

SONJA BRENTJES (ed.), PETER BARKER (associate ed.) & RANA BRENTJES (assistant ed.), *Routledge Handbook on the Sciences in Islamicate Societies. Practices from the 2nd/8th to the 13th/19th Centuries*, London & New York: Routledge, 2022 (XXXVII + 837 pp.).

In 1996, Routledge published a three-volume *Encyclopedia of the History of Arabic Science*, edited by Roshdi Rached & Régis Morelon. The work followed the standard structure of a book of this kind, authored by a small number of well-known scholars who dealt with the main periods of splendour of Arabic science (although, in this case, the term «Arabic Science» referred mainly to scientific works written in Arabic).

Now, twenty-six years later we find a book conceived in an entirely different way. This Handbook is divided into six sections and contains 64 chapters written by 63 authors. In the list of the author's names (pp. XI-XXII) we find senior and junior scholars. Besides, the 64 chapters deal with the history of all kinds of scientific knowledge, including some philosophy, between the 8th and the 19th century and in all Islamicate societies, a circumstance that implies expansions to the East towards the Indian subcontinent and to the South in sub-Saharan Africa. This entirely new focus is patent in chapter I.2 which contains small sections on translations into Coptic and into Ethiopian Ge'ez (pp. 29-31).

Sonja Brentjes' Introduction (pp. 1-11) stresses the interest of a social history of science (p. 2), draws attention to the different meanings of the word *'ilm* (pp. 2-3) and states that «the goal of this book is to provide a multitude of stories as told in current research...» (p. 5). This is associated with her own remark that «the book has more than one structure» (p. 9), something that is obvious when one reads it and tries to understand the order and the contents of the different sections. In the following lines I will try to describe the main contents of the volume and explain its structure. The reader will have to accept, however, that I am not competent to evaluate all the subjects dealt with in such a large volume, although I will provide a few critical comments. I should also add that I am not the ideal candidate to write this review for the very simple reason that I am the author of one of the chapters (VI.3).

Section I is entitled «Late antiquity, translating and the formation of the sciences» between the 5th and the 13th centuries. It begins with an excellent introduction by Brentjes herself (I.1, pp. 1-24) which contains a summary of translations,

mainly into Arabic, between the 8th and the 10th centuries. In this section we also find good analyses of translations in the mathematical sciences (I.3), and medical and occult sciences (I.4). This is complemented by a multi-authored chapter (I.2) which deals with Iranian and Syriac translations, as well as some intriguing short sections dedicated to translations into Coptic and to Ethiopian Ge'ez (pp. 29-31).

This section continues with chapters on the history of geometry (I.5), astral sciences (I.6), algebra and arithmetic (I.7), optics and its applications to other sciences (astronomy, meteorology, physiology, military technology, I.8), mechanical engineering (I.9, *hiyal* and the development of this discipline in the Islamic East, with a very brief reference to Ibn Khalaf al-Murādī's *Al-Asrār fī natā'ij al-afkār* from 11th c. (?) al-Andalus, medicine (I.10), natural philosophy (I.11, mainly physics, insisting in the importance of Ibn Sīnā's *Shifā'*), alchemy and chemical crafts (I.12), geography and mapmaking (I.13), dealing with mathematical and administrative geography, but omitting, curiously, the Ma'mūnī measurement of the degree of the meridian, the correction of the size of the Mediterranean, or, in the 15th and 16th centuries, the Maghribī portolan nautical charts made by chart-makers like Aḥmad al-Ṭanjī and 'Alī al-Sharafī.

The rest of the section seems to be less conventional as it deals with chapters on physiognomy (I.14, *Firāsa*), the analysis of a treatise on 93 ancient and secret alphabets attributed to Ibn Waḥshiyya, including hieroglyphic Egyptian script (I.15), the practices of Zoroastrian scholars before and after Islam (I.16) and, finally, an interesting study of the points of view of Ishāq b. Ḥunayn, Ibn al-Nadīm, Ibn Juljul and Ṣā'id al-Andalusī concerning the scientific developments of old nations before Islam.

Section II is entitled «Scientific practices at courts, observatories and hospitals» between the 13th and the 19th centuries. With the change in the chronology comes a change in the venues of scientific activity and we find the emergence of both Persian (II.1) and Ottoman Turkish (II.2) as scientific languages, as well as health practices under the Ottoman and Safavid Empires (II.5), and Ottoman maps and *firāsa* (II.8 and 11). This section also contains a chapter on the practice of occult sciences mainly in Iran in the early modern period (II.9) and on princely patronage in several Eastern dynasties between the 10th and the 17th centuries. Within the same chronological period we find a chapter on planetary theory (II.6) which deals exclusively with «physical» planetary models beginning with Ibn al-Haytham's book on *hay'a* and continuing with the same tradition in the new models designed in the 13th century and afterwards in Marāgha and elsewhere. References to the previous period and to the small corrections introduced in Ptolemaic

models and in their numerical parameters can be found in the chapter on observations, observatories and astronomical tables (*zījjes*) (II.7) in which we find an extremely brief reference to the theory of trepidation which was so important in Western Islam during the Middle Ages. Generally speaking, the Andalusī astronomical contributions are ignored.

Section III deals with «Learning and collecting institutions – debates and methods» between the 13th and the 19th centuries. Collecting institutions are represented by libraries (III.1) dealt with in an excellent chapter by L. Richter-Bernburg which analyses libraries of the 9th and 10th centuries. Learning is dealt with in the chapter on *madrasas* (III.2) which appeared, in Eastern Islam in the 12th century, and in the Maghrib one century later. Although this institution seems to have been created for the teaching of religious and legal sciences, the chapter gathers together some interesting information about scientific works (mainly on mathematics) written by *madrasa* teachers. Chapters 3-6 in this section deal mainly with philosophical topics which are difficult to locate within the general title: scientific matters (mainly physics) dealt with in *Kalām* works (III.3), al-Ghazālī's *Tahāfut al-falāsifa* (III.4), sense and experience (*tajriba*) in Arabic theories of science (III.5), and Logic and its application in other sciences (medicine, magic, *firāsa*, alchemy) (III.6). With chapters III.7 and III.8 we return to what can be considered properly scientific topics: medical commentaries on Greek and Islamic sources (III.7) and textual astronomical and astrological genres where we find *zījjes* (see also II.7), and several other kinds of texts (introductions, commentaries, epistles, treatises etc.) to which the chapter adds visual representations of the heavens like the ones we find in al-Šūfī's Uranography (III.8).

Section IV deals with the materiality of the sciences between the 9th and the 19th centuries. In my view, its structure makes good sense: it begins with a wealth of information about the materials used for writing (papyrus, parchment, paper, ink, pens), one text and multiple text codices, and the layout of the page (IV.1). This is followed by three-dimensional astronomical instruments including celestial globes and armillary spheres (IV.2), but not spherical astrolabes, briefly mentioned in IV.3 and splendidly represented in the photograph of Mūsā's spherical astrolabe (Oxford Museum of History of Science) which appears on the cover of the *Handbook*. IV.3 deals also with standard plane astrolabes as well as with Maghribī and Eastern universal astrolabes; but in this chapter, which seems to deal with two-dimensional astronomical instruments, there is no reference to equatoria. These apparently had an Eastern origin (Abū Ja'far al-Khāzin), but were mainly developed in al-Andalus. Medical (mainly surgical) instruments are dealt with in

IV.4, in which we find references to two Andalusī surgeons (Abū l-Qāsim al-Zahrāwī and Muḥammad al-Shafra) and an Eastern one (Ibn al-Quff). Chapter IV.5 is concerned with alchemical equipment and IV.6 mainly irrigation technology (*qanāts*, norias, watermills) using examples from Syria, Jordan, Iran, Oman, but not al-Andalus, where these techniques were studied by Thomas F. Glick. Finally, IV.7 is mainly concerned with artistic illustrations in manuscripts dealing with uranography (al-Šūfī), botany (Dioscorides), veterinary medicine, luxury books for the education of princes, maps, mechanical treatises (al-Jazarī, but not al-Murādī) and astrological and magical texts.

Section V bears the title «Centers, regions, empires and the outskirts» between the 9th and the 19th centuries and it actually deals with scientific and pseudo-scientific practices in regions located on the borders of the Islamicate world. Such is the case of chapters dealing with pharmaceutical texts in modern India (V.7), medical texts and practices in Persianate South Asia and Tibet (V.8 and V.11), Islamicate astral sciences in Eastern Eurasia during the 13th-14th centuries (V.12), Arabo-Persian scientific texts in early modern China (V.13), and scientific practices in sub-Saharan Africa (V.10).

In other cases, the chapters deal with areas that cannot be regarded as being on the outskirts, like the section on Premodern Ottoman views of natural phenomena (earthquakes, comets, rainbow, tides...) explained both scientifically or through popular/religious beliefs (V.9). Some examples are the chapters dealing with al-Andalus and the Maghrib, areas that are often ignored in other sections of this book. V.5 contains a good review of the general evolution of Andalusī science, V.3 is concerned with Andalusī astrology and V.4 with agricultural calendars (*anwā'* books) and the practice of *mīqāt* in Western Islam, while V.I, entitled «Mathematical knowledge fields in the Islamicate world: similarities and differences», underlines the contributions of the Maghrib and al-Andalus in the development of symbolic algebra, combinatory analysis and other fields of mathematics. Finally, chapters V.2 and V.14 deal with scientific communities which contributed to the diffusion of Islamic science. V.2 focuses on Jewish mathematical activities, in which the contribution of Eastern Jews (Sanad b. 'Alī, al-Samaw'al, Abū l-Barakāt al-Baghdādī) is mentioned, but emphasizes, especially, the contribution of transmitters of the Iberian Peninsula (Abraham bar Ḥiya, Abraham ben 'Ezra, Abner of Burgos) and Southern France (Jacob b. Makhir, Immanuel Bonfils of Tarascon, Levi ben Gerson etc.). For its part, V.14 deals with translations of Arabic scientific texts into Latin and into Castilian in Iberia, but not the beginning of this translation process in 10th century Catalonia.

The final section of the book is labelled «Encounters, conflicts, changes» between the 10th and the 19th centuries, and it is the most heterogeneous of the volume. It begins (VI.1) with an analysis of contacts and interactions between Jews, Muslims and Christians in «neutral fields» like mathematics, medicine and philosophy, to which interesting remarks are added concerning written texts, the relation between masters and students, and the patronage of science. Chapter VI.2 deals with the different procedures to determine the direction of the *qibla*, VI.3 studies al-Ghazālī's *Tahāfut al-falāsifa*, his criticisms of Ibn Sīnā's philosophy and the discussions of whether philosophers can or cannot be considered Muslims. VI.4 studies the different classifications of knowledge and sciences found in al-Farābī, al-Ghazālī, Ibn al-Nafīs and several Ottoman authors. VI.5 studies the different channels through which Islamicate scientific works reached Europe between the 16th and the 18th centuries. VI.6 is a review of the scientific contents of two private libraries in Ottoman Syria which are now preserved in German libraries. Finally, VI.7 studies translations of modern European scientific texts into Urdu in colonial India in the 19th century, as well as the local conflicts between tradition and modernization.

Taken as a whole, this *Handbook* contains a wealth of information about the history of science in Islamicate countries in chronological periods and geographical areas which have often been ignored. Each chapter contains a list of sources and secondary bibliography, complemented on pp. 808-812 by a «Consolidated bibliography» which contains bibliographical items of a more general character. The book ends (pp. 813-837) with excellent indexes which increase the usefulness of this volume.

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