

"The Status of the Natural Sciences in the Early Modern Muslim World: the Case of Morocco"

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Introduction: the Problem

To begin with a few general observations. I come to you as an intellectual historian, and as such I feel something of the outsider here at *AALIMS*, even as I am heartened by the invitation to present my own work in this forum and am grateful to have been included in these two days of discussions on Muslim societies. The story I wish to present to you and where I look forward to feedback relates to the place of the natural sciences in Islamic Societies historically, and specifically in the early modern period. Early Modern is a Eurocentric term, but it has the benefit of situating us in the 15-18th centuries and also of indicating that I'm interested in the status and role of the natural sciences in Muslim societies during the very period that the events we commonly gloss as the rise of Modern Science took place in Europe. Let me rehearse why this question is both interesting and problematic. A generation ago, the story of the rational sciences in the Muslim world would have gone something like this: during the first three centuries after the rise of Islam in the seventh century, scholars in the Muslim world translated a vast body of Greek, Syriac, and Sanskrit philosophical texts into Arabic, expanding Arabic itself from primarily a language of scripture, poetry, and religious ritual to one of philosophy in the broadest sense, including the natural and mathematical sciences as well as metaphysics, ethics and political philosophy. From the ninth to the thirteenth century the Muslim world witnessed a Golden Age of intellectual and cultural production, a period that marked its central contribution to world history, and which ended either following the reactionary and defensive theological writings of the Sufi al-Ghazali (d. 1111), the fall of Baghdad to the Mongols in 1258, or perhaps the exclusion of the rational sciences from the institution of the madrasa that emerged in the eleventh century in Iraq and Iran and then spread throughout the Muslim world. Following this Golden Age, the rational sciences in the Muslim world and Islam itself slipped into a long

decline from which they didn't emerge until European expansion in the 18-19th centuries introduced modern education and modern science along with it to the Muslims of India and the Ottoman Empire. Since then, Muslims have been struggling to catch up with the West, and here the position of the natural sciences in Muslim societies functions metonymically for the trappings of technological modernity.

This is a nice story. It feels good because it acknowledges the role Muslims played in the past in preserving and maybe even expanding rational knowledge and in bringing about the European Renaissance. It makes sense as it maps smoothly onto the various versions of the Great Divergence between the West and the Rest that historians, economists, and political scientists have laid out in the past few decades. There is also a nice sense of teleological closure that it provides: since it is self-evident that modern science emerged in Europe following the Scientific Revolution of the seventeenth century (or scientific revolutions of the 17-19th centuries if you aim to be nuanced about it), and that the West exemplifies the legacy of this revolution in the technological modernity that characterizes it today, there must have been something within Muslim societies that prevented them from achieving the same results (in this one can hear echoes of modernization theory).

Like many nice and tidy stories, this one has lost a great deal of its explanatory value in recent years. The last few decades have shown us that al-Ghazali, far from opposing the Greek Hellenistic legacy in Islamic thought, was one of its champions. The Mongols' destruction of Baghdad, apocalyptic though it was for its contemporaries, was followed by a period of remarkable intellectual ferment under the Ilkhans that included the construction of observatories in the fourteenth century and afterwards. Most importantly, perhaps, we now have ample evidence that between the 13-15th centuries the study of the rational sciences was institutionalized in the central Arab lands of the Ottoman empire, and that well through the European Renaissance of the 15-16th centuries, the rational sciences occupied an important place in Muslim education and Muslim societies writ large. So where do we stand now? Can we save

the story we once held onto, one that has made a resurgence in the Muslim world itself in a series of nostalgic if not romantic reconstructions of the nature and influence of an Islamic Golden Age? Or does the problem of European scientific exceptionalism need to be approached in a different fashion, and our categories of analysis revisited? Unsurprisingly, perhaps, I will now make an argument for the second approach.

A solution

Intellectual historians are infamous for their obsession with terminology. Two of the main problems with the classic decline narrative and its more nuanced manifestations, the naturalization and compartmentalization theses, are that they are based on the assumptions that it makes sense to consider Muslim societies as a coherent unit of analysis and that we know what we mean we use the term science. We have good reason to doubt both of these propositions. On the one hand, the decline narrative itself, paired in a dialectic with the story of the rise of modern science in Europe, flattened our study of the intellectual history of the Muslim world and contributed to a lack of local studies of the various regions that composed the far-flung Muslim dynasties of early modernity: the Ottomans, Safavids, and Mughals (and the same could be said to a lesser degree of the politically much more fragmented 13-15th centuries). In the last two decades major improvements are being made in establishing an understanding of the intellectual production of the period once glossed as one of “decline” — roughly the 13-18th centuries — but the vast majority of texts written in this period are still in the process of being catalogued, much less edited, read, studied or translated. We need to take the scope of our ignorance seriously and the best way to do this is not to make claims for Muslim societies in general but to restrict ourselves to focused case studies of individual regions during well-defined periods, much though we will always be tempted to generalize more broadly. This argument also functions as a justification for my limiting myself below to talking about Morocco between the 16-18th centuries. Now, along with this focus on the local, we also need to revisit what we mean by the term science.

The history of science itself was founded as a teleological narrative of progress beginning with the natural sciences of the twentieth century and looking backwards in time for antecedents for models, methods, and results. Much of the past half century of scholarship has worked to mitigate and nuance the subfield's presentism, and here scholarship on Europe during the early modern period has been at the forefront in challenging the assumptions with which the field began. It is, for example, taken as a given today by scholars of Newton that his interests in and writings on alchemy need to be taken seriously and that his work on gravity cannot be surgically isolated from this or his religious beliefs. Scholars of Spanish history have shown how the contributions of peninsular Catholic scholars of the natural sciences during the early modern period have been unfairly minimized by a historiography that privileged a strong correlation between the Protestant Reformation, the Scientific Revolution, and the Industrial Revolution. Implicit assumptions about how religious traditions forward or impede rational inquiry are, in other words, important. The upshot of these interventions has been that when surveying the landscape of rational and natural sciences we now understand the sciences in European early modernity much more along contemporary definitions and welcome consideration of the occult sciences of alchemy, astrology, and divination alongside the old stalwarts of astronomy, medicine, and mathematics. It is not that every astronomer in sixteenth century Germany practiced astrology or that every physician in seventeenth century France drew on alchemy, but there was not yet a singular Science, and we have come to understand how our modern categories have at times deeply distorted our understanding of what scholars of the past believed that they were doing when they studied the natural world.

By comparison, scholarship of the natural sciences in Muslim societies has clung for much longer onto the older history of science narrative and has spent a great deal of time on the early reception and appropriation of philosophical knowledge by Muslim scholars. Precisely because of the power of the Golden Age narrative, chiefly those aspects of Muslim scholarly production that reinforced the importance of Muslim societies as precursors to Western

modernity, scientific and otherwise, have been studied and included in narratives of “science.” Astronomy is in, alchemy is only now becoming a hot area of research. Medicine is an area of scientific inquiry, lettrism and divination have only in the past few years become the subject of widespread interest. Of all the occult sciences, astrology has perhaps fared the best, but overall, only in the last decade have we seen a series of studies arguing for the importance of the occult sciences in understanding the range and social impact of the natural sciences in Muslim societies between the 13-18th centuries. At the same time, there is little consensus of how to replace previous master narratives of the natural sciences. In part, the field’s failure to present a coherent paradigm is tied to the broader intellectual developments in the Muslim world during this period having only relatively recently begun to be studied more systematically, this in turn partly due to the plethora of sources remaining in manuscripts. In part, it is because historians do not agree with each other, much less with (other) social scientists about their categories of analysis and about how much they need to push back against a Whiggish presentism that privileges modern ways of knowing. I’ll note in passing that some of this conceptual confusion relates to the old anthropological concern with the interrelated categories of science, religion, and magic, and that what types of practices and actions we choose to study often tells us far more about ourselves than about the societies we are purportedly studying.

But enough. This has all been rather abstract. Let’s tell this story again through with a particular case study: that of Morocco between the 16-18th centuries. This time period is interesting as it covers precisely those centuries with which the so-called Scientific Revolution is identified. Morocco is interesting both because is a politically and socially discrete unit resting beyond the control of the Ottoman Empire and because recent scholarship on theology, law, and mysticism has identified it as one of the geographically marginal Muslim societies that played an important role in intellectually revivifying the central Arab lands of the Ottoman Mediterranean in the seventeenth century.

The Moroccan Case

During the sixteenth century Morocco was ruled by the Saadi dynasty (1565-1603), which initially based in the Saharan oasis Sijilmasa in the south of the country, united the country under Sherifian rule after prior centuries of being ruled over by Berber dynasties of varied ideological persuasion. The Saadis demonstrated their political strength and strengthened their own legitimacy by defeating the Spanish and Portuguese armies at the battle of the three kings in 1578. They subsequently demonstrated their imperial ambitions under the rule of Ahmad al-Mansur (1578-1603), sending an army across the Sahara to bring Timbuktu and much of West Africa under their control. At the same time, they were significant patrons of learning, renovating and expanding the madrasas built in the main Moroccan cities by the Merinids in the fourteenth century, and overseeing the expansion of Sufi lodges in both rural and urban area, which became centers of learning in their own right. The study and transmission of knowledge was further supported through a number of public libraries in the urban centers of Fes, Marrakesh, Taroudant, Meknes, Rabat and Asfi and rural areas such as the oasis of Figuig and the Sufi lodge at Dila', not to mention the hundreds of private libraries throughout the country. When Ahmad al-Mansur died unexpectedly due to the plague in 1603, the country broke apart politically and until the Alawites were able to take consolidate control over the country in 1668 a variety of factions, including rural Sufi lodges at Dila' in the Middle Atlas and Iligh in the anti-Atlas, vied for power with each other and the remnants of the Saadis and the rising Alawites. During this period of political chaos, the educational infrastructure established by the Saadis continued to play an important role and some of the greatest Moroccan scholars of the period flourished during the very half-century Morocco was politically fractured. When it comes to establishing the place of the natural and rational sciences in Morocco during this period, I have turned to five principle sources: 1) taxonomies of knowledge, 2) biographical dictionaries, 3) intellectual autobiographies, 4) legal opinions, 5) works of science themselves.

Thus, the Berber Sufi, theologian, and logician al-Hasan al-Yusi (d. 1691), who spent much of his career at the Dila' lodge in the Middle Atlas, wrote late in his life an influential taxonomy of knowledge, *al-Qanun*, in which he argued at length against previous taxonomies of knowledge that all sciences that benefitted the Muslim community should be studied and considered legally mandated. It is this aspect of his taxonomy that jumps out, not his inclusion in the natural sciences of dream interpretation, magic, and knowledge of talismans alongside medicine, astrology and alchemy — this was largely consistent with earlier classifications of knowledge in the Muslim world (see Appendix 1). While al-Yusi's advocacy for the natural sciences and the rational sciences more broadly is striking and was influential for later Moroccan scholars in the 18th century such as al-Umayri and al-Taranbati (d. 1779), a survey of the bibliographical literature of the period shows that he was hardly an exception when it came to including the natural sciences within his broader intellectual vision.

With the *tabaqat* genre, we have something in the Arabic tradition that has no parallel in the premodern Latinate European world: an attempt to comprehensively set down the names of all scholars who studied and transmitted knowledge in a specific generation. Specific examples of the genre are usually limited in geographic or temporal scope, but in their attempt to record what each scholar of a certain time studied they give us a much more fine-grained understanding of the scope of the scholarly interests and pursuits of Muslim scholars for a certain period than we have of their European contemporaries. Drawing on the sources listed in Appendix II we can state that roughly a tenth of the scholars in Morocco in the seventeenth century studied the rational sciences to some extent (this includes the mathematical and natural sciences as parts of philosophy). This is arguably not a high number, but it should be remembered that the genre itself was usually tailored to the religious sciences that composed the bulk of contemporary curricula in both madrasas and lodges, and so the fact that one in every ten scholars in seventeenth century studied these sciences to some degree speaks to their social pervasiveness and importance.

To explore this last point further, let me turn to two further sources: the scholarly autobiography (*fabrāsa*), a genre particular in its nature to North Africa, and the legal opinion (*fatwa*). Beyond a simple percentage, these two genres give us a better sense of the significance of the natural sciences. The scholarly autobiography is of particular interest as it is a genre particular to the Maghreb, especially in the form that it takes during the Saadi and subsequent periods. For the 16th-18th centuries, 112 works of this type are recorded to have been written by Moroccan scholars, 95 or so of which are extant, although the vast majority of them remain in manuscript. Of these I have consulted a dozen, which vary widely in scope and content. During these centuries in the Maghreb, the *fabrāsa* moves beyond being simply a list of a scholar's teachers and students, which is how it began, including at most the names of specific books a scholar had studied. Instead, it expands to include extensive reflections of a scholar on his career, anecdotes, legal opinions, and at times medical recipes or omen interpretation. Let me give you two examples to show you how the genre can throw light on the place and role of the natural sciences. The first is taken from the *Fabrāsa* of the prominent legal scholar of the Moroccan south, al-Tamanarti (d. 1650), who when writing about one of his teachers, says the following:

It was he [al-Bu'aqīlī (d. 1597)] who placed in each one of Tarundant's two minarets a piece of marble on which was engraved the hour, the opened fingers (*al-aṣābī' al-mabsūṭa*), the azimuth, the line for sunset (*khaṭṭ al-zawāl*), the line for noon (*al-zuhr*), the line for mid-afternoon (*khaṭṭ al-aṣr*), and the line for the end of mid-afternoon for the city of Tarundant and every town on its latitude. He fixed in the middle of it a nail, the shadow of which was considered in relation to each of these lines. If the shadow rested on the line of sunset, he knows it, and the same for the remaining ones, so that the one who calls to prayer (*mu'adhḥin*) does not need to take any other steps.

This anecdote could be taken as one of many that shows what A. I. Sabra referred to as the naturalization of the sciences in service of the demands of Islamic rituals (something like what Augustine referred to when he called philosophy a handmaiden to religion). Sabra himself argued that this naturalization process — in which astronomy and mathematics for example were studied only insofar as they facilitated telling the time of prayer, ascertaining the beginning or end of a day (vital during Ramadan), or aiding in calculating inheritance shares — that this naturalization process itself led to the decline of the rational sciences in the Muslim world. Hold

that thought — I'll come back to it. Let's look at another anecdote. This one is from al-Mirghithi's (d. 1678) *fabrasa*. The author was well known for his medical knowledge and also wrote on alchemy. He included many medical recipes in his autobiography, including this one, for someone suffering pain in their foot:

Go before dawn on Thursday or Saturday to the bush called henbane, which intoxicates and which can be used to intoxicate fish by putting it in water. Then cut off a twig, cut off the end of the root from which the twig grew and dig around it until a hand width and three fingers are visible. Order the sick person to place the hurting foot on the root. Take a cutting blade and put it in the earth and recite the 15th verse of Surat al-Hajj seven times, then cut off the root and say "I have cut your root, o son of so and so [presumably the name of the patient]." Place it on the rock and take it to a bier as with the dead to the grave.

In this context — as opposed to that of legal testimony, where a physician's knowledge of leprosy or the plague might be invoked, or a midwife's of virginity — the medical knowledge involved does not map on ritual matters and also reaches beyond the Graeco-Arabic tradition to more occult means of curing and what has been called Prophetic medicine. It would, I believe, be a mistake to see this as another example of naturalization — such an interpretation only makes sense if we use contemporary categories to artificially differentiate between what we consider today science and pseudo-science. To further this point, let me give you a third example — this one from the eighteenth century scholar al-'Umayri (d. 1764), who in his autobiography explained the proper interpretation of a certain omen on a specific day, using a table:

You look at the line of the days, how many days of the month you are in have passed in the Arab calendar, then place the finger of your right hand on it, and you will know which of the foreign (*al-'ajam*) months the Arab month begins in (*istahalla*). Then place the finger of your left hand on of the months, and move the finger of your right hand horizontally (*'arq^{an}*) and the finger of your left hand vertically (*tū^{an}*), and where they meet, the moon is in that house, God willing. Then look at what is below the mansion that the moon is in to find the omen in the table and what will happen according to the table of the moon.

My point here is that the impressionistic evidence we get from these autobiographies of respected scholars who were well established within networks of knowledge production and political patronage was that the occult sciences were integral to contemporary understandings of the natural sciences during this period, and that the natural sciences formed an important part of the scholars' intellectual world.

If we turn from accounts of studies and knowledge transmission to the broader impact of the natural sciences on Muslim intellectual discourses, there is perhaps no better place to look than Islamic jurisprudence or *fiqh*. With its focus on normative public and private behavior and its encompassing ethical component, jurisprudence and in particular the legal opinion (*fatwa*), offer us a window onto how Muslim scholars who have perhaps not studied the natural sciences construct their salience and significance to Muslim societies as a whole. When deemed important, legal opinions were collected into compilations under the names of individual, influential scholars or in certain striking cases, amassed into super-collections covering the most important opinions of hundreds of jurists over centuries. While I consider the presence of the natural sciences in such collections elsewhere, in these brief comments I will take up the Great Tobacco Debate that swept the Muslim Mediterranean during the seventeenth century and beyond. This debate, which followed the introduction of tobacco into the Muslim world—most likely from West to North Africa, Moroccan chroniclers link it to a caravan arriving from Timbuktu in the late 16th century—turned on the permissibility of smoking, split Muslim scholars into for and against camps, and at times pitted contemporary governments against the own populations. See Appendix 3 for a partial list of Muslim scholars in east and west who took part. This debate also demonstrates the central nature of the natural sciences—in this case medicine—to certain areas of Islamic jurisprudence. This is because the question of whether or not tobacco is licit turns whether it is an intoxicant and whether it harms your health. These are medical questions, empirical questions. One example, from a treatise by the Fassi jurist Abu ‘Abdallah Muḥammad al-‘Arabi b. Yusuf al-Fasi (d. 1052/ 1641-42), which like many of these opinions, remains in manuscript, read as follows:

I answer that if it were harmful then death or sicknesses would spread among the people because of smoking to the degree that it has spread among them. Nothing of this has happened, so it isn’t harmful. Yes, if it were agreed that there was an association of sickness with consuming it in some people, and a judgment of experience or if the opinion of a doctor were that it caused damage, then it would be prohibited in that person’s case, and the same would be the case if medicine made a judgment of this regarding its consumption. That is a general ruling regarding all things that are consumed, and does not single out that which has been asked about . . . What happens rarely to some of those who smoke is not a confusion of the mind in any way, but is akin to one who inhales fire (*nāfikh al-nār*), and is similar to being dizzy while the mind remains sound,

not influenced in any way. That is what a smoker claims, and whoever claims something else, let him prove it and clarify the type of confusion. Is it inebriation, corruption, anesthesia (*irqād*) or loss of reason (*tajnīn*)?

The presence of medical terminology and the evocation of medical expertise in these legal treatises and opinions speaks to the social authority of natural sciences, and even at times, to the desire of individual jurists to speak as physicians within their own legal opinions, demonstrating yet again if we still need to do so, that the binary distinction between science and religion is seldom productive when applied to the pre-modern world.

Finally, I would briefly like to turn to the actual production of texts in the mathematical and natural sciences from Morocco from the 16-18th centuries. In the manuscript catalogs of the nearly 30 public and private libraries that I have been able to consult I have been able to identify roughly 120 relevant extant works (see Appendix 4), which vary widely in nature and length. The majority of these texts dealt with matters related to astronomy and astrology (72), followed by medicine (27), with much smaller numbers of texts being devoted to lettrism (10), and alchemy (5) — and the nature of other works being difficult to ascertain from catalog entries alone.

Broadly speaking, these texts speak to the larger themes explored in this paper so far: a serious interest in the mathematical and natural sciences among Moroccan scholars that was reflected both in summaries and commentaries on earlier works as well as in original works. The content of these works is unlikely to strike us as highly innovative, although it bears repeating that our current level of knowledge of scholarship for this period makes it difficult to chart developments in a nuanced fashion. Still, their scope and nature reveal a broad interest in and fascination with the natural world that we can productively take up with what Sonja Brentjes has called the “horizontal perspective” that is more common among Europeanist historians of science of the same period.¹ With this term, she is referring to the trend of looking at the degree of dispersion of knowledge of the sciences throughout society, and not just the achievements of a small group

¹ See Sonja Brentjes, “The Mathematical Sciences in the Safavid Empire: Questions and Perspectives,” in D. Hermann, F. Speziale (eds.), *Muslim Cultures in the Indo-Iranian World during the Early-Modern and Modern Periods* (Berlin: Klaus Schwarz Verlag, 2010), 325-402, **328-9**.

of scholars. I haven't said much regarding the content of these texts, in part because I continue to work through them, but they can briefly be summarized as the astronomical texts addressing predominantly practical considerations such as calendar conversions, calculating longitude and latitudes in Morocco, as well as how to carry out astronomical observations; medical texts in the Arabic-Graeco tradition using a humoral framework for a wide variety of recipes for ailments; there is some lettrism and reference to talismans as well, although we should be careful of explaining their inclusion with the older name of Prophetic medicine — these texts do not recognize a differentiation between a broader Galenic tradition and a more religiously infused body of material; in alchemy we seem to have texts that focus both on practical experiments as well as those focusing on the spiritual alchemy of the refinement of the soul, although here I still have much more work to do. In brief, the writing of new works in these sciences, of commentaries on older canonical works, and of their being framed in an intellectual and social framework that was supportive and curious goes a good way towards demonstrating the continued importance of the natural sciences in Morocco during this period.

To conclude

What does the Moroccan case study do for our understanding of the place of the natural sciences in pre-modern Muslim societies in the centuries immediately preceding European expansion into the Muslim world? How in other words do we account for the prevalence of a deep and institutionally supported interest in a wide range of natural sciences during the very period that was previously thought of as one of decline or intellectual stagnation? What I have argued here is that we need to take care that our analytical categories do not predetermine our conclusions and to remark on how the teleological narratives of intellectual and technological development supplied by the classical history of science and many more of our disciplinary master narratives. Well then, you might rightfully ask: what other kinds of stories could we tell? One model that I have been going back to repeatedly during the past years is that alluded to at the end of Thomas Kuhn's much debated *Structure of Scientific Revolutions*, where he takes up a

metaphor to explain what he means by his claim that progress in scientific development only makes sense within a given paradigm of inquiry and that there is no movement towards any kind of absolute truth or scientific knowledge. Instead, he suggests that the ongoing progression of scientific paradigms is much more productively understood in light of Darwin's tree of life: much as life does not progress towards any goal but only continues to evolve in an ever-branching manner, so scientific traditions develop but not towards any absolute goal or understanding of reality. For my purposes what this means when considering the history of the sciences, natural and otherwise, in Muslim societies, is that not only do we need to adopt the rather tired analytical move of understanding the role of these sciences on the terms of the Muslims who studied and practiced them — and to take their curiosity in and engagement with these sciences seriously, no matter how distinct they are from models provided by European intellectual and economic history — we also need to revise our own analytical categories when it comes to what we measure of this history. To be sure, if we are looking to understand why developments in the natural sciences in Europe, for example, took place the way they did, we can find intriguing counterexamples in Muslim societies that refine our grasp of European contexts and contingencies. If, however, we wish to understand what it meant to engage in a range of natural sciences in 17th century Morocco, we will need to develop a finely grained local intellectual and institutional history by counting and reading those things that Moroccan scholars thought were important, and then and only then turn to broader comparative frameworks, frameworks which hopefully will have been altered by interaction with local categories. Pursuing this approach offers several opportunities and challenges.

Among the opportunities is that we can now see Muslim societies as engaged in a broad, curious, and productive engagement with the natural sciences during a period once thought of as intellectual stagnation. Instead of measuring their intellectual interests and institutional arrangements by those of their European contemporaries and successors, they are shown to have been deeply engaged with a broad array of natural sciences in ways that reflect their own

educational institutions and social and intellectual contexts. These contexts included jurisprudence, which I have briefly commented on here, but also the presence of a range of Sufi orders that played an important role socially through the networks they provided scholars, as well as a series of intense if not traumatic theological debates that reverberated through Morocco during this period. The study and practice of the natural sciences did not and could not have taken place independently of these other contexts, and any serious study would need to take them into greater account than I have here.

What I do hope to have been able to suggest here is that by abandoning the decline narrative as an organizing principle we can begin to carry out a series of localized studies that cumulatively will begin to offer us a much more nuanced understanding of the role of the natural sciences throughout Muslim societies during the centuries under consideration. Doing so will help us chart local shifts in intellectual behavior, as Khaled El-Rouayheb has shown, for example, in his study of logic and theology in the seventeenth century, where what was dynamic in the seventeenth century had largely faded by the end of the eighteenth century as new intellectual projects became more influential. A great deal remains to be done.

Appendix 1:

Al-Yūsī's Division of the Sciences:²

- mathematical knowledge (*al-‘ilm al-riyādī*)
 - geometry (*‘ilm al-handasa*)
 - engineering (*‘ilm ‘uqūd al-abniya*)
 - optics (*‘ilm al-manāzir*)
 - science of burning mirrors/magnifying glasses (*‘ilm al-marāyā al-muḥriqa*)
 - weights (*‘ilm al-marākiz al-athqāl*)
 - surveying (*‘ilm al-masāḥa*)
 - science of discovering water (*‘ilm inbāṭ al-mayāh*)
 - the science of pulling weights (*‘ilm jarr al-athqāl*)
 - science of producing time-telling devices (*‘ilm al-bankāmāt*)
 - science of siege engines (*‘ilm al-ālāt al-ḥarbiyya*)
 - science of spiritual devices (*‘ilm al-ālāt al-ruḥāniyya*)
 - astronomy (*‘ilm al-haya*)
 - science of the astronomical almanac (*‘ilm al-zījāt*)
 - science of timekeeping (*‘ilm al-mawāqīt*)
 - science of stargazing (*‘ilm kayfiyyat al-arṣād*)
 - science of mapping the earth (*‘ilm taṣṭīḥ al-kurra*)
 - science of shadow measuring devices (*‘ilm al-ālāt al-ḥilliyya*)
 - arithmetic (*‘ilm al-‘adad*)
 - science of open arithmetic (*‘ilm al-ḥisāb al-maftūḥ*)
 - ??????? *ḥisāb al-takht wa-l-mayl*
 - science of algebra (*‘ilm al-jabr wa-l-muqābila*)
 - ??????? *ḥisāb al-khaṭāin*
 - the science of houses and bequests (*‘ilm al-dūr wa-l-waṣāyā*)
 - the arithmetic of dinars and dirhams
 - music
- natural science (*al-‘ilm al-ṭabī‘ī*)
 - medicine
 - veterinary medicine
 - physiognomy
 - dream interpretation
 - astrology
 - magic
 - science of talismans
 - natural magic (*al-sīmyā’*)
 - alchemy
 - agriculture
- Islamic sciences (First Division)
- Foundational Sciences Desired for Themselves
 - Jurisprudence
 - The science of inheritance

² Al-Yusi, *al-Qanun*, 151-164.

- Sufism
- Propaedeutic Sciences (compared to the role played by the sciences of arithmetic and timekeeping in the philosophical sciences)
 - Qur’anic exegesis
 - Prophetic Tradition
 - Sciences that are subsidiary to these propaedeutic sciences:
 - Science of recitations
 - Science of writing
 - Sciences of the Arabic language
 - The science of Logic
- Main Islamic Sciences (Second Division)
 - Theology
 - Jurisprudence
 - Sufism
 - Qur’anic Exegesis
 - Prophetic Tradition
 - Legal Theory
- Subsidiary Islamic Sciences:
 - Linguistics
 - Science of vocalization
 - Declination
 - Syntax (*‘ilm al-ma’ānī*)
 - Exposition (*‘ilm al-bayān*)
 - Medicine
 - Arithmetic
 - Logic

Appendix 2: Biographical Dictionaries Consulted

1. Muḥammad al-Kattānī (d. 1345/1927), *Salwat al-anfās wa muḥādathat al-akyās bi-man uqbira min al-‘ulamā’ wa’l-ṣulahā’ bi-fās* (contains 1453 entries)
2. Ibn al-Qāḍī (d. 1025/1616), *Durrat al-ḥijāl fī asmā’ al-rijāl* (contains 1552 entries)
3. al-Rasmūkī (11th/17th century), *Wafayāt al-Rasmūkī*
4. ‘Abdallāh b. Muḥammad al-Fāsī al-Fihri (d. 1131/1718), *al-ʿlām bi-man ghabara min ahl al-qarn al-ḥādī ‘ashar*
5. Muḥammad al-Ḥājj al-Ifrānī (d. 1150/1737), *Ṣafwa man intishara min akhbār ṣulahā’ al-qarn al-ḥādī ‘ashar*
6. Muḥammad al-Qādirī, *Nashr al-mathānī li-ahl al-qarn al-ḥādī ‘ashr wa l-thānī (d. 1187/1773)* (contains 843 entries)
7. Muḥammad al-Ḥuḍaygī (d. 1189/1775), *Ṭabaqāt al-Huḍaygī* (contains 823 entries)

Appendix 3: The scholars of the Great Tobacco Debate (partial list)

Scholars in the Mashriq

Sālim al-Sanhūrī (d. ca. 1610)

- wrote forbidding smoking.

Nūr al-Dīn ‘Alī b. Yaḥyā al-Zayyādī (d. 1615)

- wrote defending smoking.

Mar‘ī al-Karmī (d. 1623/24)

- disliked smoking, but didn’t see enough evidence to forbid it.

Ibrāhīm al-Laḡānī (d. 1041/1631)

- wrote forbidding smoking

Aḥmad al-Aqḥiṣārī (fl. Early 17th century)

- wrote forbidding smoking.

‘Alī al-Ujhūrī (d. 1066/1657)

- wrote defending smoking.

‘Abd al-Ghānī al-Nābulusī (d. 1143/1731) [written in 1093/1682]

- wrote defending smoking

Muḥammad Ibn ‘Abidīn (d. 1836)

Scholars in the Maghrib

Muḥammad b. Qāsīm al-Qaṣṣār (d. 1603)

- jurist of Fes, advised al-Manṣūr to ban smoking

‘Abd Allāh b. Ḥassūn (d. 1604)

- jurist of Salé, also advised al-Manṣūr to ban smoking

Muḥammad b. Aḥmad b. ‘Abd al-Raḥmān (d. 1608) [Judge of Timbuktu]

Ibn Abī Maḥallī (d. 1022/1613)

- wrote defending smoking.

Aḥmad b. Muḥammad al-Būsa‘īdī (d. 1046/1636-37)

- believed tobacco had medical benefits.

‘Alī b. Aḥmad al-Shāmī (d. 1622)

Abū Qāsīm b. al-Nu‘aym al-Ghassānī (d. 1623)

‘Abd al-Raḥmān b. Muḥammad al-Fāsī (d. 1626)

- wrote forbidding smoking.

Aḥmad Bābā al-Tinbuktī (d. 1036/1627)

- wrote defending smoking.

Abū Zayd ‘Abd al-Raḥmān b. Muḥammad al-Fāsī (d. 1036/1626-27)

- wrote forbidding smoking.

Aḥmad b. Muḥammad al-Maqarrī (d. 1631)

- an author of the collective Fassi fatwa against smoking.

Abū ‘Abdallāh Muḥammad al-‘Arabī b. Yūsuf al-Fāsī (d. 1052/ 1641-42)

- wrote defending smoking.

‘Abd al-Qādir al-Fāsī (d. 1091/1680)

- concerned with the ritual purity of tobacco, forbade buying from foreigners.

Muḥammad ibn Ja‘far al-Kattānī (d. 1927)

- wrote forbidding smoking.

Appendix 4: Manuscripts on the Natural Sciences from the 16-18th centuries written in Morocco³

Muḥammad b. Aḥmad b. Ghāzī (d. 919/1513)	Manzūma fī asrār al-ḥurūf	Lettrism	Royal Library [6462] ⁴
Muḥammad b. Muḥammad al-Ḥājj al-Baqqāl (fl. During the Sa'adi period)	Al-Faṭḥ al-rabbānī fī ṭarīqat al-imām al-Murjānī	Lettrism	Royal Library [2347] ⁵
Muḥammad b. Muḥammad b. 'Abd al-Raḥmān al-Ra'īnī al-Mālikī al-Ḥaṭṭāb	Risāla fī-l-tawqīt	Astronomy	Royal Library [6665] ⁶
Aḥmad b. Humayd al-Mutarrafi al-Marrakushi (d. 1001/1592)	Jam' al-muḥimmāt al-muḥtāj ilayhā fī 'ilm al-mīqāt	Astronomy	S (Salé)[1040, 1041] ⁷ /Royal Library [6662] ⁸
	Sharḥ rawḍat al-azhār	Astronomy	Royal Library [4151] ⁹
	Al-Muqarrab fī waṣf al-mujayyab	Astronomy	Royal Library [1638, 1009] ¹⁰
'Abd al-Ghānī al-Zammūrī (fl. 1578-1602)	Al-Qānūn al-mufīd fī 'alāj al-khiṣṣā bi-qawl sadīd	Medicine	'Allāl al-Fāsī Library [318 ayn]

³ This list is constrained by my ability (and that of the authors of the catalogs I have drawn on) to identify the authors of individual manuscripts — I have listed only those whose authors I could identify as having lived between the 16-18th centuries — as well as, naturally, by whether manuscripts are extant or not. I have not listed manuscripts by authors from outside of Morocco. Considering the number of anonymous manuscripts that plausibly date from the period in question, this is a conservative approach. Consider, for example the anonymous *Tuḥfat al-aḥbāb fī māhīyat al-nabāt wa-l-a'shāb*, the author of which likely wrote in southern Morocco in the seventeenth century: H. P. J. Renaud and Georges S. Colin (eds. and trans.), *Tuḥfat al-aḥbāb: Gloassaire de la matière médicale Marocaine* (Paris: Librairie Orientaliste Paul Geuthner, 1934).

⁴ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 5, 308.

⁵ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 5, 320-21. The library has six copies of this text.

⁶ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 213-15.

⁷ See Muḥammad Ḥajjī, *Fihris al-khizānah al-'ilmiyya al-ṣubḥiyya bi-Silā* (Kuwait: Manshūrāt ma'had al-makḥṭūṭāt al-'arabiyya, 1985), 482-83.

⁸ al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 181. The library has four copies of this treatise.

⁹ al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 311-12.

¹⁰ al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 372-73.

'Abd al-Karīm Mu'min b. Yahyā al-Janawī al-'Ilj (fl. under Moulay 'Abdallāh (rl. 1557-74))	Sharḥ al-urjūza fī al-amrāḍ al-bībshiyya	Medicine	Printed. ¹¹
Abd al-'Aziz al-Maghrāwī (d. 1014/)	Urjūza fī tarḥīl al-shams	Astronomy	Great Mosque of Wazzan
	Nihāyat tarḥīl al-shams bi-l-manāzil	Astronomy	Royal Library [6441] ¹²
al-Wazīr al-Ghassānī (d. 1019/1610)	Rīḥānat al-juyyūb fī khawwāṣ al-'aqāqīr wa-l-'ushshūb	Medicine	S (Salé) [1227] ¹³
	Sharḥ al-mufradāt al-ṭibbiyya	Medicine	Gannun Library
	Tafsīr ba'ḍ al-a'shāb wa-l-'aqāqīr muqtaṭaf min Rīḥānat al-juyyūb fī Khawwāṣ al-'aqāqīr wa-l-'ushshūb	Medicine	National Library ¹⁴
	Ḥadīqat al-azhār fī sharḥ māhīyat al-'ush wal-l-'aqqār	Medicine	Royal Library [2294, 7336, 1063]/Printed. ¹⁵
	Al-Rawḍ al-maknūn fī sharḥ rajaz Ibn 'Azrūn	Medicine	Royal Library [569] ¹⁶
Abd al-Rahman b. 'Amr b. Ahmad al-Bu'aqīlī, known as Ibn al-Muftī (d. 1006/1597 or 1020/1611)	Sabk al-'ibāra bi-alfāz al-yasāra	Astronomy	S (Salé) [1099] ¹⁷
	Sharḥ rawḍat al-azhār	Astronomy	Royal Library [1691] ¹⁸
	Qaṭf al-anwār min rawḍat al-azhār	Astronomy	Great Mosque of Wazzan/ Royal Library [489] ¹⁹
	Taḥṣīl al-maṭlab min al-rub' al-mujayyab	Astronomy	Royal Library [10366] ²⁰
	Mukhtaṣar manzūm li-risālat Badr al-dīn al-Māridīnī fī-l-rub' al-mujayyab	Astronomy	Royal Library [10109] ²¹
Aḥmad b. Yusuf al-Qaṣrī al-Fāsī (d. 1021/1612)	Kayfiyyat al-jadwal al-ma'īnī	Astronomy	Royal Library [5483] ²²

¹¹ This is one of the four works edited and translated in H. P. J. Renaud and G. S. Colin, *Documents Marocains pour servir a l'histoire du "mal franc"* (Paris: Librairie Larose, 1935).

¹² al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 386-87. There is some debate on the death date of the author.

¹³ See Muḥammad Ḥajjī, *Fihris al-khizānah al-'ilmiyya*, 565.

¹⁴ See Muḥammad al-'Arabī al-Khaṭṭābī, *Fahāris al-khizānah al-malakiyya* (Rabat: 1982), v. 2, 94. This work has been edited and printed. See below.

¹⁵ Abū Qāsim al-Ghassānī, *Ḥadīqat al-azhār fī māhīyat al-'ushab wa-l-'uqqār*. Muḥammad al-'Arabī al-Khaṭṭābī (ed.) (Beirut: Dār al-Gharb al-Islāmī, 1990).

¹⁶ Muḥammad al-'Arabī al-Khaṭṭābī, *Fahāris al-khizānah al-malakiyya* (Rabat: 1982), v. 2, 118.

¹⁷ Muḥammad Ḥajjī, *Fihris al-khizānah al-'ilmiyya*, 506.

¹⁸ al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 311.

¹⁹ al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 410-15. The library has nine copies of this text.

²⁰ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 148-49. This treatise sets al-Māridīnī's — a *muwaqqit* of the al-Azhar mosque who died in 912/1506 — treatise on the al-rub' al-mujayyab to verse.

²¹ al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 339-40.

²² al-Khaṭṭābī, *Fahāris al-khizānah*, v. 5, 303.

Abū al-'Abbās Aḥmad b. Muḥammad, known as al-Ma'yūb (d. 1022/1613)	Shuhūr al-'arab	Astronomy	Royal Library [2803] ²³
'Abd al-Raḥmān b. Muḥammad al-Fāsī (d. 1036/)	Tafsīr asmā' al-u'shshāb wa-l-'aqāqīr al-shā'i'a	Medicine	Royal Library ²⁴ [K 267]
Abd al-Rahman b. Isa b. Sayyid al-'Amri al-Hanafi (d. 1038/1628)	Urjūza fī manāzil al-kawākib	Astronomy	S (Rabat)
Muḥammad b. Abī al-Qāsim b. al-Qādī, known as Ibn al-'Āfiyya (d. 1040/1631)	Tafjīr al-anhār khilāl rawḍat al-azhār	Astronomy	S (Salé)[1023] ²⁵ / Wazzan/ Royal Library [9312, 259] ²⁶
	Juma' al-fawā'id wa ḥaṣr al-qawā'id	Astronomy	Royal Library [315] ²⁷
	Tuḥfat al-mawālī fī sharḥ silk al-lālī fī-l-mukhammas al-khālī	Astronomy	Royal Library [5484, 9214] ²⁸
Amaḥd al-Maqqarī (d. /1632)	Namaṭ al-akmal fī dhikr al-zamān al-mustaḡbal	Astronomy	Royal Library [4505] ²⁹
al-Hashtuki (d. 1046/)	Risāla fī 'ilm al-falak	Astronomy	Hamziyya Zawiya
Abū al-Qāsim b. Ahmad b. Muhammad b. 'Isa al-Ghūl al-Fishtali (d. 1059/1649)	Kayfiyyat qism al-mayāh 'alā al-sāqiyya aw al-qādūs	Engineering	S (Salé) [1160] ³⁰
	Urjūza fī-l-ṭibb	Medicine	Royal Library [12030z; 12069z] ³¹
	Urjūza fī-l-awfāq	Lettrism	Royal Library [6675] ³²
	Ghayāt al-iksīr fī 'amal al-tawfiq wa-l-taksīr	Alchemy	Royal Library [6675] ³³
'Abd al-Qādir al-Shiblī (fl. 1070/1659)	Urjūza fī manāzil al-fuṣūl	Astronomy	Royal Library [1052] ³⁴
Aḥmad b. 'Abdāllah b. Ya'qūb al-Samlālī al-Rasmuki (d. 1073/)	Masā'il fī-l-ṭibb	Medicine	Royal Library ³⁵
Muhammad b. Ahmad al-Sabbāgh (d. 1076/)	Sharḥ nazm fī ṣinā'at al-awfāq	Lettrism	Great Mosque of Wazzan

²³ al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 322-23.

²⁴ al-Khaṭṭābī, *Fahāris al-khizānah*, v. 2, 80.

²⁵ Muḥammad Ḥajjī, *Fihris al-khizānah al-'ilmiyya*, 475.

²⁶ al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 165-66.

²⁷ al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 184-85.

²⁸ al-Khaṭṭābī, *Fahāris al-khizānah*, v. 5, 284-85.

²⁹ al-Khaṭṭābī, *Fahāris al-khizānah*, v. 5, 314.

³⁰ See Muḥammad Ḥajjī, *Fihris al-khizānah al-'ilmiyya*, 543.

³¹ al-Khaṭṭābī, *Fahāris al-khizānah*, v. 2, 209-10.

³² al-Khaṭṭābī, *Fahāris al-khizānah*, v. 5, 276.

³³ al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 465-66.

³⁴ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 120-21.

³⁵ al-Khaṭṭābī, *Fahāris al-khizānah*, v. 2, 156.

Abdallah b. 'Abd al-Qadir Abi Shaykh al-Lakhmi (d. 1079/1668)	Bustān al-abrār fi ḥall alfāz rawḍat al-azhār	Astronomy	S (Salé)[990] ³⁶ /Royal Library [4151,7077] ³⁷
Muhammad b. Sa'id b. Muhammad al-Mirghiti (d. 1089/1678)	Tuḥfat al-muḥtāj fi ḥukm akl al-nās al-dajjāj	Medicine	Q (Fes)
	Qaṣīdat lāmiyya fi al-awfāq	Lettrism	Q (Fes)
	Qasida fi ahkam aql al-dajjaj	Medicine	Tamagrut/ 'Uthmāniya Collection in Inzakān in the Sūs/ Dha'ib Collection ³⁸
	Taqyīd fi umūr kullīya yuntafi' bi-hā fi ibṭāl la-a'māl al-siḥriyya	Magic (on the forbidden nature of)	Mahjūbiya Collection ³⁹
	Al-Muqni' fi 'ilm Abī Muqri'	Astronomy	Imam 'Alī Library in Taroundant ⁴⁰ /Royal Library [12248z] ⁴¹
	Al-Mumti' fi sharḥ al-muqni'	Astronomy	Mahjūbiya Collection /Dha'ib Collection ⁴² /Royal Library [10352, 12472z] ⁴³ /Hathi Trust ⁴⁴ /Printed. ⁴⁵
	Al-Muṭla' 'alā masālik al-muqni'	Astronomy	Mahjūbiya Collection/ al-Tīdsīya Library ⁴⁶ /Royal Library ⁴⁷ / S (Salé) [1174] ⁴⁸
	Sharḥ urjūza fi tariq al-kīmyā'	Alchemy	Royal Library [10413] ⁴⁹
	Sharḥ al-mukhtaṣar 'alā al-Muqni' fi 'ilm Abī Muqri'	Astronomy	Royal Library [10353] ⁵⁰
	Fī 'ilm al-kīmyā'	Alchemy	National Library [accessed through the copy kept by the Juma al-Majid Center]
Abdallah b. Hamza b. Abi Salim (d. 1090/)	Sharḥ al-yawāqīt fi 'ilm al-mawāqīt	Astronomy	Hamziyya Zawiya

³⁶ Muḥammad Ḥajjī, *Fihris al-khizānah al-'ilmiyya*, 462.

³⁷ al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 139-41. The author was a *muwaqqit* in Madinat al-Qasr. There is some debate about his death date, so check this.

³⁸ For the last two copies, see Najib, *Fihris ma lam yufiras*, 33.

³⁹ See Najib, *Fihris ma lam yufiras*, 38-39.

⁴⁰ See Najib, *Fihris ma lam yufiras*, 57.

⁴¹ al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 373-76. The library has six copies of this poem.

⁴² See Najib, *Fihris ma lam yufiras*, 104. The text has now also been edited printed. See below.

⁴³ al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 349-51.

⁴⁴ The Hathi Trust's copy of this manuscript is from the University of Michigan's holding (originally from Max Meyerhof's collection) and can be accessed at <https://hdl.handle.net/2027/mdp.39015081447024>.

⁴⁵ Al-Marghītī, *al-Mumti' fi sharḥ al-muqni'*. al-Mundhir 'Abd al-Raḥmān (ed.) (Casablanca: Dār al-Rashshād al-ḥadītha, ND). 95pp.

⁴⁶ See Najib, *Fihris ma lam yufiras*, 101.

⁴⁷ al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 343-48. The library has ten copies of the text.

⁴⁸ See Muḥammad Ḥajjī, *Fihris al-khizānah al-'ilmiyya*, 539-40.

⁴⁹ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 5, 155-57. The library has four copies of the text. This is the same commentary that I have from the King 'Abd al-'Aziz Library.

⁵⁰ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 312-13.

Muḥammad b. Sulaymān al-Rudani al-Susi (d. 1094/)	Qalā'id al-la'ālī	Astronomy	Sulemaniye [2756]
	Maqāṣid al-'awālī bi-qalā'id al-la'ālī	Astronomy	Hamziyya Zawiya/ Royal Library [4151] ⁵¹ /Hathi Trust ⁵²
'Ali b. Muhammad al-Dādīsī (d. 1094/1683)	Urjuzat bidayat al-tullab fi 'ilm waqt al-yawm bi-l-hisab	Astronomy	Tamagrut
	Ithāf dhawī al-albāb fi sharḥ bidāyat al-ṭullāb	Astronomy	Royal Library [9510] ⁵³
	Fatḥ al-muqīt fi sharḥ al-yawāqīt	Astronomy	Royal Library [5789, 315] ⁵⁴ /Hathi Trust ⁵⁵
	Ikmāl fatḥ al-muqīt fi sharḥ al-yawāqīt	Astronomy	Royal Library [1045] ⁵⁶
	Naẓm al-yawāqīt fī-l-mubtaghī min ṣan'at al-mawāqīt	Astronomy	Hamziyya Zawiya/Royal Library [10866] ⁵⁷
'Abd al-Rahman b. 'Abd al-Qadir Abi Zayd al-Fasi (d. 1096/1685)	al-Marqūm fī al-'amal bi-l-nujūm	Astronomy	S (Salé) [1172] ⁵⁸
	Masālik al-akhyār fī 'ilm waqt al-layl wa-l-nahār	Astronomy	S (Salé) [1173] ⁵⁹ / Royal Library [6441] ⁶⁰
	Urjūza fī al-'amal bi-l-ruba' al-mujayyab	Astronomy	Great Mosque of Wazzan/ Royal Library [7416] ⁶¹
	Tuḥfat al-ṭullāb fī 'amal bī-l-aṣṭrulāb	Astronomy	Great Mosque of Wazzan/Royal Library [7106] ⁶²
	al-Ghurra fī-l-kalām 'alā bayt al-ibra	Astronomy	Great Mosque of Wazzan/ Royal Library [6662] ⁶³
	Manzūma fi i'mār al-'aqqār	Medicine	Great Mosque of Wazzan [1548] ⁶⁴
	Risāla fī 'ilm al-falak	Astronomy	Hamziyya Zawiya
	Naẓm fī 'ilm al-falak	Astronomy	Hamziyya Zawiya
	Mishkat al-anwār fī awqāt al-layl wa-l-nahār	Astronomy	Hamziyya Zawiya
	Ta'lif fī-l-aṣṭrulāb	Astronomy	Hamziyya Zawiya

⁵¹ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 376. This is only a chapter of the work.

⁵² The Hathi Trust's copy of this manuscript is from the University of Michigan's holding (originally from Max Meyerhof's collection) and can be accessed at <https://hdl.handle.net/2027/mdp.39015081447016>.

⁵³ See al-Khaṭṭābī, *Fahāris al-khizānah al-Ḥasaniyya* (Rabat, 1983), v. 3, 116-17.

⁵⁴ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 401-02.

⁵⁵ The Hathi Trust's copy of this manuscript is from the University of Michigan's holding (originally from Max Meyerhof's collection) and can be accessed at <https://hdl.handle.net/2027/mdp.39015081446802>.

⁵⁶ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 135-7. The library has three copies of the text.

⁵⁷ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 427.

⁵⁸ See Muḥammad Ḥajjī, *Fihris al-khizānah al-'ilmiyya*, 539.

⁵⁹ See Muḥammad Ḥajjī, *Fihris al-khizānah al-'ilmiyya*, 539.

⁶⁰ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 341-42.

⁶¹ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 124.

⁶² See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 121-23. The library has three copies of this text.

⁶³ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 397-99. The library has four copies of this text.

⁶⁴ See Badr al-'Amrānī al-Ṭanjī and Muḥammad Saīd al-Ghāzī, *al-Fihris al-waṣfī li-makḥṭūṭāt khizānat al-masjid al-a'zam bi-Wazzān*. 'Abd al-Laṭīf al-Jīlānī (ed.) (Rabat: Wizārat al-Awqāf, 2008), v. 2, 753.

	Manzūma fī-l-aṣṭrulāb	Astronomy	Hamziyya Zawiya
	Uṛjūza fī-l-tawqīt	Astronomy	Royal Library [6678] ⁶⁵
	Rajaz fī bayt al-ibra	Astronomy	Royal Library [3964, 1638] ⁶⁶
	Al-Ightibāṭ fī sharḥ nuzhat al-istinbāṭ li-l-marjānī	Lettrism	Royal Library [5819, 10910] ⁶⁷
	Al-maṭḥaf al-manwāl	Lettrism	Royal Library [10396] ⁶⁸
	Al-Maṭlab fī-l-rub' al-mujayyab	Astronomy	Royal Library [6665] ⁶⁹
	Uṛjūza fī-l-ḥabb al-ifranjī	Medicine	Printed. ⁷⁰
Abu 'Abdallah Sidi Muhammad b. Sa'id al-Susi (d. 1098h/)	Manzūma fī ayām al-'ām al-'arabī	Astronomy	Hamziyya Zawiya
Muhammad b. Ahmad al-Bu'aqili al-Susi (d. 11th century)	Majmū' al-manāfi' fī 'ilm al-ṭibb al-nāfi'	Medicine	Great Mosque of Wazzan/ al-Tīdsīya Library ⁷¹ /Royal Library [10088, 1941] ⁷² /National Library
Al-'Arabī b. 'Abd al-Salām al-Fāsī (d. fl. 17 th century)	Shifā' al-'alīl fī bayan qiblat ṣāhib al-tanzīl	Medicine	Royal Library [6588] ⁷³
'Ubaydallah Ahmad b. Ibrahim b. 'Abd al-Mu'min (alive in 1106h)	Kitāb nathr al-durar 'alā naẓm al-hadiya fī-l-ṭibb	Medicine	National Library
Muhammad b. Habbus al-Sanhaji (d. 1109)	al-Manafi' al-bayyina wa ma yuslah fī al-arba'a al-azmina	Medicine	Tamagrut
Muhammad b. Ibrahim al-Sanburi (d. 1110)	Kitab al-rahma fī-l-tibb wa-l-hikma	Medicine	Tamagrut
Muḥammad b. 'Abd al-'Azīz al-Andalusī al-Asfī (fl. 1113/1701)	Irshād al-sā'il ilā ma'rifat jihat al-qibla bi-l-dalā'il	Astronomy	Royal Library [1110] ⁷⁴
	Sharḥ rajaz fī manāzil al-qamr	Astronomy	Royal Library [1110] ⁷⁵
	Risāla fī-l-'amal bi-l-rub'	Astronomy	Royal Library [1110] ⁷⁶
'Abd al-Salām b. Aḥmad Ibn Zākūr (fl. 1113/1701)	Kifāyat al-labīb fī-l-tawqīt bi-'amal al-nisba min al-jayyūb	Astronomy	Royal Library [1213] ⁷⁷
Muhammad al-Ghamari al-Ash'ari al-Azhari (d. 1128/1716)	Maknūn ḍamā'in arbāb al-jafriyyāt wa-l-ḥufriyyāt	Lettrism	S (Salé) [1262] ⁷⁸
Aḥmad b. Muḥammad b. Muḥammad b. Ya'qūb al-Wallālī (d. 1128/1716)	Nuzhat al-anzār fī rawḍat al-azhār	Astronomy	Royal Library [6006] ⁷⁹

⁶⁵ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 123-24.

⁶⁶ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 198-99.

⁶⁷ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 5, 279. This is a commentary on a text by the Tunisian scholar 'Abdallāh b. Muḥammad al-Murjānī.

⁶⁸ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 5, 306.

⁶⁹ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 342-43.

⁷⁰ This is one of the four works edited and translated in H. P. J. Renaud and G. S. Colin, *Documents Marocains pour servir a l'histoire du "mal franc"* (Paris: Librairie Larose, 1935).

⁷¹ See Najib, *Fihris ma lam yufra*, 95.

⁷² See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 2, 138-39.

⁷³ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 321-22. This is a reply to the Algerian scholar al-Tājūrī, and in the introduction the author refers to "our teacher, 'Abd al-Raḥmān al-Fāsī."

⁷⁴ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 130-31

⁷⁵ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 300-1.

⁷⁶ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 244

⁷⁷ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 326-27. This library has three copies of this treatise.

⁷⁸ See Muḥammad Ḥajjī, *Fihris al-khizānah al-'ilmiyya*, 571.

⁷⁹ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 381-

Ahmad b. Sulayman al-Rasmuki (d. 1133/ 1721)	Kifāyat dhuwī al-albāb	Astronomy	S (Salé) [1152] ⁸⁰
	Sharḥ nazm fī kayfiyyat istikhrāj dukhūl yanāir	Astronomy	Q (Fes)
	Sharḥ manzūma fī-l-burūj wa-l-manāzil	Astronomy	Great Mosque of Wazzan
	Al-Fawā'id al-marḍiyya fī istikhrāj al-manāzil wa-l-burūj al-mutawahhima wa-l-ṣūriyya	Astronomy	Maḥjūbiyya Collection ⁸¹
	Mukhtaṣar fī al-Ṭibb	Medicine	Al-Tidsīya Library ⁸²
	'Umdat al-rughghāb fī ḥall alfāz ma'ūnat al-ṭullāb	Astronomy	Royal Library [5987, 3979] ⁸³
Abū 'Abdallāh Muḥammad b. 'Abd al-Raḥmān b. 'Abd al-Qādir al-Fāsī (d. 1134/1721)	Risāla fī-l-taqwīm	Astronomy	Royal Library [9908, 1534] ⁸⁴
Ṣāliḥ b. Muḥammad al-Mu'ṭī al-Sharqī (d. 1139/1726]	Tuḥfat al-ṭullāb fī kashf mā khufiyya min al-astrulāb	Astronomy	Royal Library [7421] ⁸⁵
'Abd al-Qādir b. al-'Arabī Ibn Shaqrūn al-Maknāsī (d. 1140/1728)	Al-Nafḥa al-wardiyya fī-l-'ushba al-hindiyya	Medicine	Royal Library [3636] ⁸⁶
	Manzūma fī-l-aghdiyya wa-l-ashriba wa-l-adwiyya	Medicine	Royal Library [7587] ⁸⁷
	Al-Urjūza al-shaqrūniyya	Medicine	Printed. ⁸⁸
Muḥammad b. Ya'qūb b. Muḥammad al-Sūsī al-Tamlī (sp?) al-Sajāwī (sp?) (fl. 1141)	Sharḥ urjūzat al-Mirghithī		Royal Library [10389] ⁸⁹
Muḥammad al-'Arabī b. 'Abd al-Raḥmān al-Shafshāwnī (fl. 1143/)	Risāla fī-l-'amal bi-l-astrulāb	Astronomy	Royal Library [5367, 1818] ⁹⁰
Ahmad b. Salih Abū al-'Abbās al-Dara'ī Lakanāwī (d. 1144/1731)	Hadiyat al-maqāl fī al-ṭibb li-l-nisā' wa-l-rijāl	Medicine	Great Mosque of Wazzan
	al-Hadiyya al-maqbula fi ḥulal al-tibb al-mashmula	Medicine	Imam 'Ali Library in Taroundant/ al-Tidsī Collection ⁹¹ /Royal Library [5256] ⁹² / S (Salé) [1239/1240]/ Printed. ⁹³

⁸⁰ See Muḥammad Ḥajjī, *Fihris al-khizānah al-'ilmiyya*, 529.

⁸¹ See Najib, *Fihris ma lam yufra*, 85-86.

⁸² See Najib, *Fihris ma lam yufra*, 97.

⁸³ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 394-95.

⁸⁴ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 209-10.

⁸⁵ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, ???

⁸⁶ al-Khaṭṭābī, *Fahāris al-khizānah* v. 2, 163-64. On this text see H. P. J. Renaud and G. S. Colin, *Documents Marocains pour servir a l'histoire du "mal franc"* (Paris: Librairie Larose, 1935), 27-29.

⁸⁷ al-Khaṭṭābī, *Fahāris al-khizānah* v. 2, 207-09. The Royal Library has a total of 12 copies of this text.

⁸⁸ This text has been edited and translated into French by Badr Tazi and Abdelhadi Tazi (eds.), *La médecine arabe au XVIII^e Siècle à travers al "Urdjuza Ash-Shakruniyya"* (Cairo: L'Organisation Egyptienne Générale du Livre, 1984).

⁸⁹ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 5, 156-57.

⁹⁰ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 236-37.

⁹¹ See Najib, *Fihris ma lam yufra*, 117.

⁹² al-Khaṭṭābī, *Fahāris al-khizānah* v. 2, 212-13. The Royal Library has a total of 8 copies of this text.

⁹³ This poem has been edited by the author's descendant Moulay al-Mahdī b. 'Alī al-Ṣāliḥī, *al-Hadiyya I-maqbula fī-l-ṭibb* (Ourarazate: Mu'assisat al-Furāt, 2011).

	Al-Durar al-mahmula 'ala al-hadiya al-maqbula fi 'ilal al-tibb al-mashmula	Medicine	Tamagrut/ al-Tīdsī Collection ⁹⁴ /National Library/Royal Library [357; Z12030; 9048] ⁹⁵
'Abd al-Wahhāb b. Aḥmad Adarrāq (d. 1746)	Urjūza fi-l-ḥabb al-ifranjī	Medicine	Printed. ⁹⁶
Abū 'Abdallāh Muḥammad b. Muḥammad al-Dalīmī al-Warzāzī al-Dara'ī (fl. 1160/1747)	Sharḥ al-muqni' fi 'ilm Abī Muqri'	Astronomy	Royal Library [5889, 12472z] ⁹⁷
Muhammad b. 'Abd al-Salām b. Ḥamdūn Bannānī al-Fāsī (d. 1163/1750)	Sharḥ al-manzūma al-ma'mūla fī muhimmāt 'ilm al-aṣṭrulāb	Astronomy	S (Rabat) [1118] ⁹⁸ /Hamziyya Zawīya/Royal Library [492] ⁹⁹
Abū Madyān Muḥammad b. Muḥammad al-Manbihī (sp?) (d. 1164/)	Urjūza fi-l-ṣina'ah	Alchemy	Royal Library [4195] ¹⁰⁰
Muḥammad b. 'Alī al-Hawzālī	Mufīd al-rughbān sharḥ mahmāz al-ghuflān 'alā fur' al-waqt wa-l-adhān	Astronomy	Maḥjūbiyya Collection/al-'Uthmāniyya Collection ¹⁰¹
Muhammad b. Ali al-Ḥumaydī (d. 1179/1765)	Risāla fī ālat al-raṣd dhāt al-kursī	Astronomy	S (Salé)[1055] ¹⁰² / Royal Library [826, 265] ¹⁰³
'Abdallāh b. Aḥmad b. Muḥammad al-Kaḍāḍī al-Tinzāḍī (fl. 1181/1767)	Nubdha min al-fawā'id al-ṭibiyya/'Unwān al-shifā ma' ṣidq al-ṭibb wa-l-wafā	Medicine	Royal Library [1160, 5518] ¹⁰⁴
'Abd al-Raḥmān b. Muḥammad al-'Arabī al-Mufarraj al-Andalusī al-Ansārī (fl. 1188/1774)	Risāla fī-l-tawqīt (wa jadāwil mulḥaqa bi-hā)	Astronomy	Royal Library [2523 (two copies)] ¹⁰⁵
'Abd al-Salām b. 'Alī al-Rijrājī (fl. 1190/)	Khulāṣat al-durar fī ālat al-ḥajar		Royal Library [1025, 1925] ¹⁰⁶
	Sharḥ baytayn min qaṣīda		Royal Library [1025] ¹⁰⁷
	Qaṣīda fī al-ṣina'ah	Alchemy	Royal Library [1025] ¹⁰⁸

⁹⁴ See Najib, *Fihris ma lam yufiras*, 54.

⁹⁵ al-Khaṭṭābī, *Fahāris al-khizānah al-malakiyya*, v. 2, 100-102.

⁹⁶ This is one of the four works edited and translated in H. P. J. Renaud and G. S. Colin, *Documents Marocains pour servir a l'histoire du "mal franc"* (Paris: Librairie Larose, 1935).

⁹⁷ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 318-20. This is a commentary on al-Mirghithī's poem.

⁹⁸ Muḥammad Ḥajjī, *Fihris al-khizānah al-'ilmiyya*, 515.

⁹⁹ al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 295-97. The library has a total of 3 copies of this text, which is a commentary on the poem on the astrolabe by 'Abd al-Raḥmān al-Fāsī.

¹⁰⁰ al-Khaṭṭābī, *Fahāris al-khizānah al-Ḥasaniyya* (Rabat, 1986), v. 5, 13.

¹⁰¹ See Najib, *Fihris ma lam yufiras*, 103.

¹⁰² Muḥammad Ḥajjī, *Fihris al-khizānah al-'ilmiyya*, 488.

¹⁰³ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 226-27.

¹⁰⁴ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 2, 160, 167-68. This work is an abridgement of al-Dara'ī's *al-Durar al-mahmūla*.

¹⁰⁵ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 219-220.

¹⁰⁶ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 5, 67-68. Compare with *Ibid.*, 204, where a fragment of a unidentified work by this author is listed.

¹⁰⁷ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 5, 151-52.

¹⁰⁸ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 5, 261. The library has two copies of this poem in this volume.

Muḥammad b. al-Ṭīb b. ‘Abd al-Qādir Skīrj al-Andalusī (d. 1194/1780)	Mu‘īnat al-ṭullāb ‘alā al-tawaṣṣul li-l-aṣṭrulāb	Astronomy	Royal Library [127] ¹⁰⁹
Muhammad b. al-Hasan Bannānī al-Fāsī (d. 1194/1780)	Risāla ḥawl al-naẓar ilā al-nujūm wa-l-istidlāl bihā	Astronomy	S (Salé) [1049] ¹¹⁰
Muḥammad b. Ḥabībballāh b. al-Fāḍil al-Ya‘qūbī al-Tiyūsī (sp?) (fl. 1195)	Ithāf al-Muṣannaf al-Sa‘īd li-sharḥ qaṣīdat Muḥammad b. Sa‘īd (al-Mirghithi)		Royal Library [7205] ¹¹¹
‘Abdallāh b. ‘Abd al-‘Azīz al-Marrākushī (Ibn ‘Azzūz) (d. 1204/1789)	Dhahāb al-kusūf wa nafy al-ẓalma fī ‘ilm al-ṭibb wa-l-ṭabā‘i’ wa-l-ḥikma	Medicine	Royal Library [5799, 11887z, 314, 5774] ¹¹² /National Library/ S (Salé) [1224] ¹¹³
	Ithmad al-baṣā‘ir fī ma‘rifat ḥikmat al-mazāhir		Royal Library [6891] ¹¹⁴
	al-Amr al-wāfi wa-l-tartīb al-kāfi fī-l-sirr al-khāfi		Royal Library [1678, 758] ¹¹⁵
	Al-Anwār fī sirr al-ikhtiṣār		Royal Library [31] ¹¹⁶
	Lubāb al-ḥikma fī-l-‘ilm al-ḥurūf wa ‘ilm al-asmā’ al-ilahiyya	Lettrism	Royal Library [1081, 1514] ¹¹⁷
	Al-Fuṣūl fī ḥall al-ma‘qūd wa ‘aqd al-maḥlūl		Royal Library [4576] ¹¹⁸
Al-Ṭayyib b. ‘Abdallāh Sāsī al-Samlālī al-Asfī (d. 1204/1789)	Risāla fī tafsīr jadāwil tawqītiyya	Astronomy	Royal Library [12288z] ¹¹⁹
	Riyāḍ al-azhār fī ma‘rifat awqāt al-layl wa-l-nahār	Astronomy	Royal Library [1739,] ¹²⁰
Abū al-Rabī‘ Sulaymān b. Aḥmad al-Fishtālī al-Fāsī al-muwaqqit (d. 1208/1794)	Bughyat dhawī al-raghbāt fī sharḥ ‘awīṣ risāla al-Māridīnī fī-l-rub’ al-jībī min al-mīqāt	Astronomy	Royal Library [10177, 10056, 11984z] ¹²¹
	Risāla fī-l-ṣafiḥa al-jāmi‘a	Astronomy	Royal Library [1009] ¹²²
Aḥmad b. ‘Alī al-Balghīthī (d. 12008/1794)	Sharḥ manhāj al-ṭālib fī ta’dīl al-kawākib	Astronomy	S (Salé) [1120] ¹²³

¹⁰⁹ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 363-64.

¹¹⁰ See Muḥammad Ḥajjī, *Fihris al-khizānah al-‘ilmiyya*, 486.

¹¹¹ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 5, 273-4.

¹¹² See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 2, 106-08.

¹¹³ See Muḥammad Ḥajjī, *Fihris al-khizānah al-‘ilmiyya*, 564.

¹¹⁴ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 5, 274-75. The library has three copies of this text.

¹¹⁵ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 5, 276, and compare with v. 3, 433.

¹¹⁶ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 5, 277

¹¹⁷ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 5, 304-05.

¹¹⁸ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 5, 322-23.

¹¹⁹ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 208-09.

¹²⁰ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 279-83. The library has four copies of this work.

¹²¹ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 141-43

¹²² See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 235, 379-80.

¹²³ See Muḥammad Ḥajjī, *Fihris al-khizānah al-‘ilmiyya*, 515.

Muḥammad b. al-Tayyib b. al-Makkī al-Ajbārī al-Ḥasanī (fl. 1214/1799)	Risāla fī khaṣaṣ al-awqāt min zījay Ibn al-Shāṭir al-Dimashqī wa-l- Samarqandī	Astronomy	Royal Library [8873] ¹²⁴
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¹²⁴ See al-Khaṭṭābī, *Fahāris al-khizānah*, v. 3, 223-24.