

Revealed Sciences

Demonstrating the vibrancy of an Early Modern Muslim society through a study of the natural sciences in seventeenth-century Morocco, *Revealed Sciences* examines how the natural sciences flourished during this period, without developing in a similar way to the natural sciences in Europe. Offering an innovative analysis of the relationship between religious thought and the natural sciences, Justin K. Stearns shows how nineteenth and twentieth-century European and Middle Eastern scholars jointly developed a narrative of the decline of post-formative Islamic thought, including the fate of the natural sciences in the Muslim world. Challenging these depictions of the natural sciences in the Muslim world, Stearns uses numerous close readings of works in the natural sciences to a detailed overview of the place of the natural sciences in scholarly and educational landscapes of the Early Modern Maghreb, and considers non-teleological possibilities for understanding a persistent engagement with the natural sciences in Early Modern Morocco.

Justin K. Stearns is Associate Professor of Arab Crossroads Studies at New York University Abu Dhabi, where his research interests focus on the intersection of law, science, and theology in the premodern Muslim Middle East. He is the author of *Infectious Ideas: Contagion in Premodern Islamic and Christian Thought in the Western Mediterranean* (2011) and *al-Yūsī: The Discourses* (2020).

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Revealed Sciences

The Natural Sciences in Islam in Seventeenth-Century Morocco

JUSTIN K. STEARNS
New York University Abu Dhabi



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For my parents, Bev and Steve

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Preface: Paths not Taken

When some years ago I began writing a dissertation on how Muslims and Christians responded to the Black Death in Iberia in the fourteenth century, I thought that I was writing a comparative study of social and intellectual responses to a devastating epidemic. And, to some degree, this is what the resulting book became.¹ Yet, working on the subject of contagion in the pre-modern Muslim world also confronted me with the extent to which nineteenth to twenty-first century debates on the tension between modern science and religion on the one hand, and the marginal position of the Muslim world in modern scientific production on the other, had distorted historians' understanding of Muslims writing about the natural sciences in the pre-modern world. Thus, scholars such as the Granadan Lisān al-Dīn Ibn al-Khaṭīb (d. 776/1374), who affirmed the phenomenon of contagion, had in much of the previous scholarship on Muslim responses to plague been described as exceptions proving the rule of general Muslim fatalism and anti-empiricism when faced with epidemic disease.² The sources I found suggested, instead, that while innovative and creative, his response and his defense of the transmission of disease was not unique and was part of a larger body of writings by Muslim authors that drew in various and

¹ Justin Stearns, *Infectious Ideas: Contagion in Premodern Islamic and Christian Thought in the Western Mediterranean*.

² See Michael Dols, *The Black Death in the Middle East*, 92–94; Ullmann, *Die Medizin im Islam*, 246–47; Ullmann, *Islamic Medicine*, 92–96; Rofail Farag, “The Muslims’ Medical Achievements,” 303; Vásquez de Benito, “La materia médica de Ibn al-Jaṭīb,” 140–41; Arjona Castro, “Las epidemias de peste bubónica en Andalucía en el siglo XIV,” 58; Calero Secall, “La peste en Málaga, según el malagueño al-Nubāhī,” 58; al-Bazzāz, *Tārīkh al-awbi’ a wa-l-majā’at bi-l-maghrīb fi l-qarnayn al-thāmin wa-l-tāsi’ ashara*, 393; Congourdeau and Melhaoui, “La perception de la peste en pays chrétien byzantine et musulman,” 110.

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diverging ways on religious, medical, and empirical evidence and authorities to address the challenge posed by the transmission of disease.³ The historiography surrounding contagion had been substantially distorted by our present day understandings of disease transmission and of the necessity of distinguishing between religious and medical discourses. As I finished this first project, a figure marginal to one of its later chapters, the eleventh/seventeenth-century Moroccan polymath al-Ḥasan al-Ÿūsī (d. 1102/1691), increasingly preoccupied me and became the impetus for writing the book the reader holds now. I had initially become interested in al-Ÿūsī for his views on contagion, eloquent but not particularly innovative.⁴ Yet, reading al-Ÿūsī pushed me to broaden my interest in the contemporary framings and concomitant distortions of Islamic intellectual history from contagion to the natural sciences in general. Specifically, I became interested in how contemporary teleologies of the rise of modern science had encouraged historians to either ignore developments in Islamic thought that had no place in its genealogies or to more starkly dismiss them as pseudoscience or intellectual decline. There were two central issues here, the first more clearly related to what I had observed with contagion and which could be summarized as the reduction of past intellectual thought to those elements that had a role in shaping our current understandings of science, or at least represented a parallel with them. The second was distinct, if related, and consisted of clarifying the social and intellectual context of the natural sciences and the ways Muslims drew on them within the religious discourses of law, theology, and Sufism – aspects largely unexplored for the post-formative period. This engagement with the writings of al-Ÿūsī and the scholarly dynamism of his age, along with the accident of my own specialization in the Islamic West, led to my pursuing these interests through the prism of Morocco in the eleventh/seventeenth century, a period of intellectual and political ferment that I describe in Chapter 1.

Much of what I have addressed above could be summarized under the rubric of Whig History or writing the story of the past with the values of the present, something that all students of history and especially of the history of science are repeatedly warned against. Yet this belongs to the class of imprecations that are especially poignant because we sense that they are in vain: while in the following I have done my best to establish the nature and

³ Not all my readers were convinced. See the passing remarks in Gotthard Strohmaier, “Galenism Caught between Faith in God and ‘Prophetic Medicine’,” 38, and in the same volume the warning of Lutz Richter-Bernburg, “Medicine in Islam: Contested Autonomy,” 49.

⁴ See Stearns, *Infectious Ideas*, 137–38, and al-Ÿūsī, *The Discourses*, vol. 1, 245–51.

significance of the natural sciences for the scholars of early modern Morocco, my own interest in doing so is a profoundly modern one that situates itself in conversation with a host of other modern voices. Many of these are scholarly ones whose names the reader will find in the body of the book itself. But there are also two conversations taking place in the broader public sphere that have played a role in my choosing to write *Revealed Sciences*, although neither finds much support among students of Islamic intellectual history today.

The first of these is the argument that Islam or the Islamic world has opposed the development and study of philosophy and the natural sciences since a purported Golden Age that ended sometime in the (European) Middle Ages after European scholars translated what Muslims had preserved of Greek philosophy.⁵ Once widespread among historians and some orientalists, this view is today especially prevalent among the so-called New Atheists, including Richard Dawkins and Sam Harris, but also among other prominent scientists who have turned to writing histories of science, such as Steven Weinberg, and populizers of science such as Neil DeGrasse Tyson. At their most benign, these figures depict all religion as inimical to scientific inquiry; more perniciously they can represent Islam as particularly opposed to science and to modernity in general.⁶ In the Introduction below, I will discuss how at the end of the nineteenth century two narratives became widespread: 1) the story of Western European history containing a struggle between religion and science culminating in science's victory; and 2) the description of the Muslim world having been in a state of intellectual decadence and decline since the Middle Ages. Here, I would like to draw attention to how the simplistic civilizational discourse that underlies these narratives and locates both science and modernity in a uniquely European rationality adds to the force of the Islamophobia that both Europe and the United States are witnessing in the first decades of the twenty-first century.

⁵ See my comments in "Writing the History of the Natural Sciences in the Pre-modern Muslim World: Historiography, Religion, and the Importance of the Early Modern Period," *History Compass*, vol. 9 (2011), 923–51, and at 926–28 for my discussion of the great Orientalist Ignaz Goldziher's confusing and influential views on the fate of the rational sciences in post-formative Islamdom.

⁶ For Dawkins' remarks, which are part of his more extensive views of Islam on social media, see the overview in Abby Ohlheiser, "A Short History of Richard Dawkins vs. The Internet"; for Sam Harris' views, see the opening to his chapter "The Problem of Islam" in *The End of Faith: Religion, Terror, and the Future of Reason*, 108–09; for Steven Weinberg, see *To Explain the World: The Discovery of Modern Science*, 116–23; Neil DeGrasse Tyson's views on the influence of al-Ghazālī in bringing about the intellectual collapse of Islam are expressed in his reboot of the series *Cosmos* and in this lecture (www.youtube.com/watch?v=Fl1nJC3lvFs).

An opposing view that is nonetheless based on the similar premise of the Islamic world having witnessed its last moment of vibrancy and contribution to world history during the European Middle Ages is found in the exhibition *1001 Inventions* and the associated publications that have proceeded from the work of the British-based Foundation for Science, Technology, and Civilization.⁷ Here we have a narrative that not only celebrates the achievements of Muslim scholars during a Golden Age that stretched from roughly the third/ninth to sixth/twelfth century celebrated, but they are described as the origin of modern science and modernity in general. As with the first group, the intellectual production of the Muslim world during the Early Modern period is passed over entirely and assumed to be either irrelevant or in decline.⁸ This narrative also originated in the late nineteenth century, this time in the works of Muslim reformers who responded to the writings of European orientalist and colonial administrators by stressing the past glory of Muslim achievements and the need to return to that glory through dramatic reforms. Here I note that such attempts to emphasize the importance of the work of scholars working in the Muslim world during the European Middle Ages – based on the same Hegelian civilizational approach shared by many of the first group – not only distort the past, but also lead Muslims and non-Muslims alike to a lack of interest in those aspects of Islamic intellectual history that were not valued by European scholars or which did not lead to developments in European intellectual history.⁹

The misleading relay-race narrative in which the Muslims receive the baton of science from the Greeks and then pass it on to the Europeans is shared with varying emphases by both groups, and contributes to a general lack of interest in what happened intellectually in the Muslim world after Europeans stopped translating Arabic texts.¹⁰ Even more important for

⁷ See www.fstc.org.uk/, www.1001inventions.com, as well as the associated short film *1001 Inventions and the Library of Secrets* (www.youtube.com/watch?v=JZDe9DCx7Wk).

⁸ The *1001 Inventions* and associated FSTC events and publications have been incisively critiqued in Sonja Brentjes et al. (eds.), *1001 Distortions: How (Not) to Narrative History of Science, Medicine, and Technology in Non-Western Cultures*. See also Sonja Brentjes' review of Salim T. S. al-Hassani (ed.), *1001 Inventions: The Enduring Legacy of Muslim Civilization*.

⁹ A point I made in an abbreviated fashion in *The National* after visiting the *1001 Inventions* exhibition when it came to Abu Dhabi in 2011 (www.thenational.ae/1001-innovations-and-the-living-heritage-of-islamic-science-1.375391).

¹⁰ The impression that translations into Latin from Arabic ended in the Middle Ages is widespread among historians as well. For a nuanced and comprehensive discussion of the Renaissance translations of Arabic philosophical works, which are rarely invoked in these narratives, see Dag Nikolaus Hasse, *Success and Suppression: Arabic Sciences and Philosophy in the Renaissance*. Shifting the period of translation from the Middle Ages to

this book, however, is that the bulk of the scholarly research on the natural sciences in the Muslim world over the past century has focused on the so-called “Golden Age” associated with the ‘Abbasid caliphate from the third/ninth to seventh/thirteenth centuries and subsequent Mongol and Timurid states into the ninth/fifteenth centuries, with less attention being paid to the Islamic West, much less Morocco, following the division of much of the Islamic world into the Mughal, Safavid, and Ottoman Empires in the sixteenth century.¹¹ This generalization should clearly not be pushed too far, for as Chapters 2–4 will show, there is a growing body of work addressing the natural sciences during what we can tentatively call the post-classical period of Islamic intellectual history – chronology being a constant bugbear for historians – which stretched from the thirteenth to eighteenth centuries.¹² Yet the balance of research and interest is still clearly in the Eastern Mediterranean and Central Asia during the eleventh–fourteenth centuries and that is where much of the best work is being done.¹³ The richness of secondary scholarship on this region and period has no parallel in either the later centuries or in the Islamic West. An exception to this last statement is the study of the natural sciences in al-Andalus, which has received considerably more attention than North Africa, but which also ended, at the most generous estimate, with the expulsion of the Moriscos at the beginning of the seventeenth century.¹⁴

the Renaissance does little, of course, to increase interest in the intellectual production of the Muslim world following this.

- ¹¹ For a recent nuanced discussion of some of the problems of identifying the Abbasid caliphate with a Golden Age of Islamic civilization, see Michael Cooperson, “The Abbasid ‘Golden Age’: An Excavation.”
- ¹² The “post” here refers to a general agreement in Islamic studies that by the fifth/twelfth century the classical intellectual and institutional structures for Islamic jurisprudence, theology, and mysticism (a poor gloss for Sufism) had crystalized and would form the basis for subsequent developments. For a concise overview differentiating between processes that could be considered formative and classical in terms of the development of Islamic civilization, see Chase Robinson, “Conclusion: From Formative Islam to Classical Islam.” For insightful remarks on the problem of chronology in the historiography on the Muslim world, see Shahzad Bashir, “On Islamic Time: Rethinking Chronology in the Historiography of Muslim Societies,” 519–44.
- ¹³ To take just four important works of the past two decades, this is as true of the biographical monographs of Robert Morrison and Nahyan Fancy on, respectively, Nīzām al-Dīn al-Nīsābūrī (d. ca. 1330) and Ibn al-Nafīs (d. 1288), as it is of François Charette’s study and translation of Najm al-Dīn al-Miṣrī’s fourteenth century treatise on mathematical instrumentation or Sally Ragep’s recent translation of Jāghmīnī’s thirteenth century introduction to contemporary reformulations of Ptolemaic Astronomy.
- ¹⁴ Consider only two comparatively recent works, Miquel Forcada’s 2011 study of Ibn Bājjā (d. 1139), and Robert Morrison’s 2016 study and translation of Joseph ibn Naḥmīas’ (fl.

Revealed Sciences aims to address this imbalance by focusing on the natural sciences in seventeenth century Morocco, but the lacuna that it mainly attempts to fill is not principally geographic but methodological. Instead of focusing on the works of a scholar who specialized in one or more of the natural sciences, or on a specific site of scientific production, it seeks to contextualize the role played by the natural sciences within the broader scholarly production of the time. Doing so entails the reading of biographical dictionaries, scholarly autobiographies, legal opinions, theological asides, mystical and moral reflections, as well as works on astronomy, medicine, and alchemy. I am interested here not so much in intellectual influence or progress, terms with their own connotations, as much as I am in establishing the presence and range of the natural sciences in knowledge production and transmission.¹⁵ Accurately carrying out this task necessitates first sidestepping the teleological questions of progress and development that characterize so much writing in the history of science in order to fully establish the range and nature of the natural sciences during this period. Only once we have described an epistemological field that included Prophetic and humoral medicine, astronomy, alchemy, astronomy, magic and mathematics, and the various debates in which scholars discussed the categorization and the value of these sciences, can we turn to the broader historical question of change over time. Put differently: we should describe what Muslim scholars of seventeenth century Morocco perceived as natural sciences and the uses to which they put them before we can begin to move to tracing how their understandings differed from those of their colleagues from previous or subsequent centuries. Finally, if we wish to understand the broader social impact of the natural sciences, we need to move our focus from the work of the exceptional scholar of one of these sciences to the more general reception of these disciplines by both nonspecialists and their more ordinary representatives.

I am well aware that the approach taken here will not appeal to a number of groups. For those who believe in a singular teleology of science that can be traced from Aristotle through the European Middle Ages to the European Scientific revolutions of the seventeenth–nineteenth centuries, and then to the present day, the story told here will have the value of a historical curiosity at best, proof of civilizational

1400) Judeo-Arabic work on theoretical astronomy, *The Light of the World: Astronomy in al-Andalus*.

¹⁵ For a nuanced discussion of terminological pitfalls related to the spread of knowledge between distinct cultural spheres, see James E. Montgomery, “Islamic Crosspollinations.”

decline at worst.¹⁶ Many historians of science in the Muslim world, for their part, who tend to focus on the work of a scholar specializing in one of the natural sciences, may look askance at the marginal place of the discussion of texts in the natural sciences, and note that there is little of scientific interest here in general. While more sympathetic to the second than the first group's concerns, *Revealed Sciences* represents an argument for shifting our focus from exceptional scholarly production to the context of what might be called the more pedestrian types of Kuhnian normal science.¹⁷ I do not subscribe to a "strong" version of Kuhn's evocative, influential, and thoroughly critiqued theory of scientific paradigms setting out research agendas for normal science that experiences crises leading to scientific revolutions, nor do I think that it readily applies to the material under consideration. Yet, Kuhn's description of normal science as "mop-up work" dealing with "puzzle-solving" the problems set out by an initial paradigm does go some way toward explaining the types of scholarship produced in the natural sciences in seventeenth-century Morocco.¹⁸ The reference is imprecise, and not only because Kuhn himself understood science and its revolutions, regardless of how one understands the much debated term "incommensurability" that he used to describe distinct paradigms, as decidedly a story of Western European modern science.¹⁹ Nevertheless, it was a passage at the end of Thomas Kuhn's classic *The Structure of Scientific Revolutions* that precipitated my thinking at an early stage of this book. Describing Darwin's greatest challenge in gaining acceptance for the theory of evolution, Kuhn notes that it was Darwin's arguing that evolution had no goal where he encountered the greatest resistance: "What could 'evolution,' 'development,' and 'progress' mean in the absence of a specified goal? To many people, such terms suddenly seemed

¹⁶ For one unapologetic defense of a teleological reading of the history of science, see Steven Weinberg's defense of Whig readings of the history of science in "Eye on the Present – The Whig History of Science," *The New York Review of Books*, December 17, 2015 (www.nybooks.com/articles/2015/12/17/eye-present-whig-history-science/). But see also the comments of the scholar of Avicenna, Dimitri Gutas, who argues for a clear differentiation between "science" and "religion" in the formative period of Islamic thought, with all philosophy tinged by religious dogma being paraphilosophy (Dimitri Gutas, "Ibn al-Nafis's Scientific Method").

¹⁷ See Thomas Kuhn, *The Structure of Scientific Revolutions*, chapter 3 "The Nature of Normal Science."

¹⁸ See *ibid.*, 24 and chapter 4 "Normal Science as Puzzle-Solving."

¹⁹ This aspect of Kuhn's theory received an especially great deal of criticism. For some of his later reflections on the subject, see Kuhn, "Commensurability, Comparability, Communicability."

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self-contradictory.”²⁰ Darwin’s famous tree of life, ever branching outwards in many directions but not moving toward any single goal, provided Kuhn with a powerful analogy to his own description of scientific progress – one that offered a sustained critique of modern science as an asymptotic movement toward absolute truth. Insofar as the analogy remains useful, it helps us understand the story of the natural sciences in early modern Morocco not as one of retardation or decline, but of divergence from the path taken in Europe during the same centuries – distinct, but no less rational or curious.

If the main impulses of this book are, first, to draw attention to the nature and place of the natural sciences in the Muslim world in the Early Modern period, and, second, to focus on engagement with these sciences beyond the writings of exceptional thinkers, the third is to add nuance to the now rather stale debate about the compatibility between science and religion. Proceeding from the assumption that both this debate and the two central terms assumed their current significance at the end of the nineteenth century, *Revealed Sciences* dwells on the porous nature of the natural and transmitted sciences during this period, tracing how they lent their authority to each other and the ways that individual scholars saw them as compatible. While these and related questions emerge from a decidedly twenty-first century context and are those of a scholar writing from within a modern, secular, institution that is distinct from those in which the scholars discussed here lived and wrote, I do not think that these questions would have been wholly unintelligible to them (or incommensurable with their own).

²⁰ Kuhn, *The Structure*, 171. See also the excursus on Kuhn after Chapter 3.

Acknowledgments

It has been over a decade since I first began working on this project, and it has acquired many debts along the way. It is a great pleasure to be able to acknowledge them here, even as doing so leaves me chastened to contemplate how long it took me to get to this point. I need to start by thanking Cambridge University Press for its patience. The book began with a conversation with Marigold Acland at MESA in 2010, and following Marigold's retirement it went through several hands, resting now with the very capable and encouraging Maria Marsh. I am deeply grateful to everyone at Cambridge for giving me the time I needed to complete this project. Finally, I am indebted to Martin Grosch for his work on the wonderful map of Morocco that accompanies the text. A good map is worth far more than a thousand words.

Along the way, my work on this book has received support from a number of fellowships, beginning with a residency at the Rockefeller Center at Bellagio in the fall of 2010, where I completed my first reading of al-Yūsi's writings and presented my still inchoate thoughts to the other fellows. It was a gift to be able to return to Bellagio in the spring of 2019 as my work on a first draft of this book was nearly done, this time accompanying my wife Nathalie Peutz on her residency there, in something of a full circle. An American Institute for Maghrebi Studies Grant allowed me to visit the Ḥamziyya-ʿAyyāshiyya lodge in June of 2015 and to consult the manuscripts there, and an NYUAD Research Enhancement Fund supported research on the project between 2015 and 2017, including visits to the Nāṣiriyya lodge in Tamgrout in 2016 and to Taroudant in 2018. The bulk of the writing of the first draft took place with the support of an American Council for Learned Societies grant in 2017 and 2018, and I had

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Sections of Chapters 2 and 3 are drawn from “‘All Beneficial Knowledge is Revealed’: The Rational Sciences in the Maghrib in the Age of al-Yūsī (d. 1102/1691),” *Islamic Law and Society*, vol. 21 (2014), 49–80, and “The Legal Status of Science in the Muslim World in the Early Modern Period: An Initial Consideration of *fatwas* from Three Maghribi Sources,” in Ahmed, Sadeghi, Bonner (eds.), *The Islamic Scholarly Tradition: Studies in Islamic History, Law, and Thought in Honor of Professor Michael Allan Cook on His Seventieth Birthday* (Leiden: Brill, 2011), 265–90, and

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a version of the section on al-Ṣāliḥī's medical writings – here in Chapter 4 – should appear in a special issue of *Early Science and Medicine* in 2021.

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