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The Coherence of the Arabic-Latin Translation Program in Toledo in the Twelfth Century*

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Argument

This article reassesses the reasons why Toledo achieved prominence as a center for Arabic-Latin translation in the second half of the twelfth century, and suggests that the two principal translators, Gerard of Cremona and Dominicus Gundissalinus, concentrated on different areas of knowledge. Moreover, Gerard appears to have followed a clear program in the works that he translated. This is revealed especially in the *Vita* and the "commemoration of his books" drawn up by his students after his death. A new edition of the *Vita*, *Commemoratio librorum* and *Eulogium*, based on all the manuscripts, concludes the article.

Toledo is justifiably famous as the principal center for the translation of Arabic scientific and philosophical texts into Latin. Several factors contributed to its preeminent position. One was the linguistic mix of its population. When Alfonso VI of Castile captured Toledo from the Arabs in 1085, the city capitulated without bloodshed and its inhabitants were allowed to stay and to keep their possessions and privileges; Alfonso declared himself "the king of the two religions." Nevertheless, we are told, most of the Islamic elite emigrated, while the common people converted to Christianity in great numbers (Rubiera Mata 1991, 75–91). The Jews in the city stayed put, though they were subject to periodic pogroms. However, the most significant element in the population was the Mozarabs, the "Arabized" Christians who had preserved the liturgy of the Visigothic church and whose numbers were augmented by the Islamic converts. The bulk of the population, therefore, spoke both Arabic and a Romance dialect, and Arabic was the language of religion and culture.

A second factor was Toledo's preeminence as a center of scientific learning even before the capitulation to Alfonso. In Islamic Spain, after the breakup of the caliphate in 1031, the kingdom of Toledo under the Banū Nūn was rivaled as a center of learning only by Saragossa under the Banū Hūd. The cadi of Toledo, Ṣāʿid al-Andalusī (1029–70), wrote a history of science (*The Categories of the Nations*), and also patronized scientific research, most notably that by az-Zarqāllūh, who compiled

* I am very grateful for the help of Danielle Jacquart, Richard Lorch, Peter Linehan, and Patricia Stirnemann.

astronomical tables and other practical works on the science of the stars (Jacquart and Micheau 1990, 135–37). The departure of the Islamic elite may have prevented this scientific tradition from developing. It is likely, however, that scientific expertise and, even more so, books, remained among Arabic scholars in Toledo. One indication of this is that the translator Gerard of Cremona at the beginning of his career (and therefore perhaps already in the late 1130s) was attracted to Toledo because he knew that he would find there Ptolemy's *Almagest* (in Arabic). Another indication is that, some time before 1140, az-Zarqāllūh's tables were rendered into Latin as *The Toledan Tables*. The drawing up of astronomical tables for a particular place was often associated with an important political event, and the coronation of Alfonso VII as Emperor in 1135 would have presented a suitable occasion for a new version of the tables.[1]

That it is not until the 1130s that we have any evidence in Toledo of an interest in translating Arabic texts into Latin is not surprising, for translations can only be made if there is an interested audience who do not know the original language of the texts. The only such audience in Toledo in the decades immediately after its conquest were the Cluniac clergy brought in by the French archbishops, Bernard of Sédirac (1086–1125) and his successor Raymond de La Sauvetat (1125–52), and their primary interest was in reforming the Church rather than in advancing scientific learning. Moreover, they were hostile to the indigenous Mozarabic parties who could have introduced them to Arabic science. Nevertheless, it is in the context of the Cathedral, as the only influential segment of Toledan society who did not understand Arabic, where one must look for the beginning of the translation movement in Toledo.

The first evidence of this is a translation of Qusṭā ibn Lūqā's *On the difference between the soul and the spirit*, by John of Seville and Limia, dedicated to Raymond de La Sauvetat. John also dedicated a translation of the regimen of health from "Aristotle's" advice to princes (*Secretum secretorum*) to a person of importance, Queen Teresa, the natural daughter of Alfonso VI and first ruler of the kingdom of Portugal. John was perhaps casting around for patronage; it would have been natural to turn to Queen Teresa because he himself seems to have originated from Portugal where he completed other translations.[2] His dedication of a text to Raymond represents an attempt to find favor in another quarter. The text was wisely chosen. It is short and easy to read, and treats of a subject that is relevant to theology; for it puts into context the prominence given to "spirits" in the new medical learning taken from Arabic texts in Italy, which posed a threat to Christian doctrines on the immortal soul.

[1] The date and authorship of the Latin version of the *Toledan tables* remains unknown. A possible use of the *Toledan tables* in Aragon in February 1106 is discussed in North 1995. However, the form in which they were known at this date is not clear. The earliest clear use of the Latin tables is by Raymond of Marseilles who adapts them to the meridian of Marseilles in 1141. Note also that the author of the *Almagestum parvum*, which appears to belong to the mid-twelfth century, speaks of the tables as "very recently composed" (see Lorch 1995, V, 410: "et super hoc arzacel tabulas motuum toleti novissime composuit").

[2] For his biography, and translations made "in Limia" (a region in Northern Portugal), see Burnett 1995a.

Whether this dedication ensured John a place among the cathedral clergy is not known. The earliest substantial use of the translation itself was made shortly afterwards by an archdeacon in the cathedral, Gundissalinus (to whom we shall return), but John's dedication remains an isolated testimony to an Arabic-Latin translation destined for Toledo (aside from the astronomical tables) in the first half of the twelfth century. Even this translation may not have been made *in* Toledo,[3] and it dates to a period in which translations were being made in other parts of Spain, and in particular in the valley of the Ebro where the remnants of the kingdom of the Banū Hūd were still in power (see Burnett 1977 and 1992, 1041–44).

The situation changes towards 1150, when Toledo becomes the principal center for translations. Various factors may account for this. First, in 1140 the last of the Banū Hūd, Jaʿfar Aḥmad III Sayf al-Dawla, whose library had been used by the translators of the valley of the Ebro, exchanged his property in Rueda Jalón (on a tributary of the Ebro) for part of the city of Toledo.[4] We know that the royal library of the Banū Hūd was particularly rich in works on mathematics, astronomy, astrology, and magic, and the texts on geometry that Gerard of Cremona chose to translate correspond to those used by one of the kings of the dynasty in the late eleventh century.[5] Secondly, the rise of the intolerant Islamic regime of the Almohads in North Africa and their spread to Islamic Spain in 1147 forced Arabic Christians (Mozarabs) and Jews to emigrate, and Toledo was the natural place for them to choose as their new home. Moreover, under archbishop John of Castellmoron (1152–66), there was much more communication between the Mozarabic community and the Frankish clergy than during the first decades after the conquest. Thirdly, the continual arrival of Frankish clergy (which included nationals from several European countries), and the development of a Frankish quarter in Toledo ensured that translations from Arabic both would receive an audience locally and could easily be conveyed abroad.

Among the exiles from the Almohads was the Jewish philosopher, Abrahām ibn Dāūd. He had fled from Córdoba, and had settled in Toledo by 1160, where he wrote works in Arabic and Hebrew on philosophy and astronomy and the history of the Jews in Spain. He is, in all likelihood, the "Avendeuch Israhelita" who wrote a letter, in poor Latin, addressed to some important person, advertising the fact that he intended to translate the *Shifāʾ*, the philosophical encyclopedia written by Avicenna (d. 1037); he added a specimen of his translation to his letter (see Birkenmajer 1970,

[3] The work was also known at an early date in Salernitan circles; see Jacquart 1988, 426.

[4] According to the Arabic historian Ibn al-ʾAbbār, he was given "half the city of Toledo"; see *Encyclopedia of Islam*, s.v. Hūd. González Palencia considers Sayf ad-Dawla (Zafadola) to be one of the very few Muslim elite who remained in Toledo: see González Palencia 1926–30, I, 151–53.

[5] The sources of the comprehensive book on geometry, *al-Istikmāl*, written by Yūsuf al-Muʾtaman ibn Hūd, king of Saragossa from 1081 to 1085, include Euclid's *Elements* and *Data*, the *De spheris* of Theodosius, Menelaus, the *Conics* of Apollonius, Archimedes' *On the Sphere and Cylinder*, Eutocius' commentary on that work, Thābit ibn Qurra's treatise on amicable numbers and Ibn al-Haythām's *Optics*; cf. Gerard's translations in "geometria," Appendix I below, nos 4, 5, 8 and 16. Gerard's version of Theodosius' *De spheris* belongs to the same family as that used by al-Muʾtaman; see Lorch 1996, 165, 172.

95–100). It is probable that the important person was Archbishop John, and that this "letter of introduction" achieved its purpose. For, the same Avendauth secured the help of the archdeacon who knew John of Seville and Limia's work, Dominicus Gundissalinus, and together they translated a complete book of the *Shifā'* – the one on the soul. Avendauth dedicated the translation to Archbishop John in the following terms:

> To John, the most reverend archbishop of Toledo and primate of Spain, Avendauth, the Israelite philosopher, gives hommage, recognizing the debt that is due to him. . . . Therefore I have attempted to put into effect your order, Lord, to translate the book of Avicenna the philosopher concerning the soul. . . . Thus you have the book, translated from Arabic, with me taking the lead and rendering each word in the vernacular language, and archdeacon Dominicus turning the words into Latin. (D'Alverny 1989, reprinted in idem 1994, article III, 195)

This dedication describes what became a common practice: that a Mozarab or Jew, who was not proficient in Latin, made an intermediate translation of a text into the vernacular language (whether the colloquial Arabic of Toledo or the local Romance dialect), which a cleric educated in the Latin schools transferred into good Latin (Villanueva 1996, 23–34). It also implies that the project of translating Avicenna's work was, if not commissioned, at least supported by the archbishop himself. Gundissalinus, who presumably came from Old Castile and may have been educated in the French schools,[6] was particularly interested in psychology and cosmology, which led him to translate further Arabic texts on these subjects, and to use these in his original works. Avendauth's name does not appear again as a collaborator, but rather that of "Iohannes Hispanus." Some scholars have made one person out of these two collaborators, but it is possible that "Iohannes Hispanus" was a Mozarab and the same as the "Iohannes Hispanus" who was dean of Toledo, who succeeded Gundissalinus as archdeacon of Cuéllar, and died in 1215.[7]

No dedication exists associated with any translation of the greatest of the Toledan translators, Gerard of Cremona (1114–87), to whom over seventy translations are ascribed, in subjects ranging from mathematics, through medicine to Aristotelian philosophy. There is, however, evidence that he was a member of the clergy of the cathedral. He attestated three documents, in 1157, 1174, and 1176, as a canon of the cathedral, and after his death in 1187 his students or colleagues (*socii*) wrote a eulogistic poem in which they called him "the glory of the clergy" (*gloria cleri*), and stated that, although he was born in Cremona, he lived and died in Toledo.[8] The later documents (of 1174 and 1176) append to Gerard's name the words "*dictus magister*"

[6] See below, p. 264.
[7] The identity of 'Iohannes Hispanus' is explored in Burnett 1994.
[8] See p. 256 and Appendix I below.

"called the Master." The implication of this sobriquet is not clear, but it is probably a term of approbation like calling Aristotle "the Philosopher" or Averroes "the Commentator"; it is certainly not an official title for a teacher in a school or college.[9]

The patronage of an archbishop and the participation of an archdeacon continued in the next generation of translators. Mark of Toledo and Michael Scot were both canons of the cathedral (as Gerard had been) at the turn of the twelfth to the thirteenth century. Michael accompanied the archbishop, Rodrigo Jimenez (1208–47) to the Fourth Lateran Council in Rome in 1215. He continued the translations of Aristotle's works begun by Gerard, and added those of commentaries by Averroes (d. 1198), Gerard's near contemporary in Córdoba. Mark's main interest was in medicine, but on the request of Mauritius, an archdeacon of Toledo, he also translated the Coran and the profession of faith of the founder of the Almohad movement, Ibn Tūmart. Michael Scot left his canonship in Toledo some time before 1229 (Hernández 1995, 68), and ended his life working for Frederick II Hohenstaufen in Sicily. But Hermann the German continued the translation of Averroes' commentaries, one of which he completed in Toledo on June 3, 1240, "in the chapel of Saint Trinity." This has recently been identified with the monastery of St. Trinity, in the Frankish quarter next to the Cathedral, which had been founded a little after 1195 specifically for rescuing Christian captives in Islamic territory. Since the Brothers were taught Arabic so that they could negotiate with Islamic authorities, it is quite likely that Hermann found linguistic help there (González Ruiz 1996. 51–64, and González Ruiz 1997, 586–602).

At least until the departure of Michael Scot for Italy, then, the translation activity was associated with the cathedral rather than with any other institution in Toledan society. Until 1180 (the date of the death of Cérébrun of Poitiers) the archbishops were French, and the cathedral chapter remained predominantly Frankish until the early thirteenth century (see Hernández 1996). Some members of the local community participated in the translations. We are told of a Mozarab called "Galippus," who helped Gerard translate Ptolemy's *Almagest*, and of a Jew "Abuteus" who helped Michael Scot translate a text on cosmology. Nevertheless, the direction of the translation enterprise remained preeminently in the hands of foreigners, and was an export commodity, rather than one for the local community, who, for the most part, could not read Latin. Gerard of Cremona himself probably kept in contact with Italian centers; one report states that his books were returned to Cremona after his death, and to three manuscripts of a translation of a work on the calendar, probably made by him, is added a horoscope cast in Cremona on 23 March 1191.[10] The earliest collection of his translations is an Italian manuscript written in the late

[9] This is also the interpretation in Ricklin 1995, 81.

[10] MSS Cambrai 168/163, fol. 103v, Vatican, Reg. Lat. 1285 and Vienna, Östereichische Nationalbibliothek, 5463 (the work is the *Liber erarum*, a short text based on Hebrew chronology): see Burnett and Yamamoto 2000, II, xxiii.

twelfth century.[11] Scholars came from several countries to Toledo to seek out texts and copy manuscripts. A "Thaddeus" came from Hungary and copied a manuscript of Gerard of Cremona's translation of the *Almagest* in 1175;[12] a Frenchman (possibly Roger de Fournival, the court astrologer of King Philippe Auguste) copied the same text, using local – i.e. Toledan – parchment.[13]

Typical, perhaps, is the itinerary of the Englishman, Daniel of Morley, who relates that, disappointed in the kind of studies that were being pursued in Paris, and hearing "that the doctrine of the Arabs, which was devoted almost entirely to the quadrivium, was all the fashion in Toledo in those days," went there and both disputed with Gerard of Cremona about the validity of astrology, and learned "the doctrine of the Arabs" from Gerard's assitant, Galippus, "*in lingua Tholetana*" (i.e., in the local Romance dialect). He probably did not stay there long, however, but rather, on his own testimony, brought books back with him to England.[14] The predominance of this "export market" for the translations explains, and is explained by, the fact that no university developed in Toledo itself. There was not sufficient local interest or clientele for a large number of students and teachers to form themselves into a corporate university body, as was happening in Paris, Bologna, and Oxford. Most of those who were interested in Arabic learning had their roots elsewhere and wished to benefit the countries or centers from which they originated. The program for translation was, to a large extent, determined by what was required in the newly burgeoning European universities, which were outside Spain.

What was this program? We get some idea of it from the report of Gerard's students (*socii*) who, after his death in 1187, drew up a list of his works, accompanied by a brief account of his life, summarised in a poem, and attached this to his last translation, the *Tegni* of Galen with the commentary of ʿAlī ibn Riḍwān. The text may be translated as follows:

> Just as a lit candle should not be put in a secret place or under a bushel, but must be raised up on a candlestick,[15] so the glowing deeds of good men should not be left unspoken of, as if buried under silence and neglect, but should be presented to the ears of the people of today (*moderni*), since they open the door of virtue to those coming afterwards, and the examples of the ancients, worthily commemorated, as it were instil an ideal image of life into the eyes of those now living. Lest, then, master Gerard of Cremona lie hidden

[11] Paris, BNF, lat. 9335; see d'Alverny 1982, 458–59, reprinted in idem 1994, article II. For the dating of the manuscript see Lorch 1995, article II, 71.

[12] MS Florence, Biblioteca Medicea Laurenziana, 89, sup. 45; see Kunitsch 1986–91, I, 16.

[13] I owe the last detail to Patricia Stirnemann; the manuscript is Paris, BNF, lat. 14738.

[14] Daniel of Morley, *Philosophia*, ed. G. Maurach, *Mittellateinisches Jahrbuch*, 14, 1979, 204–05 (at p. 212); the relevant passages are reproduced and discussed in Burnett 1995b.

[15] Luke 11, 33: "Nemo lucernam accendit et in abscondito ponit neque sub modio sed supra candelabrum." The following translation owes much to McVaugh (in Grant 1974, 35) and translates the text edited on pp. 275–6 below.

under the darkness of silence, lest he lose the favour of the renown that he has merited, lest through presumptuous theft an alien heading be affixed to the books translated by him – especially since he himself inscribed none of them with his name – all the works translated by him, as much those on dialectic as those on geometry, as much those on astronomy as those on philosophy, as much also those on medicine as those on other sciences, have been listed very carefully by his students (*socii*) at the end of this *Tegni*, translated by him last (*or* most recently) – imitating Galen in commemorating his own books at the end of the same work – so that if anyone who is an admirer of their aims is looking for one of his works, through this list he might find it more quickly and become more confident about it. For although Gerard spurned the glory of fame, although he fled fawning praises and the empty pomp of this world, although he refused to allow his name to be spread around by clutching at clouds and vanities, nevertheless the aroma of the fruit of his works, diffused through the centuries, announces and declares his goodness.

Although he flourished also with temporal goods, his mind was not elated or depressed by the abundance or absence of those goods, but in a manly way faced good and bad turns of fortune alike, and always remained in the same state of constancy. An enemy to the desires of the flesh, he adhered to spiritual values only; he laboured to benefit all present and future generations, not unmindful of those words of Ptolemy: "Do even better when you approach the end of life."[16]

Although from his very cradle he had been educated in the lap of philosophy and had arrived at the knowledge of each part of it according to the study of the Latins (*Latinorum studium*), nevertheless, because of his love for the *Almagest*, which he did not find at all amongst the Latins, he made his way to Toledo, where, seeing an abundance of books in Arabic on every subject (*facultas*) and, pitying the poverty he had experienced among the Latins concerning these subjects, out of his desire to translate, he thoroughly learnt the Arabic language, and in this way, trustworthy in each – i.e., the subject-matter (*scientia*) and the language (as Aḥmad in his letter *On Ratio and Proportion* says, "It is necessary that the interpreter, in addition to the excellence which he has acquired from the knowledge of the languages from which and into which he translates, should also have knowledge of the subject (*ars*) which he translates"),[17] in the manner of a prudent man who, walking through green meadows, weaves a crown from flowers – not from all of them, but from the more beautiful – he read through the writings of the Arabs (*scriptura Arabica*), from which he did not cease until the end of his life to transmit to Latinity, as if to a beloved heir, in as plain and intelligible way as was possible for him, books of many subjects

[16] This is one of the "sayings of Ptolemy" from the section of Abū l-Wafāʾ al-Mubashshir ibn Fātik's *Mukhtār al-ḥikam* devoted to Ptolemy; one may compare the quaint English translation by Scrope in Bühler 1941, 224: "The nerer that thou arte dethe þe more þou shuldiste travaile to do wele". The whole of the biography and a selection of the sayings of Ptolemy appears in the preface of Gerard's translation of the *Almagest*; see Kunitzsch 1974, 98–99.

[17] The context and the wording of this quotation as it occurs in the copy of Aḥmad's *De proportione et proportionalitate* in MS Paris, BN 9335, fol. 95vb is the following: "Possibile enim est ut verba hic translata 'proportionis minutionem' in Greco sint significantia, sed in linguam Arabicam non sunt in suo loco translata. Locutionum namque ordo in duabus linguis est inequalis. Hec autem est habitudo eius qui non perfecte transfert. Oportet enim ut interpres preter excellentiam quam adeptus est ex noticia lingue de qua et in quam transfert, artis quam transfert scientiam habeat." For a discussion of this passage see Burnett 1999.

(*facultates*) – whatever he esteemed as the most choice. He went the way of all flesh in the seventy-third year of his life, in the year of our lord Jesus Christ 1187.

These are the names of the books that he translated.

The list follows, after which there are eight lines of verse:[18]

Gerard, fount, light and glory of our clergy,
author of good counsel, hope and consolation of the poor,
was an enemy to fleshly desire, but praised spiritual values.
His brightness was that of the inner man.
The deeds of the man preserve his life as long as scholarship flourishes.
The books which he translated adorn his living fame.
Cremona boasts that she has given birth to this *sans pareil*.
He lived at Toledo. Toledo returned him to the stars.

The *socii* not only knew the titles of the works translated by Gerard, but also had a good knowledge of their subject-matter. For, in the *Vita*, they quote from two of them: Ptolemy's *Almagest* and Aḥmad ibn Yūsuf's *On Ratio and Proportion*.[19] Moreover, they add certain details about the texts in the list of works that they append: that Gerard did not translate the second book of the Pseudo-Aristotelian work *De causis proprietatum et elementorum* because he did not find a complete text in Arabic; and that he only translated the first three books of Aristotle's *Meteora* because he certainly would have known (as the *socii* knew) that the fourth book had already been translated. They added notes on ar-Rāzī, az-Zahrāwī and Ibn Sīnā, in the first case mentioning the book *al-Ḥāwī*, which Gerard had not translated.[20]

They also had some idea about the place in scholarship of Gerard's translations. For they have classified the works according to dialectic, geometry, astronomy, philosophy (i.e. natural philosophy and metaphysics), and medicine, with some miscellaneous texts at the end.

[18] The verses are in rhyming hexameters. Lemay claims that the *Vita*, *Commemoratio librorum* and *Eulogium* were not written at the same time and by the same people (see Lemay 1978, 173–74); his arguments are not convincing.

[19] These quotations are significant since the first is from a biography of Ptolemy which emphasizes his moral qualities and which provides a kind of model for this *Vita* of his successor Gerard; the second is from a work which points out the necessity of the study of logic for mathematics.

[20] In the case of Abū 'l-Qāsim az-Zahrāwī they were aware that the *Surgery* was only one part of his vast work *Kitāb at-taṣrīf li-man ʿajiza ʿan at-tasnīf*, but they gave to this work part of the name of the author himself ("azaugui" < "azaragui" = az-Zahrāwī). This is confirmed by the explicit of the translation (cited by Leclerc 1876, 423, from Paris, BNF, lat. 7127): "Hunc librum transtulit Magister Gerardus Cremonensis in Toleto de arabico in latinum, et est tricesima particula libri Azaragui quem composuit Albucasim." According to Michael Scot, the *Canon* too was said to be known by the name of its author, Avicenna: *Liber introductorius*, MS Munich, clm 10268 fol. 19r. *Al-Ḥāwī* (*Continens*) was not translated until the second half of the thirteenth century by Faraj ben Sālem in Sicily.

This classification is not haphazard. The *socii* have chosen first the subjects of the seven liberal arts that provided the framework for traditional education in the secular sciences among the Latins. The fact that these seven arts, which were the parts of "*philosophia*," were the (supposed) curriculum of Classical Antiquity (and especially Greek Antiquity) is significant. The Latins were aware from Boethius and Martianus Capella and other authors of late antiquity that a complete education (*enkyklios paideia*) consisted in the arts of language – grammar, rhetoric, and dialectic – and the arts of things – arithmetic, geometry, music, and astronomy. In all these arts the Latins of late antiquity had Greek models, and attempted to build up a body of texts in their own language that would substitute for those Greek models. The arts of language, or trivium, were well provided for by the works of Donatus, Priscian, Cicero, Quintilian – and Boethius. Boethius (*ca.* 480–524/5) succeeded in transmitting to the Latins several translations of, and commentaries on, Aristotle's works on dialectic. But he also intended to translate or adapt the basic Greek texts on each of the subjects of the quadrivium into Latin. He got as far as translating Nicomachus' *Introduction to Arithmetic* and writing a textbook on music based on the work of the same author and further texts by Euclid and Ptolemy. It appears that he started to translate Euclid's *Elements* but did not get further than the fifth book, and only translated the proof of the first theorem. Finally, Cassiodorus attributes to him a translation of a work by Ptolemy, but, if he did make such a translation, nothing remains of it (see Pingree 1981, 155–61).

These, then, are the *Latinorum studia* that Gerard was brought up on from his cradle. According to his *socii* Gerard was aware of the gaps in the *Latinorum studia* – *Latinorum penuria* ("the poverty of the Latins") – just as his fellow translator, Burgundio of Pisa, was.[21] There was no need to translate anything on grammar or rhetoric, theoretical arithmetic or music, because the Latins were well supplied with textbooks on these subjects. The main gaps were the remaining parts of rhetoric and dialectic, geometry, and astronomy. The textbooks for these were known both through their being mentioned by Boethius and Cassiodorus, and, in the case of Aristotelian rhetoric and dialectic, in al-Fārābī (we shall come back to this). One can see from the beginning of the translating movement in the twelfth century that it was the aim of the translators to fill in these gaps.

For example, Adelard of Bath, in the early years of the century wrote a book in which he outlined the subject-matter of the seven liberal arts, emphasizing their mutual dependence and how they are embraced under the term "*philosophia*": this is the subject of his *De eodem et diverso* (Willner 1903; Burnett et al. 1998). He himself translated Euclid's *Elements* and some texts on astrology and astronomy. A manuscript

[21] The phrase "penuria apud Latinos" is used in Burgundio of Pisa's prologue to his translation (from Greek) of the commentary of St John Chrysostom on the Gospel of St John; see Classen 1974, 84. For the Latins' inadequacy in geometry in particular see the statement of Stephen the Philosopher in the prologue to the fourth book of his *Liber Mamonis*: "et ap < p > robata argumentis quorum latinitas inscia in divulgato diu multumque volutatur errore"; see Burnett 2000, 58.

written by English and Norman hands in *ca.* 1140 (now Oxford, Trinity College, 47) adds Adelard's translation of Euclid's *Elements* to Boethius' translations of Aristotle's rhetorical and logical texts, and Boethius' texts on arithmetic and music, to make an "up-to-date" textbook of the liberal arts.

The most thoroughgoing example of this process before Gerard of Cremona, however, is the *Heptateuchon* of Thierry of Chartres, the two-volume library of texts on the liberal arts, with an introduction concerning the importance of marrying science with philology (drawing on Martianus Capella), which was probably put together in Chartres in the early 1140s, and which provides a nice counterpoise to the sculptures of the seven arts on the Portail Royal of Chartres Cathedral, dating from the same period.[22] Inserted into the relevant sections of the *Heptateuchon* are a redaction of Adelard's translation of Euclid's *Elements*, and Adelard's translation of the astronomical tables of al-Khwārizmī. Moreover, probably after the completion of the *Heptateuchon*, another translator, Hermann of Carinthia, who addresses Thierry as his master, recommends to him further works on geometry and astronomy that he and his collaborator Robert of Ketton had been translating from Arabic.[23]

This is the context, too, in which the new translations from Greek, made by James of Venice, must be viewed (Minio-Paluello 1972, 189–228). He was probably slightly older than Gerard. The first notice we have concerning him is his presence as an interpreter for discussions between the Eastern and Western churches in Constantinople in 1136. His translating activity is mentioned in the entry in the Chronicle of Robert of Torigni added between 1157 and 1169 which reads that "James, the clerk of Venice, translated from Greek into Latin and commented upon some books of Aristotle: i.e., the *Topics*, and the *Prior* and *Posterior Analytics*." In other words, he was completing the arts of rhetoric and dialectic with new translations and commentaries.[24]

It is against this background that one must look at the first three categories of Gerard's translations, as listed by his *socii*. These are three of the seven liberal arts, in their canonical order: logic (dialectic), geometry, and astronomy. Gerard obviously did not see the need to translate anything from Arabic on grammar or rhetoric, and the three texts listed on logic all relate to the *Posterior Analytics* (including a translation of the work itself), this being a text especially relevant to the demonstrative argument used in the sciences. Gerard probably did not know James' translation, which is first mentioned by Robert of Torigni (as we have seen), and by John of Salisbury writing in 1159; the priority of the two versions is debatable. The *socii*'s geometry list begins with the standard textbook on the subject – Euclid's *Elements*. The only version that Gerard is likely to have known is the redaction attributed to Adelard of Bath, which is also represented in the *Heptateuchon*: this redaction was copied either entirely without proofs, or with brief "directions for proof" replacing the proofs and their

[22] See Jeauneau 1995, and, for the quadrivial texts in the *Heptateuchon*, Burnett 1984.
[23] Hermann's preface to his translation of Ptolemy's *Planisphere* is in Heiberg 1907, clxxxiii-clxxxvi.
[24] For his translation of works on natural science see below, pp. 259–60.

accompanying labeled figures. Gerard's own translation[25] reproduced the proofs in full. For the rest, Gerard expanded not only the number of texts on geometry, but also the range of geometry itself by including algebra; moreover, he added mathematical arts previously unknown to the Latins: perspective and statics.[26] The texts chosen by Gerard are those of Greek authors – Euclid, Theodosius, Archimedes, "Mileus" (= Menelaus), "Tideus" (= Diocles) – commentaries on the *Elements* by Arabic authors, and some original Arabic texts on the same topics, and on topics that were unknown to the Greeks, such as algebra.

The last of the seven liberal arts is astronomy, and this forms the next section in the *socii*'s list. One might expect the *Almagest* of Ptolemy to come first – after all it was for this that Gerard came to Toledo, according to the *Vita* – but it is preceded by one work: the *Rudiments* of al-Farghānī.[27] In fact this is an easy introduction to the subjects covered in the *Almagest*, and either could have been tackled before the great work by Gerard himself, or might have been intended by him to be read first by his students. The work of al-Farghānī proved very popular, and we know that Michael Scot used al-Farghānī, but never graduated as far as the *Almagest*. The other texts under the heading of astronomy comprise, once again, works by Greek and Arabic authors, including the Spanish Muslims, Ibn Muʿādh of Jaén (d. 1093) and Jābir ibn Aflaḥ of Seville (fl. *ca.* 1150). Astrology is conspicuous by its absence, a point we shall come back to later.

With the next category – philosophy – we leave the seven liberal arts behind and come to a completely different area of study, Aristotelian natural philosophy and metaphysics. The very fact that the word "*philosophia*" has been transferred from the seven liberal arts to natural science and metaphysics is significant. Unlike in the case of the subjects of the seven liberal arts there was no pre-existing Latin educational program into which these subjects could fit. Nor would Gerard even have found a list of the textbooks for these subjects in Latin sources. Yet it is clear from the works that he translated, and, in particular, from the order in which they are listed, that Gerard knew the canonical order of Aristotle's works on natural science. This canonical order had been established in Alexandria in the late Classical period, and was transmitted, with the works themselves, both to the Islamic world, and to Byzantium. It is from the latter source that James of Venice and Burgundio of Pisa (d. 1193), both of whom were together in Constantinople in the famous 1136 meeting of the Eastern and Western Churches, must have derived their knowledge of some of Aristotle's texts on natural philosophy and metaphysics. For, between them, they translated the *Physics*, *De generatione et corruptione*, the *De anima*, part of the *Parva naturalia*, and the

[25] Or revision, see pp. 267–8 below.

[26] Perspective immediately follows geometry in al-Fārābī's *On the Classification of the Sciences* (see below, p. 260), while statics follows astronomy (the same order is found in Gundissalinus' *De divisione philosophiae*).

[27] The same text had been translated by John of Seville and Limia in Limia in 1135. Gerard appears to have known John's translation, the phrasing of which he sometimes follows; for examples of his revision of John's translations see below, pp. 268–9.

Metaphysics.[28] Whether they had the intention of creating a complete Latin corpus of Aristotle's natural science and metaphysics, however, is less clear. Burgundio, at least (who translated the *De generatione et corruptione*), was partly motivated by consideration of the relevance of natural science to medicine, a motivation which may also have induced their contemporary in Sicily, Henricus Aristippus, to translate the fourth book of the *Meteora*, which, like the *De generatione et corruptione*, is about the mixing of the elements.

Gerard's program seems more clear-cut than that of his contemporary Greek-Latin translators. And it is so, in large measure, no doubt because of his knowledge of the Arabic philosophers' divisions of sciences along Aristotelian principles.[29] This is manifest in several texts, including ones by Qusṭā ibn Lūqā,[30] al-Kindī,[31] and Avicenna.[32] But a source immediately at hand is a work listed at the end (bar one) of the texts of philosophy translated by Gerard: *On the Classification of the Sciences* of al-Fārābī.[33] Al-Fārābī's work not only provided a template for the subjects to be covered in a course of "philosophy" in the Aristotelian sense, but also supplied a checklist of textbooks to be used for that course. For, if one turns to the section on natural science, one finds that al-Fārābī divides it into eight parts or "enquiries" (*fuḥūṣ*), and for each enquiry he specifies which text or section of a text by Aristotle (or in the Aristotelian tradition) covers that enquiry.[34]

Thus al-Fārābī's first three enquiries are covered by Aristotle's *Physics*, *De caelo* and *De generatione et corruptione* respectively. These are listed in this order by Gerard's *socii*, with a pseudo-Aristotelian text, *De causis proprietatum et elementorum quatuor*, inserted quite naturally between the *De caelo* and the *De generatione et corruptione*; for it covers both consideration of different parts of the earth (in fact, it is the most "geographical" of the Aristotelian corpus) and the elements themselves. The next enquiry, according to al-Fārābī, "is concerning the principles of actions and passions and those things which are proper to the elements alone, without considering what is composed from the elements" and is covered by the first three books of the *Meteora* of Aristotle. This is the next work on the *socii*'s list. The *socii* add that "Gerard did not translate the fourth book, because he surely found that it had already been translated." The fourth book of the *Meteora* had, indeed, been translated by Henricus Aristippus in Sicily, and

[28] See Vuillemin-Diem and Rashed 1997. That Burgundio and James coordinated their activity is still to be determined.
[29] For the Arabic situation see Jolivet 1996.
[30] See Daiber 1990.
[31] See Guido and Walzer 1940.
[32] Michot 1980; French translation by Rabi'a Mimoune in Jolivet and Rashed eds. 1984, 143–51; Latin translation by Andrea Alpago in *Avicennæ philosophi præclarissimi ac medicorum principis, Compendium de anima, De mahad…, Aphorismi de anima, De diffinitionibus et quæsitis, De divisione scientiarum*, Venice, 1546, fols 139v–145v.
[33] Al-Fārābī had also been important in Islamic Saragossa, since his commentaries on Aristotle formed the basis of those of Ibn Bājja (Avempace, d. 1139).
[34] See Appendix II.

that translation must have been known in Toledo at least by the time of the *socii*. But one could propose another reason for Gerard's non-translation of the book: simply that he did not get that far in al-Fārābī's list. For the fourth book of the *Meteora* is, in fact, described by al-Fārābī as the textbook for the fifth enquiry of natural science. It is at this point that Gerard stopped, whether being prevented by his death in 1187, or for some other reason. He had, however, made sure that, for the first four parts of the program in natural science, he had provided some Greek and Arabic discussions of Aristotle's works: Alexander of Aphrodisias' small treatises on time and "that augment and increase occur in form not in matter," al-Fārābī's commentary on Aristotle's *Physics*, and al-Kindī's *On the five essences*. That Gerard was not uninterested in the remaining parts of natural science is shown by the fact that he also translated some texts relevant to the *parva naturalia* (belonging to al-Fārābī's "eighth enquiry"): Alexander's *On the Senses*, and al-Kindī's *On Sleep and Vision*. But one indication that Gerard was following a program (and specifically al-Fārābī's program) of translating Aristotle's works on natural science, is that the same program was continued by a successor of Gerard's at Toledo – in fact, most likely by one of the very *socii* who wrote the *Vita*.

This was the Englishman, Alfred of Shareshill. He translated textbooks for al-Fārābī's next two enquiries of natural science: the sixth, on minerals, and the seventh, on plants. Finding no work on minerals by Aristotle himself, he translated the chapters on minerals in the *Shifā'* of Avicenna (to which we shall return). He was probably responsible for adding Aristippus' translation of the fourth book of the *Meteora* to Gerard's translation of the first three, and tacking the chapters on minerals onto the end of the text. For this composite *Meteora* is described in its colophon as:

> The book of *Meteora* of which the supreme philosopher, master Gerard the Lombard, translated the first three books from Arabic into Latin, but Henricus Aristippus translated the fourth from Greek into Latin. The last three chapters were translated by Alfred the Englishman of Shareshill from Arabic into Latin. (MS Oxford, Selden supra 24, fol. 109r.)

For the botany, Alfred translated a work *De plantis*, which was in reality composed by Nicholas of Damascus but included much of Aristotle's lost work on plants. Alfred wrote glosses to the whole of the composite text of the *Meteora* as well as to the *De plantis*. The strongest indication that Alfred had al-Fārābī's list in his mind when choosing to translate works on minerals and plants is in his first gloss to the *Meteora*, which reads:

> The title of the book is etc. . . . It must be noted that al-Fārābī in his book *On the sciences*, the chapter on the natural sciences, says: "The fourth enquiry is concerning the principles of actions and passions and those things which are only the first elements,

> without considering what is composed from the elements, and it is in the first three books of the book *Meteora*."[35]

Al-Fārābī's eighth, and last, enquiry is "concerning what is common to the species of animals and what is proper to each of the species" and is the subject of the "book of animals" and the book of the soul and the books which are after them until the end of the *libri naturales*.[36] It is curious that no Toledan translation of Aristotle's *De anima* appears to have been made; and even James of Venice's Greek-Latin translation of the work is first cited only after the turn of the thirteenth century. This may be because the section of Avicenna's *Shifā'* devoted to the soul was translated in Toledo by Avendauth and Dominicus Gundissalinus, as we have seen, and became popular immediately. As for the "book of animals," al-Fārābī had in mind the 15-book Arabic *De animalibus* which combined three books on the subject by Aristotle. Although Alfred of Shareshill refers to this work in his original writings, he does not appear to have embarked on the formidable task of translating it. It fell to another Britisher at Toledo to complete this task: i.e., Michael Scot, who was a canon of Toledo cathedral by 1215, and completed his translation of the *De animalibus* there before 1220.

But, to return to Gerard. Preceding the four works on natural science in the *socii*'s list is a single work on metaphysics: *Liber Aristotilis de expositione bonitatis pure*, a work better known in the Latin tradition as *De causis* by "Aristotle" (see Ricklin 1995, 69–121). Aristotelian metaphysics and natural science naturally accompanied each other. In the condemnations of the new science in Paris, in 1215, it is the works of Aristotle on natural science and metaphysics and the commentaries on them that are mentioned. It is quite logical that metaphysics, dealing with first principles, should precede natural science, and this is the order that Avicenna adopted in his *Dānesh-nāmeh*, which was consequently followed by Algazel in his *Maqāṣid al-falāsifa*, "the intentions of the philosophers," translated by Gundissalinus and Johannes Hispanus in Toledo at the same time as Gerard was working there. However, Avicenna in his *Shifā'*, and al-Fārābī "rise up," as it were, to metaphysics, as "*scientia divina*," after natural science. In the *Catalogue of the Sciences*, Gerard would have found that the whole topic was dealt with in Aristotle's book *de metaphysicis*.[37]

It appears that this work was not available in Arabic in Toledo. Instead, Gerard turned to the *De causis*. This text is, in reality, a Neoplatonic compilation based largely

[35] Alfred of Sareshel's *Commentary on the* Metheora *of Aristotle*, ed. J. K. Otte, Leiden, 1988, p. 37: "Titulus talis: *Liber Aristotelis philosophi sapientis in factura impressionum superiorum que sunt in alto et inferius, tractatus primus*. Notandum Alfarabius in libro *De scienciis* capitulo de naturalibus, ait: 'Quarta inquisitio est de principiis actionum et passionum et que prima sunt elementa solum sine compositis ab eis, et est in primis < tribus > tractatibus *Libri impressionum superiorum*'".

[36] The phrase "and the books which are after them until the end of the *libri naturales*," referring to the *parva naturalia*, does not occur in the Arabic as edited by González Palencia 1932, and could be the Latin translator's addition.

[37] González Palencia 1932, 163: "in libro suo de metaphysicis."

on the *Elements of Theology* of Proclus. It is not mentioned at all by al-Fārābī, and of the mere five Arabic writers known to have used the work (or a derivative text), three are from al-Andalus, one being Moses Ben Jacob ibn Ezra of Granada, who died not long after 1135, another being Solomon ibn Gabirol, the Jewish philosopher and poet who was born in Malaga in 1021, lived in Saragossa, and died in Valencia in 1058, whose *Fons vitae* was translated by Gundissalinus and Iohannes Hispanus (Kraye et al. 1987, 41; and Schlanger 1968, 73–76).

It must be remembered that Aristotle was always regarded as being "obscure" and needed elucidation. Gerard of Cremona, as we have seen, translated some texts that were regarded as helpful for understanding Aristotle's works – by Alexander of Aphrodisias, al-Kindī and al-Fārābī. Alfred of Shareshill composed commentaries on the *Meteora* and *De plantis*, perhaps using glosses (e.g., by Alexander) that were already in the Arabic manuscripts. The culmination of this process, however, is found in the later work of Michael Scot, who, after translating the *De animalibus* and moving to Italy, made use of the recent work of Averroes to provide commentaries for the other texts on natural science: the *Physics*, the *De Caelo*, the *De anima*, and the *Metaphysics*.[38]

It was this combination of texts of Aristotle, translated from Greek or Arabic, and the commentaries of Averroes and (in the case of the *Meteora* and *De plantis*) Alfred of Shareshill, which became the textbooks in natural philosophy and first philosophy (i.e. metaphysics) in the universities from the second quarter of the thirteenth century onwards.

The *Shifāʾ* of Avicenna has already been mentioned quite frequently in passing. This large work, as is well known, is Avicenna's encyclopedia of philosophy in the Aristotelian tradition. It is divided into four units, each called a *jumla*, or "collection": on logic, on natural science, on mathematics, and on metaphysics. Avicenna, like al-Fārābī, divides natural science into eight parts, though not quite in the same order: the *De anima* comes sixth, before plants and animals; separate parts are given to the soul and to animals; and combinations of the elements and minerals are put together in one part. He devotes to each of these parts a single book of the "natural science" collection (*jumla*) of the *Shifāʾ*. The *Shifāʾ* is not a commentary on Aristotle's works, but provides Avicenna's own philosophy on the same topics as those covered by Aristotle, with the addition of the mathematical sciences, which Aristotle did not write about. The translation of the *Shifāʾ* in Toledo (and, later, elsewhere) can be seen as running parallel to that of Aristotle and his commentators. The books of the *Shifāʾ* on the same topics as Aristotle's books were sometimes translated in addition to those of Aristotle, sometimes in substitution for Aristotle's. Gerard of Cremona, however, apparently played no part in translating the *Shifāʾ*. Instead, this was superintended by his colleague, Dominicus Gundissalinus.

[38] Of these commentaries, only the *De caelo* is clearly attributed to Michael; the attribution of the *De anima* occurs in one manuscript only, the others are unattributed. Nevertheless, on the grounds of style and date it is likely that Michael was responsible for them all.

In contrast to the "Master" Gerard, Gundissalinus did not teach, but was actively engaged in ecclesiastical administration. He was an archdeacon of Segovia cathedral who was resident in Toledo, the metropolitan diocese, and is mentioned in numerous documents from the cathedral until 1181. His interest in the Aristotelian division of sciences is manifest in the fact that he too made a version of al-Fārābī's *On the Classification of the Sciences*, and used this as a framework for his own *De divisione philosophiae*. In this, and in the several original works that he wrote, he shows that he has been well educated in the *Latinorum studia*, and, in particular, in the works of scholars associated with Chartres, including Thierry of Chartres and the translator Hermann of Carinthia.[39] But he did not show any interest, either in his original works or in the works he chose to translate, in the texts of Aristotle on natural science and metaphysics. Instead, he translated the philosophical texts that were being read by Islamic, and especially, Jewish, scholars educated in Islamic Spain – and one such Jewish scholar, as we have already seen,[40] may have introduced him to these texts: Abrahām ibn Dāūd.[41]

Between them Gundissalinus and Avendauth translated the *jumla* of the *Shifā'* the metaphysics ("first philosophy"), a part of the logic, and the individual book on the soul. The beginning of the physics – the first book of the *jumla* on natural science – was also translated at this time, probably under the supervision of Gundissalinus, though no name is attached to the translation.[42] That Gundissalinus apparently had the whole *Shifā'* at hand is evident from the fact that in his *De divisione philosophiae* he cites another passage from Avicenna's logic ("on the subalternation of the sciences"), which does not appear in Latin elsewhere. A hundred years later, another translator, Juan Gonsalvo of Burgos, continued the translation of the physics section from the very point where the twelfth-century translator had broken off (in fact, in mid-sentence), and translated several further books of the *jumla* on natural science. It is presumably from Avendauth's Arabic manuscript that Alfred of Shareshill made his translation of the chapters on mineralogy (and possibly of a chapter on flooding). Michael Scot translated the section on animals (the last book of the natural science *jumla*) which he dedicated to Frederick II Hohenstaufen, his patron in Sicily. But the

[39] For correspondences in Gundissalinus' works with texts connected with Chartres and Paris, see Burnett 1990. That Gundissalinus owed his system of *accessus* to each of the sciences in his *De divisione philosophiae* to Thierry is argued by Fredborg 1988, 16–20; he is the only author known to have used the cosmological material from the *De essentiis* of Hermann of Carinthia, a pupil of Thierry of Chartres.

[40] See pp. 251–2 above.

[41] The identity of 'Avendeuch/Avendauth Israhelita' with Abrahām ibn Dāūd was first suggested in d'Alverny 1954. It would seem to be confirmed by the pervading influence of Avicenna in Ibn Dāūd's writings: see Cohen 1967, xxiv: "Above all, although he [Ibn Dāūd] never acknowledges the fact, he seems to have absorbed thoroughly the writings of Ibn Sīnā and to have appropriated the Aristotelian thought which the great Arab philosopher had expounded in his commentaries." The willingness of Avendauth to collaborate with a Christian scholar also fits the character of Ibn Dāūd who, unusually for a Jewish scholar, wrote about the history of Rome and the beginnings of Christianity (ibid., xxvii–xxviii).

[42] For details of the translations of the *Shifā'*, see d'Alverny 1993, article IV. All these texts, with the exception of the *Logic*, have been edited by van Riet 1968–92.

work was not necessarily translated there, since it was copied alongside Michael's translation of Aristotle's *De animalibus*, made, as we have seen, in Toledo.

The Arabic texts in which Gundissalinus' collaborator is "Iohannes Hispanus" are also distinctive of the Hebrew academic community: one is the *Maqāṣid al-falāsifa* of Algazel (al-Ghazzālī), which was much used by Abrahām ibn Dāūd; the other is the *Fons Vitae* or "fount of life" written in Arabic by the Jewish philosopher Ibn Gabirol. It does not seem unfeasible that these two works should have been brought to the attention of Gundissalinus and the Archbishop of Toledo by Abrahām ibn Dāūd alongside the *Shifā'* of Avicenna. Another work that Abrahām could have brought is the *Liber de causis*, which, as we have seen, was known to Ibn Gabirol; for it was called in its earliest manuscript (Oxford, Bodleian Library, Selden supra 24), the "*Metaphysica Avendauth*", and its author is named by Albertus Magnus as "David Iudaeus."[43]

Thus, in the field of Aristotelian philosophy in Toledo, we see a remarkably rich mixture in the mid- to late-twelfth century: on the one hand, the original texts of Aristotle and accompanying works by Alexander of Aphrodisias, al-Kindī and al-Fārābī; on the other hand, works of Avicenna and Algazel which did, in fact, more accurately represent the reading-matter of the Jewish and Arabic scholars of the time. The outbreak of an interest in the works of Aristotle himself among a group of Arabic scholars in Córdoba in the late twelfth century is an isolated phenomenon that had momentous repercussions in the West, through the translations of Averroes' commentaries and al-Biṭrūjī's Aristotelian astronomy (see Sabra 1984), but which failed to affect, to any noticeable degree, the general predominance of Avicenna among Arabic philosophers, and of Algazel among the theologians. Averroes (d. 1198) was working in Córdoba at the same time as Gerard was working in Toledo and both scholars were interested in the same subjects. But whether this Córdoban "Aristotelian revolt" in the court of the Almohads (which, it must be remembered, was entirely Islamic, since the Jews had been expelled) had repercussions in the Toledo of Gerard of Cremona's time is difficult to tell. It must be noted, however, that Gerard had access to Arabic texts in the Aristotelian tradition which had ceased to be read elsewhere in the Islamic world, including treatises of al-Kindī which have been preserved in Arabic only thanks to a chance interest on the part of the Theosophists of Isfahan in the seventeenth century (see Endress 1994, 175). And even they did not rescue al-Kindī's text *On the five essences* which Gerard translated.[44]

Nevertheless, Aristotelian philosophy was not Gerard's main interest, nor did his translations in this field have such a large influence as those in other fields. For his

[43] "Ibn Dāūd" means "son of David." The *De causis* is the first of Gerard's philosophical translations to be known outside Spain, and travels with Gundissalinus' translations; see Burnett 1997, 69. Some scholars, such as Adriaan Pattin, suggest that Gundissalinus played some part in its translation: see discussion in Taylor (in Kraye et al. 1987).

[44] The Arabic text of *De quinque essentiis*, which appears among the *Rasā'il al-Kindī* edited by Abū Riḍā (Cairo, 1953, II, 8–34), is a modern translation of the Latin text.

Arabic-Latin translations of Aristotle's works were eventually replaced by translations directly from Greek – first, by those of James of Venice and Burgundio of Pisa, and then, towards the end of the thirteenth century, by those of William of Moerbeke – and his translations of Arabic commentaries and other accompanying works were eclipsed by the great commentaries of Averroes.

In the field of mathematics (which we have already surveyed) Gerard's translations had a much more lasting effect on Western scholarship. But surpassing even this achievement, in terms of quantity and effect, were Gerard's translations of medical texts, which are the next category in the list of the *socii*. This field has been covered very expertly by Danielle Jacquart, to whom I am much indebted.[45] As in philosophy, so in medicine, she sees that the "Toledan enterprise of translation" evidenced not a haphazard affair, but a project in the true sense of the word (Jacquart 1992, 60 and in Cardaillac 1991, 177–91). This is clear from the list of texts of the *socii*. First come nine texts of Galen. Although Galen was known to the Latins as the greatest of the Greek doctors, very few of his writings had been translated into Latin before Gerard's time. Galen was regarded as being as much a philosopher as a doctor, and as being too complicated for the requirements of the ordinary physician. Constantine the African, Gerard's principal predecessor as a translator of medical texts from Arabic into Latin, knew of the list of 16 works which had been selected from amongst Galen's vast output for the teaching of medicine in Alexandria, but he translated only one of these (the *Megategni* or *Methodus medendi*). Gerard, on the other hand, translated at least five more texts on this list. The choice of the remaining texts seems to have been made in accordance with his interests (and that of his contemporaries) in element-theory, the temperaments and therapeutic method (Jacquart 1992, 58). The next two items on the *socii*'s list also treat these philosophical aspects of medicine: Isaac Israeli's *On the Elements* and *On the Description of Things and their Definitions*. The other texts in this section are, for the most part, substantial texts on medicine by the Arab successors to Galen, ar-Rāzī (represented by three texts), two natives of al-Andalus – az-Zahrāwī and Ibn al-Wāfid – and, above all, Avicenna, whose *Canon medicinae*, in Gerard's translation, became the principal comprehensive text for medical training in Europe, and remained on the curriculum into the eighteenth century. Appropriately, this work comes at the end of the section, followed only by the *Tegni* (or *Ars parva*) of Galen, to the end of which the list itself has been appended.

Considering its importance, one should pay more attention to the medical section of the *socii*'s list, but I have neither the time nor the competence to do this. Moreover, the list does not end here, and we must briefly consider the last items.

These are two groups of three works, the first on alchemy,[46] the second on divination. The relationship of alchemy both to natural science and to medicine is obvious. Alchemy is listed amongst the divisions of natural science by Gundissalinus, who took his list from an anonymous translation of an anonymous Arabic text called

[45] Jacquart's articles are conveniently collected in Jacquart 1997.

[46] On the identification of the works on alchemy translated by Gerard, see Halleux 1996, 891–92.

"On the rise of the sciences" (*De ortu scientiarum*).[47] Avicenna included an attack on alchemy in his *Shifāʾ*, but elsewhere seems to approve of it (see Anawati 1996, 875–79).

The last group of works concerns divination: first, divination by means of figures drawn randomly on the sand or on paper (i.e., geomancy),[48] then divination according to a system of questions which are related to answers derived by a process of random calculation,[49] and, finally, a divinatory technique based on the Moon's position in the zodiac each month.[50]

The very last item is the most local of the texts, for it is a calendar put together from an Arabic calendar arranged according to the risings and settings of the *anwāʾ* (or "lunar mansions") and a Christian liturgical calendar, for the Arabic-speaking Christians of Córdoba.[51]

The *socii* were justly proud of the achievements of their master. Modern scholarship has attributed even more translations to Gerard (see especially Lemay 1978, 175, nn. 58a-d, 183 and 187f.), but what has also become clear is that Gerard was not always translating *de novo*. This has been demonstrated in the case of the translation of ar-Rāzī's *Liber Almansoris*, of which two versions exist. Danielle Jacquart has suggested that the first version was made by an as yet unidentified translator, whereas the second shows the application of a more rigorous word-for-word equivalence and, in particular, of Gerard's terminology.[52] Other works may exhibit

[47] Dominicus Gundissalinus, *De divisione philosophiae*, ed. L. Baur, *Beiträge zur Geschichte der Philosophie des Mittelalters*, 4.2–3, Münster, 1903, p. 20: "scientia naturalis universalis est quia octo sciencie sub ea continentur: scilicet sciencia de medicina, sciencia de iudiciis (*corrected from* Baur's 'indiciis'), sciencia de nigromantia secundum physicam, sciencia de ymaginibus, sciencia de agricultura, sciencia de navigacione, sciencia de speculis, sciencia de alquimia, que est sciencia de conversione rerum in alias species, et hec octo sunt species naturalis sciencie"; from *De ortu scientiarum*, ed. C. Baeumker 1918, 20.

[48] For the texts on geomancy attributed to Gerard see Charmasson 1980, 111–19, 129–39. The text with the incipit "Estimaverunt Indi," mentioned in one manuscript of the *Commemoratio librorum*, is also attributed to Hugo of Santalla, whereas a text with the incipit "Si quis per artem geomanticam," which is more consistently attributed to Gerard, already seems to have been known in Hereford in c. 1195–97; see Burnett 1995c.

[49] A summary of the history of this text is given (alongside that of Gerard's other astronomical translations) in Kunitzsch 1992, 79–80.

[50] The title "Alfeal (i.e. Arabic *al-faʾl*, "omen, fortune") secundum motum lune" is found in Paris, BNF, lat. 9335, fol. 140r (see p. 281 below), at the beginning of a table of "accidentia," or "happenings" when the Moon is in each of the signs of the zodiac. A preliminary table indicates which sign of the zodiac the Moon is in on each day of each Latin month. The two tables are introduced with the instruction: "Capitulum cognitionis mansionis Lune: Scias quid preteriit de mense arabico (*in margin*: id est lunari, id est quota erit Luna) et accipe illud in linea que est super tabulam, et extrahe ipsum ad signa que sunt in linea que opponitur mensi Latino in quo tu es, et scies tunc ubi mansio est Lune ex signis per illud, si deus voluerit."

[51] For the description of this text as a "*sacerdocii mar(tyro)logium*" compare the use of the word "*martyrologium*" for a computus written in Spain in 1055 A.D. in MS Tortosa Cathedral, no. 10: "Incipit martyrologium de circulo anni"; see Martínez Gazquez and Gómez Pallarès 1994, 414.

[52] Jacquart 1997, article VIII "Note sur la traduction latine du *Kitāb al-mansūrī* de Rhazès."

the same phenomena.[53] Such a process of revision is particularly obvious in the case of a subject-matter not mentioned at all by the *socii*: i.e., astrology.

The absence of astrology from the list of the *socii* is especially striking, considering that the only eye-witness evidence we have of Gerard's teaching portrays him expounding an astrological text. This is by Daniel of Morley, the Englishman who visited Toledo early in Gerard's career. He would have us believe that he heard Gerard of Cremona lecturing on astrology, and held a disputation in which Gerard defended astrology and Daniel raised objections (see Burnett 1995b). The fact that Daniel makes Gerard's authorities Firmicus Maternus and the versions of Abū Maʿshar's introduction to astrology made by Adelard of Bath and Hermann of Carinthia, all three being works already well known in England, makes one a little suspicious about his account. Nevertheless, it would be a little surprising for Gerard to deliberately neglect astrology when it was regarded as being of equal scientific cogency as medicine, and when most astronomers were also astrologers.

In fact, it seems that a large corpus of Latin astrological texts of Arabic origin was put together in Toledo. The evidence for this is the common terminology and the comprehensiveness of the astrological corpus best represented by the manuscript Paris, BNF, lat. 16204, a manuscript copied for Richard of Fournival, the son of the astrologer of the French royal court, Roger. This manuscript contains, in order, astrological texts by Abū Maʿshar, works on horoscopes and weather forecasting, texts by Māshāʾallāh, "Jergis," Sahl, ʿAlī al-ʿImrānī (Haly), Thābit b. Qurra and Pseudo-Ptolemy.[54] The largest of these texts – the *Great Introduction to Astrology* and the *Great Conjunctions*, both by Abū Maʿshar – are comparable in their bulk to Euclid's *Elements* and Ptolemy's *Almagest*. The texts in the Paris manuscript provide between them a curriculum in astrological science as complete and coherent as do Gerard's translations for the science of medicine. While it is not possible at this stage in our research to assert categorically that all these texts were collected in Toledo,[55] the bulk of them exhibit a homogeneity that suggests a single enterprise. That enterprise is probably due to John of Seville and Limia, whose name as translator is attached to the first text, Abū Maʿshar's *Great Introduction*.[56] However, Richard Lemay has demonstrated that the *Great Introduction* was thoroughly revised, with further

[53] For example, Galen's *On the Temperaments* (no. 47 below) and the translation of Euclid's *Elements* attributed to Gerard (no. 45 below) which has been observed to be not in Gerard's style. His revision of a previous translation of the *Elements* is an alternative explanation to that given by the editor: that a subsequent reviser couched Gerard's translation in a more elegant Latin style: see Busard ed. 1984; the extent of the knowledge of the Greek tradition manifest in this version is striking.

[54] On the original contents of this manuscript and its connection with Richard of Fournival, see Pingree 1987, esp. 84–87, 100–02.

[55] The work of ʿAlī al-ʿImrānī on elections, at least, was "interpreted in Barcelona by Abraham [bar Hiyya] in 1134."

[56] I was over cautious in hesitating to identify "John of Seville and Limia" with "John of Seville" in Burnett 1994, 242, especially considering that two manuscripts of the *Great Introduction* name the translator as "Johannes Hyspalensis/Hyspanensis ex Luna" (Paris, Bibliothèque de l'Université, lat. 640, and Cambridge, University Library, Kk.1.i).

consultation of the Arabic original, and his hypothesis that the reviser was Gerard of Cremona is quite plausible.[57] *The Great Conjunctions* has been subjected to a similar revision, and comparison of the terminology suggests that the same two scholars were involved.[58] No translator or reviser is named in the manuscripts, but to manuscripts of the revision (including Paris, BNF, lat. 16204) detailed notes on variant Arabic and Latin readings, interpretations of obscure passages, and comments on the mathematical calculations have been added. Among these comments is reference to a word "in the Toledan dialect."[59] This suggests that, while the place of activity of John of Seville and Limia remains unclear,[60] the revision of this text, and presumably of other texts in this astrological corpus, took place in Toledo.

We have seen in Toledo, then, that there was a clear division between the translating activities of Gerard of Cremona and Dominicus Gundissalinus. The one favored the authentic works of the Greeks and their Arabic commentators, the other favored Avicenna's philosophical approach to philosophy and the reading-matter of contemporary Jewish scholars. Considering that both Gerard and Gundissalinus worked within the precincts of Toledo cathedral, it is hard to believe that they were unaware of each other's work, or inimical to it (the key text here is al-Fārābī's *On the Classification of the Sciences*: in this case they certainly shared each other's findings).[61] Another large subject-area, astrology, had been dealt with by another scholar, John of Seville and Limia (the translations of his that have dates were written between 1133 and 1145), but its texts were being studied and revised by Gerard and his colleagues. Thus, while the internal coherence and rationale of the translating enterprise of Gerard is demonstrated in the *Commemoratio librorum* by his *socii*, one can see strategies and a sense of order also at the level of the translating activity in twelfth-century Toledo as a whole, whether one looks at it chronologically – from Gerard, through Alfred of Shareshill to Michael Scot (and eventually Hermann the German) – or synchronically, with Gerard and Gundissalinus sharing responsibilities between themselves, and building on the work of John of Seville and Limia. What remains to be explained is the driving force behind this translation enterprise. I have suggested above that the intellectual motivation came from the burgeoning universities and other intellectual centers outside Toledo. But that is an insufficient explanation for the question of who organised the production and who paid for it. The *Vita* of Gerard

[57] Lemay 1996–97.

[58] See Burnett and Yamamoto 2000, and Burnett 2001. A feature common to the revision of both texts of Abū Maʿshar is the substitution of "generatio" for "effectus," "impressio" for "vestigium," "continuatio" for "coniunctio," and "dispositio" for "esse."

[59] Paris, BNF, 16204, p. 246: "et in Toleto dicitur maluero." Lemay had already pointed out the importance of these comments, but did not realize that they accompany only the revised version: Lemay 1962, 14.

[60] As pointed out above (pp. 251–2), the only place of translation mentioned in any of John of Seville and Limia's works is Limia itself.

[61] Other texts on which they probably both worked (for there are two versions of them) were al-Kindī's *De intellectu* (though this is not mentioned in the *Commemoratio* librorum) and Isaac Israeli's *De definitionibus*, both texts being keys for the understanding of the other works they were interested in.

suggests that he was a rich man, and a later legend claimed that he was paid by the king of Castile,[62] but documentary evidence is lacking. What is beyond doubt is the scale and importance of the enterprise, which has no match in the history of western culture.

References

D'Alverny, Marie-Thérèse. 1954. "Avendauth?" *Homenaje Millás Vallicrosa*, 19–43. Barcelona: CSIC.

D'Alverny, Marie-Thérèse. 1982. "Translations and Translators." In *Renaissance and Renewal in the Twelfth Century*, edited by R. L. Benson and G. Constable, 421–62. Oxford: Clarendon Press.

D'Alverny, M.-T. 1989. "Les traductions à deux interprètes, d'arabe en langue vernaculaire et de langue vernaculaire en latin." In *Traduction et traducteurs au moyen âge*. Colloques internationaux du CNRS, IRHT 26–28 mai 1986, 193–206. Paris: CNRS.

D'Alverny, M.-T. 1993. *Avicenne en Occident*. Paris: Lirairie philosophique J. Vrin.

D'Alverny, M.-T. 1994. *La transmission des textes philosophiques et scientifiques au Moyen Age*. Aldershot: Variorum.

Anawati, George C. 1996. "Arabic Alchemy." In *Encyclopeia of the History of Arabic Science*, 3 vols. Edited by Roshdi Rashed, vol. III, 853–85. London and New York: Routledge.

[Anonymous] 1710–40. *Giornale de letterati d'Italia*. Venice.

Baeumker, Clemens, ed. 1918. *De ortu scientiarum*. Beiträge zur Geschichte der Philosophie des Mittelalters 19. Münster: Aschendorff.

Birkenmajer, Aleksander. 1970. *Etudes d'histoire des sciences et de la philosophie du moyen âge*. Studia Copernicana I. Wroctaw, Warsaw and Cracow: Ossolineum.

Bjørnbo, Axel A. 1902. "Über zwei mathematische Handschriften aus dem vierzehnten Jahrhundert." *Bibliotheca Mathematica* 3.3:63–75

Boncompagni, Baldassare. 1851. *Della vita e delle opere di Gherardo Cremonese traduttore del secolo duodecimo e di Gherardo da Sabbionetta astronomo del secolo decimoterzo*. Atti dell'Accademia Pontificia de' Nuovi Lincei IV. Rome.

Bühler, Curt F., ed. 1941. *The Dicts and Sayings of the Philosophers: The Translations by Stephen Scrope, William Worcester and an Anonymous Translator*. Early English Text Society 211. Oxford: Oxford University Press.

Burnett, Charles. 1977. "A Group of Arabic-Latin Translators Working in Northern Spain in the Mid-Twelfth Century." *Journal of the Royal Asiatic Society* year 1977:62–108.

Burnett, C. 1984. "The Contents and Affiliation of the Scientific Manuscripts Written at, or Brought to, Chartres in the Time of John of Salisbury." In *The World of John of Salisbury*, edited by M. Wilks, 127–59. Oxford: Blackwell.

Burnett, C. 1990. "A New Source for Dominicus Gundissalinus' Account of the Science of the Stars?" *Annals of Science* 47:361–74.

Burnett, C. 1992. "The Translating Activity in Medieval Spain." In *The Legacy of Muslim Spain*, edited by S. K. Jayyusi, 1036–58. Handbuch der Orientalistik, 12. Leiden: E. J. Brill.

Burnett, C. 1994. "Magister Iohannes Hispanus: Towards the Identity of a Toledan Translator." In *Comprendre et maîtriser la nature au moyen âge. Mélanges d'histoire des sciences offerts à Guy Beaujouan*, 425–36. Geneva: Librairie Droz.

[62] MS Chantilly, 322, fol. 45v: "libri [*on geomancy*] quem magister Gerardus de Cremona, magnus medicus in phisica, transtulit de arabico in latinum, habens expensas a rege Castelle"; quoted in Charmasson 1980.

Burnett, C. 1995a. "'Magister Iohannes Hispalensis et Limiensis' and Qustā ibn Lūqā's *De differentia spiritus et animae*: a Portuguese Contribution to the Arts Curriculum?" *Mediaevalia. Textos e estudos* 7–8:221–67.

Burnett, C. 1995b. "The Institutional Context of Arabic-Latin Translations of the Middle Ages: A Reassessment of the 'School of Toledo'." In *The Vocabulary of Teaching and Research between the Middle Ages and Renaissance*, edited by O. Weijers, 214–35. Turnhout: Brepols.

Burnett, C. 1995c. "Mathematics and Astronomy in Hereford and its Region in the Twelfth Century." In *Medieval Art, Architecture and Archaeology at Hereford*, edited by D. Whitehead, 50–59. Leeds: British Archaeological Association.

Burnett, C. 1997. *The Introduction of Arabic Learning into England*. London: British Library.

Burnett, C. et al. 1998. *Adelard of Bath, Conversations with his Nephew.* Cambridge: Cambridge University Press.

Burnett, C. 1999. "Dialectic and Mathematics According to Aḥmad ibn Yūsuf: A Model for Gerard of Cremona's Programme of Translation and Teaching?" In *Langage, sciences, philosophie au XIIe siècle.* Edited by J. Biard, 83–92. Paris: Librairie philosophique J. Vrin.

Burnett, C. 2000. "Antioch as a Link between Arabic and Latin Culture in the Twelfth and Thirteenth Centuries." *Occident et Proche-Orient: Contacts scientifiques au Temps des Croisades.* Edited by I. Draelants, A. Tihon, and B. van den Abeele, 1–78. Turnhout: Brepols.

Burnett, C. 2001. "The Strategy of Revision in the Arabic-Latin Translations from Toledo: The Case of Abū Ma'shar's *On the Great Conjunctions*." In *Translators at Work: Their Methods and Manuscripts*, edited *by J. Hamesse, Louvain-la-Neuve*: FIDEM (in press).

Burnett, C. and Keiji Yamamoto, eds. 2000. Abū Ma'šar, *On Historical Astrology: The Book of Religions and Dynasties (On the Great Conjunctions)*, 2 vols. Leiden: Brill.

Busard, Huburtus L. L., ed. 1984. *The Latin Translation of the Arabic Version of Euclid's Elements Commonly Ascribed to Gerard of Cremona*. Leiden: E. J. Brill.

Cardaillac, Louis, ed. 1991. *Tolède, XIIe-XIIIe siècles*. Paris: Autrement.

Charmasson, Thérese. 1980. *Recherches sur une technique divinatoire: la géomancie dans l'occident médiévale.* Geneva and Paris: Librairie Droz.

Classen, Peter. 1974. *Burgundio von Pisa*. Sitzungsberichte der Heidelberger Akademie der Wissenschaften, phil.-hist. Klasse, 4.

Cohen, Gerson D. 1967. *Ibn Dāūd Sefer Ha-Qabbalah*. London: Routledge and Kegan Paul.

Daiber, Hans. 1990. "Qosṭā ibn Lūqā (9 Jh.) über die Einteilung der Wissenschaften." *Zeitschrift für Geschichte der Arabisch-Islamischen Wissenschaften* 6:93–129.

Dunlop, Derrick M. 1971. "Hūdids." In *Encyclopedia of Islam*, new ed. III:542–3. Leiden and London: E. J. Brill and Luzac.

Endress, Gerhard. 1994. "Al-Kindi über die Wiedererinnerung der Seele." *Oriens* 34:174–221.

Fredborg, Margareta. 1988. *The Latin Rhetorical Commentaries of Thierry of Chartres*. Toronto: Pontifical Institute of Mediaeval Studies.

González Palencia, Angel. 1926–30. *Los mozarabes de Toledo en los siglos xii y xiii*. 4 vols. Madrid.

González Palencia, Angel. 1932. *Alfarabi. Catálogo de las ciencias*. Madrid: CSIC.

González Palencia, R. 1996. "El traductor Hermann el Alemán." In *El Escuela de Traductores de Toledo*, edited by F. M. Villanueva,.51–64. Toledo: Diputación provincial de Toledo.

González Ruiz, Ramón. 1997. *Hombres y libros de Toledo (1086–1300)*. Madrid: Fondación Ramón Areces.

Grant, Edward, ed. 1974. *A Source Book in Medieval Science.* Cambridge: Harvard University Press.

Guido, M. and Richard Walzer. 1940. "Uno scritto introduttivo allo studio di Aristotele." *Memorie della R. Accademia Nazionale dei Lincei*. Classe di scienze morali, storiche e filologiche. Serie VI, vol. VI, fasc. V. Rome.

Halleux, Robert. 1996. "The Reception of Arabic Alchemy in the West." In *Encyclopedia of the History of Arabic Science.* 3 vols. Edited by R. Rashed, vol. 3:886–902. London: Routledge.

Hernández, Fernando J. 1991. "La cathédrale, instrument d'assimilation." In Cardaillac 1991.

Hernández, Fernando J. 1995. "La Fundación del estudio de Alcalá de Henares." *En la España Medieval* 18:61–83.
Jacquart, Danielle. 1988. "Aristotelian Thought in Salerno." In *A History of Twelfth-Century Western Philosophy*, edited by P. Dronke, 407–29. Cambridge: Cambridge University Press.
Jacquart, Danielle. 1992. "Les traductions médicales de Gérard de Crémone." In Pizzamiglio 1992.
Jacquart, Danielle. 1997. *La science médicale occidentale entre deux renaissances (XIIe s.-XVe s.)*. Aldershot: Variorum.
Jacquart, D. and Françoise Micheau. 1990. *La médecine arabe et l'occident médiéval*. Paris: Maisonneuve et Larose.
Jeauneau, E. 1995. *L'Age d'or des écoles de Chartres*. Chartres: Editions Houvet.
Jolivet, Jean, and Roshdi Rashed, eds. 1984. *Etudes sur Avicenne*. Paris: Les Belles Lettres.
Jolivet, J. 1996. "Classifications of the Sciences." In *Encyclopedia of the History of Arabic Science*, edited by R. Rashed, vol. 3:1008–25.
Kraye, J., Ryan, W. F. and C. Schmitt, eds. 1987. *Pseudo-Aristotle in the Middle Ages*. London: Warburg Institute.
Kunitzsch, Paul. 1974. *Der Almagest*. Göttingen: Vandenhoeck und Ruprecht.
Kunitzsch, Paul, ed. 1986–91. *Ptolemy. Der Sternkatalog des Almagest*. 3 vols. Wiesbaden: Harrassowitz Verlag.
Kunitzsch, Paul. 1992. "Gerard's Translations of Astronomical Texts, especially the *Almagest*." In Pizzamiglio 1992, 71–84.
Leclerc, Lucien. 1876. *Histoire de la médecine arabe*. Paris: E. Leroux.
Lemay, Richard. 1962. *Abu Ma'shar and Latin Aristotelianism in the Twelfth Century*. Beirut: American University of Beirut.
Lemay, R. 1978. "Gerard of Cremona." In *Dictionary of Scientific Biography*, edited by C. L. Gillispie, Supplement I: 173–92. New York: Scribners.
Lemay, Richard, ed. 1996–7. Abū Ma'shar al-Balḫī. 1996–97. *Liber Introductorii maioris ad scientiam judiciorum astrorum*. 9 vols. Naples: Istituto universitario orientale.
Lorch, Richard. 1995. "Some Remarks on the *Almagestum parvum*." In idem, *Arabic Mathematical Sciences*, article 5. Aldershot: Variorum.
Lorch, R. 1996. "The Transmission of Theodosius' *Sphaerica*." In *Mathematische Probleme im Mittelalter: der lateinische und arabische Sprachbereich*, edited by M. Folkerts, 159–83. Wolfenbütteler Mittelalter-Studien 10. Weisbaden: Harrassowitz Verlag.
Martínez Gazquez, J. and J. Gómez Pallarḍs. 1994. "Manuscritos científicos latinos de la Catedral de Tortosa." *Hispania Sacra* 46:413–24.
Maurach, Gregor, ed. 1979. "Daniel of Morley, *Philosphia*." *Mittellateinisches Jahrbuch* 14:204–5.
Michot, Jean. 1980. "Les sciences physiques et métaphysiques selon la *Risālah fī aqsām al-ʿulūm* d'Avicenne." *Bulletin de Philosophie médiévale* 22:62–73.
Minio-Paluello, Lorenzo. 1972. *Opuscula: the Latin Aristotle*. Amsterdam: Hakkert.
North, John D. 1995. "'Aragonensis' and the Toledan Material in Trinity MS O.8.34." *Cahiers du moyen âge grec et latin* 65:59–61.
Otto, James K., ed. 1988. *Alfred of Sareshel, Commentary on the* Metheora *of Aristotle*. Leiden: Brill
Pingree, David. 1981. "Boethius' Geometry and Astronomy." In *Boethius: His Life, Thought and Influence*. Edited by M. Gibson. Oxford: Blackwell.
Pingree, David. 1987. "The Diffusion of Arabic Magical Texts in Western Europe." In *La diffusione delle scienze islamiche nel medio evo europeo*. Edited by B. Scarcia Amoretti, 57–102. Rome: Accademia nazionale dei Lincei.
Pizzamiglio, Pierluigi, ed. 1992. *Gerardo da Cremona*. Annali della Biblioteca statale e libreria civica di Cremona XLI. Cremona: Biblioteca statale e libreria civica.
Ravaisson, Félix. 1849. *Catalogue géneral des manuscrits des bibliothèques publiques des départements*. Vol. I. Paris: Plon.

Ricklin, T. 1995. *Die 'Physica' und der 'Liber de causis' im 12. Jahrhundert*. Freibourg: Universitätsverlag Freiburg Schweiz.
Rubiera Mata, M. J. 1991. "Les premiers Mores convertis ou les prémices de la tolérance." In Cardaillac 1991.
Sabra, Abdelhamid I. 1984. "The Aristotelian Revolt against Ptolemaic Astronomy: Averroes and al-Biṭrūjī." In *Transformation and Tradition in the Sciences: Essays in Honor of I. Bernard Cohen*, edited by E. Mendelsohn, 133–53. Cambridge: Cambridge University Press.
Sarton, George. 1950. *Introduction to the History of Science*, Vol. II.1. Baltimore: Williams and Wilkins.
Schlanger, Jacques. 1968. *La philosophie de Salomon Ibn Gabirol*. Leiden: E. J. Brill.
Sezgin, Fuat. 1974. *Geschichte der arabischen Schrifttums*. Vol. 5. Leiden: E. J. Brill.
Steinschneider, Moritz. 1904. *Die europäischen Übersetzungen aus dem arabischen bis Mitte des 17. Jahrhunderts*. Vienna: Carl Gerold's Sohn.
Sudhoff, Karl. 1914. "Die kurze *Vita* und das Verzeichnis der Arbeiten Gerhards von Cremona." *Archiv für Geschichte der Medizin* 8:73–82.
Van Riet, Simone. 1968–92. *Avicenna Latinus*. Louvain and Leiden: Editions orientalistes E. J. Brill.
Villanueva, F. M. 1996. "In lingua tholetana." In idem, ed., *El Escuela de Traductores de Toledo*, 23–34. Toledo: Diputación provincial de Toledo.
Vuillemin-Diem Gudrun and Marwan Rashed. 1997. "Burgundio de Pise et ses manuscrits grecs d'Aristote: Laur. 87.7 et Laur. 81.8." *Recherches de théologie et philosophie médiévale* 64:136–98.
Willner, Hans, ed. 1903. *Adelard of Bath: De eodem et diverso, Beiträge zur Geschichte der Philosophie des Mittelalters*, edited by C. Baeumker, IV.1. Münster: Aschendorff.
Wüstenfeld, Ferdinand. 1877. *Die Übersetzungen Arabischer Werke in das Lateinische seit dem XI. Jahrhundert*. Abhandlungen der Königlichen Gesellschaft der Wissenschaften zu Göttingen, 21. Göttingen: Dieterich'sche Verlags-Buchhandlung.

Appendix I

A Critical Edition of *the Vita, Commemoratio librorum* and *Eulogium* of Gerard of Cremona

The *Vita, Commemoratio librorum* and *Eulogium* have been transmitted in the following manuscripts:

- A: Erfurt, Wissenschaftliche Bibliothek der Stadt, Amplon. Fol. 266a, s. xiii^2, fol. 126v
- B: Oxford, Bodleian Library, Ashmole 357, s. xiv, fol. 57r (list of astronomical works only)
- L : Leipzig, Universitätsbibliothek, 4° 1119, s. xiii^1, fol. 39r
- La: Laon, Bibliothèque municipale, 413, s. xiv (Italian), fol. 100v (*Commemoratio librorum* only)
- M: Leipzig, Universitätsbibliothek, 4° 1148, s. xiv^1, fols 233v–234v
- O: Oxford, All Souls, 68, s. xiii, fol. 111r (*Commemoratio librorum* only)
- P: Paris, Bibliothèque nationale de France, lat. 14390 (from St Victor), s. xiv, fols 223r-v

- V: Città del Vaticano, Biblioteca Apostolica, Vat. lat. 2392, s.xiii, fols 97v–98r
- W: Città del Vaticano, Biblioteca Apostolica, Vat. lat. 2393, s. xv, fol. 100v

In addition, most of the *Vita* is quoted by Francesco Pipino (d. 1316) in his *Chronicon*, ed. Muratori, *Rerum Italicarum scriptores ab anno aerae Christianae quingentesimo ad millesimumquingentesimum*, Milan, 1723–51, IX, col. 600–01 (= Pi).

The *Vita, Commemoratio librorum* and *Eulogium* have been edited in whole or part in the following works:

1) [Anonymous] 1710–40, X, 286–89 (excerpts from MSS VW); cited Boncompagni 1851.
2) Ravaisson 1849, 218–19 (MS La).
3) Boncompagni 1851 (MSS VPi and readings from B, O and W); this includes a facsimile of V.
4) Leclerc 1876, II, 402–07 (French translation of *Vita* and transcription of *Commemoratio librorum* and *Eulogium*, all from MS P; occasional mention of readings from VLaO).
5) Wüstenfeld 1877, 56–77 (MSS LM with occasional readings from VP).
6) Sudhoff 1914 (MSS ALMV; L is used as the base manuscript).

Modern studies and translations are based on these editions (especially 3, 5 and 6), and include the valuable English translation and commentary of Michael McVaugh (in Grant 1974, 35–38), and the annotations on the list of translations by George Sarton (in Sarton 1950, 338–44), and Richard Lemay (in Lemay 1978).[1] None of these editions, however, include readings from all the known manuscripts, and none is satisfactory from a philological point of view.[2] The following is a first attempt at an edition of the *Vita*, *Commemoratio librorum* and *Eulogium*, paying particular attention to the philological aspects of the text.[3] MSS V and P are clearly the best manuscripts; readings and orthography of V[4] have been preferred where both manuscripts give equally plausible versions. P is the only manuscript to give all the section headings to the *Commemoratio librorum*, after each of which he adds "R" (presumably for "rubrica"). Additional readings taken from other manuscripts or added by the editor are placed in angle brackets: < >. In parallel columns to the list of Gerard's works are placed the titles of the mathematical texts as they are given in the earliest and most authoritative manuscript: Paris, Bibliothèque nationale, lat. 9335 (late twelfth century), described by A. A. Bjørnbo (Bjørnbo 1902), and checked personally.

All the texts in this manuscript are included in the *commemoratio librorum* except *Tractatus Euclidis de speculis* (fols 82r–82v), *Liber de aspectibus Euclidis* (fols 88v–92r), two short works on trigonometry – *Liber Saydi Abuothmi* (fols 125v–126r) and *Liber Aderameti* (fols 126r–126v) – and a work on arithmetical puzzles: *Liber augmenti et diminutionis, vocatus numeratio divinationis, ex eo quod sapientes Indi posuerunt, quem Abraham compilavit et secundum librum qui Indorum dictus est composuit* (fols 126v–133v). In addition, the scribe has added on fol. 28v the order in which certain geometrical and astronomical texts should be read, according to "Iohanicius" (presumably

Ḥunayn ibn Isḥāq, the major translator of works from Greek and Syriac into Arabic), using the same format as that of the compilers of the *commemoration librorum* (whose numbers are added after the relevant texts):

> Ordo qui est post librum Euclidis (4) secundum quod invenitur in scriptis Iohanicii: Euclidis de aspectibus tractatus unus; Theodosii de speris tractatus tres (5); Autolici de spera mota tractatus unus (30); Euclidis de apparentibus tractatus unus; Theodosii de locis habitabilibus tractatus unus (26); Autholici de ortu et occasu duo tractatus; Theodosii de die et nocte duo tractatus; Esculei de ascensionibus tractatus unus (27); Arsodochii de elongationibus planetarum et earum (*sic*) magnitudinibus tractatus unus.

Modern identifications of the works are given in brackets.[5]

< *Vita*; MSS ALMVPPi >

Sicut lucerna relucens in abscondito non est ponenda neque sub modio, sed[6] supra[7]candelabrum locanda, sic nec splendida facta[8] bonorum, velut sub pigra[9] taciturnitate[10] sepulta, sunt reticenda,[11] sed auribus modernorum presentanda, cum virtutis ianuam[12] sequentibus[13] aperiant[14] et antiquorum exempla[15] quasi vite ymaginem oculis presentium digna commemoratione[16] insinuent. Ne igitur[17] magister Gerardus[18] Cremonensis sub taciturnitatis tenebris[19] lateat,[20] ne fame gratiam quam meruit, amittat,[21] ne per[22] presumptuosam rapinam libris ab ipso[23] translatis[24] titulus infigatur[25] alienus,[26] presertim cum nulli eorum nomen suum inscripsisset, cuncta opera ab eodem translata, tam de[27] dyaletica[28] quam de geometria, tam de[29] astrologia[30] quam de phylosophia,[31] tam etiam[32] de physica quam de aliis scientiis,[33] in fine huius Tegni,[34] novissime ab eo translati – immitando Galienum de[35] commemoratione suorum librorum[36] in fine eiusdem – per socios[37] ipsius[38] diligentissime fuerunt connumerata, ut, si aliquis intentionum[39] ipsorum amator de eis aliquid optaverit,[40] per hanc inscriptionem citius inveniat et de eo securior[41] fiat. Licet[42] enim fame gloriam spreverit, licet favorabiles laudes et vanas[43] seculi pompas[44] fugerit, licet nomen suum nubes et inania captando[45] nollet[46] dilatari,[47] fructus tamen operum eius per secula redolens probitatem[48] ipsius[49] enuntiat atque declarat.

Is[50] etiam cum bonis floreret temporalibus, bonorum tamen[51] affluentia vel absentia eius animum nec extulit nec depressit, sed viriliter duplicem oc < c > ursum[52] fortune[53] patiens,[54] semper in[55] eodem statu constantie permanebat;[56] carnis desideriis inimicando,[57] solis[58] spiritualibus adherebat,[59] cunctis etiam[60] presentibus atque futuris prodesse laborabat,[61] non immemor[62] illius Ptolomei:[63] 'cum fini[64] appropinquas, bonum cum augmento operare.'

Et cum ab[65] istis[66] infantie[67] cunabulis[68] in gremiis phylosophie[69] educatus esset et ad cuiuslibet partis[70] ipsius[71] notitiam secundum[72] Latinorum studium pervenisset, amore tamen[73] Almagesti, quem[74] apud Latinos minime reperit,[75] Toletum[76] per < r > exit, ubi librorum[77] cuiuslibet[78] facultatis habundantiam[79] in Arabico cernens et[80] Latinorum penurie de ipsis quam[81] noverat miserans,[82] amore transferendi

linguam < e > didicit[83] Arabicam, et sic[84] de utroque – de[85] scientia videlicet[86] et ydiomate – confisus,[87] quemadmodum Hametus[88] in epistula sua De proportione et proportionalitate[89] refert:[90] 'Oportet ut[91] interpres[92] preter excellentiam[93] quam adeptus est ex notitia lingue de qua et[94] in quam[95] transfert, artis[96] quam transfert[97] scientiam habeat,' more prudentis, qui[98] virida[99] prata perlustrans, coronam de floribus – non de omnibus, sed de pulcrioribus – connectit,[100] scripturam[101] revolvit Arabicam, de qua plurium[102] facultatum libros quoscunque[103] valuit[104] elegantiores[105] Latinitati tamquam[106] dilecte heredi, planius ac intelligibilius quo ei possibile fuit, usque ad finem vite sue[107] transmittere non cessavit. Viam autem universe carnis ingressus est anno vite sue.lxxiii.°, in anno domini nostri Ihesu Christi.mclxxxvii.°[108]

< *Commemoratio librorum*; MSS A (until 23) B (21–32) Lla (33–68) O (4–71) LMPV >

Hec vero[109] sunt nomina librorum quos transtulit:[110]

De dialetica[111]	
	Paris, BNF, lat. 9335 and identification
< 1 > Liber analeticorum[112] posteriorum Aristotilis tractatus .ii.	(Aristotle, *Posterior Analytics*)
< 2 > Liber commentarii Themistii[113] super posteriores analeticos[114] tractatus .i.[115]	(Themistius, *Comm. on Aristotle's Post. Anal.*)
< 3 > [116] Liber Alfarabii de silogismo	(al-Fārābī, *On the Syllogism*)
De geometria[117]	
< 4 > Liber Euclidis[118] tractatus .xv.	(Euclid, *Elements*)
< 5 > Liber Theodosii[119] de speris tractatus .iii.[120]	1r Liber Theodosii de speris (Theodosius, *Spherics*)
< 6 > Liber Archimedis[121]tractatus .i.[122]	28v Liber Arsamithis de mensura circuli (Archimedes, *On the Measurement of the Circle*)
< 7 > Liber de arcubus similibus tractatus .i.	30r Epistola Abuiafar Ameti filii Iosephi de arcubus similibus (Aḥmad b. Yūsuf, *On Similar Arcs*)
< 8 > Liber Milei[123] tractatus .iii.	32v Liber Milei de figuris spericis (Menelaus, *On Spherical Figures*)
< 9 > Liber Thebit[124] de figura alkata[125] tractatus .i.	(Thābit b. Qurra, *On the Sector-Figure*)

< 10 > [126] Liber Trium Fratrum tractatus .i.	55r Verba filiorum Moysi filii Sekir, id est Maumeti, Hameti, Hasen (The Banū Mūsā, *On Geometry*)
< 11 > Liber Ameti[127] de proportione et proportionalitate tractatus .i.	64r Epistola Ameti filii Iosephi de proportione et proportionalitate (Aḥmad b. Yūsuf, *On Ratio and Proportion*)
< 12 > Liber Iudei super decimum Euclidis tractatus .i.	92v Abbacus (Ibn ʿAbd al-Bāqī, *The Book of the Jew on the Tenth Book of Euclid*)
< 13 > Liber Alchoarismi[128] de[129] iebra[130] et almucabula[131] tractatus .i.	110v Liber Maumeti filii Moysi Alchoarismi de algebra et almuchabala (al-Khwārizmī, *Algebra*)
< 14 > Liber de practica[132] geometrie tractatus .i.	116v Liber in quo terrarum corporumque continentur mensurationes Abhabuchri, qui dicebatur Heus, translatus a magistro Girardo Cremonensi in Toleto de Arabico in Latinum, abreviatus (Abū Bakr, *On Terrestrial Measurements*)[133]
< 15 > [134] Liber Anaritii[135] super Euclidem[136]	(An-Nayrīzī, *Comm. on Euclid's Elements*)
< 16 > [137] Liber datorum Euclidis tractatus .i.	(Euclid, *Data*)
< 17 > Liber Tidei[138] de speculo tractatus .i.	84r Sermo de eo quod homo in speculo < videt > et in eo quod non est speculum et de causis illius, quem collegit ea ex libris antiquorum Tideus filius Theodori a Ruegoiu (?) medicus (Diocles, *On Burning Mirrors*)
< 18 > [139] Liber Alchindi[140] de aspectibus tractatus .i.	75r Liber Iacob Alkindi de causis diversitatum aspectus et dandis demonstrationibus geometricis super eas (al-Kindī, *On Optics*)
< 19 > Liber divisionum[141] tractatus .i.	(Euclid, *Book of Divisions* or Ibn ʿAbd al-Bāqī, *On the Division of Surfaces*?)[142]
< 20 > Liber carastonis[143] tractatus .i.	(Thābit b. Qurra, *Book of the Roman Balance*)
De astrologia[144]	
< 21 > Liber alfagrani[145] continens capitula .xxx.[146]	(al-Farghānī, *Rudiments*)
< 22 > Liber Almagesti tractatus .xiii.	(Ptolemy, *Almagest*)

< 23 > Liber introductorius[147] Ptolomei[148] ad artem spericam[149]	(Geminus of Rhodes, *Introduction to the Phenomena*)
< 24 > Liber Iebri[150] tractatus .viiii.	(Jābir b. Aflaḥ, *On the Flowers from the Almagest*)
< 25 > Liber Messehala[151] de orbe tractatus .i.	(Māshāʾallāh, *On the Orb*)
< 26 > Liber Theodosii[152] de locis habitabilibus tractatus .i.	25r Liber Theodosii de locis in quibus morantur homines (Theodosius, *On Habitable Places*)
< 27 > Liber Esculegii[153] tractatus .i.	22r Liber Esculei de ascensionibus (Hypsicles, *On the Rising of the Signs*)
< 28 > Liber Thebith[154] de expositione nominum Almagesti tractatus .i.[155]	23v Liber quem edidit Tebit filius Chore de his que indigent expositione antequam legatur Almagesti (Thābit b. Qurra, *On the Exposition of Terms in the Almagest*)
< 29 > Liber Thebit[156] de motu accessionis et recessionis[157] tractatus i.	141r Tractatus patris Asen Thebit filii Core in motu accessionis et recessionis (Thābit b. Qurra, *On the Forward and Backward Motion of the Stars*)
< 30 > Liber Autolici[158] de spera mota tractatus .i.[159]	19r Liber Autoloci de spera mota (Autolycus, *On the Moving Sphere*)
< 31 > Liber tabularum Iahen[160] cum regulis suis.	(Ibn Muʿādh, *Tables of Jaèn*)
< 32 > Liber de crepusculis tractatus .i.[161]	(Ibn Muʿādh, *On the Dawn*)
De phylosophia[162]	
< 33 > [163] Liber Aristotilis de[164] expositione[165] bonitatis pure.[166]	(Pseudo-Aristotle, *De causis*)
< 34 > Liber Aristotilis de naturali auditu tractatus .viii.	(Aristotle, *Physics*)
< 35 > Liber Aristotilis[167] celi et mundi tractatus quatuor.[168]	(Aristotle, *On the Heavens*)
< 36 > Liber Aristotilis de causis proprietatum et[169] elementorum[170] quatuor[171] tractatus primus;[172] tractatum autem secundum non transtulit eo quod[173] non invenit eum[174] in Arabico[175] nisi de fine eius parum.[176] [177]	(Pseudo-Aristotle, *On the Causes of the Properties and the Four Elements*)
< 37 > Liber Aristotilis de generatione et corruptione	(Aristotle, *On Generation and Corruption*)

< 38 > Liber Aristotilis methaurorum[178] tractatus .iii.; quartum[179] autem[180] non transtulit eo quod[181] sane invenit eum translatum.[182] [183]	(Aristotle, *Meteorology*, Books I-III)
< 39 > [184] Tractatus unus Alexandri[185] Affrodisii[186] de tempore et alius de sensu et alius de eo quod augmentum et incrementum fiunt[187] in forma et non in yle.	(Alexander of Aphrodisias, *On Time*, *On the Senses*, and *That Augment and Increase Occur in Form, not in Matter*)
< 40 > Distinctio[188] Alfarabii[189] super librum Aristotilis de naturali auditu.	(al-Fārābī, *Comm. on Aristotle's Physics*)
< 41 > [190] Liber Alkindi de[191] quinque essentiis.	31v Liber de quinque essentiis quem Iacob Alchildus (*sic*) filius Ysaac compilavit de dictis Aristotilis (al-Kindī, *On the Five Essences*)
< 42 > Liber Alfarabii[192] de scientiis.	143v Liber Alfarabii de scientiis translatus a magistro Girardo Cremonensi in Toleto de Arabico in Latinum (al-Fārābī, *On the Classification of the Sciences*)
< 43 > Liber Iacob[193] Alkindi[194] de sompno et visione.[195]	(al-Kindī, *On Sleep and Vision*)
De fisica[196]	
< 44 > [197] Liber Galieni de elementis[198] tractatus .i.[199]	(Galen, *On the Elements*)
< 45 > Expositiones[200] Galieni super librum Ypocratis de regimine acutarum egritudinum[201] tractatus .iiii.[202]	(Galen, *Comm. on Hippocrates' Treatment of Acute Diseases*)
< 46 > Liber de secretis Galieni tractatus .i.	(Pseudo-Galen, *Secrets of Medicine*)
< 47 > Liber Galieni de complexionibus tractatus .iii.[203]	(Galen, *On the Temperaments*)
< 48 > Liber Galieni de malitia complexionis diverse[204] tractatus .i.	(Galen, *On the Evils of an Unbalanced Temperament*)
< 49 > Liber Galieni de simplici medicina tractatus .v.	(Galen, *On Simple Medicines*)
< 50 > [205] Liber Galieni[206] de creticis diebus tractatus .iii.	(Galen, *On Critical Days*)
< 51 > Liber Galieni de crisi tractatus .iii.[207]	(Galen, *On Crises*)

< 52 > Liber Galieni de expositione libri Ypocratis in pronosticatione[208] tractatus .iii.	(Galen, *Comm. on Hippocrates' Prognostics*)
< 53 > Liber veritatis[209] Ypocratis tractatus .i.[210]	(Pseudo-Hippocrates, *Book of the Truth*)
< 54 > Liber Ysac[211] de elementis tractatus .iii.	(Isaac Israeli, *On the Elements*)
< 55 > Liber Ysac[212] de[213] descriptione rerum et diffinitionibus earum[214] et de differentia inter descriptionem et diffinitionem[215] tractatus .i.[216]	(Isaac Israeli, *On the Description of Things and their Definitions*)
< 56 > Liber Abubecri[217] Rasis qui dicitur Almansorius[218] tractatus.x.[219]	(ar-Rāzī, *The Book of Almansor*)
< 57 > Liber divisionum[220] continens.cliiii. capitula cum quibusdam confectionibus eiusdem.	(ar-Rāzī, *The Book of Divisions*)
< 58 > Liber Abubecri[221] Rasis introductorius in medicina parvus.	(ar-Rāzī, *Short Introduction to Medicine*)
< 59 > Pars[222] libri Albenguesim[223] medicinarum simplicium[224] et ciborum.	(Ibn al-Wāfid, *Book of Simple Medicines and Foods*)
< 60 > Breviarius[225] Iohannis Sarapionis[226] tractatus .vii.[227]	(Yaḥyā b. Sarafyūn, *Breviary*)
< 61 > [228] Liber Azaragui[229] de cirurgia[230] tractatus .iii.	(Abū-l-Qāsim az-Zahrāwī, *Surgery*)
< 62 > [231] Liber Iacob[232] Alkindi[233] de gradibus tractatus .i.	135r Liber Iacob Alkindi phylosophi de gradibus (al-Kindī, *On Degrees of Compound Medicines*)
< 63 > [234] Canon Aviceni[235] tractatus .v.[236]	(Avicenna, *Canon*)
< 64 > Tegni[237] Galieni cum expositione Ali Abrodoan[238]	(Galen, *Tegni*, with the *Comm.* of ʿAlī ibn Riḍwān)
De alchimia[239]	
< 65 > Liber divinitatis[240] de[241] .lxx.[242]	(Jābir b. Ḥayyān, *Book of Divinity*)
< 66 > Liber de aluminibus[243] et salibus	(Pseudo-Rāzī, *On Alumens and Salts*)
< 67 > Liber luminis luminum	(Pseudo-Rāzī, *The Light of Lights)*
De geomantia[244]	
< 68 > Liber[245] geomantie de artibus divinatoriis[246] < qui incipit: estimaverunt Indi. > [247]	(*Geomancy*)[248]
< 69 > [249] Liber alfadhol,[250] id est dharab de bachi[251]	(Alfadhol, *Book of Lots*)

< 70 > Liber de accidentibus alfel.[252]	140r Alfeal secundum motum lune (*Divination according to the Movement of the Moon*)
< 71 > Liber Anohe[253] et est tamquam sacerdocii mar(tyro)logium[254] t. .xiii.[255]	151v Liber Anoe. In hoc libro est rememoratio anni et horarum eius et reditionum anoe in horis suis et temporis plantationum et modorum agriculturarum et rectificationum corporum et repositionum fructuum, Harib filii Zeid episcopi quem composuit Mustansir imperatori (ʿArīb b. Saʿd, *Calendar*)

Rasis Abubecri[256] fecit alhaugui[257] et almansorium et divisiones.[258]

Albucasim[259] fecit azaugui[260] et[261] eius cirurgiam,[262] cuius cirurgiam[263] transtulit Magister Gerardus.[264]

Aviceni Alboali[265] fecit canonem.

< **Eulogium**; MSS LMPV >

Gerardus[266] nostri[267] fons, lux et gloria[268] cleri,
auctor[269] consilii, spes et solamen egeni,
voto[270] carnali fuit hostis[271] spirituali
applaudens,[272] hominis splendor fuit interioris.
Facta viri vitam studio florente[273] perhennant[274]
viventem famam[275] libri quos transtulit ornant.[276]
Hunc sine consimili[277] genuisse Cremona superbit,
Toleti[278] vixit, Toletum[279] reddidit astris.[280]
Deo gratias.[281]

Notes to Appendix I

[1] See also the discussion in Steinschneider 1904, 16–32, in Ricklin 1995, 71–76, and in Pizzamiglio ed. 1992, 3–7.

[2] The text has suffered from the fact that Leclerc and Wüstenfeld were bitter enemies, and that the manuscript-readings of the most recent edition (that of Sudhoff) cannot be relied upon.

[3] I am grateful to the librarians of the University Library in Leipzig, the Amplonian Library in Erfurt, and the Vatican Library, for sending me photographs of their respective manuscripts. MSS B, La and W have not been consulted personally; their readings have been taken from the secondary works mentioned above.

[4] The orthography of V has not been followed where the scribe inserts an extra 'h', writes 'ngn' for 'gn' ('dingna', 'Tengni') or 'ct' for 't' ('tolectum') or 'tt' ('mict-'). These spellings may reflect the scribe's vernacular.

[5] These agree with the identifications in McVaugh (in Grant 1974), except where mentioned otherwise.

[6] P *om.*

[7] super LMP.

[8] fama M.
[9] A *adds* 'bonorum'.
[10] tacitur morte M.
[11] reticeda L, recitenda M, retinenda P.
[12] iamiam P.
[13] sequentibus L *om*.
[14] apereant M, apperiant P.
[15] exemplo M.
[16] commemoratione A] cum memoratione LMV.
[17] ergo MP.
[18] G. etardus A, Girardus LMP.
[19] tenebri L.
[20] luceat L *before correction*, lateat L *after correction*.
[21] admictat V.
[22] per L *om*.
[23] eo MP.
[24] translatatis L.
[25] infingatur L.
[26] abenus M.
[27] L *om*.
[28] dialetica ALP.
[29] LP *om*.
[30] astronomia M.
[31] phya A, phisolophia L, phica et M, phylosophya V.
[32] etiam AL *om*.
[33] tam de dyaletica…scientiis] *first excerpt in Pipino's* Chronicon.
[34] Tengni V.
[35] in M.
[36] librorum suorum AMP.
[37] sotios V.
[38] ipsius M *om*.
[39] intencionem L.
[40] optavit M.
[41] de eo securior] de certior M, de eo certior P.
[42] *The passage from this word until the end of the* Vita *is quoted by Pipino, with the exception of the words* "*que*madmodum Hametus… revolvit Arabicam."
[43] novas Pi.
[44] pompas L *om*.
[45] in mania captanda M.
[46] noluerit Pi (*perhaps correctly*).
[47] dilari LM.
[48] probitataton proprietate M.
[49] eius P.
[50] quo M.
[51] cum M.
[52] cursum M.
[53] duplice fortune occursum P.
[54] patiens fortune AM.
[55] in A *om*.
[56] permanebis M.
[57] inmutando M.
[58] solum M.
[59] detrahent (*or* detraherit) A.

[60] etiam A *om.*
[61] laborat A.
[62] inmemo A, inmemor P.
[63] Tholomei MP; L *adds in margin* 'morale verbum'.
[64] filii M.
[65] L *om.*
[66] ipsis ALMPPi.
[67] in facie L, insince (?) M.
[68] cunabilis M.
[69] ph(ylosoph)ie AMPiV, phisice L, ph'ye P.
[70] artis Pi.
[71] illius M, Pi *om.*
[72] si M.
[73] tantum AL.
[74] quod M.
[75] repirit LM, reperiit APV.
[76] tolectum V.
[77] in librorum copiam M, libros Pi.
[78] cuiusque AL.
[79] Pi *om.*
[80] A *om.*
[81] quas M.
[82] miserat L.
[83] didicit V.
[84] si L.
[85] utroque de] utraque L.
[86] scilicet P.
[87] confixus L.
[88] Hametus L *om.*, hannerus A.
[89] proportionato M.
[90] referri A.
[91] M *om.*
[92] interpretes V.
[93] excellencia L.
[94] AL *om.*
[95] qua V.
[96] artes M.
[97] artis quam transfert] P *om.*
[98] quia LM.
[99] viridia P.
[100] conectit L.
[101] A *om.*
[102] de qua plurimum ALP, de quamplurium Pi.
[103] libros quoscumque] quosque P.
[104] voluit MPPi, L *adds* 'quam'.
[105] elonganciores A.
[106] numquam M, tanquam P.
[107] ALMP *om.*
[108] mclxxxiiii W.
[109] ALaOP *om.*
[110] La *adds* 'Magister Girardus Cremonensis'; O *adds* 'Magister Girardus Cremonensis in Toleto'.
[111] De dialetica V] de dialectica P, ALMO *om.*
[112] amaleticorum LMP.

[113] themesii A, ithemistii L, temistii M, Temetistii P.
[114] analencorum P.
[115] primus P.
[116] L *omits 3*.
[117] De geometria] P *only*.
[118] etuclidis A.
[119] Teodosii V.
[120] tertius P.
[121] Archimedis A, archimenidis LMP, archinenidis O, archimendis V.
[122] primus P.
[123] milci M, misey P.
[124] thobit L, tebith M.
[125] arthacata A, albeata L, alchata MP.
[126] M *om. 10–12*.
[127] Hameti LMO.
[128] argorismi A, acharismid. L, argorisim M, algorismi OP.
[129] L *om*.
[130] gebra M.
[131] almucabala AO, ali\mi/cabala L, altacabila M, almicubila P.
[132] pratia P, pratica OV.
[133] *For discussion of the identity of Abū Bakr, see Sezgin 1974, 389–91*.
[134] M *omits 15–16*.
[135] avaricii L.
[136] A *adds* 'tractatus'; OP *adds* 'tractatus.i.'.
[137] A *transposes 16 and 17*; P *omits 16*.
[138] thidei MP.
[139] A *omits 18–20*.
[140] askimii M.
[141] demonstrationum MP.
[142] Sezgin 1974, 387–88.
[143] tarastonis M; *O omits 20*.
[144] De astrologia VP] Isti sunt libri ast(rolog)ie quos transtulit Gerardus Cremonensis de Arabico in Latinum B, ALMO *om*.
[145] affagani L, alfragan M, alfragani P.
[146] xxx.i. M,.xx. V.
[147] introductoriis L.
[148] tholomei AP, talemei M, potlomiei O.
[149] A *ends*.
[150] rebi M.
[151] messobala L, messanala M, messæhala O.
[152] todosii L; O *omits 26*.
[153] esclilegii M, Cusculei P.
[154] thebith *post* nominum L, thelith M, thebiti P, thelith M, thebit O, tēbit V.
[155] Almagesti tractatus.i. M *om*.
[156] thebith L, thebth M.
[157] translationis P.
[158] autolosicide M, actolici P.
[159] tractatus.i.] P *om*.
[160] et ahen L, jaberi P.
[161] B *finishes here*.
[162] De phylosophia] LMO *om*., de phylosophya P, de phylosophyia (*sic*) V.
[163] La *starts here*.
[164] MO *om*.

[165] compositione La.
[166] pure bonitatis M.
[167] PV *om.*
[168] tractatus quatuor] La *om.*
[169] LaV *om.*
[170] helementorum V.
[171] LaV *om.*, tractatus quatuor P.
[172] tractatus primus] LP *om.*, primus tractatus O.
[173] quia L.
[174] P *om.*
[175] arabicum M.
[176] parum in ipsius fine M.
[177] tractatum autem…parum] P *om.*
[178] meteororum L, metheororum LaM, metaurorum O, metaherorum P.
[179] quantum L, P *om.*
[180] P *om.*
[181] eo quod] quia P.
[182] invenit eum sane translatum M, sane translatum invenit P.
[183] quartum autem…translatum] La *om.*
[184] La *omits 39.*
[185] aserande M.
[186] afrodisii LMP, anfrodisii O.
[187] et incrementum fiunt] fuit L.
[188] distinctio LM *om.*
[189] Affarabii LM, alfharabii O.
[190] MLa *omit 41.*
[191] Alkindi de] alchinididus L, Alchindi de O P.
[192] alfharabii O, Alpharabii P.
[193] M *om.*, iacobi P.
[194] alchindi LOP, Alchini La, alkemii M.
[195] sompno in visione L, sopno et visione V.
[196] De fisica V] LMO *om.*, de physica P.
[197] La *swaps 44 and 45.*
[198] esis M.
[199] ii. LaM.
[200] Expositionem La.
[201] acutarum egritudinum] acutorum egritudinum LP, egritudinum acutarum M, acutorum La.
[202] iii LM, 3 P. *Early manuscripts of this work consist of only three books; apparently the fourth book was translated later; the relative roles of Constantine the African and Gerard are unclear.*
[203] tractatus.ii M, La *om.*, tractatus 3 P.
[204] LaP *om.*, diverso O.
[205] La *swaps 50 and 51*; O *omits 50.*
[206] *From here onwards* La *omits* 'Liber Galieni'.
[207] i. La.
[208] pronostic. M, prognostic. O.
[209] virtutis M.
[210] iii. LaP.
[211] ysaac LMOP.
[212] isaac L, ysaac MOP.
[213] M *om.*
[214] et diffinitionibus harum L, La *om.*, et de diffinitionibus earum O.
[215] diffinitionem et descriptionem OV.
[216] i.] L *om.*, primus P.

[217] erubecri L, albubatri M, albubecri P, abubetri V.
[218] almasorius LP, almansor La.
[219] i. P.
[220] V *adds* 'almansoris'.
[221] abubetri L, albubetri M, albubecri P, V *om.*
[222] Ars La.
[223] abenguefiti LV, albenguesui La, abenguefeti O, albenguenfin M.
[224] simplitium V.
[225] breviaarius M.
[226] sarapionis iohannis L, iohannis serapionis MLaP.
[227] xv. O, 8 P.
[228] La *omits 61.*
[229] arazugni L, azaragrii M, azarugui OP, azatugui V.
[230] cyrugia M, cirugia V.
[231] V *exchanges 62 and 63.*
[232] V *om.*, iacobi P.
[233] achindi LLaP, alkimi M.
[234] La *omits 63.*
[235] civconn M.
[236] v.ZI L, ZI O (*possibly '21'*).
[237] Tengni V.
[238] aliacro doan L, Haly Abrodahan La, hali abrodohan M, Haly abrodoan OP.
[239] De alchimia] P *only.*
[240] diminuitatis M.
[241] L adds a lacuna, P *om.*
[242] lxxx. M.
[243] liminibus L, alluminibus La, alm'bus M, luminibus V.
[244] De geomantia] P *only.*
[245] LM *add* 'de'.
[246] de artibus divinatricibus La, de artibus divinantibus M, LOV *om.*
[247] qui incipit: estimaverunt Indi] M *only.*
[248] See p. 267 above.
[249] La *omits* 69–71 *and* 'Rasis Abubecri…transtulit Magister Gerardus'.
[250] alfadoch L, alfadolum M, alfodochî P.
[251] id est dharab de bachi] V *supra*, id est de arab de bachi L (tharab M), id est de arab de biachi O, de arabachi P, *i.e., perhaps ḍarab dhahabī* = 'golden bough'.
[252] alfeth L, alfa M, alfhel O, alfeb (*or* alfeh) V.
[253] anoche L, arite M, anhoe O, anoe P.
[254] mar(tyro)logium] mar'legium L, quatuor togiū M, P *corrects* 'inar-' to 'marlogium'.
[255] et est….xiii.] OV *om.*, …t..i. M.
[256] albutrati M, albubetri P, abubetri V.
[257] alhangui LM, alhagui P.
[258] L *adds* 'lbi'.
[259] albugafī L, albucasin M.
[260] azauguri L, titangin M, azaugin (*with an abbreviation mark on the 'g'*) P.
[261] L *om.*
[262] cuius cyrirgiam M, cuius cirugiam V, quam P.
[263] cyrurgiam M, cirugiam V.
[264] Giraldus L, Girardus M, OV *om.*
[265] Aviceni Avolai La, Avicenni aboali M, Viceni alboai P.
[266] Girardus ML.
[267] uten M.
[268] gloria MV, regula LW.

[269] actor VW.
[270] foto M *in rubrication but* 'voto' *in instructions for rubrication*.
[271] hostis MV.
[272] Ad plaudens P.
[273] florento M, florere P.
[274] perhennat M.
[275] vincentem famam M, viventem formam L.
[276] hornant L.
[277] consilii L, consilio W.
[278] tolecti V.
[279] toledum M, tolectum V.
[280] artis L.
[281] Deo gratias] V *only*.

Appendix II

The Eight Parts of Physics and Their Books

Al-Fārābī, *On the Classification of the Sciences*, trans. Gerard of Cremona, in González Palencia 1932, 161–63:

Et dividitur scientia naturalis in octo partes magnas.

(1) Quarum prima est inquisitio de eo in quo communicant corpora naturalis omnia, simplicia eorum et composita ex principiis et accidentibus consequentibus illa principia. Et hoc totum est in *Auditu naturali*.

(2) Et secunda est inquisitio de corporibus simplicibus an sint inventa et si sunt inventa tunc que corpora sunt et quantus sit eorum numerus. Et hec est consideratio in mundo quid est et que sint partes eius et quot sint et quod ipse sunt in summa tres aut quinque. Et hoc est in consideratione in celo et discretione eius a reliquis partibus mundi et quod materia que est in eo est una. Et est in parte prima tractatus primi libri *Celi et mundi* . . . usque ad finem tractatus primi libri *Celi et mundi* . . . est in principio tractatus secundi libri *Celi et mundi* usque circiter duas tertias eius . . . et hoc est illud quod consideratur in fine tractatus secundi et tercii et quarti libri *Celi et mundi*.

(3) Et tertia est inquisitio de generatione corporum naturalium et eorum corruptione sive commutatione. . . . Et hoc est in libro *De generatione et corruptione*.

(4) Et quarta est inquisitio de principiis accidentium et passionum que propria sunt elementis solum sine compositis ab eis. Et est in primis tribus tractatibus libri *Impressionum superiorum*.

(5) Et quinta est consideratio in corporibus compositis ab elementis et quod ex eis sunt similium partium et ex eis que sunt diversarum partium . . . hoc est in tractatu quarto libri *Impressionum superiorum*.

(6) Et sexta, et est in libro *Mineralium*, est consideratio in eo in quo communicant corpora composita similium partium . . .

(7) Et septima, et est in libro *Plantarum*, est consideratio in eo in quo communicant species plantarum . . .

(8) Et octava, et est in libro *Animalium* et libro *Anime* et qui sunt post utrosque usque ad postremum *Librorum naturalium*, est consideratio in eo in quo communicant species animalium et quod propriatur omni speciei eorum. Et est pars secunda speculationis in compositis diversarum partium.