scientific Arabic material into the north-east of the Iberian peninsula in the 12th century (J. Samsó). There follows a very instructive chapter on the less known Jewish contribution to the transmission of sciences in Catalonia and in Languedoc and the Provence (J. Samsó). Ll. Cifuentes then discusses the use of Catalan in the scientific texts during the late Middle Ages and the early Renaissance. Hereafter follow chapters on medicine (M. R. McVaugh), on universities (J. Arrizabalga), on Ramon Llull (L. Badia), on Arnald of Villeneuve (M. R. McVaugh), on alchemy (M. Pereira), astronomy (J. Chabás), cartography (M. Comes; unfortunately, most of the map illustrations appear too dark and, therefore, almost illegible), and on hydraulic, agricultural and pre-industrial technology (M. Viladrich).

The mass information here assembled, according to the most up-to-date state of knowledge, is overwhelming. The editors are to be praised and deserve the gratitude and acknowledgment of the scholarly community for having invested this huge amount of work and organisation necessary for presenting a comprehensive volume of this kind. Readers should, however, keep in mind that this admirable piece of work is centered on the developments in Catalonia. It is not a general history of sciences in medieval to Renaissance Spain. All those acquainted with Millàs *Assaig* of 1931 find here a worthy continuation of these earlier endeavours, and it is to be hoped that many will feel tempted to continue the study of these intriguing materials – notwithstanding the unfavourable conditions that are presently prevailing in many places towards such historical research.

Paul Kunitzsch

George Saliba, *Islamic Science and the Making of the European Renaissance*. Transformations: Studies in the History of Science and Technology. The MIT Press. Cambridge, Mass. & London, England. Cambridge, 2007. 315 pp.

1998 saw the publication of two important essays on the origins of Islamic Science and its connections with its Greek predecessors: on the one hand, Dimitri Gutas published *Greek Thought, Arabic Culture. The Graeco-Arabic Translation Movement in Baghdad and Early ʿAbbāsid Society (2nd-4th/8th-10th centuries)* (Routledge, London), which stressed the significance of the ʿAbbāsid period in the process of transmission of Graeco-Arabic science, and argued that the previous stage, the Umayyad Caliphate, was less important. In the same year George Saliba published, in Arabic, *al-Fikr al-ʿIlmī al-ʿArabī. Nash'atu-hu wa-taṭawwuru-hu* (Markaz al-Dirāsāt al-Masīḥiyya-al-Islāmiyya, Balamand University, Lebanon), a book that has many points of contact with the one I am presenting here and which defended the opposite view: that is, that the Umayyad period is vital to an understanding of the beginnings of this transmission. Both books were published independently of each other and were clearly complementary.

Islamic Science and the Making of the European Renaissance is a new, updated, English version of *al-Fikr al-ʿIlmī al-ʿArabī*. It is not a translation of the Arabic work and it has clearly been rewritten and fully annotated with a different kind of reader in mind, though the common centres of interest are obvious. One thing should be said before anything else: both *al-Fikr al-ʿIlmī al-ʿArabī* and *Islamic Science* bear titles that do not entirely reflect their content. In spite of the frequent references to other sciences (for example, Ibn al-Nafīs's discovery of the lesser circulation and its influence on European Renaissance anatomists), both books deal with Astronomy, considered as a case study (Saliba uses the word *template*) that may provide an accurate representation of the origins and development of the other sciences. This approach is no surprise, given the author's standing in the history of this particular science.

The volume has two main centres of interest: the origins of Islamic astronomy and science and the influences that its later developments (from the Marāgha school, in the 13th c. onwards) had in the European Astronomy of the Renaissance (particularly Copernicus). This latter topic has been thoroughly discussed since the first evidence began to appear towards the end of the nineteen fifties and Saliba has published several syntheses (see, for example, his collection of articles in the volume *A History of Arabic Astronomy. Planetary Theories during the Golden Age of Islam*, New York U.P., New York & London, 1994, or his contributions to the first volume of the *Encyclopaedia of the History of Arabic Science*, ed. by R. Rashed and R. Morelon, London & New York, 1996). His ideas on the origins of Islamic Science are less well known and they begin with a criticism of what he calls "the classical narrative" in its different forms: 1) the nascent Islamic civilization came into contact with the ancient Byzantine and Sasanian civilizations as a consequence of the political expansion of the Islamic State ("the contact theory"); 2) the survival of scientific and philosophical texts in a few cities in Byzantium and Iran – like Antioch, Ḥarrān or Jundīshāpūr – is the basis of "the pocket transmission theory"; 3) Transmission began to take place indirectly, through the Syriac medium. All these contacts began mainly during the Abbasid period, due to the rise of the "Persian elements" or the ascent of al-Ma'mūn to the Caliphate in 813 and his reliance on Muʿtazilite theology. This picture is convincingly discussed by Saliba who argues that scientific knowledge and practice in both Byzantium and Iran was extremely limited, representing hardly any advance on pre-Islamic Arabia, while the Syriac texts written by authors such as Severus Sebokht (ca. 660) and others were also elementary. Thus, even though ancient Greek and Iranian texts were preserved, no native Byzantine, Syriac or Persian scholars would have been able to understand them and thus become the masters of the first Muslim scholars. On the other hand, the level of expertise of the Muslim scientists and Arabic translations during al-Ma'mūn's Caliphate suggests that the transmission was not recent. Indian Astronomy seems to have been introduced during al-Manṣūr's Caliphate (754-775) and al-Fazārī was able to compute his own *zīj* using the Islamic calendar, a task that probably would have been beyond a beginner. Several astrologers, among whom we find the Arab-born al-Fazārī himself, were able to cast the horoscope of the foundation of Baghdad in 762 using the Iranian *Zīj al-Shāh*: who taught al-Fazārī and his Persian colleagues (Māshā'allāh and Nawbakht) to use a *zīj*?

All this leads the author to construct an "alternative narrative". In order to do so, he reviews and reinterprets four legendary stories related to the origins of transmission which were collected in the *Fihrist* of Ibn al-Nadīm (Saliba prefers to call him al-Nadīm, see p. 28), for two of which the sources are Abū Sahl b. Nawbakht (fl. end of the 8th c.) and Abū Maʿshar (d. 886). In the fourth story Ibn al-Nadīm apparently links the alchemical translations patronized by Khālid b. Yazīd b. Muʿāwiya (ca. 668-ca. 709) with the process of Arabization of the *dīwān* in Iraq in the days of ʿAbd al-Malik (r. 685-705) and in Syria during the Caliphate of his son Hishām (r. 724-743). This leads Saliba to formulate a new theory concerning the reasons for the new interest in ancient sciences in Islamic civilization: the Arabization of the *dīwān* affected only the administration of revenues (the rest of the administrative tasks already used Arabic) which required certain knowledge of elementary arithmetic and other sciences. This process had obvious social consequences: the secretaries of the administration who had hitherto used Persian and Greek – and who were precisely the ones with the required elementary scientific knowledge – lost their posts to Arabic speakers who did not necessarily have the same level of competence. To recover their positions, these Iranian and Greek-Syriac secretaries (probably in this chronological order) had to develop their knowledge of the sciences of the ancients for which they were well prepared linguistically and in which they had already acquired a sound scientific background. They were also obliged to learn good Arabic; indeed, the most important grammarian of the 8th c. was an Iranian (Sībawayh, see p. 77). This situation is considered by Saliba (p. 73) as the origin of the opposition between partisans of the sciences of the Ancients and traditionalists dedicated to the religious sciences, who were the natural allies of the new Arabic-speaking bureaucracy. According to Saliba (p. 78), the former soon became aware of the need to develop an astronomy uncontaminated by astrology and that this was the origin of the creation of *hay'a* and, from the 11th c. onwards, *mīqāt*. The situation is not so clear in the case of *hay'a* which, in Saliba's opinion, has an early origin. The author gives two examples: Qusṭā b. Lūqā (p. 18) and Muḥammad b. Mūsā b. Shākir (pp. 92-93), the first of which does not seem to have been studied. This leads me to wonder what the exact meaning of this term would have been in the 9th c. It is clear that the *hay'a* cultivated in the Mashriq from the 11th c. onwards did not deal with astrology, but I am not sure that this was the case in the 9th c. Saliba returns to this topic, namely the non-astrological character of the *hay'a* of the 13th and following centuries, in chapter 5 of this book (pp. 171-191) in which he insists on the Islamic acceptability of this discipline: *hay'a* texts were written in Arabic in Iran during the Safavid period, to be taught in religious schools, while *zīj*es, produced because of their astrological applications, were written in Persian.

The early introduction of Greek science, as a result of the crisis produced by the Arabization of the *dīwān*, had immediate consequences: new generations of bureaucrats, the heirs of those who had previously lost their jobs, became indispensable to the government during the early years of the ʿAbbāsid Empire and sponsored the translation process. Saliba reminds us of the account by Ḥunayn ibn Isḥāq who gives us a list of 129 translations of Galen's books, most of which were done for the Banū Mūsā b. Shākir, and none for the Caliph (pp. 64, 71). Saliba seems to ignore the importance of caliphal patronage, although he reminds us, obviously, of the Ma'mūnī observations and of the measuring of the length of a degree of the meridian. Perhaps Saliba goes a little too far here: his position is diametrically opposed to that of Gutas, who extends the patronage practically to the whole of ʿAbbāsid society (*Greek Thought* p. 5): "Patrons were Arabs and non-Arabs, Muslims and non-Muslims, Sunnīs and Shīʿites, generals and civilians, merchants and land-owners etc."

Although I do not completely agree with the starting point of Saliba's argument (his interpretation of Ibn al-Nadīm's fourth story seems far-fetched), his new hypothesis is, in my opinion, full of good sense: it explains the chronological aspects of the problem well and it has important implications. He recovers the old idea of *appropriation* formulated, some years ago, by Prof. A.I. Sabra when he says (p. 66): "…the translation movement was not a movement to imitate a higher culture that was there standing in competition with one's own. Instead, the acquiring culture had to dig out texts, that is *really appropriate* those texts which were practically forgotten in the source culture." As a consequence: there is a Graeco-Arabic cycle in the history of scientific culture.

The "alternative narrative" has its best basis in the early critical assimilation of Greek mathematical and observational astronomy, explained in chapter 3 (pp. 73-129), which the author soon links to another kind of criticism: that represented by the *Shukūk* literature which began in the 11th c. with Ibn al-Haytham, who criticized the inconsistencies of Ptolemy's planetary models and their inability to provide an accurate representation of the physical world. The first attempts to design alternative models both in the East (al-Jūzjānī, d. ca. 1070) and in al-Andalus (al-Biṭrūjī, second half of the 12th c) were totally unsuccessful and we have to wait until the 13th c. to find the first adequate non-Ptolemaic planetary models, designed by al-ʿUrḍī (d. 1266) and Naṣīr al-Dīn al-Ṭūsī (d. 1274) who did their theoretical research while making their astronomical observations at the Marāgha observatory. Saliba deals with this topic, in which he stresses the mathematical innovations such as the "Ṭūsī couple" and al-ʿUrḍī's lemma, in chapter 4 (pp. 131-170). In it he traces the evolution of the problem in the works of al-Ṭūsī's student, Quṭb al-Dīn al-Shīrāzī (d. 1311), Ibn al-Shāṭir (d. 1375), ending with the very interesting new approach of Shams al-Dīn al-Khafrī (d. 1550) who designed four different, but mathematically equivalent, models for Mercury, all of which represented the physical reality adequately, though none of them could be considered to be "truer" or more "correct" than the others.

After chapter 5 ("Science between Philosophy and Religion: The Case of Astronomy", pp. 171-191), which I have already mentioned, Saliba enters the vast topic of Copernicus' knowledge of the new planetary models of the *hay'a* tradition (pp. 193-232). This is something that, in my opinion, no serious historian of astronomy can doubt today, after all the research published during the last half century, and presented, in careful syntheses, by Saliba himself during the last twenty years. Nonetheless, this new general presentation of the problem, in book form, will be a particularly useful instrument for convincing the sceptics, especially because it incorporates some novelties. The author traces (pp. 193-209) the history of the discovery: Ibn al-Shāṭir's lunar model reproduced by Copernicus, his use and proof of Ṭūsī's couple (Hartner discovered that, in Copernicus' illustration of the proof the letters are placed exactly in the same position as in al-Ṭūsī's manuscript, with only one difference which is explained here by the author) and al-ʿUrḍī's lemma (without proof), Copernicus' adaptation to heliocentrism of Ibn al-Shāṭir's models for the superior planets and his use of the model for Mercury designed by the same author, in the *Commentariolus*, without an adequate understanding of its implications. We have, here, the two ends of the same chain but the connecting link is missing. How did Copernicus obtain all this knowledge? (pp. 210-232). One of the main difficulties is that we cannot single out an Arabic source containing all the elements known to Copernicus. One of the possible answers was given by Neugebauer, who suggested Byzantine Greek translations as the source after his discovery of MS Vatican Gr. 211 which contained a qualitative description of Ṭūsī's couple. Although this suggestion was entirely reasonable and one can assume that Copernicus knew Greek, the study of MS Vatican Gr. 211 has not produced any further results. This is why the new route proposed by Saliba (pp. 217-221) is extremely interesting: he studies the figure of Guillaume Postel (1510-1581) a French Arabist contemporary of Copernicus, who bought a manuscript of al-Kharaqī's *Muntahā al-idrāk* in Constantinople in 1536, to which he added marginal notes (extant in the Bibliothèque Nationale in Paris) and who also owned a manuscript of al-Ṭūsī's *Tadhkira* which, obviously, contains the proof of Ṭūsī's couple. A complete survey of Postel's biography and works can be found in Saliba's contribution to this issue of *Suhayl*. Although, obviously, Postel does not give all the answers to our problem, it is clear that the new route opened up by Saliba has an enormous interest: there were European Arabists able to read and understand highly technical Arabic astronomical texts and the possibility of an oral transmission of its contents to Copernicus, without the need for a translation, clearly exists. The author also suggests other interesting names such as that of the Syriac Jacobite patriarch Niʿmatallāh/ Nehemias (d. 1590) who arrived in Rome ca. 1577, bringing with him Arabic astronomical books, and was appointed a member of the committee created by Pope Gregory XIII to reform the Julian calendar. This new route of transmission, as Saliba remarks, could explain the lack of a single Arabic source containing all the elements known to Copernicus: an interested European reader of Arabic manuscripts could have transmitted the contents of several different sources.

This new book by George Saliba offers a highly satisfactory explanation of the origins of the *appropriation* of Greek scientific texts by Arabic scholars, a justification of the role of Arabic astronomy in the general history of astronomy, a clear synthesis of the development of *hay'a* and of the appearance of new planetary models from the 13th c. onwards, which were influential in Copernicus, and a new and extremely interesting hypothesis on a possible way of transmission through European Arabists who read Arabic astronomical manuscripts. He also insists on a point that is well known: that we should reject the traditional ideas of a decay of Arabic science provoked by a conflict between science and religion, symbolized by al-Ghazālī's *Tahāfut al-falāsifa* (d. 1111), or by the destruction of Baghdad by the Mongols in 1258. There was no such decay and the latter date marks the beginning of what Saliba himself has named "the Golden Age of Islam". The trends of the new astronomy which began with the foundation of the Marāgha observatory have been studied until the 16th c. and research should continue into the results obtained by Islamic astronomy during the following centuries. What we have here is a first attempt to trace a general history of the subject of which the first and last (until the 16th c.) chapters have been written by Saliba. I believe somebody should now write the chapters in the middle: Arabic astronomy is not only *hay'a* but includes other kinds of disciplines such as *zīj*es, *mīqāt*, instruments and observations; the making of the European Renaissance is not only the result of the transmission of the *hay'a* planetary models but also of other kinds of more humble information which reached Europe via Latin translations. Attempts to write this history have been made in collective works such as the first volume of

Rashed's *Encyclopedia* but I think that a version written by a single author would be extremely useful for general historians of science. Nobody is better qualified to write such a book than George Saliba.

Julio Samsó

David Juste, *Les Alchandreana primitifs. Étude sur les plus anciens traités astrologiques latins d'origine arabe (Xe siècle)*. Brill's Studies in Intellectual History Vol. 152. Brill's Texts and Sources in Intellectual History Vol. 2. Leiden-Boston, 2007. XVI + 726 pp + 6 plates.

In 1931, Josep Mª Millàs Vallicrosa published his *Assaig d'història de les idees físiques i matemàtiques a la Catalunya Medieval* which contained, among many other things, a critical edition of the "old corpus" (Kunitzsch) or "old collection" (Burnett) of Latin texts, based on Arabic sources, on the construction and use of the astrolabe, the astronomical quadrant, and a few other instruments. In 2004 I was invited to write a state of the art concerning the collection and I carefully revised all the available sources, discovering, to my surprise, that they contained very few astrological materials. I have now found the answer to this intriguing puzzle in David Juste's book which is, to the best of my knowledge, the most important documenttary contribution to the study of the early introduction of Arabic astronomy and astrology in Europe since Millàs Vallicrosa's work.

Juste's book contains a critical edition and very complete study of a series of eight astrological texts which share common prediction techniques: the data of the horoscope are calculated using numerological procedures (numerical values of the letters forming the name of the subject) and the prediction is based on isolated elements (the onomatomantic ascendant, the planetary hours, the position of the planets in the triplicities or in the lunar mansions, etc.). This kind of very simplified astrology is represented in two other works written in the Iberian Peninsula during the Middle Ages: the Alfonsine *Libro de las Cruzes* and Raimundus Lullius' *Tractatus de nova astronomia*. Both books represent the same tendency towards simplification as the *Alchandreana* collection, although they have very little in common with it.

The books contained are either anonymous or attributed to a mysterious writer called Alchandreus. Apart from him, the other authorities quoted are Alexander Macedo, Ascalu Hismaelita, Argafalau/ Arfarfau Caldeus and Aluaten Sarracenus. Quite convincingly, Juste establishes relations between Ascalu and the 18th lunar mansion (*al-Qalb* spelt *Alcalu* in several sources of the collection), between Argafalau and the 26th mansion (*al-Fargh al-Awwal*, *Algarfalaul*) and between Aluaten and the 28th mansion (*Baṭn al-Ḥūt, Aluaten*). As for Alchandreus, Juste is inclined to equate this name with a corruption of al-Kindī but, given the degree of