Reviews

David A. King, *The Ciphers of the Monks. A Forgotten Number-Notation of the Middle Ages*. Boethius. Texte und Abhandlungen zur Geschichte der Mathematik und der Naturwissenschaften. Band 44. Franz Steiner Verlag. Stuttgart, 2001. 506 pp.

In 1977, Edward S. and Mary Helen Kennedy pulled David King's leg by stating that "he has published too many articles on the Islamic sciences of Qibla determination and *ʿilm al-mīqāt* (astronomical time-keeping)" (*Journal for the History of Arabic Science* 1 (1977), p. 328). Now, in 2001, we might say that David King is publishing too many books: last year *Suhayl* published a review of his brilliant *World-Maps for Finding the Direction and Distance to Mecca* (Leiden-Boston-Köln, 1999) and *The Ciphers of the Monks* is an important new book which is the result of King's project to prepare a complete catalogue of all the astrolabes extant in the world, which began to give its first fruits about 1991, precisely the year in which a fourteenth century astrolabe from Picardy became available for study for the first time. This instrument was once the property of Paschasius Berselius (ca. 1480-1535), a Belgian monk who became a good friend of important humanists such as Erasmus, Vives and Budé. In 1522 he gave the instrument to another humanist, Hadrianus Amerotius (d. 1560).

King's book contains a complete description of Berselius' astrolabe (pp. 131-151, 406-419) and, as the volume is intended for medievalists who are not historians of science, it also includes a general introduction to medieval astronomy and the use of the astrolabe (pp. 355-363), a state of the art on medieval European astrolabes including detailed studies on the quatrefoil on medieval astrolabe retes and on French astrolabes of the fourteenth century (pp. 364-405). The astrolabe, however, is not the main object of the book. Berselius' instrument has the peculiarity of using a system of numerical notation in which each integral number is represented by a single symbol. King calls these symbols "ciphers" and his book is mainly a highly developed study on the origin and history of these ciphers, to which only two important papers - by Beaujouan (1950) and Sesiano (1985) - had been published in the second half of the twentieth century, although King himself had written five preliminary papers on the subject between 1992 and 1997. King's book is, therefore, an extremely important contribution to the history of numerical symbols in medieval Europe; three appendices are dedicated to the survival of

Roman numerals, the use of alphanumerical notations and the introduction of Hindu-Arabic numerals (pp. 281-317): on this latter topic nobody seems to have followed the lead indicated by A.M. Mundó («La cultura artística escrita», in *Catalunya Romànica I. Introducció a l'estudi de l'art romànic català*, Enciclopèdia Catalana, Barcelona, 1994, pp. 140-141) according to whom Hindu-Arabic numerals appear in the Mozarabic *Geronticon*, copied in Seo d'Urgell in 938, some forty years earlier than those appearing in the Escorial codex Vigilanus (see King p. 313).

King traces the origin of the "ciphers" back to a Greek inscription extant in a fourth century B.C. stone tablet and suggests a possible relation to the "Tironian notes" (63 B.C.), in which Marcus Tullius Tiro used a system of shorthand to transcribe Cicero's speeches. This might be related to the fact that John of Basingstoke (d. 1252), archdeacon of Leicester, seems to have been the first in Western Europe to use a set of numerical ciphers which allowed him to represent numbers from 1 to 99, and he asserted that he had learnt the system in Athens where it was used by Greek scribes to represent both numbers and letters. This might be true although King remarks that ciphers similar to those used by Basingstoke are documented in England ca. 1175. In any case the ciphers were used by Cistercian monks in England towards the end of the thirteenth century from where they were transmitted to Cistercian monasteries in the region that corresponds to the present border between France and Belgium. The history of the diffusion of the ciphers in Europe between the fourteenth and the eighteenth century is traced in detail by King who develops a typology of their different forms and studies carefully their applications (not only numbers and letters but also musical notation) and use in monastic and non-monastic sources: they include astronomical manuscripts - such as the one extant in Segovia which contains tables by Abraham Zacut - wine barrels in which the ciphers are used to mark volumes, magical manuscripts of the Renaissance (some sources call these ciphers "Chaldean"), and even documents of eighteenth century French freemasons.

King's book contains a wealth of information on the European history of the ciphers, together with a very rich set of illustrations which are extremely important to follow the arguments of the author. However, what interests us most here is the fact that King dedicates a chapter to the study of "Ciphers similar to the Basingstoke ciphers in Medieval Arabic Treatises" (pp. 72-81) which includes references to a tree-shaped notation used in Turkey and in Persia to represent both letters and numbers, based on principles similar to those of the "ciphers". The similarity is increased in the set of ciphers appearing - together with other systems of numeration such as the Hindu-Arabic numerals, the *abjad* and the Hebrew alphanumerical notation, and the so-called *Rūmī* or *Fāsī* ciphers - in an anonymous Maghribī treatise, extant in El Escorial and dated April 1558, in which they seem to be called *qalam hindī* like the Hindu-Arabic notation. Very similar shapes appear in an anonymous astronomical manuscript, probably of Turkish provenance, and in a Leiden manuscript containing a work by the mystic al-Bistāmī (d. 1454) who quotes, as his source for the ciphers, a treatise on magic squares by the fourteenth century mathematician Yaʿīsh b. Ibrāhīm al-Andalusī al-Maghribī: in both sources the ciphers are called *qalam ṭabʿī* or *ṭabʿī*. Although King rejects any relation between this system of

numeration, attested in Arabic sources, and the ciphers used by Basingstoke or the Cistercian monks, he suggests the possibility of a Greek origin of all of them. In fact we might have here a very vague clue to the solution of the riddle of the mysterious ciphers appearing in talismans described in the works of al-Kindī or in the *Picatrix*. In any case it is clear that David King's book is an important contribution which surpasses the cultural limits of Western Europe and that opens up a new field of research which is extremely interesting for the history of science and, specifically, for the history of Islamic science.

J. Samsó

José Chabás and Bernard R. Goldstein, *Astronomy in the Iberian Peninsula: Abraham Zacut and the Transition from Manuscript to Print*. Transactions of the American Philosophical Society Held at Philadelphia for Promoting Useful Knowledge. Volume 90, Pt, 2, Philadelphia, 2000. 196 pp.

The first important step in the analysis of Zacut's astronomical works was taken by Francisco Cantera who published, in 1931 and 1935, two books giving the available information on Zacut's biography, a study of his *Ha-ḥibbur ha-gadol* (1478) and a critical edition of Juan de Salaya's Castilian translation of that work. No great progress had been made in this field until B.R. Goldstein published his important paper "The Hebrew Astronomical Tradition: New Sources" in *Isis* 72 (1981), 237-251. In it he offered a wealth of new materials related both to Zacut's biography and a preliminary analysis of fragmentary Hebrew manuscripts proving that, after Zacut left the Iberian Peninsula (ca. 1498), he made, in Tunis, an adaptation of the *Ḥibbur* for 1501 and prepared, ca. 1513, a new set of tables for Jerusalem using the Jewish calendar. After 1981, several papers published by Goldstein, Chabás or both authors together (see especially Goldstein & Chabás, "An Occultation of Venus Observed by Abraham Zacut in 1476", *Journal for the History of Astronomy* 30 (1999), 187-200) offered new information on the author, his sources and the general development of Astronomy in the Iberian Peninsula in the second half of the fifteenth century.

All this paved the way for the appearance of this excellent book which deals with an updating of Zacut's biography, a study of Astronomy in Salamanca in Zacut's time, an analysis of the *Ḥibbur* and, especially, of the *Almanach Perpetuum* published by Josef Vizinus (Leiria, 1496) and reprinted on many occasions after that date. To all this the authors add information on Zacut's explicit sources, disciples and influence of his works in Jewish, Christian and Muslim circles. In this review I will concentrate on a few aspects of the book that have attracted my attention.

The biographical chapter (pp. 6-15) reviews critically all known data about Zacut's life, establishing clearly that he was born in 1452 (evidence confirmed by the 1513 tables for Jerusalem) and died ca. 1515 in Damascus or Jerusalem, after living in Salamanca, Gata (ca. 1486), Portugal (1492-ca. 1496), Tunis (ca. 1498-1501) and Jerusalem (ca. 1513). This chapter, on the other hand, has the interest of casting doubts on several myths related to Zacut's life. Thus, there is no known evidence about Zacut studying or teaching at the University of Salamanca or at any other University (I wonder whether a Jew would ever be

admitted to a University in Western Europe in the fifteenth century). The authors also doubt that Zacut had ever been patronized by Gonzalo de Vivero, bishop of Salamanca (d. 1480), for, as Cohn established in 1917, the famous *Epistula auctoris ad episcopum Salmantice* which appears at the front of the Latin version of the *Almanach* is a mere copy of Regiomontanus' dedication of his *Tabulae directionum* to the Hungarian Archbishop of Vienna János Vitéz (d. 1472) (see pp. 7-8, 90-95). This seems clear but I believe that a relation between Zacut and Gonzalo de Vivero must have existed, for the passage in the Bishop's will (quoted by Cantera) in which he leaves a small amount of money and wheat to a certain "Jew Abraham, astrologer", who had compiled tables the canons of which he had translated into Castilian, seems to refer to Zacut himself: I cannot think of any other character of the time who fits this description. Chabás & Goldstein also state that there is very meager evidence about Zacut being in the service of King João II (d. 1495) or of his successor Manuel I of Portugal or that he played any role in the development of nautical astronomy or the preparation of the navigations of Vasco de Gama (pp. 9-15) although their attitude is extremely prudent and leaves the question open (p. 11: "we cannot deny the possibility").

The second chapter, "Setting the scene" (pp. 16-52) begins with a brief summary of the available information on the almanac tradition (pp. 16-18) which began with the *Almanac* of Azarquiel (*radix* 1089), a topic which has been the object of a detailed study by Chabás in "El almanaque perpetuo de Ferrand Martines (1391)" (*Archives Internationales d'Histoire des Sciences* 46 (1996), 261-308). Only one comment: Chabás & Goldstein refer to Millás' paper (1946) on a Latin text attributed to Abraham ben ᶜEzra (ca. 1089-1167) and they state that this text has not yet been adequately studied (p. 17). I agree with them entirely and I believe that the known evidence points to a set of ephemerides and not to a perpetual almanach of the kind of those computed by Azarquiel and Zacut: a similar case would probably be that of the *Almanac* prepared by Pere Gilbert and Dalmau ses Planes for King Peter the Ceremonious which was probably a set of ephemerides for years 1361-1433.

The almanac tradition is followed by an extremely important study of astronomical tables available in Salamanca in Zacut's time which, thus, form the background of his tabular works. We will see that Chabás and Goldstein have established clearly that the main source used by Zacut for his *Ḥibbur*, which obviously reappears in his *Almanach Perpetuum*, are the *Alfonsine Tables*. This important conclusion is followed by another equally interesting one: the *Alfonsine Tables*, not used in Spain, were reintroduced in Salamanca ca. 1460 from Cracow by a Polish astronomer, Nicholaus Polonius, who held the chair of Astronomy in Salamanca and wrote canons for the *Tabulae Resolutae* which show the influence of the canons of John of Saxony (p. 20). Information is also given about five Hebrew versions of the *Alfonsine Tables*, one of which seems to have been computed for Salamanca (pp. 21-23). This is followed by a thorough analysis (pp. 23-47) of two sets of tables related to that city and extant in MS Madrid BN 3385: 1) the *Tabule verificate* for the computation of solar and lunar positions, conjunctions and oppositions, eclipses etc., for Salamanca, ca. 1461, which incorporate Alfonsine materials (compiled probably by Polonius or Juan de Salaya); and 2) a second set of tables for the two luminaries, in Castilian, also

computed for Salamanca using January 1, 1461 as epoch: these tables are related to the *Tabulae Resolutae* adapted for Salamanca by Polonius and to the *Tabule Verificate*. Note that the *Tabule Verificate* and these tables in Castilian, as well as the *Ḥibbur* and the *Almanach Perpetuum* include a table for lunar eclipses which derives from Jacob ben David Bonjorn (fl. 1361). Only one remark here: to the instances mentioned by the authors of unusual tables which compute the parallax in longitude in units of time (pp. 31-32), one should add the Hyderabad version of the *zīj* of Ibn Isḥāq which I suspect was known to Alfonsine astronomers (see A. Mestres in *From Baghdad to Barcelona*, Barcelona, 1996, I, 423). This part ends with a reference to other sets of tables related to Salamanca and to the year 1461 extant in MSS Toledo Cathedral 98-27 and Oxford Can. Misc. 27 (pp. 47-49).

Chapters 3 and 4 deal respectively with the *Ḥibbur* (pp. 53-89) and the *Almanach Perpetuum* (pp. 90-160) and, for both sources, the authors produce an analysis in depth of the numerical tables. The *Ḥibbur* is extant in Hebrew, in the Castilian translation by Juan de Salaya (with Zacut's collaboration) and in an anonymous Latin translation in the preparation of which Zacut might have also participated. It is clear that the *Ḥibbur* is the result of Zacut's own work and that it was intended for a Jewish audience: thus, although the almanach technique requires the use of a solar calendar, the *Ḥibbur* includes tables for finding the day of the Christian month corresponding to the beginning of the Jewish month (p. 58) as well as several other tables (for example for lunar conjunctions) which use the Jewish calendar (pp. 76-81, 84). Zacut uses the *Alfonsine Tables* but also other sources: the *Ḥibbur* reproduces two different tables for the computation of lunar eclipses at mean distance according to Jacob ben David Bonjorn and according to R. Judah ben Asher (pp. 62-63). In one instance, Zacut departs clearly from the Alfonsine tradition when he gives a mean motion to the apogees of all planets based on a displacement of 1° in about 290 years which derives from Ibn al-Kammād.

The *Almanach Perpetuum* is an entirely different case: although most of the tables are the same as those in the *Ḥibbur* and, thus, have a clear Zacutian descent, Chabás & Goldstein have proved that the canons of the *Almanach* (extant both in Latin and in Castilian) have nothing to do with those of the *Ḥibbur* and that there is no evidence that they were translated from Hebrew. They seem to be the work of Josef Vizinus, with apparently no participation of Zacut: according to the colophon, Vizinus finished the canons on February 25th 1496 and the book was printed in Leiria in that same year. The *Almanach* is clearly intended for a Christian audience: there is no reference to the Jewish calendar and the work includes a table of movable feast days and another for half the length of daylight, both copied from Regiomontanus' *Kalendarium* (pp. 154-156). As in the *Ḥibbur*, most of the tables derive from the Alfonsine ones. This applies even to the daily lunar positions (pp. 110-113) which depend on the cycle of 13325 days (precisely 13324 days and 23;34,11 hours), which is equivalent to 383.5 synodic months and contains, therefore, 767 consecutive syzygies. This period was previously known to Ibn ʿAzzūz al-Qusanṭīnī (ca. 741/1340-41) and used by Jacob b. David Bonjorn, who is, no doubt, Zacut's actual source. One wonders why Zacut did not use Bonjorn's tables which are the basis for his computation of the table of syzygies (pp. 113-115)

(although the *Almanach* also contains a crude approximation for the equation of syzygies attributed to Alfonso X for reasons not clear to the authors, cf. pp. 128-130), as well as for Zacut's table of parallax and for his table of solar and lunar eclipses (pp. 125-128). Other sources are the *Tabule Verificate* for Salamanca (table for the equation of time, pp. 108-109), Judah ben Asher (double argument table for the velocity of Mercury, the only planetary velocity table appearing in the *Almanach*, p. 145) or the *Almagest* itself (double argument tables for the latitude of planets, although the extremal values for Mars, Venus and Mercury have been corrected and only in the case of the maximum southern latitude of Mars the correction seems to derive from the *Alfonsine Tables*, see pp. 137-143).

In a few instances we can see a survival of the Andalusī astronomical tradition. Such is the case of the table of solar declination with a maximum of 23;33° (pp. 104-106). Chabás & Goldstein remark that this value of the obliquity of the ecliptic is commonly associated with the *Mumtaḥan Zīj* although Zacut mentions it in the *Ḥibbur*, where he says that it follows "the opinion of Azarquiel". This is a common remark in Andalusī sources to which I had not given much credit until the publication of a recent paper by G. Saliba ("Critiques of Ptolemaic Astronomy in Islamic Spain", *Al-Qanṭara* 20 (1999), 3-25): it contains new information from an anonymous source contemporary of Azarquiel which gives a few significant details about the Toledan astronomer's observations, one of which is the fact that he determined a value of the obliquity of 23;33,8°. Another probable source is Ibn al-Kammād whose tables for the duration of pregnancy in *al-Kawr ʿalā 'l-dawr* are very similar to the tables of the *animodar* in the *Almanach* (pp. 150-153) and whose star table, like those extant in the *Ḥibbur* and in the *Almanach*, uses the Ptolemaic longitudes with the addition of a precessional constant of 6;38°. Chabás & Goldstein also establish (pp. 130-131) that the *Almanach* contains two tables for the computation of lunar latitude: one of them reaches the Ptolemaic maximum of 5°, while the second (used only for eclipses) has a maximum of 4;29°, very near to the 4;30° of al-Khwārizmī, Yaḥyā b. Abī Manṣūr and Levi ben Gerson (a third unknown parameter of 4;45° appears in the *Ḥibbur*, see pp. 122-124). It is, however, interesting to remark, as Chabás & Goldstein do, that the *Muqtabas* of Ibn al-Kammād and the *Tables of Barcelona* (which are strongly influenced by the previous source) use both values (5° and 4;30°) of the maximum lunar latitude.

The Andalusī astronomical tradition (the same can be said of the Maghribī tradition until the fourteenth century) computes sidereal longitudes from which tropical longitudes can be obtained using trepidation tables. In my opinion one of the great merits of the present book is that Chabás & Goldstein have clearly established Zacut's Alfonsine descent. This implies that the astronomer from Salamanca is the last Iberian medieval link of a second astronomical tradition which follows Ptolemy, al-Battānī and the *aṣḥāb al-Mumtaḥan* in computing directly tropical positions and using uniform precession. I have the strong suspicion that this tradition is basically Jewish, as it is followed by Maimonides and Abraham bar Ḥiyya (whose main astronomical source was al-Battānī), Abraham ben ʿEzra (although he translated Ibn al-Muthannā's commentary on al-Khwārizmī, he used al-Ṣūfī when he computed his *Tabulae Pisanae*), the authors of the

Alfonsine Tables (Yehudah ben Mosheh and Ishaq ben Sid), Jacob ben David Bonjorn and, obviously, Zacut. The only exception would be the *Tables of Barcelona*, computed by Jacob Corsuno and strongly influenced by Ibn al-Kammād, although Chabás' analysis of the mean motions of the Sun and the planets in these tables (see his paper in *From Baghdad to Barcelona* I, 477-525) makes me think that this exception is a mere illusion. I am looking forward to the future research of Chabás and Goldstein on the Medieval Jewish astronomical tradition in order to see whether it confirms or rejects my hypothesis. At this point I can only thank them for this excellent book.

J. Samsó

Luis García Ballester, *Medicine in a Multicultural Society*. Variorum Reprints, Aldershot-Burlington USA Singapore-Sydney, 2000.

Sadly and unexpectedly, this book is posthumous. Luis García Ballester's *Medicine in a Multicultural Society*, together with another volume also published by Variorum, *Galen and Galenism: Theory and Practice* and his most recent work *La búsqueda de la salud. Sanadores y enfermos en la Corona de Castilla* (Barcelona, 2001), have set the seal on a long and fruitful career devoted to the History of Medicine which only a scholar of the first rank could have accomplished. García Ballester (València, 1936 - Puente Arce, 2000) taught and researched the area at the universities of Murcia, Valencia, Granada and Santander and at the Institució Milà i Fontanals of the CSIC, the Spanish Council for Scientific Research, in Barcelona. He researched widely in many fields, from Galen to Renaissance medicine and beyond, and was an acknowledged master in the two hemispheres of research in the History of Science: the edition and study of texts, and the investigation of the social context of scientific practice and its protagonists.

One of the most important projects that García Ballester undertook involved the cooperation of many other scholars: the edition of Arnau de Vilanova's complete works in the collection *Arnaldi de Villanova Opera Medica Omnia* (AVOMO). The project was launched in 1975, thanks to the efforts of García Ballester, Michael McVaugh and Juan Antonio Paniagua, who persuaded many other scholars to take part. The nine books of the collection that have appeared so far provide meticulous studies of the treatises, and represent roughly half of the entire project. When the collection is completed it will honour the memory not only of Arnau de Vilanova but of García Ballester as well.

As regards the study of the social context, we should stress the fact that García Ballester, perhaps like no other Spanish historian of medicine before him, spent an enormous amount of time working with the documents in historical archives. His dedication opened up new perspectives on social history in areas that no one had explored before. His conclusions were published in many innovative articles and books, some of which are compiled in the volume under review. It is no exaggeration to say that the studies on regions such as Valencia and Castile and on religious minorities conducted by García Ballester and his colleagues and pupils have laid the foundations for our understanding of

medical practice in medieval and modern Spain.

García Ballester's research in Muslim and Jewish minorities in Spain is the cornerstone of his scholarly legacy (see, for instance, *Historia social de la medicina en las España de los siglos XIII al XVI, vol.1, la minoría musulmana y morisca*, Madrid, 1976). His studies address the problem of the frontiers of Arabic-Islamic science. This fascinating collection *Medicine in a Multicultural Society* is essential reading for those interested in the medieval medicine in the Iberian Peninsula, and the work pays fitting tribute to a lifetime of research. The nine papers compiled shed light on the process by which the Arabic corpus gradually becomes appropriated by others, and also describes the fate of its ancient practitioners in an increasingly hostile milieu. The first part includes three articles on medicine in Hispanic Christian regions, two of which deal mainly with the classical question of the diffusion of Arabic scientific texts and their translations. In "Medical Science in Thirteenth-Century Castile: Problems and Prospects" the subject is treated as the touchstone of a wider problem. The author provides a careful overview of the problems of Castilian medicine in the thirteenth century, of which the following issues are particularly interesting. The first is the lack of interest of scholastic science and the universities in the growth of medicine; scholars appear almost to forget the medical treatises translated in Toledo during the previous century, and references to medicine in the Alfonsine translations, for example, are conspicuous by their absence. Second, the Muslims, now *mudéjares*, as well as the Jews, continued to practice medicine, drawing on the Arabic sources which remained in use in these circles for years to come. Third, there was no real contact between Christian and Arabic medicine, except in the case of the recently conquered kingdom of Murcia where scientific and medical texts were translated. These developments posed a question to the historian of Arabic science: were medieval translations, in addition to being an intellectual phenomenon, also a sort of spiritual conquest of the territories lost on the battlefield? "Nature and Science in Thirteenth-Century Castile. The Origins of a Tradition: The Franciscan and Dominican *Studia* at Santiago de Compostela (1222-1230)" is a novelty in the study of Hispanic medieval science. Following the path of eminent specialists such as Haskins or Beaujouan, García Ballester literally recreates a little known learned circle in Santiago on the strength of a single document that records the books borrowed by certain friars from the Archbishop's library over a few short years. In contrast, the next article, "Medical Licensing and Learning in Fourteenth-Century Valencia", written together with M.R. McVaugh and A. Rubio Vela draws on a wealth of documentary sources. This is a major study that bears witness to the painstaking work of the author and his colleagues in the archives. The article focuses on the transmission of medical knowledge and, above all, on the professional practice of the discipline at a time when medicine was becoming subject to legislation passed by the king or the parliaments. The authors study licensing procedures in Valencia, where after 1329 the regulations on the matter were very strict: in order to practise, a physician had to hold a bachelor's degree from a University and had to pass an

examination set by the Valencian medical authorities. In theory this meant that the Jewish and Muslim minorities, excluded from the universities, were prevented from practising medicine. The same was true of women. However, some medical licenses were granted without the authorization of the city, and a certain amount of medical practice by those who did not have formal licenses was tolerated. The authors show convincingly that the problem involved far more than mere legal provisions; they construct an accurate framework of medical licensing in the Crown of Aragon in which the documentary information from one of its cities, Valencia, though relatively scarce, is highly illustrative. The second section of the book focuses on Jewish medicine: "Jewish Appreciation of Scholastic Medicine" (together with L. Ferré and E. Feliu), "Changes in the *Regimina Sanitatis*. the Role of Jewish Physicians" and "Dietetic and Pharmacological Therapy: a Dilemma among Fourteenth-Century Practitioners in the Montpellier Area". From a range of perspectives, all three studies address the question of the retreat of Arabic written science due to the progress of scholastic medicine and the gradual loss of the Arabic language among Jewish communities. The first article concentrates on the areas of Catalan and Provençal culture in which Christian medicine is particularly rich, and describes the experience of Jewish physicians who saw the need to translate Latin medical treatises. The other two articles in this section also deal with Jewish medicine influenced by Latin texts, focusing on the particular case of the genre of medical literature known as *regimen sanitatis,* and the Hebrew translation of one of the most famous treatises, Arnau de Vilanova's *Regimen Sanitatis*. These books give dietary advice, and were originally written for a single person or for a group. The genre spread in the fourteenth century because at that time health became a public concern which began to interest wider segments of population. The Hebrew translations of Arnau de Vilanova and the personal comments of the translators contributed to this process. Arnau de Vilanova's *Regimen Sanitatis ad Regem Aragonum*, edited by García Ballester and McVaugh and published in AVOMO, vol X.1., Barcelona, 1996, with a long prologue written by P. Gil-Sotres assisted by García Ballester and Paniagua, presents a thorough study of the *regimina* genre. The third section of the book addresses in more detail one of the subjects dealt with in the previous section, the ebbing of Arabic medicine at both theoretical and practical levels. In "A Marginal learned Medical World: Jewish, Muslim and Christian Medical Practitioners and the Use of Arabic Medical Sources in Late Medieval Islam", the author offers the most important survey published to date of this subject in the late Middle Ages, summarising most of his own bibliography, which we warmly recommend (for example, an article that is not reproduced in this volume but is particularly interesting, "Los médicos judíos del siglo XIV y el galenismo árabe: *Kitāb al-Ṭibb al-Qashṭālī al-malūki*", *Asclepio*, 42, 1990, 119-147, written together with C. Vázquez de Benito), as well as other major contributions in the bibliography on Hispanic Islam and related subjects. Even though the article is not long, the subject has been studied at almost every possible level of analysis: social history, the history of the dissemination of knowledge and

analysis of sources (see the summary given here of the *Kitāb al-Ṭibb al-Qashṭalī al-malūkī* mentioned above, the last medical treatise written in Arabic in the Iberian Peninsula, by a Castilian Jew named Ibn al-Waqqār). The last two articles leave the Medieval period behind them and enter Modern history, following the path of Arabic medicine. We know that medicine was still taught in Arabic in the Zaragoza *madrasa* as late as 1494, but the discipline was soon to die out. There were three main reasons for its extinction: Muslim minorities lost their learned scholars, most of whom emigrated to Muslim countries; the Arabic language lost pride of place as Peninsular Romance languages and Latin took hold; and Muslims could no longer acquire scholastic knowledge since even those who converted – "Moriscos" – were denied access to universities. "Academicism versus Empiricism in Practical Medicine in Sixteenth Century Spain with Regard to Morisco Practitioners" is a vivid description of the world of Morisco healers which draws on direct testimony from Inquisition archives, aiming to ascertain the process by which a medical-scientific tradition evolved into empirical or even folkloric knowledge as contact with the sources was gradually lost. But it was also a period in which attitudes towards practical techniques (for example, surgery in medicine) changed decisively for the better. Against this background, created to all intents and purposes by the Inquisition, we see how these Morisco healers, surgeons, or doctors, most of them the heirs of a family tradition, confronted the new situation. Some were allowed to practise; others were persecuted. Most of them were quacks who healed Christian and Muslim alike by means of empirical and even magical procedures – which inevitably brought them into conflict with the Inquisition. Others managed to pursue a career (even in scholarly circles in some cases) based on the Latin and Spanish texts, though in fact one Morisco doctor still possessed an Arabic treatise as late as the beginning of the seventeenth century. Thanks to their skills, some of them, particularly surgeons, reached the highest echelons of society. The article is excellent, though perhaps in the discussion of the more folkloric aspects of Morisco medicine reference could have been made to the valuable works published on the subject in recent years (see, for example, the texts edited by A. Labarta in *Libro de los dichos maravillosos*, Madrid, 1993, and the bibliography given here). The last article "The Inquisition and Minority Medical Practitioners in Counter-Reform Spain, Judaizing and Morisco Practitioners, 1560-1610) explains how the Inquisition, always eager to act against heresy, kept a careful watch over the originally Jewish (or "conversos") and Muslim (or "Moriscos") minorities. However, whereas the Jews became fully integrated into the dominant culture, the Moriscos retained many of the customs of the Muslim faith. The Inquisition destroyed the remains of Islamic culture until finally Philip III decreed that the Moriscos be expelled. The most interesting feature of this article is its use of the Inquisition's archives, from which it reconstructs the proceedings against a *converso* Doctor (Felipe de Nájera) and against a Morisco healer, Jerónimo Jover.

Miquel Forcada

Mònica Rius, *La alquibla en al-Andalus*

y al-Magrib al-Aqṣà. Barcelona: Institut "Millás Vallicrosa" d'Història de la Ciència Àrab, 2000. 357 + 61 pp.

Many mosques built in al-Andalus and the Maghreb in the classical period of Islamic history were not accurately orientated towards Mecca. Their "deviated" *qibla* is traditionally one orientated towards the South, and this peculiarity was accepted without much discussion as to its significance for the history of the region. The book published by M. Rius (originally, her doctoral dissertation) is the first comprehensive analysis of this subject, in which science and religion interact in unique way.

The Quranic injunction (II, 145) to pray with one's face towards the Ka'āba required that those responsible for determining the *qibla* should receive scientific training. Astronomy, however, was unable to solve many of the problems related to the orientation of mosques, and *'ulamā'* and *fuqahā'* played a crucial role in the discussions over the *qibla*. M. Rius has located 20 authors, from the twelfth century to the eighteenth, who either composed a treatise on this subject or devoted to it a part of a larger work. They are Abū 'Alī al-Mittījī (12th c.), Abū Ḥāmid al-Gharnāṭī (d. 565/1169), Ibn Rushd al-Jadd (d. 520/1126), Ibn Rushd (Averroes) (d. 595/1198), Abū 'Alī al-Ḥasan al-Umawī al-Qurṭubī (m. 602/1205), Abū Isḥāq Ibn al-Ajdābī (13th c.), Abū 'Alī al-Maṣmūdī (14th c.), Ibn al-Bannā' (d. 721/1321), Ibn Juzayy (d. 741/1340), al-Wansharīsī (d. 914/1509), al-Ruhāwī al-Ḥanafī (d. after 942/1535), al-Tājūrī (d. 990/1580), al-Mirghīthī (d. 1089/1679), 'Abd al-Raḥmān al-Fāsī (d. 1096/1685), Muḥammad al-Fāsī (d. 1134/1722), al-Asfī (18th c.), al-Zarhūnī and three anonymous texts. As M. Rius notes, the great majority of these authors are from the Maghreb. Unlike Maghribians, Andalusis did not write specific treatises on the *qibla*, but rather theoretical considerations included in works of a more general character, like the *Bidāya* of Averroes or the *Qawānīn* by Ibn Juzayy. The interest of Maghribian authors in the *qibla* is well attested to by the wealth of literature uncovered by Rius in the Moroccan libraries, in sharp contrast to the dearth of Andalusi treatises.

Rius edits and translates the work of one of these Maghribian authors, *Kitāb al-qibla* by al-Maṣmūdī, which is the documentary basis of her study. The second chapter of the book under review is devoted to "Abū 'Alī Ṣāliḥ al-Maṣmūdī"; another important work by this author has been preserved, namely, the *Kitāb al-Ansāb* (recently edited by M. Ya'la, Madrid, 1996). As Rius shows, the *K. al-qibla* is not only of interest for the study of religion and science in the Maghreb, but also for the general historian, as it contains valuable information on Christians in North Africa, 'Uqba's expeditions of conquest, and the Islamization of the region.

Following the contents of the *K. al-qibla*, in the two following chapters Rius examines the theoretical foundations of the *qibla* and the archaeological evidence. The study of religious and juridical literature underlines the different attitudes of Muslim scholars towards the problem of properly locating the direction of prayer. Two tendencies appear: the first is ready to accept that the *qibla* is more a general direction than a precise point, while the second claims the necessity of practising the *ijtihād* in order to correct the mistaken

orientations of the past. The first tendency shows that *'ulamā'* could accommodate norms to reality, and also that they tried to avoid fractures in their community, as might easily have happened if they had insisted in destroying a well-established but incorrectly oriented mosque. Archaeological evidence seems to corroborate the prevalence of this tendency. According to Rius' findings, mosques in the Islamic West show a great variety of orientations, classified in five directions for Andalusi mosques and four for Maghribi mosques. Political factors played an important role in the orientation of mosques, and it is not surprise that, in al-Andalus, the "Cordoban" model was the most popular.

In chapters 5 and 6, al-Maṣmūdī's interest in particular mosques in the Muslim world takes the reader to Medina, Jerusalem, Fusṭāṭ, al-Qayrawān and Marrakesh, all considered as paradigms for the building of other mosques. Al-Maṣmūdī's treatise refers also to less well-known but perhaps more interesting mosques, located in the Sūs. His account is complemented by information from later authors allowing the recreation of an important part in the history of mosque-building in al-Maghrib al-Aqṣà. The two final chapters of the study deal with two other aspects in al-Maṣmūdī's treatise: geography and astronomy. Geographical information is closely related to the determination of the *qibla* (and al-Maṣmūdī's sources cover a selection of geographical authors, such as Abū 'Ubayd al-Bakrī or al-Fāzārī), but astronomy is obviously the privileged field in this respect. For the non-specialist, Rius' exposé of the technicalities involved in the determination of the *qibla* is clear and well developed, and the same is true of the pages devoted to popular astronomy.

This is a well researched and well written book. Both the historian of sciences and the historian of religions will find it instructive and useful. Through her ability to combine these two different approaches, the author shows the value of overcoming frontiers separating different fields of research, which in this case did not exist in the context under study.

Manuela Marín

E.S. Kennedy, P. Kunitzsch and R.P. Lorch, *The Melon-Shaped Astrolabe in Arabic Astronomy. Texts edited with translation and commentary.* Franz Steiner Verlag, Stuttgart, 1999. VI + 235 pp.

Three of the fields in which Islamic astronomy was most prolific were spherical astronomy, the compilation of tables, and the construction of astronomical instruments, especially astrolabes.

The construction and use of the astrolabe and its variants has been the subject of much of the literature research carried out by historians of Arabic Science over the past hundred years. The Arabic astronomers and astrolabe makers produced a great deal of instruments and treatises on their construction and use. But most of these materials were related to the so-called standard model, the planispheric astrolabe.

The present volume, however, is devoted to a very special kind of astrolabe which the authors of the study call "melon-shaped", after the Arabic term used to designate it: *mubaṭṭakh*, which, in turn, derives from *biṭṭīkh*, meaning water-melon, as al-Bīrūnī for instance explains in his *Tafhīm*. There, it is said that the name is due to the shape of certain circles on this

kind of astrolabe (the almucantars and the ecliptic among them) according to several Arabic sources. In some other sources the term *mubaṭṭaḥ* also occurs referring to the whole sphere or to the whole process of flattening.

The construction of this kind of astrolabe goes back to the beginnings of Arabic astronomy, namely to al-Fazārī. Among those who wrote against this mapping in the early history of Arabic astronomy were al-Fargānī, who attributed the invention of this instrument to al-Kindī, and Muḥammad ibn Mūsā ibn Shākir.

The melon-shaped astrolabe is the result of adopting for it the mapping now called azimuthal equidistant. The advantages over the stereographic type, according to the introduction of the present study, are that the entire sphere, except for the south pole, maps within a finite circle. But circles on the sphere map into transcendental curves instead of circles, and so are difficult to draw. This is, maybe, the reason why no example of melon astrolabe has survived.

The main part of the present publication is devoted to the edition, English translation and commentary of Ḥabash's treatise on the construction of the melon-shaped astrolabe as found in one manuscript, Paris, BN ar. 2457, ff. 141r-149v (the reference in page 12 to ms. 2157 is, no doubt, a misprint).

Ḥabash's objective in this treatise is to produce a set of numerical tables that make it possible to plot on a plate both families of curves for the horizon co-ordinate net for the latitude of Samarra. To do this he first explains how to solve some related problems of spherical astronomy. The editors have divided the text in seven problems. To work out each of these problems the author first gives an elaborate diagram, then he deduces a trigonometric rule and, in some cases, gives a numerical example. In these examples the latitude given is 34°, which is the value ascribed by Ḥabash to Samarra. Some of the diagrams given in Ḥabash's text correspond to what has been described as geometric trigonometry. The topics dealt with in these problems are how to find the day arc of a star of a given declination for a given latitude, the day arc of a star from rising until a fixed moment, and other concepts such as the equation of daylight, or half the equation of daylight, and the equatorial azimuth, the meaning of which is clearly explained in the introduction of the study.

After these problems, the treatise describes how to construct the rete of the instrument, and how to map the ecliptic and certain fixed stars on it with two examples: α Carinae (Suhayl, Canopus) and β Cassiopeiae, as well as the mapping of the plate with the horizon co-ordinate net.

Finally, the text gives three numerical tables: the first one aims to map the altitude circles on the horizon plate for the latitude of Samarra for different values of declination and equatorial azimuth. The second table is for mapping the circles of azimuth. The last table contains the coordinates of nine southern stars: its mediation and declination. These tables make it possible to construct the different elements of the instrument.

So in this treatise we find a representation of the three fields in which astronomical activity developed in Arabic astronomy, as mentioned at the beginning.

The explanations given by the authors of the study in the introduction are clear and self-contained for readers who are not well acquainted with the topic.

As for the translation of the star table, the column corresponding to its transit may be somewhat confusing. A footnote informs us that the number in this column is the one assigned to the zodiacal signs. But there are two exceptions, since the two last stars whose transit corresponds to Taurus and Aquarius respectively are shown with letters instead of numbers.

The commentaries to the text are illustrated by the reconstruction of the figures found in the manuscript and supplementary figures of the celestial sphere showing the significant arcs involved in the questions (in these figures I think I identify Kennedy's characteristic style of drawing) which help to understand the topics described. The tables at the end of Ḥabash's text are recomputed by the authors of the study; for instance, the first one shows differences that in most cases do not reach 2 minutes of arc.

This study is completed with three appendices. One of them includes three texts which are considered relevant to the trigonometric procedures described by Ḥabash because they contain descriptions of similar procedures by other astronomers. These texts are al-Māhānī's treatise giving graphical solutions for five spherical astronomical problems without proofs and without application to an instrument. Ḥabash applied most of them to the construction of the melon astrolabe. The second is an anonymous text in ms. 2457 ff. 150r-v in which we find two procedures for finding the azimuth and the arc of daylight also found in al-Māhānī's text. The third one is a text by Abū Naṣr ibn ʿIraq on azimuths in the astrolabe.

The second appendix includes nine texts relevant to the history of this instrument, written by al-Fargānī, al-Sijzī, Ibn al-Nadīm, al-Bīrūnī (four of them), Ibn al-Ṣalāḥ and Ḥājjī Khalīfa. The scope of these texts is enormous because they include almost all that is said in Arabic literature on this kind of astrolabe. In these two appendices we find the edition and translation of these texts and also commentaries of most of them.

The third appendix is a commentary of a passage in Ḥabash's *zīj* on transformation of coordinates: from the sun's horizon coordinates, the text calculates the solar equatorial coordinates and the solar longitude. The example is worked out for Samarra (local latitude taken as 34;12º). The study is completed by a final list of technical terms in Ḥabash's text ordered by Arabic roots.

In the preface the authors ask the reader to forgive any inconsistencies possibly remaining due to the fact that this book has three different authors. I think that they have succeeded not only in harmonizing the style but also in making the characteristics of the melon astrolabe more understandable to the reader, and, therefore, that the final result is a highly commendable piece of work.

Emilia Calvo

Menso Folkerts and Richard Lorch (eds.), *Sic Itur ad Astra. Studien zur Geschichte der Mathematik und Naturwissenschaften. Festschrift für den Arabisten Paul Kunitzsch zum 70. Geburtstag.* Harrassowitz Verlag, Wiesbaden, 2000. XII + 598 pp.

This book is a well deserved tribute to Paul Kunitzsch to mark his seventieth birthday and its title (Virgil's *Aeneid*, IX, 641) could not be more appropriate, given

Kunitzsch's long, deep and fruitful interest in stars. The tribute starts with a short biography, followed by a complete list of publications. Kunitzsch's interests cover a wide range of subjects, and this variety is reflected in the 29 papers presented here.

Reflecting one of Paul Kunitzsch's interests, eleven articles describe the transmission of Greek scientific writings into Arabic and of Arabic writings into Latin and Romance languages, above all the transmission of numerical forms. Charles Burnett ["Latin Alphanumerical Notation, and Annotation in Italian, in the Twelfth Century: MS London, British Library, Harley 5402", 76-90] presents the use of Latin letters in their alphabetical order as numerals -following a Greek, Arabic and Hebrew tradition- in a group of works by a certain Stephen of Pisa and an ᶜAbd al-Masīḥ of Winchester. Some of these works were copied at the very beginning of the 12th century in Antioch. The paper points to the interest of one of these texts, a planetary table in MS British Library Harley 5402, for scholars of Italian philology, due to the fact that it contains a set of annotations written in a mixture of Latin and Italian. These annotations probably are one of the few examples extant of the language used by Jewish or Arabic scholars in Tuscany as a translation intermediate stage. Richard Lemay's paper ["Nouveautés fugaces dans des textes mathématiques du XIIe siècle. Un essai d'abjad latin avorté", 376-392] aims to show the adoption of the Arabic numerals and the Latin *abjad* representation of numbers in the *Astronomia*, a hitherto unknown work, by Hermann of Carinthia (MS Cambrai Bibliothèque Municipale 930). In Hermann's Latin *abjad* only 21 letters have values, due to the elimination of some letters whose similarities might have lead to confusion. When Hermann needs higher values he uses Indian-Arabic numerals, in the oriental form. The combined system did not prosper, maybe due to the fact that the similarity of some letters and numerals is the source of a variety of errors pointed out by the author. Lemay also offers a digression on the attribution of the *Liber Judicum* (MS Arundel 268) to Hermann, against C.S.F Burnett's attribution to Hugh of Sanctalla. Menso Folkerts's paper ["Frühe westliche Benennungen der indisch-arabischen Ziffern und ihr Vorkommen", 216-233] deals with the early western names of the first nine Indo-Arabic numerals and their origins. The author edits and comments on an anonymous ten hexameter verse from the 11th century and lists 13 manuscripts in which the verse can be found. Other short references are found in several lists of the nine names (6 manuscripts are detailed). Edgar Reich ["Ein Brief des Severus Sēḇōkt", 478-489] edits and translates a text by Severus Sēḇōkt, which gives evidence of the origins of Indian numerals in the Middle East. Danielle Jacquart ["De l'arabe au moyen français, en passant par le latin: *Le livre de Albubeth*", 285-303] presents two late 15th century translations into French of the *Kitāb al-Manṣūrī*, the medical compendium by al-Rāzī, derived from the Latin version of Gerard of Cremona, both incomplete but complementary. D. Jacquart adds a third translation, originated in 15th century southern France, kept in two manuscripts containing medical and astrological works in French or in Langue d'Oc. This translation contains only book II, which seems to have circulated in Latin independently of the rest of the treatise. The surgeon-barbers of

15th century France should be considered amongst the possible intended readership of these translations. Raymond Mercier's paper ["From *Tantra* to *Zīj*", 451-460] offers a philological digression on the origin and meaning of the Arabic term *zīj*. According to Mercier, the term would be the Persian equivalent of the Sanskrit *tantra*, with the double sense of something woven and something written. W. Hübner's paper [" Ἰχθῦς - *PISCIS*. Der singularische Gebrauch des Namens der zodiakalen Fische im Griechischen und Lateinischen", 266-284] deals with the chronological development of the use of the name corresponding to the zodiacal sign of Piscis in singular in Greek and Latin. In contrast to Arabic and other western traditions in which it always appears in the singular, in Latin and Greek the use of singular, dual and plural fluctuates. Hübner examines a wealth of textual material, from the astronomical, astrological, mythological, linguistic and chronological point of view, and from Ptolemy to the early Middle Age authors of France and the Iberian Peninsula. The author deduces that the use of the name in singular does not originate in the Arabic tradition but in the changing Greek mythology and specifically in the ambivalence of the Greek form Ἰχθῦς. Manfred Ullmann ["Die Milchstrasse in der Bildersprache der arabischen Dichter", 555-571] collects up to 109 textual metaphorical images related to the Milky Way, from the Arabs to the Middle Ages. The metaphors are grouped under images, with the corresponding transcription, author, and source. The collection, followed by an index of names and a list of the manuscripts used, is a real gold mine for readers interested in a variety of subjects. H.L.L. Busard ["Über zwei Algorismus-Schriften aus dem 13 Jahrhundert", 91-137] edits and comments on two texts on algorithms written in the first half of the 13th century: the *Demonstratio Jordani* and the *Opus numerorum*. The author compares the two treatises, in particular their terminological features, and concludes, against the previous thesis, that the *Demonstratio Jordani* may be an early work of Jordanus, previous to the *Opus numerorum*. Combining philology and astronomy with great erudition as always, John North ["Chaucer, Libra and the Crucifixion", 461-473] devotes his paper to the Christian Latin Cross, its origins and a specific aspect of its rich symbolism: the use of the balance as a symbol associated with the cross, which in turns leads to the association of the crucifixion and the zodiacal sign of Libra. The author presents the materials relating Libra with crucifixion found in Geoffrey Chaucer' *Parson's Tale* (*Canterbury Tales*), which he proves to be linked with Holbein's painting *The Ambassadors*. Finally, the most purely philological paper is Federico Corriente's ["Classical and Andalusi Arabic Features Reflected in Loanwords of Medieval Latin Translations of Scientific Works", 138-146]. The paper starts with a clear distinction between technical or scientific Arabic loanwords in European languages and those terms of Arabic origin used in everyday life, transmitted through written and oral channels respectively. Corriente's linguistic comments -numbered from 1 to 5- deal with *ʾirāb*-markers, *iḍāfa*-markers, first degree-*imāla*, disjunctive vowels and inner vocalisation. The conclusion reached is that translators or their helpers did not know Classical Arabic well, although there was no lack of first rate Muslim scholars.

Another group of eleven articles is devoted to astronomy and related sciences. Most of the articles deal with star lists. Benno van Dalen ["A Non-Ptolemaic Islamic Star Table in Chinese", 147-176] edits an Islamic Star Table in Chinese (277 stars covering a belt of around 9° on either side of the ecliptic). The stars are designated according to the system of the *Almagest*, inside or outside the Ptolemaic constellations, and their positions with respect to the traditional Chinese constellations are also given. Although in the note quoted on page 149 something is wrong, it is clearly stated that the applied precession is 4'/5 Arabic years. This precession, corresponding to 1° every 75 years, is close to Ibn Abī 'l-Shukr al-Maghribī's. Furthermore, according to van Dalen, the data in the note is recorded from an erroneous Hijra epoch. The question is: could this table have something to do with the Andalusī and Maghribī star tables calculated for the moment in which precession is 0°, corresponding to some 40 or 50 years, according to the authors, before the Hijra? The author also compares the table with other Islamic star tables from China. In particular with two tables in al-Sanjufīnī's *zīj* (Tibet) and with the star table found in a Chinese translation of Kūshyār ibn Labbān's *Introduction to Astrology*, carried out by the team that translated the *Huihui li*. Van Dalen concludes that both tables derive from the same original, dated probably around 1262-3. This date fits very well with Ibn Abī 'l-Shukr and Alphonse X, whose solar declination table -in my opinion related to that of al-Sanjufīnī- could have reached Tibet through Marāgha. Most of these papers deal with astrolabe star lists. David Pingree ["A Greek list of Astrolabe Stars", 474-477] offers a Greek list of astrolabe stars found in an astrological text. According to the author, the list (19 astrolabe stars of first and second magnitude) was computed for year 908 and was drawn up in all probability in Byzantium. The list was supposed to present Ptolemaic longitudes and latitudes with a constant value, of around 7;40°, added to longitudes, corresponding to Ptolemaic precession in 770 years. However this only occurs in a few cases; the rest of the longitudes show added values from 7;20° to 15;20° (twice 7;40°). Comparing this list with those compiled by Kunitzsch (*Typen von Sternverzeichnissen in astronomischen Handschriften des zehnten bis vierzehnten Jahrhunderts*. Wiesbaden, 1966), and leaving aside small differences and the copious errors in the longitudes, the author concludes that the list is close to *Typen* I, corresponding to Maslama al-Majrīṭī's star table for the astrolabe. Another point worth mentioning is the fact that the 14 star names in this list correspond to the stars found on the rete of the only surviving Byzantine astrolabe (1062) and the spelling is almost identical. Still more interesting is the fact that the list contains the error of giving β Cas the coordinates of α And, which is present in the Greek list as well as in *Typen* I and in Maslama's commentary to *Ptolemy's Planisphaerium*. This error, which appears in several star tables made by Andalusī and Maghribī authors since the 10th century (al-Qaṭṭān, Azarquiel, Ibn al-Kammād, Ibn al-Bannā' and al-Marrākushī, amongst others) is repeated in a number of further astrolabes, such as the one constructed in Baghdad by Aḥmad ibn Kamāl or, as we will see in other papers in this volume, in some European astrolabes. Julio Samsó's paper ["Maslama al-Majrīṭī

and the Star Table in the Treatise *De mensura astrolabii*", 506-522] is related to the above topic. Samsó supports Kunitzsch's theory about the relationship between the early Catalan-Latin text on the astrolabe and the treatises of Maslama's school on this instrument and presents new evidence derived from his study of the treatise *De mensura astrolabii*. However, in this study, he interprets that *latitudo* (α), which agrees in most cases with the *mediatio coeli*, is measured on the graduation of the circle of Capricorn instead of on the ecliptic. According to the author, the star table in this treatise - classified by Kunitzsch as *Typen* III- is related to *Typen* XI and depends on a hypothetical table from Maslama's school, compiled in Cordova after year 978, the date of compilation of *Typen* I. Both tables (*De mensura* and Maslama), carefully recalculated, appear appended at the end of the paper. E. Dekker ["A Close Look at two Astrolabes and their Star Tables", 177-215] poses the problem of interpreting the stellar data found on astrolabes and, after dismissing Stautz's graphical method, presents the author's own procedure for analysing this material, through the study of the stars in two astrolabes. The star lists on which the retes of these astrolabes are based are related to Kunitzsch's *Typen* XI and VI. To compare the longitudes of the stars with Ptolemy's and then derive the precession value used and the date of composition, the author converts mediation and declination into longitude and latitude. The procedure is not as simple as it appears. To begin with, the correspondence of the pointers with the correct position of the stars is often inaccurate. Secondly, the author's use of mean data does not seem to be reliable enough; examples of the possible errors that could be derived from its use can be seen if we try to use the procedure, for instance, in the list in D. Pingree's paper. Furthermore, we have to take into account the different values for precession as well as the possibility of using trepidation tables, because any one of these possibilities will lead to different solutions. It is interesting to find a confusion between β Peg (and indirectly α And) and β Cas in the astrolabe NMM AST 0570, which supports, in part, the author's hypothesis, also mentioned by Samsó, that *Typen* XI derive from Maslama's corpus of stars. David A. King ["The Star-Names on Three 14th-Century Astrolabes from Spain, France and Italy", 307-333] stresses once again the potential of the study of the surviving astronomical instruments as a historical source, in this case from a philological point of view. King records the star names of three 14th century astrolabes from different parts of medieval Europe: Christian Spain, Northern France (Picardy) and Italy. To these astrolabes, King adds a fourth dated in Urbino, 1462, and now lost. The two following papers are also related to astrolabes. G.L'E. Turner ["A Critique of the Use of the First Point of Aries in Dating Astrolabes", 548-554]. The author questions the use of the date of the Vernal Equinox for dating Medieval and Renaissance astronomic scientific instruments, especially astrolabes, although he does not propose a new procedure. According to Turner, the possibility of error is considerable. The problem is that the date depends on the type of calendar used (i.e. civil or astronomical), the instrument makers often use out-of-date texts, the accuracy achieved by the craftsman is debatable and they do not

always choose the actual data for their instruments. The author gives examples of the inaccuracy of the procedures used. In some cases, the dates given for certain instruments differ by almost 300 years. Richard Lorch ["Ibn al-Ṣalāḥ's Treatise on Projection: a Preliminary Survey", 401-408] offers a preliminary study of Ibn al-Ṣalāḥ's treatise *Tasṭīḥ basiṭ al-kura*. The treatise is divided into chapters I and II, comprising thirteen and seven propositions respectively, and the projection used is stereographic, in contrast with the melon-shaped projection he describes in *al-Asṭurlāb al-mubaṭṭakh*. One of the most interesting points is the relationship between one of Ibn al-Ṣalāḥ's propositions and a proposition found in Maslama's commentary to Ptolemy's *Planispherium*. Different explanations are possible, but the Andalusī connection deserves further investigation. Two more papers deal with clocks. Anne Tihon ["*Un texte byzantin sur une horologe persane*", (523-535)] edits, translates and comments on a short Byzantine text on a Persian candle clock. This clock is quite primitive, compared with the ones in the rich Arabic tradition. As it has neither automats nor sophisticated mechanisms it seems to be a common instrument, of the kind usual in Byzantium during the 14th and 15th centuries. A.J. Turner ["*The Anaphoric Clock in the Light of Recent Research*" (536-547) presents an account of the situation of the Latin anaphoric clocks following Vitruvius' tradition and the relationship between this instrument and the astrolabe. The author uses Nordon's and Soubiran's descriptions of the fragments of the dials of two anaphoric clocks, discovered in the last quarter of the 19th century in Grand (Vosges) and Salzburg, which attested to the diffusion of these instruments throughout the Roman Empire during the first centuries of our era. On a different subject, George Saliba ["The Ultimate Challenge to Greek Astronomy *Ḥall mā lā yanḥall* of Shams al-Dīn al-Khafrī" (d. 1550)", 490-505] examines the three known works of the 16th century Persian astronomer al-Khafrī. As he had already studied the first two -*Takmila* and *Muntahā*-, which he calls "supercommentaries", Saliba devotes this paper to the third one, *Ḥall mā lā yanḥall* ("Resolving that which cannot be resolved"). In this short text, al-Khafrī's main aim is to show how to solve the most difficult problems of Greek astronomy simply by following his application of the five astronomical principles common to all the planets. Finally, Miquel Forcada ["The *Kitāb al-Anwā'* of ᶜArīb b. Saᶜīd and the *Calendar of Cordova*", 234-251] aims to prove that the Kātib al-Andalusī, author of an *anwā'* book, is Abū l-Ḥasan ᶜArib b. Saᶜīd al-Kātib, one of the authors of the *Calendar of Cordova*. In the paper the author presents and discusses four reasons for his conclusion: the date of composition, the coincidence of long sections of both texts, the *shuhra* of both authors and the comparison of the two texts with the *Risāla fī l-anwā'* by Ibn al-Bannā'.

The rest of the book deals with Mathematics, Magic and Natural Philosophy. Sonia Brentjes ["Aḥmad al-Karābīsī's Commentary on Euclid's *Elements*", 31-75] focuses on the *Commentary on Euclid's "Elements"* by Aḥmad al-Karābīsī. The work tries to explain the principles of geometry to beginners. Al-Karābīsī devotes his attention to the theorems that raise doubts and to the ones for which new constructions have been proposed,

although he rarely mentions his sources. The paper is divided in two sections, dealing with the materials of Greek and Arabic origin, and ends with an Appendix, showing al-Karābīsī's direct quotations from the *Elements*, grouped by books and divided into: definitions, postulates and axioms. The author compares al-Karābīsī's commentary with other Arabic materials on the *Elements*, showing that this commentary deserves to be edited and translated, not only on account of the new elements it provides but also because of the information on the didactics of teaching geometry in the 10th century. Jan P. Hogendijk ["Al-Nayrīzī 's Own Proof of Euclid's Parallel Postulate", 252-265] edits and translates the Persian Abū 'l-ᶜAbbās al-Faḍl ibn Ḥātim al-Nayrīzī's *On the Proof of the Famous Postulate of Euclid*. He compares al-Nayrīzī's proof with the proof by al-Aghānis (5th c. Greece), presented by the same al-Nayrīzī in a Commentary he wrote to Euclid's *Elements*. The two proofs, based on the concept of equidistant lines, are different, though related. The author explains the above mentioned concept, presents the main differences, which are found in the final propositions, and proves the influence of al-Nayrīzī on other Islamic authors, mainly Thābit b. Qurra. E.S. Kennedy ["The Operation of Multiplication in a Sixteenth Century Persian Treatise", 304-306] describes a set of ten rules for multiplying numbers found in an anonymous Persian treatise, entitled *Qavā'id-i ḍarb wa qismat*, which appears appended to a manuscript copy of the *Irshād al-Zirāᶜa* (Instructions in Agriculture) by Qāsim b. Yūsuf Abū Naṣr from Herat (1515). The treatise belongs to a set of four appended to the *Irshād*, which contain rules for mensuration enabling different calculations, for instance to determine the areas of various shapes. The rules, presented in prose and verse as a mnemonic device, are based on the decimal system, no numeral symbols appear and a word for zero is never stated. The anonymous author uses a single digit (1-9) multiplied by a power of 10, including four kinds of numbers (ones, tens, hundreds and thousands). A translation of a section of the treatise is added to illustrate the explanation of the rules. Magic and Natural Philosophy are represented by four papers. Stefan Kirschner ["An Anonymous Medieval Commentary on Aristotle's *Meteorology* Stating the Supralunar Location of Comets", 334-361] presents an anonymous 14th century commentary on Aristotle's *Meteorology*. The interest of this commentary lies in the fact that, against the Aristotelian general view about the sublunar nature of the comets adopted by medieval scholars, a fragment here states that comets have a supralunar nature. The paper edits and studies Questions I.18 to I.21, the only four questions, of the 32 questions of book I, dealing with comets. The edition is followed by a full list of the Questions in Books I to IV. Again on Aristotle, E.I. Kouri and A.I. Lehtinen ["Disputed Questions on Aristotle's *De iuventute et senectute, De respiratione* and *De morte et vita* by Henricus de Alemannia", 362-375)] discuss a collection of Questions on Aristotle's *De iuventute, De respiratione* and *De morte*, by Magister Henricus de Alemannia (Paris University, 13th-14th c.). The authors uses the few known sources to reconstruct the life of Magister Henricus, comments on the transmission of his Latin Commentaries on Aristotle's aforementioned works and compares the texts with other contemp-

orary commentaries. Paolo Lucentini's paper ["L'ermetismo magico nel secolo XIII", 409-450] furnishes a comprehensive analysis of the magical hermetic tradition translated during the 12th and 13th centuries from Greek and Arabic into Latin. As an appendix, there follows the edition of two texts belonging to the hermetic corpus and quoted in the *Liber Introductorius* by Michael Scoto: the *De viginti quattuor horis* and the *Liber Imaginum Lunae*. Uta Lindgren ["Dämonen als Antriebskräfte in der Geographie: Frivole Thesen im *Colloquium Heptaplomers* (um 1600)", 393-400] and gives a comparative overview from Plato to the late Middle Ages of the "Colloquium of the Seven about Secrets of the Sublime" and reinterprets it as entertainment and escapist literature. The author uses the example of the demons' motive power as an explanation of meteorological phenomena to qualify the authors of around 1600 as "frivolous", because they try to break with the old scientific tradition and seek to establish a new one, based on non-scientific explanations and interpretations.

Beyond any doubt, this is an excellent book. It is highly recommended to any reader concerned with History of Science and Humanities, in general, due to the wide range of subjects treated and the interest of so many of the aspects it addresses.

Mercè Comes