salaf al-ṣāliḥ*) for justification.[36]

For a powerful illustration of the dynamic relationship between Islamic practice and new technology, we need look no further than the basic Islamic duty of pilgrimage (hajj) and the iconic innovation of the industrial age, the steam engine. Hajj provided an important market for the growth of steamer lines in the Mediterranean and, especially, the Indian Ocean. As these lines increased the speed and scale of travel, the experience of hajj began to change. Pilgrimage became more of a mass phenomenon, and it attracted more scrutiny: both from the Ottoman government, which maintained sovereignty over the pilgrimage cities in

[34] Stolz, *The Lighthouse and the Observatory*, chapter 6; Wishnitzer, *Reading Clocks, Alla Turca*, 178-82.

[35] Bayly, *Birth of the Modern World*.

[36] Halevi, *Modern Things on Trial*, 9.

western Arabia; and from other imperial powers, who regarded the steam-powered hajj as a breeding ground for the spread of political and medical hazards. By the last quarter of the nineteenth century, in the wake of several global cholera outbreaks, Muslim pilgrims navigated a system of paperwork and quarantines that spanned the Mediterranean and Indian Ocean worlds.[37] As the Ottoman government embraced the industrialization and medicalization of hajj, the sultan's longstanding claim to custodianship of the holy precincts materialized in a new rail line to western Arabia, new infrastructure for water provisioning, and even a technical assessment of the sanitary virtues of the well of Zamzam, which many pilgrims drink from during the hajj.[38]

Even as hajj and steamship travel fed off each other's growth and transformed each other, so too did more-local forms of pilgrimage enjoy an industrial-age renaissance. In Egypt, for example, the rail network that took shape beginning in the 1850s was specifically laid out to service major religious festivals, particularly the *mūlid* of Sayyid al-Badawi in Tanta. The coming of rail service allowed for the modern scale of such festivals, but also transformed them in subtler ways, such as by encouraging temporal standardization.[39] Given this close relationship between pilgrimage and steam, perhaps it is not surprising that the engine itself was sometimes understood to possess healing powers.[40]

Another new technological mediation of Islam in the nineteenth century was the use of the telegraph to communicate the sighting of the new moon, and thus to determine the beginning and end of the Islamic months. With the spread of telegraphy and print media across Asia and North Africa in the second half of the nineteenth century, Muslim authorities frequently debated whether and how to coordinate the calendar across cities and even across empires. On the one hand, the new information technologies challenged evidentiary norms in Islamic jurisprudence, including the long-privileged role of oral testimony in establishing matters of fact.[41] On the other hand, the telegraph and print media offered tempting possibilities for realizing the ideal of a global community of all Muslims (*umma*). Thus, while some jurists worried that a globally coordinated calendar would place a new scientific elite above ordinary believers, others seized upon the new technologies to promote the reform of Islam as a set of uniform practices. In the twentieth century, with the demise of the imperial order and the emergence of nation-states, a kind of middle ground was

[37] Huber, *Channelling Mobilities*; Echenberg, *Plague Ports*; Tagliacozzo, "Hajj in the Time of Cholera," Stolz, "The Voyage of the Samannud."

[38] Low, "Ottoman Infrastructures of the Saudi Hydro-State."

[39] Barak, *On Time*, chapter 3.

[40] Barak, *On Time*, 116.

[41] Skovgaard-Petersen, *Defining Islam*, 87.

reached, with the regulation of the Islamic (*hijrī*) calendar typically falling to national authorities.[42]

Pilgrimage and the sighting of the new moon were already very old Islamic practices when they came to be mediated through new technologies in the nineteenth century. In other cases, new technology allowed for experimental articulations of Islam and material goods. In Iran, for example, the global vogue of spiritism in the early twentieth century inspired practitioners to use hypnotism and talking boards to communicate with holy figures, including the Prophet Muhammad. Typically, a young woman served as medium in these seances.[43]

In the long term, the key significance of modern technology in Islam was not the use (or prohibition) of a specific object, but rather the way in which a dynamic material culture stimulated the growth of what we might call public Islamic reasoning. The *fatwā* (responsum) is one genre that has acquired special prominence in connection with debates over new technologies since the late nineteenth century. Previously, the giving of responsa (*iftā'*) occurred in a relationship between an individual jurist (*muftī*) and those who consulted them; prominent jurists might also record their *fatwā*s in compendia to be read by other scholars.[44] In the context of emerging mass media, however, debates over new technologies and material culture stimulated the growth of Islamic discourse in magazine sections, and eventually on cassette tapes, TV, and the internet.[45] New technologies thus provided both the medium and an important part of the subject matter for new public debates that defined the meaning of modern Islam.

SCIENTIFIC ISLAM: NEW RELATIONS OF AUTHORITY

A final key theme in the interplay of modern Islam and science has been the emergence of new relations of authority, within which Muslims determine what is Islamic. Scholars of religion have identified the "fragmentation of authority" as a characteristic feature of modern society, pointing to the rise of lay activism and mass media.[46] But this emphasis on "laypeople" sometimes overlooks the extent to which new assertions of authority have been linked specifically to new technical professions and their social prestige. It is perhaps more accurate to speak of a redistribution of authority. As "what is Islamic" has come to be

---

[42] Moosa, "Shaykh Ahmad Shakir and the Adoption of a Scientifically-Based Lunar Calendar"; Stolz, *The Lighthouse and the Observatory*, chapter 7.

[43] Doostdar, "Empirical Spirits," 329.

[44] Masud, Messick, and Powers, *Islamic Legal Interpretation*.

[45] Halevi, *Modern Things on Trial*; Hirschkind, *The Ethical Soundscape*; Simon, *Media of the Masses*; Bunt, *iMuslims*; Rock-Singer, *Practicing Islam*.

[46] Eickelman and Piscatori, *Muslim Politics*, 70.

understood increasingly in connection with "what is scientific," new professions and institutions have come to share in defining religious norms.

Consider, for example, the emergence of forensic medicine as a form of evidence. In the mid-nineteenth century, modernizing states began to document the deaths of their subjects in new ways, sometimes including forensic reports. In Egypt, the Arabic term for the new position of police doctor, *ṭabīb al-siyāsa*, reveals the incorporation of such evidence into the Islamic legal domain of *siyāsa*, the law generated by public authorities (as opposed to *fiqh,* the jurisprudence of Muslim scholars). The credibility of the *ṭabīb al-siyāsa*, not only among state elites but also among ordinary people seeking justice, prompted the growth of the *siyāsa* court as a site of knowledge production. Like telegraphy, the new medicine contributed to greater reliance on textual evidence, rather than oral testimony. Similarly, new sites of chemical knowledge—textbooks and laboratories—filtered into the longstanding Islamic practice of marketplace inspection (*ḥisba*). Justice was still construed in specifically Islamic terms, but the knowledge claims that undergirded the pursuit of justice were increasingly generated by members of new technical professions.[47]

Just as evidence of wrongdoing came to be produced by the new, bureaucratic figure of the forensic doctor or chemist, worshippers increasingly looked to state observatories to know the times of sunrise and sunset, which define the schedule of daily prayers; and to determine the appearance of the new lunar crescent, which defines the start (and end) of an Islamic month, including the holy month of Ramadan. Widespread reliance on modern observatory techniques represented an epistemological shift, in which the recorded representation of a phenomenon—a telescopic image, or even (according to some) a calculation of the moon's position—was understood to be equivalent to the phenomenon itself.[48] But it was also a social shift. Scholars of the astral sciences had long played a role in timekeeping in many Muslim communities.[49] With the rise of modern scientific professions and institutions, however, such scholars increasingly acquired distinct disciplinary identities, and were often in the employ of the imperial or national state. From doctors and chemists to astronomers, the ability of such actors to shape religious norms derived, in part, from the rising social prestige of the scientific professions. It also followed from the efforts of certain early twentieth-century activists, such as the journalist Muhammad Rashid Rida, who believed that the ability of modern scientific institutions to produce broad consensus could serve the project of producing a more globally uniform Islam.[50]

---

[47] Fahmy, *In Quest of Justice*.

[48] Quadri, *Transformations of Tradition*, 161.

[49] King, *In Synchrony with the Heavens*; Wishnitzer, *Reading Clocks, Alla Turca*.

[50] Stolz, *The Lighthouse and the Observatory*, chapter 6.

The desire, in some quarters, to understand Islam as a scientific religion gave rise to a new Islamic genre, "scientific exegesis" (Arabic: *tafsīr 'ilmī*). This novel type of Qur'an commentary sought to show that the revelation to Muhammad in the seventh century anticipated modern scientific findings.[51] Thus, in a work of scientific exegesis, the Qur'anic account of the creation of the human being "from a clot" (Surat al-'Alaq) might be understood to refer to embryological development. The genre's first vogue came in the early twentieth century. Between 1908 and 1911, readers of the emblematic journal of Islamic reform, Cairo's *al-Manar*, could read Muhammad Tawfiq Sidqi's articles on the Qur'an and a variety of scientific fields; the essays were later collected and published as a textbook for Egyptian schoolchildren.[52] In the 1920s, the Azharite scholar Tantawi Jawhari composed a multi-volume, complete Qur'an commentary, which consists entirely of scientific interpretations, while the Iraqi Shiite scholar, Muhammad ibn Mahdi al-Khalisi, theorized the entirety of *sharī'a* in terms of medical rationales.[53] Interestingly, the efforts of such authors were augmented, in the late twentieth century, by a small number of European and North American scientists and physicians, some of whom were not Muslim (or not known to be Muslim). The French doctor Maurice Bucaille's *The Qur'an and Modern Science* has been widely translated and can often be found in Islamic bookshops, where it is common for the Qur'an commentary section to include a shelf dedicated to such scientific works.

The genre of scientific commentary provides yet another illustration of how modern science has mobilized and given new meaning to old ideas. In the most immediate sense, scientific commentary on the Qur'an grew out of nineteenth-century efforts to argue that the Qur'an does not contradict science. But the shift toward arguing that the Qur'an *anticipates* modern science deployed one of the oldest Islamic theories of revelation, the "inimitability of the Qur'an" (*i'jāz al-Qur'ān*). The concept of *i'jāz,* which developed beginning in the ninth century, held that it is demonstrably impossible for the words of the Qur'an to be of human composition. The classical versions of this argument centered on the Qur'an's rhetorical qualities. In this sense, the belief that the Qur'an predicted modern science is merely a contemporary take on one of the oldest ways of conceptualizing the revelation to Muhammad. Yet reading the Qur'an specifically through modern science also accomplishes something new. By appealing to the social prestige of the sciences, and to the fact that modern readers are often more familiar with basic physics than with classical exegetical techniques, scientific commentary has allowed Qur'anic interpretation to appeal to audiences whom it might not otherwise reach.[54]

---

[51] Dallal, "Science and the Qur'an"; Elshakry, "The Exegesis of Science."

[52] Jansen, *Interpretation of the Koran*, 44.

[53] Fuchs, "Failing Transnationally," 450.

[54] Telliel, "Miraculous Evidence."

Scientific exegesis incurred criticism from prominent Muslim thinkers almost from its beginning, in part because of questions that it raised about who has the authority to decide what the Qur'an means. To be sure, some critics felt that to focus on scientific meaning in the Qur'an was simply to miss the point: Muhammad's message is about submission to God, not about geological strata or the germ theory of disease. But other critics worried, more specifically, that the new interpretation placed the meaning of the Qur'an at the mercy of knowledge that lacked the epistemological status of revelation, and which sometimes changed notably within the span of a human lifetime. Despite such critiques, the proliferation of scientific commentary on the Qur'an, both in print and on TV, suggests that the project of harnessing the cultural authority of modern science to the message of the Qur'an remained relevant and compelling for a large audience at the beginning of the twenty-first century.

The interpretation of Islam as a modern scientific religion was not a one-way effort, simply fashioning Islam in the image of science. Among some members of the technical professions, it became just as important to understand science as an Islamic pursuit. Perhaps the most explicit articulation of this sentiment came from the "Islamization of Knowledge" movement that emerged, transnationally, in the 1970s.[55] The advocates of "Islamization of Knowledge," who included prominent Muslim European and American voices, organized international professional groups for Muslim scientists (including social scientists), and promoted the publication of articles, books, and curricula that sought to bridge contemporary scientific training and Islamic education. The goal was to foster the growth of scientific communities—from physicians and hydrologists to sociologists and economists—who worked in the critical academic tradition of the contemporary research university, but from an explicitly Muslim perspective. Organizations associated with the movement included the Association of Muslim Social Scientists, the Association of Muslim Scientists and Engineers, the Islamic Medical Association, the American Islamic College, the International Islamic University of Malaysia, and the International Institute of Islamic Thought.

The focus on creating an associational life for Muslim scientists and physicians was evidently meant to serve the growing number of Muslims who practiced technical professions in a postcolonial context, often as part of a minority community. Ismail al-Faruqi—a key figure in many of these organizations—was a Palestinian-American who taught for many years in the Department of Religion at Temple University. His career as an activist was partly inspired by his work with one of the early chapters of the Muslim Students Association. Faruqi co-authored the manifesto, *Islamization of Knowledge: General Principles and Workplan*, with the Saudi-born scholar Abdul Hamid AbuSulayman, who had a PhD in international relations from Pennsylvanian University. Another early figure in the movement, Syed Naquib al-Attas, was a British-educated Malaysian philosopher. Although "Islamization of Knowledge" had ties to the Middle East (and enjoyed controversial funding from Saudi backers), it flourished in

[55] Stenberg, *Islamization of Science*.

places like North America and postcolonial South Asia, where some Muslim scientists felt particularly called upon to define what was Islamic about their professional work.

In its effort to infuse the research university with an explicitly Islamic ethos, the Islamization of Knowledge movement overlapped with the work of the Iranian-born philosopher Syed Hossein Nasr (b. 1933). Nasr, too, had an eclectic education, completing a PhD in the history of science from Harvard but also studying with leading Iranian Shiite scholars, especially in the Sufi tradition. A prolific author and public lecturer, Nasr's oeuvre centers on the idea that modern science is defined by the fundamental error of pursuing knowledge absent a philosophical and spiritual framework whose aim is the cultivation of the good.[56] Whereas the Islamization of Knowledge exponents saw the secularization of science as a problem for Muslims, Nasr saw it as the universal crisis of modernity. In this sense, his work partakes also in non-Muslim projects of post-Enlightenment, especially environmentalist, critique.[57]

Having established a thematic framework for analyzing modern Islam and science in terms of colonial and postcolonial context, material culture, and relations of authority, the final sections of this essay turn to further exploration of specific controversies.

EVOLUTION AND CREATION

Evolution and creation have been major topics of Islamic debate since the late nineteenth century. Sometimes these Islamic debates have closely resembled their counterparts in other traditions; at other times, the Islamic debates have diverged significantly. To a limited degree, such differences can be understood in terms of scriptural or theological particularities of Islam. But they have also been closely tied to the social and political circumstances in which Islamic evolutionary thought—as well as anti-evolutionism—has developed.

Muslim authors and readers came to the evolution debates of the late nineteenth century with enthusiasm. Vigorous discussion of "Darwin's school" (*madhhab Darwin*) played out across the Middle East and South Asia as early as the 1870s.[58] While Darwin's name was used as shorthand for evolution, these debates often centered in other areas of the large field of evolutionary ideas, especially Spencerism, which were widely discussed in the late nineteenth century. Even the most radical evolutionary philosophies attracted enthusiastic, if limited, Muslim readership, such as the late Ottoman dissidents who embraced

[56] Nasr, *Knowledge and the Sacred*.

[57] Qadir, *Traditional Islamic Environmentalism*. For broader perspective, see Gade, *Muslim Environmentalisms*.

[58] Elshakry, *Reading Darwin in Arabic*; Riexinger, "Responses of South Asian Muslims to the Theory of Evolution."

Feuerbachian materialism and laid the intellectual foundations for the revolutionary ideology of the early Turkish Republic.[59]

In other words, like most fin-de-siècle intellectuals, Darwin's early Muslim readers understood evolution as social theory. At a time when "social Darwinism" had yet to be singled out for opprobrium because of its relationship to the eugenics movement and fascism, few in fact distinguished between evolution as an account of origins and evolution as social theory. Thus, evolution underwrote a new conception of Islam as a "civilization," with a specific place in the history of human progress.[60]

A crucial context of these early Darwinian debates was the sense that the appeal of new schools—whether imperial, missionary, or colonial—threatened to marginalize the Islamic disciplines, and with them the Muslim scholarly class of ulama.[61] In this context, a variety of leading Muslim intellectuals endorsed key elements of evolutionary theory. In India, Sayyid Ahmad Khan accepted the evolution of humans from animals, not because he was a "materialist" (as Afghani charged), but rather to argue that the Qur'an and science agreed with each other.[62] Likewise, the Egyptian mufti and influential teacher Muhammad 'Abduh saw evolution as an opportunity to assert Islam's agreement with modern ideas.[63]

Of course, not all nineteenth-century Muslim thinkers accepted Darwinism without qualification. The Ottoman-Syrian scholar Husayn al-Jisr gained fame for defending the argument from design in his *Hamidian Treatise* (which he named for the reigning sultan). Interestingly, al-Jisr's arguments, though steeped in Islamic scholarship, also drew on tropes of Anglophone natural theology such as the watchmaker analogy.[64] Perhaps the larger point, in this context, is not the split between Darwinists and their critics, but rather the way in which "Darwinism"—like the new material culture of the period—prompted a vigorous and very public reengagement with Islamic discursive traditions.[65]

In contrast to the United States, where organized anti-evolutionism arose in the early twentieth century, the growth of organized Islamic anti-evolutionism came as part of what

---

[59] Hanioğlu, "Blueprints for a Future Society."

[60] Elshakry, *Reading Darwin in Arabic*, 183.

[61] Elshakry, *Reading Darwin in Arabic*, 135.

[62] Qidwai, "Reexamining Complexity," 58-60.

[63] Elshakry, *Reading Darwin in Arabic*, 177-78.

[64] Ebert, *Religion und Reform*; Stolz, "By Virtue of Your Knowledge," 230-31.

[65] Elshakry, *Reading Darwin in Arabic*, 131-59.

scholars have identified as a global creationist revival in the late twentieth century.[66] Religious movements, often lay-led, seized upon the evolution-creation issue as a site for contesting what they saw as the failed policies of a secular political establishment. In doing so, the anti-evolutionists of the late twentieth century tended to make scientific arguments, often rooted in a critique of uniformitarian geology. This "scientific creationism" reflected, on the one hand, the cultural hegemony of science in late modernity, such that anti-evolutionist arguments on purely scriptural or theological grounds had lost their appeal.[67] On the other hand, the attack on evolutionary science also reflected the growing vulnerability of scientific consensus to anti-establishment politics.

An exemplar of these trends is the internationally famous Turkish creationist Adnan Oktar, whose pen name is Harun Yahya. As a design student in the 1980s, Oktar, like many Turks at that time, embraced religious revival as an antidote to the secularist left and right, whose rivalry had brought political violence to Turkey and culminated in the authoritarian crackdown of the 1980 coup. Oktar founded the Scientific Research Institute (BAV in Turkish) in 1990, and quickly became known for his strident critiques of Darwinism, which he identified as the moral rot at the core of contemporary society. With opaque funding, Oktar and the BAV produced dozens of publications, such as *The Evolution Deceit* and *Atlas of Creation*, which they translated into numerous languages and distributed around the world, often free of charge. Oktar's fame grew with his enthusiastic and colorful embrace of TV programming, where he was known for appearing with a group of women he called his "kittens."[68] In 2021, a Turkish court convicted Oktar and associates of perpetrating years of systematic sexual abuse and financial crimes; the verdict was overturned on appeal but he was expected to face retrial as of mid-2022. Regardless of Oktar's personal fate, however, his career helped to marginalize evolution in Turkish schools, during a period that saw a broader resurgence of religion in public life.

In part, the growth of Islamic creationist movements reflected a late twentieth-century shift toward transnational activism by Anglo-American creationists. As a series of judicial defeats closed the door on their initiatives in the United States, American creationists in particular devoted a growing share of their energies to forging connections abroad. Thus, in Oktar's case, the Science Research Institute enjoyed early ties to the Institute for Creation Research

[66] Numbers, *The Creationists*, 399-431; Blancke et al, "Creationism in Europe."

[67] Toumey, "Modern Creationism and Scientific Authority."

[68] Oktar's large and multilingual media presence does not mean that his work has a wide following in every community where it has been distributed, as Moran argues in the British case. Moran, "Harun Yahya's Influence in Muslim Minority Contexts," 837-56.

(in California), and a former associate of Oktar's testified on behalf of the Intelligent Design case in front of the Kansas State Board of Education in 2005.[69]

Islamic creationism drew inspiration from its Anglo-American cousins in the late twentieth century, but it was not the same thing. One significant difference was that Muslim creationists tended not to adopt the radical, young-earth interpretation of creation that had become prevalent in Anglophone contexts. Thus, Oktar's work endorses the conventional, geological age of fossils. Rather than questioning the age of the earth, the focus is on disputing the evolutionary hypothesis, in particular the evolutionary origin of humans. This difference may be traced, in part, to the Qur'anic account of creation, which references six days but is less detailed than the Genesis narrative. Perhaps more to the point, however, the six-day creation did not play as prominent a role in the history of Islamic scriptural interpretation (*tafsīr*) as it did in Christian, especially Protestant, exegesis. This circumstance, added to the relative decentralization of religious authority for much of Islamic history, has contributed to a sense that there is no single prevailing Islamic view on evolution.[70] The same could be said of any religion, of course. However, the field of creationism studies was for many decades defined by work on American Christianity, and is only beginning to acquire a more global perspective.[71] Given the dearth of studies on Islamic creationism, our understanding of Islam's diversity in this area is only just emerging, and requires further research.[72]

Wherever they may be found, Muslim creationists are part of local as well as transnational contexts. For example, despite the scarcity of young-earth creationism among Muslims in general, one place where it did catch on in the late twentieth century was North America. The relative popularity of the young-earth position among Canadian Muslims, in particular, is best understood in light of how Christian activists defined what it meant to be "creationist" in that time and place.[73] Meanwhile, Oktar's allegation that the spread of Darwinism is the result of a malevolent plot plays on the trope of conspiracy in Turkish political discourse. (Oktar has also denied the Holocaust.)

Despite the growth of organized anti-evolutionism as an Islamic phenomenon in the late twentieth century, evolutionary science did not come to a halt in Muslim-majority countries. In fact, the very places that saw the loudest public denunciations of evolution also played host, quietly, to expanding communities of evolutionary biologists. This apparent

---

[69] Numbers, *The Creationists*, 421-22.

[70] Hameed, "Evolution and Creationism in the Islamic World," 134-35 and 139.

[71] Blancke et al., "Creationism in Europe"; Numbers, *The Creationists*.

[72] Hameed, "Evolution and Creationism in the Islamic World," 134-35 and 139.

[73] Chang, "Creationism," D3.

contradiction was less a matter of cognitive dissonance than of divergent audiences. In the wealthy states of the Arabian peninsula, for example, while some Muslim authorities took even a hint of evolution as a chance to denounce westernization, nearby scientists taught evolution on Anglophone campuses and contributed evolutionary research (in English) to international journals.[74]

MODERN ISLAM AND SCIENCE EMBODIED: SOME EXAMPLES IN THE DEVELOPMENT OF ISLAMIC BIOETHICS

The development of Islamic bioethics merits its own treatment, and is the subject of a growing body of scholarship.[75] However, given that some of the great public debates on science have centered on the new possibilities of the body in the age of biomedicine, I provide here an introductory discussion of two issues that have been especially generative for Islamic bioethical discourse: transplant medicine, and assisted reproductive technology.

The development of transplant medicine in the late twentieth century occasioned a variety of Islamic responses. Two divergent cases illustrate some of the issues at stake. In Egypt, organ transplants faced widespread resistance, with many potential donors and recipients hesitating to embrace the procedure because "the body belongs to God."[76] In Iran, by contrast, the Islamic Republic not only approved transplant procedures, but authorized the world's only formal system to provide monetary compensation for organs. These divergent cases demonstrate the crucial role of social and political context in defining what is at stake in controversies of "science and religion."

Despite having pioneered transplant medicine in the Middle East in the 1970s, Egypt experienced one of the most divisive and inconclusive debates over the permissibility of the practice from an Islamic perspective. In general, the state's "official" voices of Islam, including a series of chief muftis, ruled in favor of transplants as a life-preserving tool. But many Muslim activists, as well as doctors, patients, and family members, articulated concerns about the risk to donors and the equity of care. As the medical anthropologist Sherine Hamdy has shown, these concerns were rooted in the neoliberal political economy of the Mubarak era, which saw chronic underinvestment in public institutions, including hospitals. In theory, the buying and selling of organs was illegal, but it was an open secret that the fastest way to obtain a kidney was to pay for one in a private clinic. Transplant medicine thus became one more area in which Egyptian society was stratified by the degree of private services one could afford, and it was in this context that ethical critiques of the practice arose. Moreover, whereas patients had once relied on the figure of the "doctor of confidence"—a

[74] Determann, *Researching Biology*.

[75] For overviews: Ten Have and Ghaly, eds., *Global Bioethics: Transnational Experiences and Islamic Bioethics*; Brockopp and Eich, eds., *Muslim Medical Ethics*.

[76] Hamdy, *Our Bodies Belong to God*.

person trustworthy in moral as well as medical terms—the collapse of public confidence in state institutions in Egypt since the 1970s eroded the credibility of the medical professions as well as of the state's Islamic offices, such as the chief mufti.[77] Absent public trust, neither doctors nor "official" Muslim authorities could persuasively counter concerns that transplant medicine, in practice, exploited donors for the sake of dubious benefit to recipients.

By contrast, the relatively orderly regulation of transplant medicine in Iran reflects the very different history of Islamic authority in that country, yielding a different politics of scientific and medical controversy. Since the establishment of the Islamic Republic in the wake of the 1979 Revolution, and with the subsequent consolidation of religious authority in the hands of the Supreme Leader and a small number of jurists, the Iranian state has enjoyed broad latitude to define an Islamic public policy. In this context, the permission given to organ transplants, and even to provide monetary compensation in exchange for kidneys, took shape amid several factors: a long history in Iranian society, going back to the early twentieth century, of linking the biomedical professions with social progress; a close alignment between the regime, leading surgeons, and patient advocate organizations; and an acute need for transplant operations as a result of the Iran-Iraq war.[78] Facilitating transplant medicine also helped the regime promote the notion that Iranian Shiism, under the stewardship of the Islamic Republic, was distinctly harmonious with modern science (the putative contrast being both to other Islamic contexts and to other religions). The Iranian system has enjoyed notable success in reducing the wait time for kidney recipients, which has prompted reconsideration of the compensation issue among international bioethical circles. However, inequities in access to care persist, as has the stigma attached to selling an organ, even when it is legal. It is not uncommon for Iranian patients to refuse to participate on the receiving end of such transplants.[79]

The importance of the nation-state as a context for embodied practices of Islam and science in the late twentieth century can also be seen in the case of assisted reproductive technologies (ART).[80] Despite their vast ideological differences, the Iranian and Turkish governments both articulated strong support for the new reproductive techniques of the late twentieth century. In both cases, pronatalism linked reproduction with the nation-building project.[81] In Turkey's case, this connection was framed in the secular terms that underwrote Turkish state discourse for most of the post-Ottoman era, whereas in the Iranian

---

[77] Hamdy, *Our Bodies Belong to God*, 49, 56.

[78] Mireshghi, *Kidneys on Sale*; Fry-Revere, *The Kidney Sellers*. On Iran and medical modernity, see Schayegh, *Who Is Knowledgeable Is Strong*.

[79] Mireshghi, *Kidneys on Sale*.

[80] Inhorn and Tremayne, eds., *Islam and Assisted Reproductive Technologies: Sunni and Shia Perspectives*.

[81] Gürtin, "Patriarchal Pronatalism."

case, Shiite clerics legitimated ART in a series of nuanced fatwas.[82] Yet in both cases, the sanction given to assisted reproduction emphasized that it take place within the institution of heterosexual marriage. Both countries also placed limits on third-party gamete donation, due to concerns about sexual contact between unmarried partners, as well as the potential for third-party donors to trouble Islamic norms of kinship, which are rooted in biological relations. However, these limitations have tended to erode over time, with some Iranian authorities, for example, authorizing third-party gamete donation on the logic that the donor transfers their kinship claim when they confer ownership of the gamete to the recipient.[83] It is likely no coincidence that such novel formulations of technology and kinship arose specifically in Iran and Lebanon,[84] both of which had strong institutions of religious authority (the Shiite clergy), and both of which experienced bloody and socially disruptive conflicts in the late twentieth century.

CONCLUSION

An eminent historian of science and Islamic thought, Ahmad Dallal, once lamented that the centering of modern scientific research outside of Muslim-majority countries has created a rupture, in histories of Islam and science, between eras prior to the nineteenth century and more recent periods. "In the absence of a living scientific culture in the modern Muslim world, we can discuss discourses on science, not science itself," Dallal wrote.[85] This characterization is problematic, inasmuch as it understates the extent to which scientific practices, which had long been a part of many Islamic societies, continued well into the modern era and shared in the making of the modern sciences. Moreover, an absolute distinction between science and "discourses on science" is questionable to begin with, given the extent to which public debate has shaped the pursuit of scientific knowledge. Whether in terms of practice or "discourse," and notwithstanding the very real deficits in research infrastructure and academic freedom in some Muslim-majority countries, Islamic societies have certainly sustained a "living scientific culture" in modernity.

Yet Dallal's lament also contains a crucial insight. The rise of "discourses on science" has indeed been a characteristic feature of modernity. These discourses have not conformed to any one pattern or set of outcomes. There is no single "Islamic position" on creation and evolution, just as there is no one "Islamic position" on assisted reproduction, or on how to define the beginning of the month, or on any of the thousands of new technologies that have been incorporated into, or excluded from, Muslim life in the last two centuries. The

[82] Tremayne and Akhondi, "Conceiving IVF in Iran."

[83] Tremayne and Akhondi, "Conceiving IVF," 68.

[84] Clarke, *Islam and New Kinship*.

[85] Dallal, *Islam, Science, and the Challenge of History*, 175.

importance of dynamic social context is key to unravelling the complexity of these discourses. How is science Islamic? How is Islam scientific? What was at stake in answering these questions changed over time, and changed again: as the prestige of technical professions rose; as imperial rivalry and reform gave way to nationalism, and colonization morphed into the postcolonial; and as revivalist movements advanced diverse visions of an Islamic polity. Throughout, however, efforts to define the relations of science and Islam have been crucial to the emergence of both modern Islam and science.

BIBLIOGRAPHY

Adas, Michael. *Machines as the Measure of Men: Science, Technology, and Ideologies of Western Dominance.* Ithaca, NY: Cornell University Press, 1990. (Link to IsisCB)

Balsoy, Gülhan. *The Politics of Reproduction in Ottoman Society*. London: Pickering and Chatto, 2013. (Link to IsisCB)

Barak, On. *On Time: Technology and Temporality in Modern Egypt.* Berkeley: University of California Press, 2013. (Link to IsisCB)

Bayly, C.A. *The Birth of the Modern World, 1780-1914: Global Connections and Comparisons*. Malden, MA: Blackwell Publishing, 2004.

Ben-Zaken, "The Heavens of the Sky and the Heavens of the Heart: The Ottoman Cultural Context of the Introduction of Post-Copernican Astronomy." *British Journal for the History of Science* 37 (2004): 1-28. (Link to IsisCB)

Blancke, Stefaan, Hans Henrik Hjermitslev, Johan Braeckman, and Peter C. Kjaergaard. "Creationism in Europe: Facts, Gaps, and Prospects." *Journal of the American Academy of Religion* 81 (2013): 996-1028.

Brentjes, Sonja. *Teaching and Learning the Sciences in Islamicate Societies (800-1700).* Turnhout: Brepols, 2018. (Link to IsisCB)

Brentjes, Sonja. *Travellers from Europe in the Ottoman and Safavid Empires, 16th and 17th Centuries: Seeking, Transforming, Discarding Knowledge*. Farnham: Ashgate/Variorum, 2010. (Link to IsisCB)

Brentjes, Sonja, and Robert Morrison. "The Sciences in Islamic Societies, 750-1800." In *The New Cambridge History of Islam,* vol. 4, edited by Robert Irwin, 564-639. Cambridge: Cambridge University Press, 2010.

Brockopp, Jonathan, and Thomas Eich, eds. *Muslim Medical Ethics: From Theory to Practice*. Columbia: University of South Carolina Press, 2008.

Bunt, Gary. *iMuslims: Rewiring the House of Islam*. London: Hurst, 2009.

Casale, Giancarlo. *The Ottoman Age of Exploraton*. Oxford: Oxford University Press, 2010.

Chang, Kenneth. "Creationism, Minus a Young Earth, Emerges in the Islamic World." *New York Times*, 3 November 2009. D3.

Clarke, Morgan. *Islam and New Kinship: Reproductive Technology and the Shariah in Lebanon*. New York: Berghahn Books, 2009.

Crozet, Pascal. *Les Sciences modernes en Égypte: transfert et appropriation, 1805-1902*. Paris: Geuthner, 2008.

Dallal, Ahmad. *Islam, Science, and the Challenge of History*. New Haven: Yale University Press, 2010. (Link to IsisCB)

Dallal, Ahmad. "Science and the Qur'an." In *The Encyclopedia of the Qur'an*, edited by Jane Dammen McAuliffe. Leiden: Brill, 2001-2006.

Determann, J. Matthias. *Researching Biology and Evolution in the Gulf States: Networks of Science in the Middle East*. London: I.B. Tauris, 2015. (Link to IsisCB)

Doostdar, Alireza. "Empirical Spirits: Islam, Spiritism, and the Virtues of Science in Iran." *Comparative Studies in Society and History* 58 (2016): 322-49.

Doostdar, Alireza. *The Iranian Metaphysicals: Explorations in Science, Islam, and the Uncanny*. Princeton: Princeton University Press, 2018.

Ebert, Johannes. *Religion und Reform in der arabischen Provinz: Husayn al-Gisr at-Tarabulusi (1845-1909)*. Frankfurt am Main: Peter Lang, 1991.

Echenberg, Myron. *Plague Ports: The Global Urban Impact of Bubonic Plague, 1894-1901*. New York: NYU Press, 2007. (Link to IsisCB)

Eickelman, Dale, and James Piscatori. *Muslim Politics*. Princeton: Princeton University Press, 1996.

El Shakry, Omnia. *The Arabic Freud: Psychoanalysis and Islam in Modern Egypt*. Princeton: Princeton University Press, 2017. (Link to IsisCB)

El-Rouayheb, Khaled. "Opening the Gate of Verification: the Forgotten Arab-Islamic Florescence of the 17th Century." *International Journal of Middle East Studies* 38 (2006): 263-81.

El-Rouayheb, Khaled. *Relational Syllogisms and the History of Arabic Logic, 900-1900*. Leiden: Brill, 2010. (Link to IsisCB)

Elshakry, Marwa. "The Exegesis of Science in the Twentieth-Century Arabic Interpretation of the Quran." In *Nature and Scripture in the Abrahamic Religions*, edited by Jitse van der Meer and Scott Mandelbrote, 491-524. Leiden: Brill, 2008. (Link to IsisCB)

Elshakry, Marwa. "The Gospel of Science and American Evangelism in Late Ottoman Beirut." *Past and Present* 196 (2007): 173-214.

Elshakry, Marwa. "Knowledge in Motion: The Cultural Politics of Modern Science Translations in Arabic." *Isis* 99 (2008): 701-30. (Link to IsisCB)

Elshakry, Marwa. *Reading Darwin in Arabic, 1860-1950*. Chicago: University of Chicago Press, 2013. (Link to IsisCB)

Fahmy, Khaled. "The Anatomy of Justice: Forensic Medicine and Criminal Law in Nineteenth-Century Egypt." *Islamic Law and Society* 6 (1999): 224-71.

Fahmy, Khaled. *In Quest of Justice: Islamic Law and Forensic Medicine in Modern Egypt*. Berkeley: University of California Press, 2018. (Link to IsisCB)

Faruqi, Ismail. *Islamization of Knowledge: General Principles and Workplan*. Washington, DC: International Institute of Islamic Thought, 1982.

Fortna, Benjamin. *Imperial Classroom: Islam, the State, and Education in the Late Ottoman Empire.* Oxford: Oxford University Press, 2002.

Fry-Revere, Sigrid. *The Kidney Sellers: A Journey of Discovery in Iran*. Durham, NC: Carolina Academic Press, 2014.

Fuchs, Simon Wolfgang. "Failing Transnationally: Local Intersections of Science, Medicine, and Sectarianism in Modernist Shi'i Writings." *Modern Asian Studies* 48 (2014): 433-67.

Gade, Anna. *Muslim Environmentalisms: Religious and Social Foundations*. New York: Columbia University Press, 2019.

Gesink, Indira Falk. *Islamic Reform and Conservatism: al-Azhar and the Evolution of Modern Sunni Islam*. London: I.B. Tauris, 2010.

Gordin, Michael. *Scientific Babel: How Science Was Done Before and After Global English*. Chicago: University of Chicago Press, 2015. (Link to IsisCB)

Gürtin, Zeynep. "Patriarchal Pronatalism: Islam, Secularism, and the Conjugal Confines of Turkey's IVF Boom." *Reproductive Biomedicine and Society* 2 (2016): 39-46.

Halevi, Leor. *Modern Things on Trial: Islam's Global and Material Transformation in the Age of Rida, 1865-1935*. New York: Columbia University Press, 2019. (Link to IsisCB)

Hamdy, Sherine. *Our Bodies Belong to God: Organ Transplants and the Struggle for Human Dignity in Egypt*. Berkeley: University of California Press, 2012.

Hameed, Salman. "Evolution and Creationism in the Islamic World." In *Science and Religion: New Historical Perspectives*, edited by Thomas Dixon, Geoffrey Cantor, and Stephen Pumfrey, 133-52. Cambridge: Cambridge University Press, 2010. (Link to IsisCB)

Hanioğlu, M. Sükrü. "Blueprints for a Future Society: Late Ottoman Materialists on Science, Religion, and Art." In *Late Ottoman Society: The Intellectual Legacy*, edited by Elisabet Özdalga, 28-116. London: RoutledgeCurzon, 2005.

Harrison, Peter. "'Science' and 'Religion': Constructing the Boundaries." *Journal of Religion* 81 (2006): 81-106.

Hefner, Robert, and Muhammad Qasim Zaman, eds. *Schooling Islam: The Culture and Politics of Modern Muslim Education*. Princeton: Princeton University Press, 2007.

Hirschkind, Charles. *The Ethical Soundscape: Cassette Sermons and Islamic Counterpublics*. New York: Columbia University Press, 2006.

Huber, Valeska. *Channelling Mobilities: Migration and Globalisation in the Suez Canal Region and Beyond, 1869-1914*. Cambridge: Cambridge University Press, 2013.

Inhorn, Marcia, and Soraya Tremayne, eds. *Islam and Assisted Reproductive Technologies: Sunni and Shia Perspectives*. New York: Berghahn Books, 2012.

Jansen, Johannes. *The Interpretation of the Koran in Modern Egypt*. Leiden: Brill, 1974.

Karaman, Burcu. "Atatürk and the Turkish Terminology Reform: The (Re-)turkification of Geography Terms." *Bilgi* 69 (2014): 89-126.

Keddie, Nikki R. *An Islamic Response to Imperialism: Political and Religious Writings of Sayyid Jamal al-Din "al-Afghani."* 2nd ed. Berkeley: University of California Press, 1983.

King, David A. *In Synchrony with the Heavens: Studies in Astronomical Timekeeping and Instrumentation in Medieval Islamic Civilization*. 2 vols. Leiden: Brill, 2014. (Link to IsisCB)

Küçük, Harun. *Science without Leisure: Practical Naturalism in Istanbul, 1660-1732*. Pittsburgh: University of Pittsburgh Press, 2019. (Link to IsisCB)

Kurzman, Charles. *Modernist Islam, 1840-1940: A Sourcebook*. Oxford: Oxford University Press, 2002.

Lelyveld, David. *Aligarh's First Generation: Muslim Solidarity in British India*. Princeton: Princeton University Press, 1978.

Low, Michael Christopher. "Ottoman Infrastructures of the Saudi Hydro-State: The Technopolitics of Pilgrimage and Potable Water in the Hijaz." *Comparative Studies in Society and History* 57 (2015): 942-74.

Masud, Muhammad, Brinkley Messick, and David S. Powers, eds. *Islamic Legal Interpretation: Muftis and Their Fatwas*. Cambridge, MA: Harvard University Press, 1996.

Minawi, Mustafa. "Telegraphs and Territoriality in Ottoman Africa and Arabia during the Age of High Imperialism." *Journal of Balkan and Near Eastern Studies* 18 (2016): 567-87.

Mireshghi, Elham. *Kidneys on Sale? An Ethnography of Policy, Exchange, and Uncertainty in Iran*. PhD Diss., University of California-Irvine, 2016.

Moore, Taylor M. *Superstitious Women: Race, Medicine, and Magic in Egypt.* PhD Diss., Rutgers University, 2020.

Moosa, Ebrahim. "Shaykh Ahmad Shakir and the Adoption of a Scientifically Based Lunar Calendar." *Islamic Law and Society* 5 (1998): 57-89.

Moran, Glen. "Harun Yahya's Influence in Muslim Minority Contexts: Implications for Research in Britain, Europe, and Beyond." *Zygon* 54 (2019): 837-56.

Morrison, Robert. *Islam and Science: The Intellectual Career of Nizam al-Din al-Nisaburi.* London: Routledge, 2011. (Link to IsisCB)

Nasr, Seyyed Hossein. *Knowledge and the Sacred*. New York: Crossroad, 1981.

Numbers, Ronald. *The Creationists: From Scientific Creationism to Intelligent Design*. 2nd ed. Cambridge, MA: Harvard University Press, 2006. (Link to IsisCB)

Özervarlı, M. Sait. "Alternative Approaches to Modernization in the Late Ottoman Period: İzmirlı İsmail Hakkı's Religious Thought against Materialist Scientism." *International Journal of Middle East Studies* 39 (2007): 77-102. (Link to IsisCB)

Qidwai, Sarah. "Reexamining Complexity: Sayyid Ahmad Khan's Interpretation of 'Science' in Islam." In *Rethinking History, Science, and Religion: An Exploration of Conflict and the Complexity Principle*, edited by Bernard Lightman, 50-64. Pittsburgh: University of Pittsburgh Press, 2019. (Link to IsisCB)

Quadir, Tarik. *Traditional Islamic Environmentalism: The Vision of Seyyed Hossein Nasr*. Lanham, MD: University Press of America, 2013.

Quadri, Junaid. *Transformations of Tradition: Islamic Law in Colonial Modernity*. Oxford: Oxford University Press, 2021.

Ragep, F.J., and Sally P. Ragep, eds. *Tradition, Transmission, Transformation: Proceedings of Two Conferences on Premodern Science Held at the University of Oklahoma*. New York: Brill, 1996. (Link to IsisCB)

Raina, Dhruv. "Circulation and Cosmopolitanism in 18th Century Jaipur." In *Cosmopolitismes en Asie du Sud*, edited by Corinne Lefèvre, Ines G. Županov, and Jorge Flores, 307-29. Paris: Éditions de l'École des hautes études en sciences sociales, 2015.

Raj, Kapil. *Relocating Modern Science: Circulation and the Construction of Knowledge in Europe and South Asia, 1650-1900*. New York: Palgrave Macmillan, 2007. (Link to IsisCB)

Riexinger, Martin. "Responses of South Asian Muslims to the Theory of Evolution." *Die Welt des Islams* 49 (2009): 212-47.

Rock-Singer, Aaron. *Practicing Islam in Egypt: Print Media and Islamic Revival*. Cambridge: Cambridge University Press, 2019.

Sabra, A.I. "The Appropriation and Subsequent Naturalization of Greek Science in Medieval Islam: A Preliminary Statement." *History of Science* 25 (1987): 223-43. (Link to IsisCB)

Saliba, George. *Islamic Science and the Making of the European Renaissance*. Cambridge, MA: MIT Press, 2007. (Link to IsisCB)

Sajdi, Dana. *The Barber of Damascus: Nouveau Literacy in the Eighteenth-Century Ottoman Levant*. Stanford: Stanford University Press, 2013.

Salomon, Noah. "Science and the soul—An introduction." *The Immanent Frame*, September 27, 2018. https://tif.ssrc.org/2018/09/27/science-and-the-soul-introduction/, accessed July 22, 2022.

Sarton, George. *Introduction to the History of Science*. 3 vols. Baltimore: Carnegie Institute, 1927-1948.

Schaffer, Simon. "The Asiatic Enlightenments of British Astronomy." *The Brokered World: Go-Betweens and Global Intelligence, 1770-1820*, edited by Simon Schaffer, Lissa Roberts, Kapil Raj, and James Delbourgo, 49-104. Sagamore Beach, MA: Science History Publications, 2009. (Link to IsisCB)

Schayegh, Cyrus. *Who Is Knowledgeable Is Strong: Science, Class, and the Formation of Modern Iranian Society, 1900-1950*. Berkeley: University of California Press, 2009. (Link to IsisCB)

Simon, Andrew. *Media of the Masses: Cassette Culture in Modern Egypt*. Stanford: Stanford University Press, 2022.

Skovgaard-Petersen, Jakob. *Defining Islam for the Egyptian State: Muftis and Fatwas of the Dar al-Ifta*. Leiden: Brill, 1997.

Stearns, Justin. *Infectious Ideas: Contagion in Premodern Islamic and Christian Thought in the Western Mediterranean*. Baltimore: Johns Hopkins University Press, 2011. (Link to IsisCB)

Stenberg, Leif. *The Islamization of Science: Four Muslim Positions Developing an Islamic Modernity*. Lund: Lund University, 1996.

Stolz, Daniel. *The Lighthouse and the Observatory: Islam, Science, and Empire in Late Ottoman Egypt*. Cambridge: Cambridge University Press, 2018. (Link to IsisCB)

Stolz, Daniel. "Positioning the Watch Hand: 'Ulama' and the Practice of Mechanical Timekeeping in Cairo, 1737-1874." *International Journal of Middle East Studies* 47 (2015): 489-510.

Stolz, Daniel. "'By Virtue of Your Knowledge: Scientific Materialism and the *Fatwa*s of Muhammad Rashid Rida." *Bulletin of the School of Oriental and African Studies* 75 (2012): 223-47.

Stolz, Daniel. "The Voyage of the Samannud: Pilgrimage, Cholera, and Empire on an Ottoman-Egyptian Steamship Journey in 1865-66." *International Journal of Turkish Studies* 23 (2017): 1-18.

Şen, A. Tunç. "Reading the Stars at the Ottoman Court: Bāyezīd ii (r. 886/1481-918/1512) and His Celestial Interests." *Arabica* 65 (2017): 557-608. (Link to IsisCB)

Tagliacozzo, Eric. "Hajj in the Time of Cholera: Pilgrim Ships and Contagion from Southeast Asia to the Red Sea." In *Global Muslims in the Age of Steam and Print*, edited by James Gelvin and Nile Green, 103-20. Berkeley: University of California Press, 2014. (Link to IsisCB)

Telliel, Yunus Doğan. "Miraculous Evidence: Scientific Wonders and Religious Reasons." *Comparative Studies of South Asia, Africa, and the Middle East* 39 (2019): 528-42.

Ten Have, Henk, and Mohammed Ghaly, eds. *Global Bioethics: Transnational Experiences and Islamic Bioethics. Zygon* 48 (2013).

Toumey, Christopher. "Modern Creationism and Scientific Authority." *Social Studies of Science* 21 (1991): 681-99. (Link to IsisCB)

Tremayne, Soraya, and Mohammad Mehdi Akhondi. "Conceiving IVF in Iran." *Reproductive Biomedicine and Society* 2 (2016): 62-70.

Umut, Hasan. "Theoretical Astronomy in the Early Modern Ottoman Empire." PhD Diss., McGill University, 2019.

Wishnitzer, Avner. *Reading Clocks, Alla Turca: Time and Society in the Late Ottoman Empire*. Chicago: University of Chicago Press, 2015. (Link to IsisCB)

Yalçınkaya, M. Alper. *Learned Patriots: Debating Science, State, and Society in the Nineteenth-Century Ottoman Empire*. Chicago: University of Chicago Press, 2015. (Link to IsisCB)

Yaycioglu, Ali. "Guarding Traditions and Laws—Disciplining Bodies and Souls: Tradition, Science, and Religion in the Age of Ottoman Reform." *Modern Asian Studies* 52 (2018): 1542-1603.