Chapter 17 of Ḥešbon Mahalakhot ha-Kokhavim *by Abraham Bar Ḥiyya—The First Hebrew Catalog of Constellations, Fixed Stars and Lunar Mansions: Critical Edition, English Translation and Commentary*

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ABSTRACT: The present study focuses on chapter 17 of Abraham Bar Ḥiyya's (ca. 1065–ca. 1136) *Calculation of the stellar motions*, the canons of his astronomical tables. This chapter, the densest and most comprehensive account of the fixed stars written during the first phase of the reception of the Arabic astronomical tradition by Jewish scholars, includes the first ever Hebrew catalogue of the 48 Ptolemaic constellations, two lists of stars of the first and second magnitudes, and a list of the 28 lunar mansions. This study shows that for the design and contents of this chapter, Bar Ḥiyya was inspired by Farghānī's (d. Egypt, after 861) *Elements*, the first compendium of the *Almagest* that diffused the Ptolemaic astronomical tradition to the Arabic world. But the redaction of Farghānī's *Elements* on which Bar Ḥiyya drew is different from that known to modern scholarship today. The Arabic original of this text is now lost, but survives in the Hebrew translation of al-Farghānī's *Elements* by Jacob Anatoli (ca. 1230s). This paper also shows that Bar Ḥiyya's standard way of designating stars, constellations, and lunar mansions is a Hebrew translation of the common Arabic names, followed by a transliteration in Hebrew letters of the Arabic names. This was his tacit acknowledgement of the linguistic supremacy of Arabic, which had already proved its ability to absorb Greek science. In some cases, however, Bar Ḥiyya uses Hebrew biblical star- or asterism names to designate constellations, fixed stars and lunar mansions. This is how he sought to highlight his national identity.

KEYWORDS: Abraham Bar Ḥiyya, *Ḥešbon mahalakhot ha-kokhavim* (*Calculation of the stellar motions*), Hebrew medieval astronomy, Arabic medieval astronomy, Farghānī, Farghānī's *Elements*, Jacob Anatoli (translation of Farghānī's *Elements*), Ptolemy, *Almagest*, 48 Ptolemaic constellations, al-Battānī, *al-Zīj al-Ṣābi'* (al-Battānī), al-Bīrūnī, *Kitāb al-Tafhīm* (al-Bīrūnī), *Al-Qānūn al-Mas'ūdi* (al-Bīrūnī), José Maria Millás Vallicrosa, Isḥāq ibn Ḥunayn (translation of the *Almagest*), Al-Ḥajjāj (translation of the *Almagest*), *Kitāb al-mudkhal al-kabīr* (Abū Ma'shar), *Kitāb Ṣuwar al-Kawākib al-Thābita* (al-Sūfī), 28 lunar mansions, 1,022 fixed stars, 15 first-magnitude stars, biblical stars.

Abraham Bar Ḥiyya (ca. 1065–ca. 1136) was the first Jew to follow the Greco-Arabic astronomical tradition and write, in Hebrew, on the identification, location, and characterization of the fixed stars. This tradition ultimately goes back to Ptolemy's (ca. 100–ca. 170) catalogue in the *Almagest*, which lists 1025 fixed stars with their ecliptical coordinates and magnitudes, grouped into 48 constellations,[1] and was subsequently developed by prominent Arabophone astronomers. Bar Ḥiyya studied the fixed stars in all three of his works on astronomy. The entire last chapter of *Ṣurat ha-'areṣ* (The Form of the Earth), an introduction to Ptolemaic astronomy, deals with the motion of the fixed stars and the number of fixed stars in the northern, southern, and zodiacal Ptolemaic constellations.[2] *Luḥot ha-naśi'* (The Tables of the prince, henceforth *Ln*), Bar Ḥiyya's astronomical tables, include five star lists. The first two of them, which have been edited and studied by Bernard R. Goldstein,[3] list 14 first-magnitude and 14 second-magnitude stars. The other three lists are closely related to astrology.[4] The present study focuses on chapter 17 of *Ḥešbon mahalakhot ha-kokhavim* (Calculation of the stellar motions, hereafter *Ḥešbon*), which represents the canons of *Ln*, and incorporates, as will be shown below, the densest and most comprehensive account of the fixed stars written during the first phase of the reception of the Greco-Arabic astronomical Ptolemaic tradition by Jewish scholars.

Ḥešbon is extant today in at least 19 manuscripts,[5] indicating that it was one of the most popular Hebrew astronomical works circulating in the Middle Ages and the Early Modern Period. The Hebrew text of *Ḥešbon* was edited in 1959, on the basis of two manuscripts, by José María Millás Vallicrosa, who accom-

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1. Ptolemy's catalogue in the *Almagest* was transmitted to the Arabophone world through the Greek-to-Arabic translations by al-Ḥajjāj ibn Yūsuf ibn Maṭar and Isḥāq ibn Ḥunayn in the late eighth to late ninth centuries. See Paul Kunitzsch, *Claudius Ptolemäus: Der Sternkatalog des Almagest: Die arabisch-mittelalterische Tradition*. Vol. 1: *Die arabischen Übersetzungen* (Wiesbaden: Harrassowitz, 1986); idem, *Der Almagest: Die Syntaxis Mathematica des Claudius Ptolemäeus in arabisch-lateinischer Überlieferung* (Wiesbaden: Otto Harrassowitz, 1974).

2. Abraham Bar Ḥiyya, *Tzurat Haaretz*, ed. Raphael Lasri (Jerusalem: Hamachon Letchuna Vekidush Hachodesh 2009), 139–145; cf. Vatican, Biblioteca Apostolica Vaticana, MS ebr. 385, fols. 84a–88b.

3. Bernard R. Goldstein, "Star Lists in Hebrew," *Centaurus* 28 (1985): 188-191.

4. For a brief description of these five lists, see Appendix, pp. 298-299.

5. See the relevant records in the digital catalogue of the Institute for Microfilmed Hebrew Manuscripts, Israel National Library, Jerusalem.

panied it with a Spanish translation, a brief introductory study, and concise notes.[6] This edition, however, for reasons unknown to me, omits the bulk of chapter 17 (hereafter *Ch*17).[7] Despite its primordial role for our understanding of the earliest phase of the transfer of the Greco-Arabic astronomical tradition to Jewish scholars, starting in the twelfth century, *Ch*17 is today available only in manuscript and is virtually unknown to modern scholarship. To fill this conspicuous lacuna I embarked on a close scrutiny of this chapter. The present study fleshes out the main findings of this research and is divided into three parts.

The first part elucidates four main points: (1) the contents and organization of *Ch*17 and (since *Ḥešbon* represents the canons of *Ln*) the correspondences, if any, to *Ln*, to determine the extent to which *Ch*17 is a self-contained account of the fixed stars or an explanation of elements of *Ln* concerned with this topic;[8] (2) the sources on which Bar Ḥiyya drew for the structure and content of *Ch*17; (3) Bar Ḥiyya's *modus operandi* and linguistic approach when coining Hebrew names for fixed stars and other stellar objects; (4) the impact of *Ch*17 on subsequent medieval Hebrew astronomy. The second part is a critical edition, based on seven manuscripts of *Ch*17, accompanied by an English translation.[9] The third part is a commentary on this text, concerned exclusively with constellations, fixed stars, and other stellar objects, which constitute the backbone of *Ch*17. An appendix provides a brief description of the star lists in *Ln*.

6. José Maria Millás Vallicrosa, ed. and trans., *La obra Séfer hesbón mahlekot ha-kokabim* (Libro del cálculo de los movimientos de los astros) de R. Abraham bar Ḥiyya ha-Bargeloní (Madrid: CSIC, 1959).

7. Bar Ḥiyya, *Sefer Ḥešbon*, ed. Millás Vallicrosa (Hebrew part) chap. 17, pp. 101–102; (Spanish part) chap. 17, pp. 93–95.

8. For this topic, see Niran Garshtein, *The Relationship between Abraham Bar Ḥiyya's Astronomical Tables and his Treatise 'Calculation of the stellar motions'* (Hebrew), submitted for the Master degree in Bar Ilan University (Ramat Gan, 2016).

9. This edition is used for all quotations from or references to the Hebrew text of *Ch*17 and its English translation, in the format: *Ch*17 §2:1 = chapter 17 of *Ḥeshbon*, section 2, sentence 1.

Part I: Introductory Study

The Structure and Contents of Ch17 *and the Connection to* Ln

Following a title that incorporates an incomplete table of contents, *Ch*17 is organized into four parts and a coda, as follows:

(I)   The discussion of the motion of the fixed stars is divided into three sections. The first describes this motion as a steady movement around the poles of the ecliptic. This is followed by two values for the rate of motion of the fixed stars. The first, 1° in 100 years, which Bar Ḥiyya assigns explicitly to the Ancients, is Ptolemy's value; the second, which Bar Ḥiyya ascribes to the modern scholars, is al-Battānī's value: 1° in 67 years.[10]

The second section, on the apogees and the ascending nodes of the five planets, is ostensibly unconnected to the fixed stars. This topic is included in the first part of *Ch*17 because, Bar Ḥiyya says, the Ancients held that these points move at the same rate as the fixed stars: 1° in 100 years.[11] He goes on to state the values of the apogees and nodes of the five planets at the start of the first year of the 257th Metonic cycle, or 4865 AM (= 1005 CE), which is the radix for the calculations in *Ḥešbon* and *Ln*.[12] Under scrutiny, it emerges that the same values are found in one of the tables of *Ln* devoted to the same topic.[13] This table has no parallel in al-Battānī's *al-Zīj al-Ṣābi'*.

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10. *Ch*17, §1:1–4. See *Al-Battani sive Albatenii Opus astronomicum* ad fidem codicis Escurialensis Arabice editum, Latine versum, adnotationibus instructum a Carolo Alphonso Nallino (Hildesheim and New York, 1977 [Milan: Pubblicazioni del Reale Osservatorio de Brera in Milano, 1899–1907]), Arabic part, chapter 52, p. 191, line 21 – p. 192, line 4. See also Abraham Ibn Ezra's *Liber de Rationibus Tabularum*, ed. José M. Millás Vallicrosa (Madrid and Barcelona: CSIC, 1947), p. 78: "antiqui vero et Ptholomeus dicunt quod 100 annis unum gradum pretereunt Albateni vero probavit quod 66 annis uno gradu moventur"; Ibn Ezra's first version of *Book of Reasons*, ed. Sela (Leiden: Brill, 2007), §2.12:9, pp. 50–51.

11. *Ch*17, §2:1. See *Ptolemy's Almagest*, trans. and annot. G. J. Toomer (London: Duckworth, 1984), IX:7, pp. 449–453. See José Chabás and Bernard R. Goldstein, *A Survey of European Astronomical Tables in the Late Middle Ages* (Leiden: Brill, 2012), p. 47.

12. *Ch*17, §2:2–7.

13. MS Berlin OR. QU. 649, fol. 27b.

The third section offers detailed instructions for calculating the positions of these points before or after the aforementioned year.[14] Although the reason is not made explicit, these instructions are placed here because they are meant to show how to make use of the values in the aforementioned table of the apogees and the ascending nodes of the five planets in *Ln*. Their presence here also explains why Bar Ḥiyya opted to include the apparently redundant radix values of the apogees and nodes of the five planets in the previous section of *Ch*17.

(II) The second part of *Ch*17 presents, for the first time in the Jewish astronomical tradition, a Hebrew catalogue of the 48 Ptolemaic constellations, organized in three sections, on the zodiacal, northern, and southern constellations. After mentioning the canonical number of 1,022 fixed stars,[15] the first section enumerates the number of stars in the 12 zodiacal constellations, specifying that they are located slightly off the ecliptic, but gives the names of only the first and last of these constellations, omitting the others on the excuse that their names are well known to everyone.[16] The second and third sections, on the 21 northern and 15 southern constellations, respectively, give the Hebrew names for all of them, accompanied in most cases by the Arabic name transliterated into Hebrew. In a few cases Bar Ḥiyya also offers the Greek name and the name of some prominent Arabic star, transliterated into Hebrew. In both lists, the names of the constellations are preceded by the total number of stars in the northern and southern constellations.[17] The contents of each entry in these two sections are explained separately in

14. *Ch*17, §3:1–7.

15. As in the Greek text of Ptolemy's *Almagest*, also the Arabic translations give the total sum of stars as 1022, plus the three stars of a group called *Plokamos*, Coma Berenices, meaning the "lock" of Berenice. See Paul Kunitzsch, *Der Sternkatalog des Almagest*, 166–167, 182–183. Farghānī's *Elements* (between 833 and 857), the earliest Arabic compendium of the *Almagest*, took the number 1,022 from the Arabic translations of Ptolemy's *Almagest*, but was the first to specify this number alone. See Jacobus Golius, *Muhammedis Fil. Ketiri Ferganensis, qui vulgo Alfraganus dicitur, Elementa Astronomica, Arabice & Latine. Cum notis ad res exoticas sive Orientales, quae in iis occurrunt* (Amsterdam: Johannem Jansonium à Waasberge, & viduam Elizei Weyerstraet, 1669), (Arabic text) p. 75. From then on, the number 1,022 came to be considered the canonical number of Ptolemaic fixed stars. As we shall see shortly, Farghānī's *Elements* is one of the main sources on which Bar Ḥiyya drew for *Ch*17.

16. *Ch*17, §4:1–2.

17. See *Ch*17, §5:1–22 and §6:1–16.

the third part of this study. Note that there is no trace of the 48 Ptolemaic constellations in Bar Ḥiyya's *Ln*.

(III) The third part is divided into three sections. The first distributes the 1,022 fixed stars among the six magnitudes.[18] The second section lists 15 stars of the first magnitude;[19] the third, 13 stars of the second magnitude.[20] Each star in these two lists is designated by a Hebrew name, usually accompanied by the Arabic name transliterated into Hebrew and its corresponding planetary nature (and not the customary ecliptical coordinates).[21] Almost every star list in Arabic astronomical tables includes the planetary nature of the corresponding star;[22] three of the five star lists in *Ln* conform to this rule.[23] The other two star lists in *Ln* are organized in the same fashion as the two star lists in *Ch*17;[24] the names of the stars in the two parallel sets are virtually identical. However, the lists of first- and second-magnitude stars in *Ch*17 and *Ln* differ with regard to the number of stars (15 and 13 in *Ch*17; 14 and 14 in *Ln*), and the fact that the two lists in *Ch*17 include the planetary natures but not the customary ecliptical coordinates, while the parallel lists in *Ln* include the ecliptical coordinates but not the planetary natures. The content of each entry in these two lists is explained separately in the third part of this study.

(IV) The fourth part presents the first-ever Hebrew list of the lunar mansions. These are 28 asterisms in the zodiac, each occupying a bit less than 13°, where the Moon "lodges" on each day of the lunar month.[25] This part of

18. *Ch*17, §7:1–4.

19. *Ch*17, §8:1–16.

20. *Ch*17, §9:1–14.

21. The tradition of ascribing to some fixed star an astrological nature that is associated with the astrological properties of some planet goes back to Ptolemy's *Tetrabiblos* I:9.

22. E. S. Kennedy, "A Survey of Islamic Astronomical Tables," *Transactions of the American Philosophical Society* 46.2 (Philadelphia, 1956): 144, 157, 160, 162, 165. See also Chabás and B.R. Goldstein, *Survey*, 185–199.

23. See Appendix, pp. 298-299, star lists (c), (d) and (e).

24. See Appendix, p. 298, star lists (a) and (b).

25. When the Arabs adopted the lunar mansions in the pre-Islamic period, they applied the names they already used to designate the indigenous system of *anwā'*, based on heliacal risings and settings. See Paul Kunitzsch, "Al-Manāzil," in *The Arabs and the Stars* (Northampton: Variorum

*Ch*17 has two sections. The first is a short theoretical introduction.[26] The second is a list of the 28 lunar mansions, each accompanied by a Hebrew name, the number of stars in the asterism, its shape, and their magnitude. No astrological aspects are found here.[27] All these entries are discussed in the third part of this study. The 28 lunar mansions are not mentioned in *Ln*. However, the fifth star list in *Ln* is a catalogue of zodiacal asterisms (just as the lunar mansions are zodiacal asterisms), and the names of two of the asterisms in *Ln* are identical with those of lunar mansions in *Ch*17.[28]

In a sort of coda (§12:1–3), Bar Ḥiyya states that the aforementioned 1,022 stars are listed in Ptolemy's book, a clear reference to the star catalogue in the *Almagest*. Bar Ḥiyya then says that the locations of the stars of the first and second magnitude that he has given in *this book* were also derived from Ptolemy's catalogue and that these stars are usually engraved on the astrolabe and are useful for astrological prognostications.[29] In a final sentence, Bar Ḥiyya adds that he transcribed in *this book* the locations of stars that give indication in <the interpretation of> natal horoscopes of human beings.[30] To which *book* and to which *stars* was he referring here? It can only be a reference to *Ln*, certainly not *Ch*17. This is because the lists in *Ch*17 do not include the stars' positions, whereas almost all the lists in *Ln* are accompanied at least by the stars' ecliptical coordinates, and at least two of them include stars that give an indication in the interpretation of the natal horoscope.[31]

This coda, then, demonstrates that in Bar Ḥiyya's mind there was a strong connection between *Ch*17 and the star lists in *Ln*. Even though the 48 Ptolemaic

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Reprints, 1989), Essay XX, pp. 1–7. In addition to their calendrical applications, the lunar mansions were believed to be relevant to astrological weather forecasting, in general, and to rainfall in particular. See *The Book of the World*, *A Parallel Hebrew-English Critical Edition of the Two Versions of the Text*, ed., trans., and annot. Sh. Sela (Leiden: Brill, 2010), 92–95, 184–185.

26. *Ch*17, §10:1–5.

27. *Ch*17, §11:1–28.

28. See Appendix, p. 299, star list (e). The name of the first asterism in *Ln* is *kimah*, the same as the third lunar mansion in *Ch*17; the name of the 14th asterism in *Ln* is *the lion's nose*, which is also the name of the eighth lunar mansion in *Ch*17. See MS Berlin OR. QU. 649, fol. 59b, Cf. *Ch*17, §11:3 and §11:8.

29. *Ch*17, §12:1–3.

30. *Ch*17, §12:4.

31. See Appendix, pp. 298-299, star lists (c) and (d).

constellations and the 28 lunar mansions, which occupy the bulk of *Ch17*, are not mentioned in *Ln*, it stands to reason that *Ch17* is not a self-contained account of the fixed stars but was designed by Bar Ḥiyya to accompany and somehow explain the star lists in *Ln*. Because Bar Ḥiyya alludes in the coda to the star catalogue of Ptolemy's *Almagest*, the best way to place the five star lists of *Ln* in their proper astronomical tradition is by presenting a list of the 48 Ptolemaic constellations. We must also consider that the fifth star list in *Ln* is a catalogue of zodiacal asterisms, two of which share names with lunar mansions in *Ch17*.[32] Hence the best way to set these zodiacal asterisms in their proper celestial setting is to provide a complete description of the 28 lunar mansions, which also are zodiacal asterisms.

The Sources of *Ch17's* Contents and Structure

Let us ask first: Where did Bar Ḥiyya find the model for the peculiar organization of *Ch17*, which merges into a single chapter such variegated material as a discussion of the motion of the fixed stars, a catalogue of the 48 Ptolemaic constellations (but without naming their component stars), short star lists, and a description of the 28 lunar mansions? I have called it "peculiar" because all these elements of *Ch17* rarely appear in the same chapter in the Greco-Arabic astronomical tradition prior to Bar Ḥiyya. The most important catalogues of the 48 Ptolemaic constellations usually appear alongside complete, or almost complete, lists of the stars in these constellations, emulating Ptolemy's catalogue in the *Almagest*. This applies to *al-Zīj al-Ṣābi'* by al-Battānī[33] (ca. 858–929), the *Kitāb ṣuwar al-kawākib* by al-Ṣūfī[34] (903–986), and *al-Qānūn al-Masʿūdī* by al-Bīrūnī[35] (973–ca. 1050).[36] There are short lists of up to 50 stars in most treatises on the

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32. See above, note 28.

33. *Al-Battani sive Albatenii Opus astronomicum*, ed. Nallino, Arabic part, 245–274.

34. *Description des étoiles fixes composée au milieu du dixième siècle de notre ère par l'astronome persan Abd-Al-Rahman Al-Sūfi*, ed., trans., and annot. H.C.F.C. Schjellerup (St.-Pétersbourg: Commissionnaires de l'Académie Impériale des sciences, 1874).

35. Al-Bīrūnī, *Al-Qānūn al-Masʿūdī*, ed. S. H. Baranī (Hyderabad: Osmania Oriental Publication Bureau, 1954–1956), 1014–1126.

36. Two exceptions to this rule, both of them in introductions to astrology, are the catalogs of constellations in (a) Abū Maʿshar's *Kitāb al-mudkhal al-kabīr ilā aḥkām an-nujūm*; (see the

astrolabe, to illustrate the *rete*'s star list, and in astronomical tables.[37] Catalogues of the 28 lunar mansions usually appear in dedicated works, such as chapter 21 of al-Bīrūnī's *Chronology of Ancient Nations*,[38] or in astrological works, such as the section on elections in the *Kitāb al-Bāri'* by Ibn abī-l-Rijāl (died after 1037).[39] The closest resemblance to the organization of *Ch17* is found in the consecutive sections of al-Bīrūnī's *Kitāb al-Tafhīm* on the fixed stars.[40] However there is no evidence that al-Bīrūnī's star catalogue was known in the West in the Middle Ages; nor is al-Bīrūnī's *Kitāb al-Tafhīm* attested as one of Bar Ḥiyya's sources.

Millás Vallicrosa, in the introduction to his edition of *Ḥešbon*, argued that *Ḥešbon* draws heavily on the canons of al-Battānī's *al-Zīj al-Ṣābi'*.[41] He vaguely maintained that this applies to *Ch17*, too; he was more specific regarding the lunar mansions and pointed out that this section of *Ch17* is based on chapter 20 of the canons of al-Battānī's *al-Zīj al-Ṣābi'*.[42] This chapter, however, says nothing on the lunar mansions;[43] nor does any other chapter of al-Battānī's work have the structure of *Ch17*. If we pay heed to astronomical literature available in al-Andalus before Bar Ḥiyya's time, we find a star list compiled in 912–913,[44] and a book

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forthcoming edition by Charles Burnett and Keiji Yamamoto, Part II, chapter 1, section 7, lines 35–43), and (b) al-Bīrūnī's *Tafhīm* (see al-Bīrūnī, *The Book of Instruction in the Elements of the Art of Astrology*, ed. and trans. R. Ramsay Wright [London: Luzac, 1934], §§159–163, pp. 69–81).

37. See: Kennedy, "A Survey of Islamic Astronomical Tables," p. 144 *et passim*; Paul Kunitzsch, "Star Catalogues and Star Tables in Medieval Oriental and European Astronomy," in *The Arabs and the Stars*, Essay I, pp. 113–122.

38. Al-Bīrūnī, *The Chronology of Ancient Nations*, trans. and ed. C. Edward Sachau (London: Oriental Translation Fund of Great Britain & Ireland, 1879), chapter 21 ("On the lunar stations, their risings and settings, and on their images"), 336–365.

39. Aly Aben Ragel, *El libro conplido en los iudizios de las estrellas. Partes 6 a 8*, ed. Gerold Hilty (Zaragoza: Instituto de Estudios Islámicos, 2005), VII:101, pp. 171–180.

40. See *The Book of Instruction in the Elements of the Art of Astrology*, §§157–166, pp. 68–87.

41. Bar Ḥiyya, *Sefer ḥešbon*, ed. Millás Vallicrosa (Introduction), 14–17.

42. Ibid., 17.

43. This is an error. I assume that Millás Vallicrosa meant either chapter 20 of Farghānī's *Elements* as it is known to modern scholarship, which has a complete list of the 28 lunar mansions, or chapter 51 of the canons of al-Battānī's *al-Zīj al-Ṣābi'*, which briefly mentions the names of the lunar mansions in the framework of references to the amount of stars in the zodiacal constellations.

44. See Mercè Comes, "La primera tabla de estrellas de al-Ándalus," in Mònica Rius Piniés and Susana Gómez Muns (eds.) *Homenaje a Mercè Comes. Coordenadas del Cielo y de la Tierra* (Barcelona: Universitat de Barcelona, 2013), pp. 123–137. This star list is intended to illustrate the

of the *anwā'* written in 961.[45] However, stars and lunar mansions serve in them different purposes and are accompanied by parameters markedly different from those in *Ch*17. As for catalogues of the 48 Ptolemaic constellations, *Ch*17 is the first example of this sort in the Iberian Peninsula. So we must continue our search elsewhere.

For the design of *Ch*17, I will argue, Bar Ḥiyya was inspired by Farghānī's (d. Egypt, after 861) *Elements*, the first compendium of the *Almagest* that diffused the Ptolemaic astronomical tradition to the Arabic world. This should not be surprising, given that Millás Vallicrosa has already shown that *Ṣurat ha-'areṣ* (The Form of the Earth), composed by Abraham Bar Ḥiyya before *Ḥešbon*, depends heavily on Farghānī's *Elements*.[46] But the redaction of Farghānī's *Elements* on which Bar Ḥiyya drew is different from that known to Millás Vallicrosa and to modern scholarship today. The Arabic original of this text, which until at least the first half of the thirteenth century was considered to be the original redaction of Farghānī's *Elements*, is now lost, but survives in the Hebrew translation of al-Farghānī's *Elements* by Jacob Anatoli (ca. 1230s). Chapter 22 of this alternative version of al-Farghānī's *Elements* (henceforth *ECh*22), which I have recently edited, translated, annotated, and studied, is devoted entirely to the fixed stars.[47] That *ECh*22 was the main although by no means the sole source on which Bar Ḥiyya drew for *Ch*17 is indicated by the fact that *Ch*17 and *ECh*22 share the same organization and similar contents in most of their parts.

I begin with the organization. *ECh*22 combines the contents of chapters 19 and 20 of the standard Arabic text of Farghānī's *Elements* as known to modern scholarship, concerned respectively with (a) the motion of the fixed stars and

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rete of an astrolabe, and includes 16 stars accompanied by their ecliptical coordinates, diurnal arch for the latitude of Cordova, and mediation. By contrast, the 28 stars in *Ch*17 are accompanied by their planetary natures alone and appear in a different order.

45. *Le Calendrier de Cordoue de l'année* 961, publie par R. Dozy (Leyde: Brill, 1873). This calendrical work does not bring a list of the 28 lunar mansions but specifies, for each month, the lunar mansions setting or arising at sunset.

46. See José María Millás Vallicrosa, *La obra Forma de la Tierra de R. Abraham Ibn Ezra ha-Bargeloni* (Madrid-Barcelona: CSIC, 1956), pp. 14–16.

47. Sh. Sela, "Al-Farghānī on the 48 Ptolemaic Constellations: A Newly Discovered Text in Hebrew Translation," *Aleph* 16.2 (2016): 249–365. My edition of *ECh*22 is used for all quotations from or references to the Hebrew text and its English translation, in the format: *ECh*22 §2:1 = *ECh*22, ed. Sela, section 2, sentence 1.

their six magnitudes, followed by a list of 15 first-magnitude stars, and (b) a full list of the 28 lunar mansions. The bulk of *ECh22*, between these two sections, is a unique and hitherto unknown account of the 48 Ptolemaic constellations. In what follows I present the correspondences, if any, between the contents of *ECh22* and the four parts I have identified in *Ch17*. For each of these I also mention, where relevant, elements of *ECh22* that do not match anything in *Ch17*.

(I) The first part of *ECh22* discusses the motion of the fixed stars with respect to the ecliptic and endorses Ptolemy's value of precession (1° in 100 years), as *Ch17* does.[48] But the latter's discussion of the planetary apogees and nodes has no match in *ECh22*.[49]

(II) The central part of *ECh22* is a list of the 48 Ptolemaic constellations, divided into 21 northern, 12 zodiacal, and 15 southern constellations, which are described in the same format as in *Ch17*.[50] This means that each constellation is accompanied by its Arabic name, occasionally also the Greek name, and the name of a prominent star in it. The account in *ECh22* includes the total number of fixed stars in all 48 constellations and the number of stars in the zodiacal, northern, and southern constellations, as *Ch17* does. Neither *ECh22* nor *Ch17* follows the name of the constellation with a complete or partial list of the stars in it, contrary to the custom of Arabic catalogues, which follow the model of the star catalogue in Ptolemy's *Almagest*.[51] But *ECh22* also includes the number of stars in each constellation, which *Ch17* does not.

(III) Following the division of the 1,022 Ptolemaic fixed stars into six magnitudes and a count of the fixed stars in each stellar magnitude, *ECh22* lists 15 first-magnitude stars, accompanied by their Arabic names but without the usual ecliptical longitude and latitude for each. A virtually identical list of 15 first-magnitude stars appears in *Ch17*, accompanied by their planetary nature.[52] The correspondence between these two star lists is discussed below. *Ch17* also has a list of 13 second-magnitude stars, which *ECh22* does not.

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48. See *ECh22*, §2:2; Cf. *Ch17*, §1:1–4.
49. See *Ch17*, §2:1–7; §3:1–7.
50. See *ECh22*, §4:1–22; §5:1–14; §6:1–17; Cf. *Ch17*, §4:1–2; §5:1–22; §6:1–16.
51. For examples, see nn. 33, 34, and 35.
52. See *ECh22*, §1:3–7; §2:1–15; Cf. *Ch17*, §7:1–4; §8:1–16.

(IV) The last part of *ECh*22 offers a full account of the 28 lunar mansions, accompanied by their Arabic names transliterated into Hebrew script and translated into Hebrew. A similar account appears in *Ch*17. Both *ECh*22 and *Ch*17 designate the lunar mansions by virtually identical names, ignore the calendrical and astrological aspects of the lunar mansions, and are concerned exclusively with astronomical matters, such as the number of stars in the asterism, their shape, and their visibility.[53] But *Ch*17 also specifies the magnitudes of the stars.

We see, then, that except for the discussion of the planetary apogees and nodes and the list of second-magnitude stars, all the topics addressed in *Ch*17 have a counterpart in *ECh*22, presented with a similar approach. But Bar Ḥiyya's reliance on *ECh*22 also relates to the content. The names of the constellations and of other celestial objects in *Ch*17, especially the combined names, (meaning double Hebrew names sometimes accompanied by the Arabic names transliterated into Hebrew,) provide significant clues for finding his sources. The analysis of this evidence and its implications is found in the notes to each of the constellations and stars; here I limit myself to some general remarks. Most of the constellation and star names in *Ch*17 can be found in the early translations of the *Almagest* by al-Ḥajjāj and Isḥāq ibn Ḥunayn and continued to be employed in the star catalogues of al-Battānī, al-Ṣūfī, and al-Bīrūnī. Hence they do not provide unequivocal evidence about Bar Ḥiyya's dependence on a specific source. However, a few exceptions, related to combined names, point to a clear link between *Ch*17 and *ECh*22.

*Ch*17 designates the constellations Cassiopeia, Boötes, and Hydra by combined names representing separate traditions that, as far as I know, never appear together in the Greco-Arabic Ptolemaic tradition before Bar Ḥiyya except in *ECh*22.[54] *Ch*17 refers to the constellations Auriga, Lyra, Canis Major, and Canis Minor with combined names whose only appearance in the Greco-Arabic Ptolemaic tradition before Bar Ḥiyya is in al-Ḥajjāj's translation of the *Almagest* and in *ECh*22.[55] Given *Ch*17's heavy dependence on *ECh*22 for its organization and the names of some constellations, I find it much more plausible that Bar Ḥiyya drew

53. See *ECh*22, §8:1–29; Cf. *Ch*17, §11:1–28.
54. See, respectively, *Ch*17 §5:10, §5:6, §6:9 and notes.
55. See, respectively, *Ch*17 §5:13, §5:9, §6:6, §6:7 and notes.

on *ECh*22, and that *ECh*22, in its turn, drew on al-Ḥajjāj's translation of the *Almagest*, than that *Ch*17 drew directly on al-Ḥajjāj's translation.

As indicated by Millás Vallicrosa, much of the astronomical material in *Ḥešbon* is based on the canons of al-Battānī's *al-Zīj al-Ṣābi'*. That Bar Ḥiyya also drew on al-Battānī for the names of the constellations is supported by the double name used in *Ch*17 for Andromeda, whose counterpart in the Arabic Ptolemaic tradition is found only in the star catalogue in *al-Zīj al-Ṣābi'*.[56] Regarding Centaurus, the name used in *Ch*17 suggests that Bar Ḥiyya drew either on al-Battānī or on *ECh*22.[57] However, the name used for Corona Borealis (*al-fakka*) in *al-Zīj al-Ṣābi'* proves that al-Battānī could not possibly have been Bar Ḥiyya's source, since the latter employs the common Arabic name of the constellation (*al-iklīl al-šamālī*), translated into Hebrew and transliterated in Hebrew script.[58] The same applies to the discrepancy in Bar Ḥiyya's and al-Battānī's names for Lyra and Equuleus.[59]

The likelihood that the list of 15 first-magnitude stars in *Ch*17 is a virtual replica of the list in *ECh*22 is supported by the following points: (a) As far as I know, the latter is the only precedent of a *separate* list of 15 first-magnitude stars before Bar Ḥiyya's time. (b) The stars in the two lists are virtually identical and are given the same names, although not presented in the same order.[60] The only exception, a star of problematic identification, was inserted by Bar Ḥiyya as item 14 in the list of first-magnitude stars of *Ch*17, probably as a result of confusion with another first-magnitude star, which he erroneously inserted in the list of second-magnitude stars.[61]

56. See *Ch*17, §5:21 and note.

57. See *Ch*17, §6:12 and note.

58. See *Ch*17, §5:7 and note.

59. See, respectively, *Ch*17, §5:9, §5:19, and notes.

60. Bar Ḥiyya' list is not strictly ordered by the stars' ecliptical longitude. Thus, θ Eri, which according to its longitude (Ari 14° 40′) should have been the first item, as in *ECh*22, appears in the third place in *Ch*17; and α Aur, which according to its longitude (Gem 9° 30′) should have been the third item, as in *ECh*22, appears in the seventh place in *Ch*17.

61. See *Ch*17, §8:15 and note. The first-magnitude star in *ECh*22 that does not appear in *Ch*17 is β Leo, called the *tail of the lion*. Because β Leo appears in *Ch*17, but in the list of second-magnitude stars, and since item 14 in the list of first-magnitude stars of *Ch*17 is called the *tail of the horse*, I assume that Bar Ḥiyya confused the names of the two stars and swapped *the tail of the lion* with the *tail of the horse*.

But *ECh22* was certainly not Bar Ḥiyya's sole source. That Bar Ḥiyya also drew on al-Battānī is supported by the fact that (as remarked by B.R. Goldstein) the longitudes of the stars in the first- and second-magnitude star lists in *Ln* consistently agree with those of al-Battānī, with a precession of 3° 20', and with those of Ptolemy, with a precession of 14° 30'.[62] Note, however, that there are differences in the Arabic names found in al-Battānī's star catalogue and in Bar Ḥiyya's *Ch17* and *Ln*, regarding items 5, 6, and 7 in *Ch17*'s list of first-magnitude stars (α CMi, α CMa, α Aur), and regarding item 12 in its list of second-magnitude stars (δ Leo).[63] This indicates that Bar Ḥiyya's depended on al-Battānī mainly for the stars' ecliptical longitudes; but looked elsewhere for their names and other properties. Moreover, the star that appears as item 10 in the second-magnitude lists of both *Ch17* and *Ln* has no match in Battānī's catalogue, which means that Bar Ḥiyya took it from another source.[64]

That Bar Ḥiyya drew on another source is also clearly shown by the fact that every star in the two lists in *Ch17* is accompanied by its planetary nature, in contrast with the star lists in *Ln*, in al-Battānī's catalogue, and in Ptolemy's catalogue. This source is as yet still unknown. However, as shown in the notes to each star in the two star lists of *Ch17*, this source circulated widely in the Iberian peninsula: in most cases, Abū Jaʿfar Aḥmad b. Yūsuf Ibn al-Kammād, in his list of 30 stars,[65] Abraham Ibn Ezra (ca. 1089–ca. 1167), in the star lists of *Reshit Ḥokhmah*,[66] and the Old Spanish version of Ptolemy's catalogue[67] assign the same planetary nature to the same stars as *Ch17* does, indicating that they drew on a common source.

I turn now to the account of the 28 lunar mansions, for which, as shown in the notes in the third part of this study, Bar Ḥiyya's reliance on *ECh22* is clear with regard to their names, the number of stars in the asterisms, and their shapes. The

62. Goldstein, "Star Lists in Hebrew," 188.

63. See, respectively, *Ch17*, §8:6, §8:7, §8:8, §8:13, and notes.

64. See *Ch17*, §9:11 and note.

65. José Chabás and Bernard R. Goldstein, "Ibn al-Kammād's Star List," in eidem, *Essays on Medieval Computational Astronomy* (Leiden: Brill, 2015), Essay XI, pp. 373–388.

66. *Abraham Ibn Ezra's Introductions to Astrology*, A Parallel Hebrew-English Critical Edition of the *Book of the Beginning of Wisdom*, ed., trans., and annot. Sh. Sela, (Leiden: Brill, 2017), pp. 24-26.

67. Manuel Rico y Sinobas, *Libros del Saber de Astronomía del Rey D. Alfonso X de Castilla* (Madrid: Tipografía de Eusebio Aguado 1863–1867), vol. I.

lunar mansions are also mentioned in chapter 51 of the canons of al-Battānī's *al-Zīj al-Ṣābi'*. That could not have been Bar Ḥiyya's source, however: (a) Al-Battānī assigns the first and seventh lunar mansions different names never used by Bar Ḥiyya.[68] (b) The bulk of the data in *Ch*17 on the lunar mansions, such as the number of stars in the asterisms and their shape, is missing from chapter 51 of the canons, which mention the names of the lunar mansions only in the context of references to the number of stars in each zodiacal constellation.

In search of a further point of reference as to sources on the lunar mansions available in the Iberian peninsula in the first half of the twelfth century, the notes on each of them in the third part of this study include a comparison between the accounts in *Ch*17 and *ECh*22, on the one hand, and in the two lists of lunar mansions in the first and second versions of Abraham Ibn Ezra's treatise on the astrolabe. This comparison shows that whereas *Ch*17 and *ECh*22 coincide as to the names, numbers of stars, and shapes of the asterisms, Ibn Ezra sometimes uses different names not found in *Ch*17 or *ECh*22 and even assigns them different shapes and different numbers of stars.[69] This suggests that whereas *Ch*17 drew on *ECh*22, Ibn Ezra had some other source.

It is worth noting that in all of its references to the asterisms of the lunar mansions *Ch*17 specifies the stellar magnitude of their stars. The presence of this information, absent from *ECh*22 and Ibn Ezra's lists, is surprising, because the asterisms of the lunar mansions tend to consist of dimmer stars and only rarely of first- or second-magnitude stars. I assume that, because the stars' magnitude is a central main topic of *Ch*17, Bar Ḥiyya had recourse to a full star catalogue and added the magnitudes of the lunar mansion stars on his own.

The Coinage of Hebrew Names for Constellations, Stars, and Lunar Mansions

The twelfth century witnessed the emergence of a new Hebrew science that conveyed the Greco-Arabic world view to Jewish civilization. From a chronological perspective, Abraham Bar Ḥiyya was a true pioneer: he wrote all his work on

68. See *Ch*17, §11:1, §11:7, and notes.
69. See *Ch*17, §11:5; §11:6; §11:11; §11:17; §11:19; §11:20; §11:24; §11:25; §11:28, and notes.

astronomy, mathematics, the Jewish calendar, astrology, and philosophy in Hebrew, an unprecedented endeavor that required the creation of a new Hebrew scientific vocabulary. Here I focus on Bar Ḥiyya's techniques when coining Hebrew names for constellations, stars, and lunar mansions, the building blocks of *Ch*17.[70]

For most of the stars, constellations, and lunar mansions in *Ch*17, Bar Ḥiyya offers one and sometimes two Hebrew names that are literal renderings of the common Arabic names. But he frequently incorporated the Arabic, and less often also the Greek, name into the Hebrew text through transliteration, unlike his Jewish contemporaries who eschewed this procedure.[71] As illustrated in the Hebrew text of *Ch*17 and its English translation, Bar Ḥiyya's most widespread method for designating stars, constellations, and lunar mansions in *Ch*17 is to combine these two techniques; first he translates the Arabic common name (or names) of some stellar object into Hebrew, followed immediately by the transliteration in Hebrew characters of that Arabic name. Let us look at these two techniques in detail.

In most cases, Bar Ḥiyya offers a full transliteration of the Arabic name into Hebrew script. In some instances, however, the transliteration is incomplete;[72] this may involve dropping the definite article[73] or transliterating only half of the Arabic expression and translating the other half into Hebrew.[74] Regarding Greek transliterations, in some instances Bar Ḥiyya explicitly acknowledges the Greek provenance,[75] in others not;[76] but in all cases these are Greek names that had been

70. For Bar Ḥiyya's coinage of technical terms related to mathematics and historical astrology, see G. B. Sarfati, *Mathematical Terminology in Hebrew Scientific Literature of the Middle Ages* (Jerusalem: Magnes Press, 1968), 61–129 [Heb.]; Josefina Rodríguez Arribas, "Terminology for Historical Astrology According to Bar Ḥiyya and Ibn Ezra," *Aleph* 11.1 (2011): 12–40.

71. As for the names of the constellations, Abraham Ibn Ezra follows the same general politics of translation he applied in all his translations: he consistently translates the Arabic names into Hebrew and avoids simply transliterating Arabic, Greek, or double names in Hebrew letters. See, *Rešit Ḥokhmah*, §1.3:1–4, §1.4:1–16; §1.5:1–23, in Sela, *Abraham Ibn Ezra's Introductions to Astrology*, pp. 50-56.

72. See *Ch*17, §5:7, §8:5, and notes.

73. See *Ch*17, §8:8, §9:5, and notes.

74. See *Ch*17, §8:10 and note.

75. See *Ch*17, §5:5, §6:12, and notes.

76. See *Ch*17, §5:21, §6:12, and notes.

transliterated into Arabic langu

age and used as the common names of constella-
tions in the Arabic Ptolemaic astronomical tradition.

On occasion Bar Ḥiyya offers the Hebrew translation without specifying the
Arabic name behind it. Sometimes he justifies this approach by saying that his
translation "is like the Arabic name," thereby implying that the translation is not
only semantically but also phonetically equivalent to the Arabic name underlying
his translation.[77] In other instances Bar Ḥiyya provides no justification for omit-
ting the Arabic name, but it is clear that a transliteration would be superfluous,
inasmuch as the Hebrew translation is phonetically very similar to the missing
Arabic.[78] There are, however, a number of exceptions to this rule, cases where
Bar Ḥiyya's Hebrew translations are not phonetically close to the absent underly-
ing Arabic expressions.[79]

As a rule, the Hebrew names or expressions used in *Ch*17 are literal render-
ings of the Arabic. A remarkable exception is Bar Ḥiyya's use of biblical star- or
asterism names to designate constellations, fixed stars, and lunar mansions. As I
have pointed out in a separate study, Bar Ḥiyya was following closely in the foot-
steps of Saadia Gaon (882–942), who wrote most of his works in Baghdad, at a
time when scientific texts of Greek, Iranian, Syriac, and Indian origin were being
translated into Arabic and the sciences were flourishing in the Abbasid Empire;
Saadia was the first to link biblical and Arabic star names in his Arabic translation
of the book of Job.[80] Just as "ancient" or "indigenous" Arabic star names are in-
tegrated into the Arabic versions of Ptolemy's star catalogues and their deriva-
tives in medieval Arabic astronomy,[81] Bar Ḥiyya's Hebrew designations came to
supplant Arabic names of asterisms, constellations, fixed stars, and lunar man-
sions in medieval Hebrew astronomy.

In *Ch*17, Bar Ḥiyya uses the following biblical star- and asterism names:
(1) The biblical *daughters of 'ayiš* (Job 38:32) twice designates an asterism in
Ursa Major; in one instance, this biblical asterism is identified with the Arabic

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77. See, for example, *Ch*17, §5:4, §5:16 and notes.

78. See *Ch*17, §6:4, §6:5, §5:22, §6:8 and notes.

79. See *Ch*17, §5:11, §5:18, §5:19, §5:20 and notes.

80. See Sh. Sela, "Biblical Stars in Medieval Jewish Thought (Tenth-Twelfth Centuries),"
Journal of Jewish Studies 66.2 (2015): 317–340.

81. See: Paul Kunitzsch, *Untersuchungen zur Sternnomenklatur der Araber* (Wiesbaden: O.
Harrassowitz, 1961), 20ff.; Paul Kunitzsch and Tim Smart, *A Dictionary of Modern Star Names*
(Cambridge, MA: Sky Publishing, 2006), 6–7.

banāt na'š, the Arabic name for the Greater and Lesser Wains.[82] (2) In the list of first-magnitude stars, the biblical star *kesil* (Job 9:9, 38:31, Amos 5:8) is identified with the Arabic *suhayl*, α Car (Canopus).[83] (3) In the list of lunar mansions, the biblical *kimah* (Job 9:9, 38:31–32 and Amos 5:8) is identified with *al-thurayyā*, the classical Arabic name for the Pleiades group in Taurus, as well as the name of the third lunar mansion.[84]

But the Hebrew biblical lexicon was too sparse to satisfy the need to render the Arabic names of stars and constellations, particularly animal names. So it is not surprising that Bar Ḥiyya resorted to other linguistic devices. For the Arabic *al-sulaḥfāh*, "tortoise," which is one of the names of the constellation Lyra in the Arabic Ptolemaic tradition, Bar Ḥiyya drew on talmudic Aramaic for *futit'a*, used in B *Pesaḥim* 24a *et passim* as a reference to aquatic animals or fish that may not be eaten.[85] The same applies to *al-dulfīn*, the Arabic transliteration of the Greek name of the constellation Delphinus, for which Bar Ḥiyya found no better solution than an expression that combines an Aramaic word (*nun* "fish") and a Hebrew word (*ha-yam*, "the sea").[86]

I conclude this section with two examples of how Bar Ḥiyya assigned new meanings to classic Hebrew words in his Arabic to Hebrew translations of star- and constellation names. The first example shows his willingness to add a new meaning to a standard Hebrew word because he is translating an Arabic word that is phonetically similar. He translates the Arabic word *al-ḥayya*, "snake" (found in the Arabic names of the constellations Ophiuchus, Serpens, and Hydra) as the phonetically equivalent Hebrew *ha-ḥayyah*, but which means "animal."[87] He did not need to do so, because he had ready to hand the biblical word *naḥaš*, of conspicuous presence in the Adam and Eve story and elsewhere in the Bible.[88] The second example exemplifies the assignment of a new meaning to a Hebrew word when he is translating an Arabic word that has more than one astronomical meaning. In Arabic astronomical literature, *jawzā'* denotes either the constellation

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82. See *Ch*17, §9:8, §5:3, and notes.
83. See *Ch*17, §8:9, and note.
84. See *Ch*17, §11:3, and note.
85. See *Ch*17, §5:9 and note.
86. See *Ch*17, §5:18, and note.
87. See *Ch*17, §5:14, §5:15, §6:9, and notes.
88. See *Ch*17, §5:14, §5:15, §6:9, and notes.

Gemini or the constellation Orion; Bar Ḥiyya consistently renders it in Hebrew as *te'omin*, "twins," even when it refers to Orion.[89]

These methods of coining Hebrew names for constellations, stars, and lunar mansion are the most conspicuous aspect of *Ch*17's influence on subsequent Hebrew astronomy.[90] The standard way of designating stars in medieval Hebrew lists is a Hebrew translation of the common Arabic name, followed by a transliteration in Hebrew letters of the Arabic name — the method used by Bar Ḥiyya in his own star lists. Jewish scholars also rendered the Arabic *al-ḥayya* and *al-jawzā'* as *ha-ḥayyah* and *te'omin*, just as Bar Ḥiyya did in *Ch*17. I would argue that this was their tacit acknowledgement of the linguistic supremacy of Arabic, which had already proved its ability to absorb Greek science, over Hebrew, a language that had previously been used almost exclusively for religious and liturgical purposes and from the twelfth century on was being transformed into a language of science. But an eye-catching feature of virtually every medieval Hebrew star list is the use of biblical terms to supplant Arabic names of stars, constellations, and lunar mansions, as in *Ch*17. It stands to reason to assume that this is how Jewish scholars, beginning with Bar Ḥiyya, sought to highlight their national identity.

The Influence of Ch17 *on Subsequent Hebrew Astronomy*

The reverberations of *Ch*17 may be readily felt in Hebrew lists of stars, constellations, and lunar mansions compiled between the twelfth and fourteenth centuries. In the first version of his *Sefer ha-Ṭe'amim* (Book of Reasons) Abraham Ibn Ezra, who began his scientific career just after Bar Ḥiyya left the scene, referred to chapter 20 of *Ḥešbon*.[91] That Ibn Ezra was also acquainted with *Ch*17 is supported by the use in his multiple lists of stars, constellations, and lunar mansions, of names of biblical stars and asterisms to supplant their Arabic designations, precisely as Bar Ḥiyya had done in *Ch*17.[92] Ibn Ezra also emulated Bar Ḥiyya by rendering the Arabic *al-ḥayya*, in the names of Ophiuchus, Serpens, and Hydra, as *ha-ḥayyah*.[93]

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89. See *Ch*17, 6:3, §8:3, §8:5, §9:3, §11:5, and notes.

90. This topic is expanded in the next section.

91. *The Book of Reasons*, *A Parallel Hebrew-English Critical Edition of the Two Versions of the Text*, ed., trans., and annot. Sh. Sela (Leiden: Brill, 2007), §10.3:6, pp. 98–99, and note on p. 175.

92. See Sh. Sela, "Biblical Stars in Medieval Jewish Thought," 331–337.

93. See *Rešit Ḥokhmah*, ed. Sela, §1.4:9; §1.5:14; §1.5:15, 52-53 and notes.

As noted, the Arabic text underlying *ECh22* was Bar Ḥiyya's main source of in-spiration for the organization and part of the contents of *Ch17*. Jacob Anatoli, who produced the Hebrew translation of al-Farghānī's *Elements* between 1231 and 1235, was in turn inspired by Bar Ḥiyya's *Ch17* for the Hebrew nomenclature of constel-lations and stars. Like Bar Ḥiyya in *Ch17*, Anatoli turned *al-ḥayya* into *ha-ḥayyah*,[94] and rendered *jawzā'* by *te'omin*, even when it referred to Orion.[95] In addition, Ana-toli uses the biblical *benot 'ayiš* for η UMa, just as Bar Ḥiyya does in *Ch17*.[96]

In *Ḥug Šamayim* ("Circuit of Heavens"), a treatise in which he describes an armillary sphere of his own design and its use, Gersonides (1288–1344), the great fourteenth-century philosopher and scientist, included a Hebrew list of 28 stars for the year 1325.[97] Their names[98] are identical to those of the 28 stars of the first and second magnitudes listed by Bar Ḥiyya in *Ch17* and *Ln*. The likelihood that Gersonides drew on *Ch17* is suggested by the fact that he had a copy of Bar Ḥiyya's *Ḥešbon* in his library.[99] In a reference to the zodiacal, northern, and southern constellations, in his commentary on Job 10:22, Gersonides refers to all three biblical stars and asterisms (*daughters of 'ayiš*, *kesil*, and *kimah*) with the names given them by Bar Ḥiyya in *Ch17*.

The impact of *Ch17* on medieval Jewish scholars is reflected by the fact that it found its way verbatim into a vast astrological and astronomical encyclopedia composed in 1256 by an anonymous and learned encyclopedist, who made a clever selection of sources and interspersed them with articles and comments of his own.[100] Because this encyclopedia contains the earliest available text of *Ch17*, and is also the most reliable, I have used it as the copy text for the critical edition presented in the second part of this study.[101]

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94. See *ECh22*, §4:13; §4:14; §6:8.

95. See *ECh22*, §2:4; §2:5; §6:5.

96. See *ECh22*, §1:5; Cf. *Ch17*, §9:8.

97. For a characterization of this treatise, see Sh. Sela, "Postscript: Gersonides' *Ḥug Šamayim*, Astrology, and Abraham Ibn Ezra" in idem, "Gersonides' Astrology and Abraham Ibn Ezra" *Aleph*, 17.2 (2017): 324-333.

98. Mantua, Comunità Israelitica MS ebr. 10 [IMHM F 790], fols. 14a–15a.

99. Gérard E. Weil, *La bibliothèque de Gersonide* (Louvain and Paris: E. Peeters, 1991), 46.

100. See Paris, Bibliothèque nationale de France, MS héb. 1058 (IMHM: F 22230), fols. 55a–57a. For a study of this encyclopedia, see Sh. Sela, "The Astrological-Astronomical Encyclopedia in MS Paris 1058," *Aleph* 14.1 (2014): 189–241.

101. But the encyclopedist did not copy slavishly from Bar Ḥiyya's *Ḥešbon*: at the beginning of each item of the list of 28 lunar mansions he interpolated one of three keywords whose meanings

Part II: Critical Edition and English Translation of Chapter 17 of Abraham Bar Ḥiyya's *Ḥešbon*

The edition of the Hebrew text of *Ch*17 offered here is based on the following seven manuscripts, which are among the oldest, most legible, and most complete among the 19 manuscript copies of Ḥeshbon extant today.

א   Paris, Bibliothèque nationale de France, MS héb. 1058 (F 22230),[102] 14th c., fols. 55a–57b.

ר   Florence, Biblioteca Medicea Laurenziana, MS Plut.88.28 (F 17849), 14th–15th c., Italian script, fols. 208b–211b.

מ   Mantua, Comunità Israelitica, MS ebr. 8 (F 788), 1471, Ashkenazi script, fols. 44a–45a.

ע   Paris, Bibliothèque nationale de France, MS héb. 1092 (F 15732), 15th c., Italian script, fols. 69b–71b.

פ   Paris, Bibliothèque nationale de France, MS héb. 1044 (F 33995), 14th c., fols. 62a–65b.

צ   Firenze, Biblioteca Medicea Laurenziana Plut.88.30 (F 17853), 15th c., Italian script, fols. 108b–110b.

ל   London, British Library Or. 1056 (F 5950), 13th-14th c., fols. 49b–51b.

I selected MS א as my copytext because *Ch*17 is incorporated there as a component of a vast astrological and astronomical encyclopedia composed in 1265, which is substantially earlier than the date of any other manuscript of any scientific treatise written by Bar Ḥiyya, and because it provides a reliable and clear, and the most

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convey the meteorological character of the corresponding lunar mansion: either *laḥah* (moist), *yevešah* (dry), or *beinonit* (intermediate). See: Paris, BNF, MS héb. 1058, fols. 56b–57a; Sela, "The Astrological-Astronomical Encyclopedia," 198. Immediately after the end of the account of the 28 lunar mansions, the encyclopedist interpolated a passage of 20 lines with a theoretical account explaining how predictions about rainfall may be made by means of the 28 lunar mansions and some reflections about their sizes. See Paris, BNF, MS héb. 1058, fols. 57a–57b. In the sequel, the encyclopedist presented an additional table of planetary nodes and apogees, which, in contrast with *Ch*17, uses an updated precession of 1° in 70 years. See Paris, BNF, MS héb. 1058, fol. 61a.

102. This number corresponds to the film no. in the Institute for Microfilmed Hebrew Manuscripts of the Jewish National and University Library in Jerusalem.

complete text.[103] Where MS א presents lacunae, corrupted transliterations of Arabic names, or evident errors, I have preferred the readings of other manuscripts. I have added punctuation to the Hebrew text and divided it into sections and sentences to facilitate references. All the references to the Hebrew text of *Ch*17, its English translation, and the corresponding notes employ this division, in the format *Ch*17 §2:1 = chapter 17 of *Ḥešbon*, section 2, sentence 1.

The superscripted numbers in the Hebrew text refer to the *variae lectiones* of the Hebrew apparatus, which is intended to offer a succinct indication of all readings in the Hebrew manuscripts consulted that differ from the text printed here. The translation is meant to help readers understand the Hebrew text and is not addressed only to those with no Hebrew. Ultimately, the translation is a gloss and commentary on the Hebrew text. The English paragraph breaks and punctuation are virtually the same as in the Hebrew text and may also be taken as interpretative. Hebrew names of stars, constellations, and lunar mansions are as a rule translated. Whereas translated names of constellations are capitalized, star names are not. Arabic names found in the Hebrew text appear in the English translation in italics, in their standard romanized form, and not according to their transliteration in the Hebrew text, which frequently has corrupted and wildly variant readings. The numbers in the English translation refer to the notes in the commentary.

Abbreviations and Sigla

<	In the Hebrew apparatus, this siglum indicates that, for a given lemma, the word(s) following the siglum are added in the indicated manuscript in sequel to the lemma
>	In the Hebrew apparatus, this siglum indicates that, for a given lemma, the word(s) following the siglum are added in the indicated manuscript before the lemma
חסר	in Hebrew apparatus: lacuna
בשוליים	in Hebrew apparatus: in the margin
[ ]	in Hebrew text: folios in the copy texts of the editions
< >	in the translation: word(s) added to clarify the meaning
[ ]	in the translation: paraphrase or gloss

103. See above, p. 250

Hebrew Text

[55א] שער שבעה עשר[104]. בחשבון[105] מהלך כוכבי שבת, ומהלך נקודות רומי הרום וראש[106] התנינים לחמשת כוכבי הנבוכה, ומקומות כל[107] הנקודות האלה בשנת שרש[108] חשבון הספר הזה, ושמות כוכבי שבת שבמעלה הראשונה והשניה[109] שהן[110] חקוקות על הלוחות בספר הזה.

<div align="center">I</div>

(1) מהלך כוכבי שבת נסמך על אופן[111] המזלות, ומדת מהלכן כלן[112] מדה אחת שוה בשעורה[113] לכל אחד[114] מהן[115], ומרחב כל אחד מהן[116] מאופן המזלות עומד על ערך אחד, אינו לא מוסיף ולא גורע[117] ולא נוטה מצד אל[118] צד. (2) על הסדר הזה[119] מצאו אותו כל החוקרים[120] עליו מימי קדם. (3) וכל הקדמונים מצאו סדר[121] מהלכן ממזרח למערב כמהלך[122] כוכבי לכת[123] המיושר, וכלם[124] הסכימו על המהלך הזה שאין בו שום[125] חלוף. (4) והקדמונים

104. שער שבעה עשר] פערצמל; א: חסר.

105. בחשבון] פערצמל; א: חשבון.

106. וראש] אפ; ערצמל: וראשי.

107. כל] אצ; פערמ: בכל; ל: חסר.

108. שרש] אפעמל; רצ: שורש.

109. והשניה] אפעצמל; ר: והשנייה תכף.

110. שהן] פערצמל; א: שהם.

111. אופן] פערצמ; א: קוטבי אופן; ל: מהלך אופן.

112. כלן] פערצמל; א: כלם.

113. בשעורה] פערמל; אצ: בשיעורה.

114. אחד] אפע; רצמל: אחת.

115. מהן] פערצמל; א: מהם.

116. מהן] פערצמל; א: חסר.

117. אינו לא מוסיף ולא גורע] פערצמ; א: אינו מוסיף ואינו גורע; ל: אינו מוסיף ולא גורע.

118. אל] אפערצל; מ על.

119. הזה] אפערצל; מ: חסר.

120. החוקרים] אפרצמל; ע: החקוקים.

121. סדר] אפערצמ; ל: חסר.

122. כמהלך] אפערמל; צ: כמהלכן.

123. לכת] אפערל; צ: שבת; מ: חסר.

124. וכלם] פעמ; רצ: כלם; אל: וכלן.

125. שום] אפעמל; רצ: חסר.

העידו עליו שהוא מעלה אחת[126] בכל מאה[127] שנה, ומקצת האחרונים הבאים אחריהם[128] העידו[129] שהוא מעלה אחת בכל שבע וששים[130] שנה.

2

(1) ואנו סדרנו מהלכן[131] בלוח שעשינו לו על מעלה אחת בכל[132] ק'[133] שנה כדעת הקדמונים, ועל ערך המהלך הזה מצאו מהלך גובה הרום[134] וראשי התנינים לחמשת כוכבי הנבוכה. (2) והנה לך מעמדן[135] בראש מחזור רנ"ז שהוא שרש[136] החשבון בספר הזה. (3) שבתאי[137], גובה[138] רומו בשלש מעלות ממזל קשת, וראש תנינו כ"ג[139] מעלה בגדי. (4) צדק, גובה רומו כ"ב[140] מעלות בבתולה, ראש תנינו בשתי מעלות ממנה. (5) מאדים[141], גבה רומו וראש תנינו בשש מעלות מאריה.[142] (6) נגה, גובה רומו בחצי מעלת[143] י"ו[144] מתאומים[145], וראש תנינו בכדיהן מבתולה. (7) כוכב גובה, רומו[146] כ"א[147] מעלות ממאזנים, וראש תנינו בכדיהן מסרטן.

126. אחת] אפערצמ; ל: חסר.

127. מאה] ארצ; פעמל: ק'.

128. האחרונים הבאים אחריהם] אפעל; ר: חכמים; צ: הבאים אחריהם; מ: הקדמונים.

129. העידו] אפערצל; מ: > עליו.

130. שבע וששים] ארצ; פעמ: ס"ז.

131. מהלכן] אערמ; פצ: מהלכם.

132. מעלה אחת ... אחת בכל] אפערצמ; ל: חסר.

133. ק'] פערצמל; א: מאה.

134. הרום] אפערצל; מ: רום.

135. מעמדן] אערצמל; פ: מעמדם.

136. שרש] אפעמל; רצ: חסר.

137. שבתאי] אפמל; ערצ: שבתי.

138. גובה] אפער; צמל: גבה.

139. כ"ג] פערצמל; א: עשרים וארבע.

140. כ"ב] פערצמל; א: עשרים ושתים.

141. כאן מתחילה לאקונה בכ"י ל; הלאקונה מופיע בסוף הכ"י, בדף 62א.

142. מאדים גבה ... מעלות מאריה] אפערצל; מ: חסר.

143. מעלת] פעמל; רצ: חסר.

144. י"ו] פערצמל; א: שש עשרה.

145. מתאומים] פערמ; אצל: מן תאומים.

146. גובה רומו] ל' פערצמא: חסר.

147. כ"א] פערצמל; א: עשרים ואחת.

3

(1) והנקודות האלה מתגלגלות מעלה בכל ק׳ שנה, כאשר נזכר למעלה[148]. (2) ואם תרצה לדעת מעמדן לפני הזמן הזה או לאחריו, דע כמה שנים יש לו בין שני[149] הזמנים. (3) ותן לכל ק׳[150] שנה מהן[151] מעלה אחת, ולכל ה׳[152] שנים ג׳ שברים, שהן ל׳׳ו שניים לכל[153] שנה ושנה. (4) והעולה בידך מערך המהלך הוציאנו מקומן[154] הנזכר כאן אם מעמדן לפני מחזור רנ׳׳ז אתה דורש, ותהיה מוסיף אותו[155] על מקומן[156] אם אתה דורש מעמדן להבא[157]. (5) וגובה רום חמה[158] חקקנו אותו בראש מחזור[159] רנ׳׳ז על ט׳׳ו מעלות וחצי ממזל תאומים. (6) וקדמוני[160] חכמי שאר האומות[161] ורוב המתאחרים מהם רואים כי גובה רום החמה[162] מתגלגל בכל ק׳[163] שנה מעלה אחת כדרך גבה הרום לשאר כוכבי לכת, ובטלמיוס[164] לבדו היה דעתו שאין לגבה חמה[165] שום גלגול[166] כלל. (7) ורוב[167] הקדמונים והאחרונים[168] לא הסכימו על דעתו[169] מפני שמצאוהו בחקירתם[170] מתגלגל כשאר רומי הכוכבים.

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148. והנקודות האלה ... נזכר למעלה] פערצל; א חסר; מ: והנקודות מתגלגלים מעלה בכל ק׳ שנה כאשר נזכר למעלה.

149. לו בין שני] פעמ; א: בין שני; רצ בשני; ל: מן שני.

150. ק׳] פערצמל; א: מאה.

151. מהן] אפערמ; צל: מהם.

152. ולכל ה׳] פעמ; ר: וכל חמש; אצ: ולכל חמש; ל: ובכל ה׳.

153. לכל] ארצל; פעמ: בכל.

154. מקומן] תקנתי עפ׳׳י הקשר הדברים; ארצפעמל: מקומך.

155. אותו] פערצמל; א: אותן.

156. מקומן] ארצ; פעמ: מקומך.

157. להבא] אפעמל; רצ: חסר.

158. חמה] אפערצל; מ: החמה.

159. מחזור] פערצמל; א: חסר.

160. וקדמוני] אפמ; ערל: וקדמונים; צ: והקדמונים.

161. שאר האומות] א; פעמל: האומות; ר: האומנות הזו; צ: האומנות.

162. החמה] אצמ; פערל: חמה.

163. ק׳] ארצל; פמ: חסר.

164. ובטלמיוס] אפרצמל; ע: ובטולמיוס.

165. חמה] אפערצל; מ: חסר.

166. כאן מסתיימת הלאקונה בכ׳׳י ל.

167. ורוב] אפערמל; צ: ורב.

168. והאחרונים] ארצמ; פל: האחרונים.

169. דעתו] ארצל; פעמ: זה.

170. בחקירתם] אפעמל; צ: בחקירתן; ר: חסר.

4

(1) ומספר הכוכבים[171] כוכבי שבת[172] שחקקו[173] הקדמונים מקומותם[173] בספריהם הן[174] אלף כוכב וכ"ב[175] כוכבים, והם[176] נחלקים בדבריהם על מ"ח[177] צורה. (2) מהן[178] שמ"ו[179] כוכב חונים על י"ב[180] צורה שבעצם אופן המזלות או נוטה[181] ממנו מעט, והן י"ב[182] מזלות המפורסמות לכל העולם, שהראשון[183] טלה וסופן[184] דגים.

5

(1) ומהן ש"ס[185] כוכב מפוזרין[186] על כ"א[187] צורה אשר לפאת צפון מאופן המזלות[188] שהם[189] על צורות[190] חיות ובהמות, ואלה שמותן[191]. (2) א'. הדוב הקטן ובלשון ערבי אלדב[192] אלאצגר[193]. (3) ב'. הדוב הגדול[194], והוא[195] אלדוב[196] אלדב[196] אל[197] אכבר[198], ובתוכו בנות

171. הכוכבים] פערצמל; א: חסר.

172. כוכבי שבת] אפערל; צ: > ר"ל; מ: בכוכבי שבת.

173. מקומותם] פעמל; רצ: מקומותן; א: מקומו.

174. הן] אפערל; צ: הם; מ: חסר.

175. וכ"ב] פערצמל; א: ועשרים ושנים.

176. והם] אפרצמ; על: והן.

177. מ"ח] פערצמל; א: ארבעים ושמנה.

178. מהן] פעמל; א: מהם; רצ שהן.

179. שמ"ו] פערצמ; א: שלש מאות וארבעים וששה; ל: חסר.

180. י"ב] פערצמל; א: שנים עשר.

181. נוטה] פערצמל; א: נוטים.

182. והן י"ב] פערצמל; א: והם שנים עשר.

183. שהראשון] פ; עמל: שראשון; רצ: שראשון; א: שראשם.

184. וסופן] רצמל; א: וסופם; פע: וסופו.

185. ומהן ש"ס] פערצמל; א: ומהם שלש מאות וששים.

186. מפוזרין] פמל; עארצ: מפוזרים.

187. כ"א] פערצמל; א: עשרים ואחת.

188. המזלות] פערצא; מל: > ומהן שי"ו כוכבים מפוזרין על ט"ו צורה אשר לפאת דרום מאופן המזלות.

189. שהם] אמ; פערצל: שהן.

190. צורות] מל; פערצא: צורת.

191. שמותן] ערצמל; פא: שמותם.

192. אלדב] אפע; מל: אלדוב; רצ: חסר.

193. אלאצגר] פערל; א: אלאצגאר; צ: אלאיבגד; מ: חסר.

194. הגדול] מ; אפערצל: חסר.

195. והוא] אפערצמ; ל: ובלשון ערבי.

196. דוב] פערמל; א: דב; צ: אלדבב.

197. אל] ארצמ; פעל: חסר.

198. אכבר] פערצמ; א: כבר; ל כבאר.

עיש[199]. (4) ג'. תנין גדול[200], וכן שמו בערבי, וכן[201] בערבי אלתלהב,
ובלשון יון קיקאוס[202]. (5) ד'. צורת הלהב. (6) ה'. הנבח[203], ובלשון ערבי אלעוא[204], ובתוכו[205] הנסמך ברומח[206]
ובערבי[207] אלסמך אלרומח[208]. (7) ו'. הנזר הצפוני[209] ובערבי אלכליל[210]. (8) ז'. הכורע על
ברכיו, ובערבי אלגאתי[211] עלי רכבתיה[212], צורת פוטיתא, והוא הנשר הנופל[213],
ובערבי אלנסר אלואקע[214]. (9) ח'. (10) ט'. יושבת[215] הכסא, בעלת יד[216] הצבועה, ובערבי דאת
אלכרסי. (11) י'. צורת התרנגולת[217]. (12) י"א. נושא ראש השעיר או השד, ובערבי ראש
אלגול[218]. (13) י"ב. מושך הרסן[219], ובערבי ממסך[220] אלענאן[221], ובתוכו[222] הכוכב המאיר
הנקרא אלעיוק. (14) י"ג. נושא החיה הנושכת[223], ובשלון ערבי[224] חמאל[225] אל[226] חיה.
(15) י"ד. צורת החיה שביד הנושא. (16) ט"ו. צורת הנול[227], וכן שמה בערבי. (17) י"ו.

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199. עיש] אפעמל; רצ: עש.
200. תנין גדול] אפערצל; מ: התנין הגדול.
201. וכן] ארצצמל; פע: והן.
202. קיקאוס] אל; מ קקאוס; רצ: הקיאוס; פע: אוס היה אוס.
203. הנבח] ארץ] פעמל: הגבה.
204. אלעוא] אעפצ; מ: אלגול; לר: אלעזא (כ"י ר: בצד כתוב: מאזנים).
205. ובתוכו] א; פערצמל> כמין איש
206. הנסמך ברומח] מל; א: הנסמך הרמח; ע: הנתמך ברמח; רצ: הנתמך תומך; פ: הנתמך.
207. ובערבי] אפעמ; רצ: ובלשון ערבי; ל: ובע'.
208. אלסמך אלרומח] מ; פל: אלסמך אלרמח; אצ: אלסמאך אלרמח; ע: אלסמך אלראמח; ער: אלסמך אלרמאח.
209. הצפוני] אפעמל: חסר.
210. אלכליל] פערצמל; א: אלאכליל.
211. אלגאתי] אפערצ; מל: אלגאת.
212. עלי רכבתיה] אל; פע: על דוכתיה; רצ: עלי תבתיה; מ: אל רוכתיה.
213. הנופל] אמ; פערצל: חסר.
214. אלנסר אלואקע] ארצ; מ: אלנאסר אלואקע; : פעל אלנשר אלואקא.
215. יושבת] פערצמל; א: מושבת.
216. בעלת היד] פערצ; א: בעלת יד; מל: בעל היד.
217. התרנגולת] אפערצ; מל: התרנגול.
218. ראס אלגול] מצל; פע: ראס לגול; אר: רס אלגול.
219. מושך הרסן] א; פערצמ: כמין איש מושך הרסן.
220. ממסך] א; פערצל: תמסך; מ: תמך.
221. אלענאן] אמעצ; פ: אלענן; ר: אלעזאן; ל: אלענו.
222. ובתוכו] א; פל: בתאומים ובתוכו; ערצמ: ובתאומים ובתוכו.
223. הנושכת] פעמל; ארצ: הנשכת.
224. ובשלון ערבי] אפמ; ערצל: ובערבי.
225. חמאל] אפערצל; מ: האמיל.
226. אל] אפעל; רצ: עקרב.
227. הנול] תיקנתי עפ"י הקשר הדברים; אפמערצל: הנון.

צורת הפרס, והוא הנשר המעופף[228], ובערבי[229] אלנסר אלטאר[230]. (18) י‏"ז. צורת מְנוּנֵי הים[231]. (19) י‏"ח. הסוס הראשון. (20) י‏"ט. הסוס השני. (21) כ‏'. האשה האַיְלֹנִית, הנקראת אנדרמידוס.[232] (22) כא‏'[233] כא‏'. צורת המשלש.[234]

6

(1) ומהן[235] שי‏"ו[236] כוכב[237] מפוזרים על ט‏"ו[238] צורה[239] שבפאת דרום[240], ואלה שמותן[241]. (2) א. צורת חית[242] הים, ובערבי חיה אלבחר, ובלשון יון קיטוס[243]. (3) ב. צורת הגבור בתאומים. (4) ג. צורת הנהר. (5) ד. צורת[244] הארנבת. (6) ה‏'. צורת הכלב[245] הגדול, ובערבי אל שערי[246] אל עבור. (7) ו‏'. הכלב הקטן[247], ובערבי אלשערי[248] אלגמַיְצַא[249]. (8) ז‏'. צורת הספינה[250]. (9) ח‏'. צורת החיה הדרומית. (10) ט‏'. צורת הכוס, ובערבי אלכאס. (11) י‏'. צורת העורב. (12) י‏"א. צורת[251] קנטארוס[252] מחוברת[253] מאדם ומסוס.

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228. המעופף] רצמ; אפעל: העופף.

229. ובערבי] אפעמל; רצ: חסר.

230. אלנסר אלטאר] פע, צ: אלנסר אלטאיר; ר: אלנסר אלתאר; א: אלנשר אלתאזר; מל: אלנסאר אלתאיר.

231. מנוני הים] אל; רעצ: מנוניהם; פ: מי נוניהם; מ: מיניהם.

232. כ‏' האשה האילנית הנקראת אנדרמידוס] ארצל; מ: אשה שלא ראתה בעל מעולם; פע: חסר.

233. כא‏'] ארצל; פע: כ; מ: חסר.

234. צורת המשלש] אפערצל; מ: חסר.

235. ומהן] אפערצ; מל: ומהם.

236. שי‏"ו] פערצמל; א: שלש מאות ששה עשר.

237. כוכב] אר; צמל: כוכבים; פע: צורה.

238. ט‏"ו] פערצמל; א: חמש עשרה.

239. צורה] אפערמל; צ: חסר.

240. דרום] אפערצל; מ: צפון.

241. שמותן] פרצמל; עא: שמותם.

242. חית] ארצמל; פ: חיה.

243. ובלשון יון קיטוס] א; פערצ: ובלשון יון קרטוס; מ: ובלשון יון מאקנים; ל: חסר.

244. צורת] א; פערצל: צורה בתאומים; מ: בתאומים.

245. הכלב] אפערצל; מ: סרטן.

246. שערי] ארפצל; עמ: שער.

247. הקטן] פערצמ; א: הקטון; ל: חסר.

248. אלשערי] ערצ; מ: אלשער; פ: אלשע; אל: חסר.

249. אלגמַיְצַא] ערצל; פ: אלגאמצא; א: אלגִמַיְצַא; מ: אלעמיצא.

250. הספינה] אפערצל; מ: ספינה בתולה.

251. צורת] אפעמל; רצ: חסר.

252. קנטארוס] אערצמ; פ: קנטרוס; ל קנטדוס.

253. מחוברת] אמ; פערצל: מחברת.

(13) י״ב. צורת הזאב. (14) י״ג. צורת מחתה, ובערבי אל מגמארה²⁵⁴. (15) י״ד. הנזר הדרומי, ובערבי²⁵⁵ אלכליל גנובי²⁵⁶. (16) טו. הדגה הדרומית.

<div align="center">7</div>

(1) וכוכבי הצורות האלה נחלקים²⁵⁷ בשעור²⁵⁸ גופיהם²⁵⁹ אל ששה ערכין²⁶⁰. (2) [56א] הגדול²⁶¹ מכולן²⁶² נקרא מאיר ומזהיר, והן ט״ו כוכב. (3) ובערך השני מהן²⁶³ מ״ה²⁶⁴ כוכב²⁶⁵, ובערך השלישי ר״ח²⁶⁶ כוכבים²⁶⁷, ובערך הרביעי תע״ד²⁶⁸ כוכב²⁶⁹, ובחמישי²⁷⁰ רי״ז²⁷¹, ובששי מ״ט²⁷² כוכב²⁷³, ואחריהם²⁷⁴ י״ד²⁷⁵ כוכבים נקראים²⁷⁶ עננים²⁷⁷ ואפלים. (4) ובהן²⁷⁸ שלמו אלף כ״ב²⁷⁹ כוכב שחקרו עליהן.

254. אל מגמארה] ע; מ: אל מיצמרה; פ: אל מגמזרה; ר: אלכליל נונובי; א: אל; ל: אלמגמרא.

255. ובערבי] פערצמל; א: ובלשון ערבי.

256. אלכליל גנובי] פעמל; א: אלכליל אלגנובי; ר: אלמגמדה.

257. האלה נחלקים] פערצא; ל: האלה הט״ו נחלקים; מ: חסר.

258. בשעור] פערצ; מ: חסר.

259. גופיהם] פעצ; אמל: גופיהן; ר: גופתן.

260. ערכין] פערמל; צ: ערכים; א: חלקים ערכים.

261. הגדול] פאעצמל; ר: הגדולים.

262. בכולן] פערצמל; א: מכולם.

263. מהן] פעצמ; רא: מהם.

264. מ״ה] פערצמל; א: ארבעים וחמשה.

265. כוכב] אפערצ; מ: כוכבים.

266. ר״ח] פערצל; א: מאתים ושמנה; מ: מ״ח.

267. כוכבים] אפערצמ; ל: חסר.

268. תע״ד] פערצמל; א: ארבע מאות ושבעים וארבע.

269. כוכב] אפערצל; עמ: כוכבים.

270. ובחמישי] אפעצמל; ר: ובערך החמישי.

271. רי״ז] פעצמל; א: מאתים ושבע עשרה; ר: > כוכב.

272. מ״ט] פערצמל; א: ארבעים ותשע.

273. כוכב] אפערצל; מ: כוכבים.

274. ואחריהם] פעמל; אצ: ואחריהן; ר: ואחרי כן.

275. י״ד] פערצל; א: ארבע עשרה; מ: חסר.

276. כוכבים נקראים] אפערצל; מ: חסר.

277. עננים] אפעצמל; ר: ענינים.

278. ובהן] פעצמ; אל: ובהם; ר: שהן.

279. כ״ב] רצמל; א: ועשרים ושנים; פע: חסר.

8

(1) ואלה שמות ט״ו כוכבים[280] המאירים. (2) א׳. עין השור, ובלשון ערבי[281] אלדבראן[282], וכחו להעיד על מאורעי בני עולם[283], ככח[284] מאדים ולבנה. (3) ב׳. רגל תאומים[285], ובערבי רגל אלגוזא[286], כחו ככח שבתאי[287] וצדק. (4) ג׳. אחרית הנהר, כחו ככח צדק. (5) ד׳. צד[288] תאומים[289] הימני[290], ובערבי מנכב[291] אלגוזא. (6) ה׳. הכלב הקטן, הנקרא בלשון ערבי[292] שערי[293] גמיצא, כחו ככח כוכב ומאדים[294]. (7) ו׳. הכלב הגדול, הנקרא בלשון ערבי שערי עבור, ככח צדק ומאדים[295]. (8) ז׳. מושך הרסן, ונקרא[296] עיוק, כח מאדים וכותב.[297] (9) ח׳. כסיל, ובערבי סהיל[298], כח[299] שבתאי[300] וצדק. (10) ט׳. לב האריי[301], והוא לב אל אסד[302], כח[303] מאדים וצדק. (11) י׳. הנתמך הרמח[304], ובערבי אלסמאך אל רמח, כח צדק

280. כוכבים] ארצמל; פע: כוכב.

281. ובלשון ערבי] ארצ; פעמ: ובערבי.

282. אלדבראן] אפעל; ר: אלדבארן; צ: אלדאברן; מ: אלדגיראן.

283. מאורעי בני עולם] אפעמל; רצ: מאורע בני אדם.

284. ככח] אפצל; רמ: בכח; ע: > מאורעי בני עולם בכח.

285. תאומים] אפעמל; רצ: חסר.

286. רגל אלגוזא] אפעמל; רצ: אלגודא.

287. שבתאי] אפמל; ערצ: שבתי.

288. צד] אפערצמל; ל: צורת.

289. תאומים] אפרמל; ע: התאומים.

290. הימני] אפעמל; ר: היוני.

291. מנכב] אפעמל; רצ: חסר.

292. בלשון ערבי] אפעמ; צל: בערבי; ר: חסר.

293. שערי] אפעצמל; ר: > עבוד.

294. כוכב ומאדים] אפעצמל; ר: ש.

295. הכלב הגדול ... צדק ומאדים] א; רצ: ו הכלב הגדול הנקרא בלשון ערבי שערי עבו׳ כחו ומאדים; ל: הכלב הגדול הנקרא שערי אלעבור כחו ככח צדק ומאדים; פעמ: חסר.

296. ונקרא] אפערצמל; ל: > בע׳.

297. וכותב] אפצמל; ערל: וכוכב.

298. סהיל] אפעל; ר: סהילי; מ: צהילי; צ: ההילי.

299. כח] אפערצמל; ל: > כחו.

300. שבתאי] אפעמל; רצ: שבתי.

301. האריי] אפעמל; רצ: האריה.

302. אל אסד] ארצ; פעמל: אחד.

303. כח] אפערצמל; ל: > כחו.

304. הנתמך הרמח] אפלמע: רצ: הנסמך.

ומאדים.[305] (12) י"א. הנתמך שאינו מזוין[306], ובערבי אלסמך אלאעזל, כה נגה וכותב.[307]
(13) י"ב.[308] רגל הסוס הנקדמת, והוא רגל[309] אלפרס[310] אלמקדמה, כה נגה וצדק. (14)
י"ג.[311] הנשר הנופל, והוא אלנסר אלואקע[312], כה נגה וכותב.[313] (15) י"ד.[314] סוף זנב הסוס,
ובערבי אצל דנב אלפרס[315], כה נגה וכותב.[316] (16) ט"ו.[317] פי הדג[318] הדרומי, ובערבי פום
אלאחות אל גנובי[319], כה שבתאי וכותב.[320]

9

(1) ואלה שמות הכוכבים[321] מן הגדר[322] השני, שהם קרובים[323] בערך אורן אל כוכבי הגדר
הראשון. (2) א'. היד הצבועה מן היושבת[324] על הכסא, ובערבי[325] אלכאף[326] אלכציב[327], כהו
ככה מאדים וכותב.[328] (3) ב'. צד תאומים השמאלי[329], והוא מנכב[330] אלגוזא אלאיסר, כה

305. י' ובערבי אלסמאך אל רמח, כה צדק ומאדים] א; פלמערב: חסר.

306. י"א הנתמך שאינו מזוין] א; מרפמעל: חסר.

307. ובערבי אלסמך אלאעזל, כה נגה וכותב] א; מר: ובערבי אל סמאך אל עזל כה נגה וכוכב אל
סמאך אל עזל כה נגה וכותב; ל: ובע' אלעאזל, כהו כה נגה וכוכב.

308. יב] אפעמל; רצ: יא.

309. רגל] צפערמל; א: רגיל.

310. אלפרס] אפערצל; מ: אלפראס.

311. יג] אפעל; רצ: יב.

312. אלנסר אלואקע] אערצ; פ: אלנסר אלואעקע; מ: אלנסאר אלוקע; ל: אלנסאר ואקע.

313. וכותב] אפעצ; רמל: וכוכב.

314. יד] אפעמל; רצ: יג.

315. אצל דנב אלפרס] אפערצ; מל: אצעל דנב אלפראס.

316. וכותב] אפערצ; מל: וכוכב.

317. ט"ו] אפעמל; רצ: יד.

318. הדג] אפרצמל; ע: הדגה.

319. פום אלאחות אל גנובי] מ; אל: פס אלחות אל גינובי; ר: פס אלסתות אל גינובי; צ: בים אלסות אל גנובי; פ:
של אלחות אל גינובי; ע: ע שם אלאכות אל גנובי.

320. וכותב] אפערצ; מל: וכוכב.

321. הכוכבים] ארצמ; פע: כוכבים; ל: כוכבי.

322. מן הגדר] אפערצ; מ: מהגדר; ל: מגדר.

323. שהם קרובים] ארצל; פעמ: שהן קרובין.

324. מן היושבת] אפערצל; מ: מהיושבת.

325. ובערבי] פעמ; ארצ: ובלשון ערבי; ל: ובע'.

326. אלכאף] אערמ; פצל: אלכף.

327. אלכציב] פערצמל; א: אלכסיב.

328. וכותב] אפערצ; מל: וכוכב.

329. תאומים השמאלי] פערמ; א: התאומים השמאלי; ל: השמאלי תאומים.

330. מנכב] תקנתי עפ"י הקשר הדברים; אפערצמל: מכוכב.

שבתאי וצדק. (4) ג'. ראש השד[331], והוא ראס אלגואל[332], כח מאדים וכותב[333]. (5) ד'. זנב הארי, הנקרא[334] צרפה[335], כח שבתאי וכותב[336]. (6) ה'. המאיר בנזר הצפוני[337], ובלשון ערבי[338] אלפכה[339], כח נוגה וכותב[340]. (7) ו'. לב העקרב, כח מאדים עם מעט מכח צדק. (8) ז'. המאיר מבנות עיש, והם בנאת[341] נעש, כח מאדים לבדו. (9) ח'. הנשר העופף[342], והוא[343] אלנסר[344] אלטאיר[345], כח[346] מאדים וצדק. (10) ט'. זנב התרנגולת, ונקרא אלרדף[347], כח נגה וכותב[348]. (11) י'. ארכובת[349] התרנגולת, ונקרא רכבה אלדגאגה[350], כח נגה וכותב[351]. (12) י"א. צד הסוס הימני, ונקרא מנכב אלפרס[352], כח מאדים וכותב[353]. (13) י"ב. ראש השדרה לארי[354], ונקרא פקאר[355] אל אסד, כח שבתאי ונגה. (14) י"ג. המאיר בין הנתמך[356] וזנב הארי, כח שבתאי ומעט כח נגה.

331. השד] אפערצל; מ: השור.

332. ראס אלגואל] פעמ; רצל: ראס אלגול; א: רס אלגול.

333. וכותב] אפערצ; מל: וכוכב.

334. הנקרא] אצמל; פער: נקרא.

335. צרפה] מ; אפערצ: צרעה; ל: תרפא.

336. וכותב] אפערצ; מל: וכוכב.

337. הצפוני] פערצמ; אל: צפוני.

338. ובערבי] פעמ; ארצ: ובלשון ערבי; ל: ובע'.

339. אלפכה] אל; ערצמ: אלפסה; פ: אל פאצה.

340. וכותב] אפערצ; מל: וכוכב.

341. בנאת] ערמל; פא: בנות.

342. העופף] אפערצל; מ: המעופף.

343. והוא] אפצל; ע: חסר; ר: והם.

344. אלנסר] אפעצ; רמ: אלנאסר; ל: אל נסרא.

345. אלטאיר] אפערצל; מ: אלתיר.

346. כח] אפעמל; רצ: חסר.

347. אלרדף] אפעמל; ר: אלחאף.

348. וכותב] אפערצ; מל: וכוכב.

349. ארכובת] ארצמל; פע: ארכבת.

350. אלדגאגה] אמל; פ: אלדגאנאה; ע: אלדגנה; רצ: אלדגאנה.

351. וכותב] אפערצ; מל: וכוכב.

352. אלפרס] אפערצל; מ: אלפראס.

353. וכותב] אפערצ; מל: וכוכב.

354. לארי] אפערמל; צ: לאריה.

355. פקאר] א; פערצמל: סקאר.

356. הנתמך] אפעמל; רצ: הנסמך.

I 0

(1) ואנשי החכמה הזאת הפרידו מן הצורות האלה[357] צורות, קראו אותן[358] מחנות הלבנה.
(2) ואינם נרחבים[359] מאופן המזלות שהן כגון [56ב] מרחב הלבנה לצפון ולדרום. (3) ובין
אחד מהם ובין הסמוך אליו כגון י"ג מעלות, שהן קרוב ממהלך הלבנה ביום אחד. (4)
ומספרן[360] כ"ח[361] צורה[362], כגון מספר הימים שהלבנה[363] סובבת בהן[364] את הרקיע. (5) ועל
זה[365] נקראו אלו[366] מחנות הלבנה[367], ואלה שמותן.

I I

(1) א'[368]. קרני טלה, ובערבי אל נטח, שני כוכבים מן הערך השלישי. (2) ב'[369]. קרב טלה,
ובערבי אל בטין, שלשה כוכבים כמן משלש[370] מן הרביעי[371]. (3) ג'[372]. כימה[373], והוא
אלתריא[374], מן הערך[375] החמישי. (4) ד'[376]. עין השור, הוא אלדבראן, כוכב מאיר נדבקו
אליו[377] ד' כוכבים[378] מהערך השלישי ונעשים[379], כמן גדיש[380]. (5) ה'[381]. ראש תאומים,

357. האלה] אפערמל; צ: חסר.
358. אותן] פערצמל; א: אותם.
359. נרחבים] אפערצל; מ: רחבים.
360. ומספרן] אערצמל; פ: ומספרם.
361. כ"ח] פערצמל; א: עשרים ושמנה.
362. צורה] אפערמל; ע: צורות.
363. שהלבנה] אעמ; פרצל: שלבנה.
364. בהן] פערצמל; א: בהם.
365. ועל זה] אפעצמל; ר: ולזה.
366. אלו] אפערצ; מל: חסר.
367. חלבנה] אפעמ; רצל: לבנה.
368. א'] אפערצמל; א: מוסיף לפני המספר: בינונית.
369. ב'] אפערצמל; א: מוסיף לפני המספר: יבשה.
370. משלש] אפערצל; מ: חסר.
371. מן הרביעי] אפערצמ; ל: מערך רביעי.
372. ג'] אפערצמל; א: מוסיף לפני המספר: בינונית.
373. כימה] אפערצל; מ: < פי' זנב.
374. אלתריא] אפעצמל; ר: אלתחריא.
375. מן הערך] אפערצל; מ: כוכבים מהערך.
376. ד'] אפערצמל; א: מוסיף לפני המספר: לחה.
377. אליו] א; פערצמל: חסר.
378. ד' כוכבים] אפעמל; צ: כוכבים; ר: שניהם.
379. ונעשים] א; צל: ונעשין; ר: ועושין; פע: ועשו; מ: ונעשו.
380. כמן גדיש] אפערצמל; צ: כמה הגדיש.
381. ה'] אפערצמל; א: מוסיף לפני המספר: בינונית.

והוא אלהקעא[382], שני כוכבים[383] מן הערך השני. (6) ו[384]‘ יד[385] תאומים כגון קשת, והוא אלהנעה[386], ב[387]‘ כוכבים דמות חץ מן הערך השלישי. (7) ז[388]‘. הזרוע, והוא אלדרע[389], שני כוכבים קרובים בערכן מן המאירים, כנגד ראש התאומים, למטה. (8) ח[390]‘. חטם[391] האריה[392], והוא אלנתרה[393], ו[394]‘ כוכבים כמין כותרת, מערך ו[395]‘. (9) ט[396]‘. עיני אריה והוא אלטרף[397], ב[398]‘ כוכבים מערך ב‘ וג[399]‘. (10) י[400]‘. מצח הארי, והוא אלגבהה, כמין משלש, מהערך השני והשלישי. (11) י[401]“א. צלע הארי, והוא[402] אלזבדה[403], שני[404] כוכבים, קטן וגדול, מערך שני וחמישי. (12) י[405]“ב. זנב הארי, והוא דנב[406] אלאסד, כוכב אחד מאיר[407], ויקרא אלצרפה. (13) י[408]“ג. הנבח, והוא אלעוה, ארבעה[409] כוכבים מערך ששי.

382. אלהקעא] אל; פערצ: אלהקעה; מ: אלהקטה.

383. כוכבים] מ; פערצאל: חסר.

384. ו‘] אפערצמל; א: מוסיף לפני המספר: יבשה.

385. יד] אפעמל; רצ: חסר.

386. אלהנעה] ארצ; פע: אלהעוא; מ: אלהנטא; ל: אלהנעא.

387. ב‘] תקנתי עפ"י הקשר הדברים; א: ג; פערצמל: ז‘ (זה המספר של מחנה הלבנה השביעי בכ"י פערצמ, לא מפסר הכוכבים במחנה הלבנה הששי, לכן המספר הזה גורם לכ"י פערצמל להתבלבל במספור מחנות הלבנה מכאן ואילך).

388. ז‘] אמ; פערצל ח‘; א: מוסיף לפני המספר: לחה.

389. אלדרע] אפע; צ: אלדרעא; ר: אלדרועא; מ: אלזרע; מ: אלדראע.

390. ח‘] אמ; פערצל: ט‘; א: מוסיף לפני המספר: יבשה.

391. חטם] אערצל; פ: חוטם; מ: פי.

392. האריה] אפערצל; מ: הארי.

393. אלנתרה] אפצמ; ער: אלנתארה; ל: אלנתרא.

394. ו‘] א; מ: ח‘; פעל: י‘; רצ חסר.

395. ו‘] פעמל; א: הרביעי; רצ: חסר.

396. ט‘] פערמ: י‘; צ: וי“א; ל: חסר; א: מוסיף לפני המספר: יבשה.

397. עיני אריה והוא אלטרף] מ; אפערצל: בשר הארי והוא אלטרף.

398. ב‘] פעל; ארצמ: שני.

399. ב‘ וג‘] פערצמל; א: שני ושלישי.

400. י‘] ארצ; עמ: י“א; פל: חסר; א: מוסיף לפני המספר: לחה.

401. י“א] אפערצל; א: מוסיף לפני המספר: בינונית; מ: י“ב.

402. והוא] אפערמל; צ: חסר.

403. אלזבדה] אפעצמ; ר: אלזבאדה; ל: אלזבאדה.

404. שני] ארצמל; פע: ב‘.

405. י“ב] אפערצמל; א: מוסיף לפני המספר: לחה לרוב.

406. דנב] אפעל; צ: דנס.

407. י“ב זנב הארי והוא דנב אלאסד כוכב אחד מאיר] אפערצל; מ: חסר.

408. י“ג] אפערצמל; א: מוסיף לפני המספר: בינונית.

409. ארבעה] א; פעצמל: י‘; ר: עשרה.

(14) י‏''ד‏[410]. נתמך שאינו מזוין, והוא אלסמאך אלאעזל[411], כוכב אחד מאיר[412]. (15) ט‏''ו[413]. לשון המאזנים, והוא אלגפר[414], שלשה[415] כוכבים מערך ד‏'[416]. (16) י‏''ו[417]. כפות המאזנים, אלזבאנה, שני כוכבים מערך שני. (17) י‏''ז[418]. נזר ראש עקרב, והוא אלכליל[419], ג‏'[420] כוכבים מערך ששיי[421]. (18) י‏''ח[422]. לב העקרב, כוכב חונה בין שני כוכבים[423], והוא מאיר מהן, נחשב מן הערך השני. (19) י‏''ט[424]. מחטט[425] העקרב, ונקרא אלסולה[426], שני[427] כוכבים מערך ו‏'[428]. (20) כ‏'[429]. המקנה הבא והמקנה השב, ח‏''ה[430] כוכבים, ד‏'[431] נחברים לצד וד‏'[432] נחברים לצד, ונקראו אלנאאים[433], מהערך השלישי והרביעי. (21) כ‏''א[434]. העיר, דמות אות חית[435] הפוכה[436], למעלה מוקפת כוכבים כמין קשת, ובערבי אלבלדה[437]. (22) כ‏''ב[438]. יופי

410. י‏''ד] אפערצמל; א: מוסיף לפני המספר: בינונית.

411. אלאעזל] אצ; פע: אלעזאל; רמ: אלעזל; ל: עזאן.

412. אחד מאיר] אפעמל; רצ: ﭏ.

413. ט‏''ו] אפערצמל; א: מוסיף לפני המספר: לחה.

414. אלגפר] אמ; ער: אלגער; פ: אלג; ל: אלעדג.

415. שלשה] אר; פעצמל: ג‏'.

416. ד‏'] פעמל; א: הרביעי; ר: עשירי; צ‏'.

417. י‏''ו] אפערצמל; א: מוסיף לפני המספר: לחה.

418. י‏''ז] אפערצמל; א: מוסיף לפני המספר: לחה לרוב.

419. אלכליל] אפערמל; צ: שלכליל.

420. ג‏'] פערצמל; א: שלשת.

421. ששי] אפרצמל; ע: ו‏'.

422. י‏''ח] אפערצמל; א: מוסיף לפני המספר: יבשה.

423. שני כוכבים] רצמ; פע: ב‏' כוכבים; א: הכוכבים; ל: כוכבים.

424. י‏''ט] אפערצמל; א: מוסיף לפני המספר: מטר לרוב.

425. מחטט] אפערצל; מ: קצה זנב.

426. אלסולה] פערמ; אל: אלסולא; צ: אלסול.

427. שני] ארמל; ע: ב‏'; צ: השני; פ: י‏''ב.

428. ו‏'] פעצמל; א: רביעי; ר: ששי.

429. כ‏'] אפערצמל; א: מוסיף לפני המספר: מטר: רב.

430. ח‏''ה] פעצל; ארמ: שמנה.

431. ד‏'] פעצמ; אר: ארבעה; ל: חסר.

432. וד‏'] פערצמל; א: וארבעה.

433. אלנאאים] פערמל; א: אלנעאין; צ: אלנעים.

434. כ‏''א] אפערצמל; א: מוסיף לפני המספר: בינונית.

435. חית] אפעל; רצ: חיה; מ: חסר.

436. הפוכה] אפעצמל; ר: הכתובה.

437. אלבלדה] אפערמ; ל: אלבלדא; צ: אלברלה.

438. כ‏''ב] אפערצמל; א: מוסיף לפני המספר: לחה לרוב.

הזובח, סעד אלדבח439, ג'440 כוכבים, הקטן בכולן441 חונה בין השנים. (23) כ"ג442. יופי
הבולע, סעד בלע, שני כוכבים, האחד נבלע בפי השני. (24) כ"ד443. יופי היופי, סעד אלסעוד,
ג'444 כוכבים445 נפרדים כמין משולש446. [57א] (25) כ"ה447. יופי האהלים, סעוד
אלאכביה448, ד' כוכבים, ב'449 מהם450 עומדים כמין451 גל על ב'452 שאינן מאירין בהן453, 454.
(26) כ"ו455. שפך הדלי, אלפרג456 אלאול, ב'457 כוכבים מערך רביעי. (27) כ"ז458. שפך459
שני460, אלפרג461 אלתני462, ב' כוכבים נוטים משפך הדלי לפאת דרום. (28) כ"ח463. בטן
הדגה, בטן אלחות464, ז'465 כוכבים נעקמים כמו גוף הדג והם קרובים מאופן המזלות.

439. אלדבח] ארצמל; פע: אלדאבח.

440. ג'] אפעצמל; ר: שלשה.

441 בכולן] ארמל; פעצ: בכולם.

442. כ"ג] אפערצמל; א: מוסיף לפני המספר: בינונית.

443. כ"ד] אפערצמל; א: מוסיף לפני המספר: בינונית.

444. ג'] אפעצמל; ר: שלשה.

445. כוכבים] אפערצמ; ל: > מערך ד'.

446. כמין משולש] אפערצמ; ל: ממשלש.

447. כ"ה] אפערצמל; א: מוסיף לפני המספר: יבשה.

448. אלאכביה] אצ; פע: אלכביה; ר: אלאכפיה; מ: אלכביר.

449. ב'] אפעצמ; ר: שנים.

450. מהם] אפעצ; רמ: מהן.

451 כמין] פערצמ; א: חסר.

452. ב'] אפעצמ; ר: שנים.

453. שאינן מאירין בהן] אפצר; עצ: שאינם מאירים בהם.

454. יופי האהלים סעוד אלאכביה ד' כוכבים ב' מהם עומדים כמין גל על ב' שאינן מאירין בהן] אפערצמ; ל: חסר.

455. כ"ו] אפערצמ; א: מוסיף לפני המספר: מטר לרוב.

456. אלפרג] אפערצל; מ: אלפראג.

457. ב'] פעמל; ארצ: שני.

458. כ"ז] אפערצלמ; א: מוסיף לפני המספר: יבשה.

459. שפך] ארצמ; פע: הפך.

460. שני] ערצמ; : פ השני; א: הדלי; ל: חסר.

461 אלפרג] אפערצל; מ: אלפראג.

462. אלתני] אפע; צמל: אלתאני; ר: חסר.

463. כ"ח] אפערצמל; א: מוסיף לפני המספר: בינונית.

464. בטן אלחות] אפעצמ; ר: בטן אלחוט; ל: חסר.

465. ז' כוכבים] אפערצמ; ל: חסר.

12

(1) [57ב] וכל אלף כ״ב כוכב שבצורות האלה נחקקים[466] במקומותם[467] ונקראים בשמותם[468] בספר בטלמיוס[469] היוני. (2) והעתקתי מהן[470] אל הספר הזה מקומות הכוכבים המאירים והקרובים אליהם[471] באור מן הגדר השני. (3) והם[472] החקוקים בכלי האסטרולאב[473], והם מועילים בחכמת הנסיון[474] לדעת[475] [45א] מהן[476] [65ב] מזלות הילודים מבני האדם[477]. (4) והעתקתי עמהם מקומות כוכבים שאינם[478] מאירים שיש להם[479] עדות במולדות בני אדם, כאשר תראה כל זה מפורש ומסודר בספר הזה, ב״ע״ה[480].

466. נחקקים] אערצמל; פ: נחקקין.

467. במקומותם] אצמל; פער: במקומותן.

468. בשמותם] אפערמל; צ: בשמותן.

469. בטלמיוס] אפרצמל; ע: בטולמיוס.

470. מהן] אפערמל; צ: מהם.

471. אליהם] אפצמל; ער: אליהן.

472. והם] אפרצמל; ע: והן.

473. האצטורלב] אערצ; פ: האסטרולאב; מל: האצטרולוב.

474. הנסיון] ארצמל; פע: הניסיון.

475. לדעת] אפעמל; רצ: שעת.

476. מהן] פערצמ; א: מהם; ל: חסר.

477. האדם] אפע; רצמל: אדם.

478. שאינם] אערצמל; פ: שאינן.

479. להם] אפרצמל; ע: להן.

480. כאשר תראה ... הזה ב״ע״ה] פערצמל; א: חסר.

English Translation

Chapter seventeen: on the calculation of the motion of the fixed stars, the motion of the points of apogee and the ascending nodes of the five planets, the positions of all these points at the year that is the radix for the calculations in this book, and the names of the fixed stars of the first and second magnitude that are inscribed in the tables of this book.

I

(1) The motion of the fixed stars is along [lit. is based on] the ecliptic, <meaning that> the extent [lit. the measure] of their motions is the same for each and every one of them [i.e., the fixed stars], and the latitude of every one of them with respect to the ecliptic remains the same, neither increasing nor decreasing nor inclining to any side. (2) All those who have studied them since Antiquity found it [the positions of the fixed stars] to be according to this order. (3) All the Ancients found that the course of their motion is from east to west, like the direct motion of the planets, and all of them agreed that this motion is unchangeable. (4) The Ancients determined that it is one degree in 100 years; but some of the modern <scholars> who followed in their footsteps determined that it is one degree in 67 years.

2

(1) I arranged their motion in the table I have compiled according to <the value of> one degree in 100 years, in keeping with the opinion of the Ancients; it is on the basis of this value for the motion <of the fixed stars> that they found <the value> for the motion of the apogee and the ascending nodes of the five planets. (2) Their positions at the beginning of the 257th cycle, which is the radix for the calculations in this book, follow. (3) Saturn's apogee is at Sagittarius 3° and the head of its dragon [its ascending node] at Capricorn 23°. (4) Jupiter's apogee is at Virgo 22° and the head of its dragon at 2° of the same <sign>. (5) Mars's apogee and the head of its dragon are at Leo 6°. (6) Venus's apogee is at Virgo 16° 30' and the head of its dragon is at the same number <of degrees> of Virgo. (7) Mercury's apogee is at Libra 21° and the head of its dragon is at the same number <of degrees> of Cancer.

3

(1) These points move one degree in 100 years, as mentioned above. (2) If you wish to know their position before this time or after it, find out how many years elapsed between the two dates. (3) Then assign one degree to every 100 years, and 3 minutes to every 5 years, which correspond to 36 seconds every year. (4) <Then,> if you wish to establish their position before the beginning of the 257th cycle, subtract the computed value for the

motion <of these points> from their positions mentioned here; and if you wish to find their position after <the beginning of the 257th cycle>, add this <result> to their <afore-mentioned> positions. (5) We have determined the Sun's apogee at the beginning of the 257th cycle to be at Gemini 15° 30'. (6) The ancient scholars of the other nations, and the majority of the modern <scholars> observed that the Sun's apogee moves one degree every 100 years, like the apogees of the other planets, but Ptolemy alone was of the opinion that the Sun's apogee has no motion at all. (7) But the majority of the ancient and the modern <scholars> did not agree with him because they found in their investigations that it moves the same as the apogees of the other stars.

4

(1) The number of stars whose positions were determined by the Ancients in their books is 1,022 stars, which they divide into 48 constellations. (2) Of them, 346 stars are placed in 12 constellations at the ecliptic or slightly off it; these are the zodiacal constellations that are well known to everyone, with Aries the first and Pisces the last.

5

(1) And 360 of the stars are distributed among 21 constellations in the northern side with respect to the ecliptic, which have the shape of animals and beasts, and these are their names. (2) *(i)* The Lesser Bear, which in Arabic is *al-dubb al-aṣghar*.[1] (3) *(ii)* the Greater Bear, which is *al-dubb al-akbar*; the *daughters of 'ayiš* are there.[2] (4) *(iii)* <The> Great Dragon, and it has the same name in Arabic.[3] (5) *(iv)* The constellation of the Flame, which in Arabic is *al-multahib* and in Greek *cepheus*.[4] (6) *(v)* The Howler, which in Arabic is *al-'awwā'*; within it is the man leaning on a spear, in Arabic *al-simāk al-rāmiḥ*.[5] (7) *(vi)* The Northern Crown, in Arabic *al-iklīl <al-šamālī>*.[6] (8) *(vii)* The One Kneeling on his two Knees, in Arabic *al-jāthī 'alā rukbatayhi*.[7] (9) *(viii)* The constellation of *Fuṭit'a*, which is the Falling Eagle, in Arabic *al-nasr al-wāqi'*.[8] (10) *(ix)* The <Woman> Sitting on a Chair, the <Woman> with the Dyed Hand, in Arabic, *dhāt al-kursīy*.[9] (11) *(x)* The constellation of the Hen.[10] (12) *(xi)* The Carrier of the Head of the Goat-Demon or the Demon, in Arabic <ḥāmil> *ra's al-ghūl*.[11] (13) *(xii)* <The Man> who Holds the Reins, in Arabic *mumsik al-a'inna*, and in it the bright star called *al-'ayyūq*.[12] (14) *(xiii)* The One who Carries the Biting Snake, in Arabic *ḥāmil al-ḥayya*.[13] (15) *(xiv)* The constellation of the Snake in the hand of the carrier <of the snake>.[14] (16) *(xv)* The constellation of the Loom, and this is also its name in Arabic.[15] (17) *(xvi)* The constellation of the Vulture, which is the Flying Eagle, in Arabic *al-nasr al-ṭā'ir*.[16] (18) *(xvii)* The constellation <with the shape> of One of the Sea Fish.[17] (19) *(xviii)* The First Horse.[18] (20) *(xix)* The Second Horse.[19] (21) *(xx)* The Barren Woman, who is called Andromeda.[20] (22) *(xxi)* The constellation Triangle.[21]

6

(1) And 316 of the stars are distributed among 15 constellations in the southern side <with respect to the ecliptic>, and these are their names. (2) *(i)* The constellation of the Sea Animal, in Arabic *ḥayawān al-baḥr*, in Greek *cetus*.[1] (3) *(ii)* The constellation of the Mighty One in the Twins.[2] (4) *(iii)* The constellation of the River.[3] (5) *(iv)* The constellation of the Hare.[4] (6) *(v)* The constellation of the Greater Dog, in Arabic *al-ši'rā al-'abūr*.[5] (7) *(vi)* The constellation of the Lesser Dog, in Arabic *al-ši'rā al-ghumayṣā'*.[6] (8) *(vii)* The constellation of the Ship.[7] (9) *(viii)* The constellation of the Southern Snake.[8] (10) *(ix)* The constellation of the Goblet, in Arabic *al-ka's*.[9] (11) *(x)* The constellation of the Crow.[10] (12) *(xi)* The constellation Centaurus, which combines a man and a horse.[11] (13) *(xii)* The constellation of the Wolf.[12] (14) *(xiii)* The constellation of the Censer, in Arabic *al-mijmara*.[13] (15) *(xiv)* The constellation of the Southern Crown, in Arabic *al-iklīl al-janūbī*.[14] (16) *(xv)* The Southern Fish.[15]

7

(1) The stars of these constellations are divided according to the size of their bodies into 6 magnitudes. (2) <A star> with the greatest <magnitude> is called bright and shining, and there are 15 stars <of this magnitude>. (3) There are 45 stars of the second magnitude, 208 stars of the third magnitude, 474 stars of the fourth magnitude, 217 stars of the fifth magnitude, and 49 stars of the sixth magnitude, and after them there are 14 stars, which are called nebulae and dark. (4) This completes <the enumeration of> the 1,022 stars that were studied.

8

(1) These are the names of the 15 bright stars. (2) *(i)* The eye of the bull, in Arabic *al-dabarān*, with a power to indicate what happens to human beings, like the power of Mars and the Moon.[1] (3) *(ii)* The leg of the twins, in Arabic *rijl al-jawzā'*, with the power of Saturn and Jupiter.[2] (4) *(iii)* The end of the river, with the power of Jupiter.[3] (5) *(iv)* The right side of the twins, in Arabic *mankib al-jawzā'* <al-ayman>.[4] (6) *(v)* The lesser dog, called in Arabic *al-ši'rā al-ghumayṣā'*, with the power of Mercury and Mars.[5] (7) *(vi)* The greater dog, called in Arabic *al-ši'rā al-'abūr*, with the power of Jupiter and Mars.[6] (8) *(vii)* The one holding the reins, called <al->'ayyūq, with the power of Mars and Mercury.[7] (9) *(viii)* Kesil, in Arabic *suhayl*, with the power of Saturn and Jupiter.[8] (10) *(ix)* The heart of the lion, which is the heart of *al-asad*, with the power of Mars and Jupiter.[9] (11) *(x)* The one leaning on the spear, in Arabic *al-simāk al-rāmiḥ*, with the power of Jupiter and Mars.[10] (12) *(xi)* The unarmed <one who is> leaning <on a spear>, in Arabic *al-simāk al-a'zal*, with the power of Venus and Mercury.[11] (13) *(xii)* The foreleg of the

horse, which is *rijl al-faras al-muqaddama*, with the power of Venus and Jupiter.[12] (14) *(xiii)* The falling eagle, which is *al-nasr al-wāqiʿ*, with the power of Venus and Mercury.[13] (15) *(xiv)* The end of the horse's tail, in Arabic *aṣl dhanab al-faras*, with the power of Venus and Mercury.[14] (16) *(xv)* The mouth of the southern fish, in Arabic *fam al-ḥūt al-janūbī*, with the power of Saturn and Mercury.[15]

9

(1) These are the names of the stars of the second magnitude, which are close in the value of their light to the stars of the first magnitude. (2) *(i)* The dyed hand of the Woman Sitting on a Chair, in Arabic *al-kaff al-khaḍīb*, with the power of Mars and Mercury.[1] (3) *(ii)* The left side of the twins, which is *mankib al-jawzāʾ al-ʾaysar*, <with the> power of Saturn and Jupiter.[2] (4) *(iii)* The head of the devil, which is *raʾs al-ghūl*, <with the> power of Mars and Mercury.[3] (5) *(iv)* The tail of the lion, which is <*al->ṣarfa*, <with the> power of Saturn and Mercury.[4] (6) *(v)* The bright <star> in the Northern Crown, in Arabic *al-fakka*, <with the> power of Venus and Mercury.[5] (7) *(vi)* The heart of the scorpion, <with the> power of Mars and a little of the power of Jupiter.[6] (8) *(vii)* The bright <star> in the daughters of *ʿayiš*, which are *banāt naʿš*, <with the> power of Mars alone.[7] (9) *(viii)* The flying eagle, which is *al-nasr al-ṭāʾir*, <with the> power of Mars and Jupiter.[8] (10) *(ix)* The tail of the hen, which is called *al-ridf*, <with the> power of Venus and Mercury.[9] (11) *(x)* The knee of the hen, which is called *rukbat al-dajāja*, <with the> power of Venus and Mercury.[10] (12) *(xi)* The shoulder of the horse, which is called *mankib al-faras*, <with the> power of Mars and Mercury.[11] (13) *(xii)* The top of the lion's spine, which is called *faqār al-asad*, <with the> power of Saturn and Venus.[12] (14) *(xiii)* The bright <star> between the <man> leaning <on a spear> and the lion's tail, <with the> power of Saturn and a little of the power of Venus.[13]

10

(1) Those conversant in this science distinguished some asterisms from these constellations and called them lunar mansions. (2) Their latitude with respect to the ecliptic is not higher than the northern or southern latitude of the Moon. (3) Between any of them and the next one there are 13°, which is approximately the Moon's motion in one day. (4) The number of these asterisms is 28, corresponding to the number of days that the Moon travels through them in the sky. (5) Consequently, they were called lunar mansions, and these are their names.

11

(1) *(i)* The ram's horns, in Arabic *al-naṭḥ*, < consists of> two third-magnitude stars.[1] (2) *(ii)* The ram's entrails, in Arabic *al-buṭayn*, <consists of> three 4th<-magnitude> stars, in a sort

of triangle.[2] (3) *(iii) Kimah*, which is *al-thurayyā*, of the fifth magnitude.[3] (4) *(iv)* The eye of the bull, which is *al-dabarān*, a bright star along with four third-magnitude stars, like a shock of grain.[4] (5) *(v)* The head of the twins, which is *al-haqʿa*, <consists of> two second-magnitude stars.[5] (6) *(vi)* The hand of the twins, like a bow, which is *al-hanʿa*, <consists of> two third-magnitude stars with the shape of an arrow.[6] (7) *(vii)* The arm, which is *al-dhirāʿ*, <consists of> two stars whose magnitude is close to that of the bright <stars>, <located> in the front of and below the head of the twins.[7] (8) *(viii)* The lion's nose, which is *al-nathra*, <consists of> six stars like flower petals, of the sixth magnitude.[8] (9) *(ix)* The eyes of the lion, which is *al-ṭarf*, <consists of> two stars of the second and third magnitudes.[9] (10) *(x)* The forehead of the lion, which is *al-jabha*, <consists of stars in> a triangle, of the second and third magnitudes.[10] (11) *(xi)* The side of the lion, which is *al-zubra*, <consists of> two stars, a small and a large one, of the second and fifth magnitudes.[11] (12) *(xii)* The tail of the lion, which is *dhanab al-asad*, <consists of> one bright star, called *al-ṣarfa*.[12] (13) *(xiii)* The howler, which is *al-ʿawwāʾ*, <consists of> four sixth-magnitude stars.[13] (14) *(xiv)* The unarmed <one who is> leaning <on the spear>, which is *al-simāk al-aʿzal*, <consists of> one bright star.[14] (15) *(xv)* The beam of the scale, which is *al-ghafr*, <consists of> three fourth-magnitude stars.[15] (16) *(xvi)* The pans of the scale, <which is> *al-zubānā*, <consists of> two second-magnitude stars.[16] (17) *(xvii)* The crown of the scorpion's head, which is *al-iklīl*, <consists of> three sixth-magnitude stars.[17] (18) *(xviii)* The heart of the scorpion <consists of> a star located between two stars; it is brighter than them and is considered to be of the second magnitude.[18] (19) *(xix)* The sting of the scorpion, which is called *al-šawla*; <it consists of> two stars of the fourth magnitude.[19] (20) *(xx)* The flock that comes and the flock that returns; <it consists of> 8 stars, four grouped on one side and four grouped on the other side; they are called *al-naʿāʾim*; of the third and fourth magnitudes.[20] (21) *(xxi)* The town, with the shape of a reversed letter *ḥet*, it is surrounded by stars above in a sort of arch; in Arabic <it is called> *al-balda*.[21] (22) *(xxii)* The luck of the slaughterer, <which is> *saʿd al-dhābiḥ*, <consists of> three stars; the smallest is located between the other two.[22] (23) *(xxiii)* The luck of the swallower, <which is> *saʿd al-bulaʿ*, <consists of> two stars, one of which is swallowed up by the other.[23] (24) *(xxiv)* The greatest luck [lit. luck of the lucks], <which is> *saʿd al-suʿūd*, <consists of> three stars forming a triangle.[24] (25) *(xxv)* The luck of the tents, <which is> *saʿd al-akhbiya*, <consists of> four stars, two of them standing like a wave on the <other> two, which do not emit light on them.[25] (26) *(xxvi)* The spout of the bucket, <which is> *al-fargh al-awwal*, <consists of> two stars of the fourth magnitude.[26] (27) *(xxvii)* The second spout <of the bucket>, <which is> *al-fargh al-thāni*, <consists of> two stars inclined from the spout of the bucket towards the south.[27] (28) *(xxviii)* The belly of the fish, <which is> *baṭn al-ḥūt*, <consists of> seven stars twisted like the body of a fish; they are close to the ecliptic.[28]

12

(1) The locations and names of all these 1,022 stars are recorded in the book of Ptolemy, the Greek. (2) In this book I have copied the locations of the bright stars and of those that are close in light to them, which belong to the second magnitude. (3) These are <the stars> that are engraved on the astrolabe and are useful in the empirical science [i.e., astrology] for knowing the fortunes of newborn human beings. (4) I have also copied the locations of stars that are not bright <stars> but that give an indication in <the interpretation of> natal horoscopes of human beings, as you will see explained and arranged in this book, with God's help.

Part III: Commentary

This commentary is related to the names and descriptions of stars, constellations, and lunar mansions, which constitute the backbone of *Ch*17. As the notes are full of repetitive references to the same sources, the following sigla and formats are employed:

Ba, 246	*Al-Zīj al-Ṣābi'* (al-Battānī), ed. Nallino (1977), Arabic part, p. 246.
Bi, 1019	*Al-Qānūn al-Masʿūdī* (al-Bīrūnī), ed. Baranī (1954–1956), p. 1019.
*ECh*22, §1:7	Jacob Anatoli's Hebrew translation of Chapter 22 of Farghānī's *Elements*, ed. Sela (2016), section 1, sentence 7.
Cn, 344	The Chronology of Ancient Nations (Al-Bīrūnī), ed. C. Edward Sachau (1879), p. 344.
Ḥa, 340	Al-Ḥajjāj's translation of Ptolemy's catalogue of stars in the *Almagest*, in: P. Kunitzsch, Claudius Ptolemäus: Der Sternkatalog des *Almagest* (1986), p. 340
Is, 341	Isḥāq ibn Ḥunayn's translation of Ptolemy's catalogue of stars in the *Almagest*, in: Paul Kunitzsch, Claudius Ptolemäus: Der Sternkatalog des *Almagest* (1986), p. 341
Ik, §1	Ibn al-Kammād's Star List, ed. Goldstein and Chabás (2015), item §1, on p. 377
Kn I, 13a	First version of *Keli ha-Neḥoshet* (Abraham Ibn Ezra), MS St. Petersburg B 446, fol. 13a.
Kn II, 193b	Second version of *Keli ha-Neḥoshet* (Abraham Ibn Ezra), MS Paris 1045, fol. 193b.

Ln, 57a	*Luḥot ha-nasi'* (Bar Ḥiyya) in: MS Berlin OR. QU. 649, fol. 57a.
Mk, II:1 [7]:37	*Kitāb al-mudkhal al-kabīr* (Abū Maʻshar), ed. Burnett and Yamamoto, Part II, chapter 1, section 7, line 37.
Os, II	Old Spanish version of Ptolemy's catalogue, rueda II (Ossa Mayor) in: Manuel Rico y Sinobas, Libros del Saber de Astronomía del Rey D. Alfonso X de Castilla (Madrid: Tipografía de Eusebio Aguado 1863–1867), vol. I.
Pc, 278–279	Ptolemy's star catalogue in: P. Kunitzsch, *Der Sternkatalog des Almagest* (1986), pp. 278–279.
Rḥ, §1.3:22	*Rešit ḥokhmah* (Abraham Ibn Ezra), ed. Sela, chapter 1, section 3, sentence 22.
Ṣu, 55	*Kitāb Ṣuwar al-Kawākib al-Thābita*h (al-Ṣūfī), ed. Schjellerup (1874), p. 55.
Ta, §352, 213	*Kitāb al-Tafhīm* (Al-Bīrūnī), ed. Ramsay Wright (1934), section 352, p. 213.

§5

[1] 1: **The Lesser Bear … *al-dubb al-aṣghar***. Ursa Minor (ʼΆρκτος μικρά), the first northern constellation in *Pc*, 338–341. Here Bar Ḥiyya translates and transliterates the Arabic name of Ursa Minor (*al-dubb al-aṣghar*) used in *ECh*22 §4:1; *Ba*, 245; *Ṣu*, 44; *Bi*, 1014; *Mk*, II:1 [7]:37. *Ḥa*, 340 and *Is*, 341 use a slightly different name (*kawkabat al-dubb al-ṣugrā*).

[2] 2: **The Greater Bear … *ʻayiš* are there**. Ursa Major (ʼΆρκτος μεγάλη), the second northern constellation in *Pc*, 334–339. This constellation is referred to here by two Hebrew names. The first, *ha-dov ha-gadol*, is the Hebrew translation of *al-dubb al-akbar*, the name used in *ECh*22 §4:2; *Ba*, 245; *Ṣu*, 44; *Bi*, 1015; *Mk*, II:1 [7]:37. *Ḥa*, 338 and *Is*, 339 use a slightly different name (*kawkabat al-dubb al-kubrā*). Then Bar Ḥiyya refers to Ursa Major by pointing out an asterism within this constellation, which he calls by the biblical name *daughters of ʻayiš* (Job 38:32). The same biblical name is used again by Bar Ḥiyya to designate Ursa Major in the list of stars of the 2nd magnitude of *Ch*17, in a reference to η UMa, no. 27 in the constellation Ursa Major in Ptolemy's star catalogue. For a characterization of this asterism and for the rationale behind using the *daughters of ʻayiš* in this regard, see §8:8 and note.

[3] 3: **<The> Great Dragon … name in Arabic**. Draco (Δράκον), the third northern constellation in *Pc*, 330–333. Bar Ḥiyya does not spell out the Arabic name behind his Hebrew translation because the Hebrew *ha-tannin* is phonetically close to the Arabic

al-tinnīn (both = the dragon). The latter is Draco's Arabic designation in *Ḥa*, 332; *Is*, 333; *ECh*22 §4:2; *Ba*, 246; *Ṣu*, 55; *Bi*, 1019; and *Mk*, II:1 [7]:37.

[4] 4: **The constellation … Greek *cepheus*.** Cepheus (Κηφεύς), the fourth northern constellation in *Pc*, 328–329. Here Bar Ḥiyya transliterates the Arabic name (*al-mul-tahib* = the blazing one) and the Greek name (קיקאוס). *Ḥa*, 328, *Is*, 329, *ECh*22 §4:4, *Ba* 247, and *Ṣu* 60 designate Cepheus by the same Greco-Arabic double name.

[5] 5: **The Howler … *al-simāk al-rāmiḥ*.** Boötes (βοώτης = clamorous), the fifth northern constellation in *Pc*, 325–327. Bar Ḥiyya gives this constellation two names. One is *al-'awwā'*, the howler, one of the names used in the Arabic-Ptolemaic tradition translated literally from Greek to designate the constellation Boötes: *Ḥa*; 326; *Ṣu*, 64; *Ta*, §160, 71; *Mk*, II:1 [7]:37. The other is *al-simāk al-rāmiḥ*, a name of the Arabic indigenous tradi- tion which is also the name of the brightest star in Boötes (α Boo) and in the northern celestial hemisphere. Bar Ḥiyya mentions again this star as item no.10 in the list of stars of the first magnitude. See §7:11 and note. Only *ECh*22, §4:5, mentions together *al-'awwā'* (though in a distorted form) and *al-simāk al-rāmiḥ* in a reference to Boötes.

[6] 6: **The Northern Crown … *al-iklīl <al-šamālī>*.** Corona Borealis (Στέφανος βόρειος), the sixth northern constellation in *Pc*, 322–325. *Al-iklīl al-šamālī* (the northern crown), the Arabic name translated here into Hebrew, is one of the common names in the Arabic Ptolemaic tradition for Corona Borealis: *Ḥa*, 324; *Is*, 325; *ECh*22, §4:6; *Mk*, II:1:37–38; *Ṣu*, 69; *Ta*, §160, 71. Note that *Ba*, 248, one of Bar Ḥiyya's main sources in *Ḥešbon*, does not mention *al-iklīl al-šamālī* at all and renders Corona Bo- realis as *al-fakka*, a name of the indigenous Arabic tradition which is one of the alter- nate names of Corona Borealis in the Arabic Ptolemaic tradition.

[7] 7: **The One Kneeling … *'alā rukbatayhi*.** Hercules (Ὁ ἐν γόνασιν = the man on his knees), the seventh northern constellation in *Pc*, 318–323. Here Bar Ḥiyya translates and transliterates the common Arabic name (*al-jāthī 'alā rukbatayhi*) of the constel- lation Hercules in the Arabic Ptolemaic tradition: *Ḥa*, 322; *Is*, 323; *ECh*22, §4:7; *Ba*, 148; *Mk*, II:1 [7]:38; *Ṣu*, 70; *Ta*, §160, 71.

[8] 8: **The constellation … *al-nasr al-wāqi'*.** Lyra (Λύρα = lyre), the eighth northern constellation in *Pc*, 312–317. Here Bar Ḥiyya uses a double name for Lyra, as follows: (1) the Aramaic *futit'a*, used in B *Pesaḥim* 24a *et passim* with reference to aquatic animals or fish that may not be eaten; as such, *futit'a* is Bar Ḥiyya's peculiar transla- tion of "tortoise," corresponding to the Arabic *al-sulaḥfāh* (tortoise), one of the names of the constellation Lyra in the Arabic Ptolemaic tradition; (2) *ha-nešer ha-nofel* (the falling eagle), which is the Hebrew translation of *al-nasr al-wāqi'*, a name of the in- digenous Arabic tradition. Both names first appear together as an appellation for Lyra in *Ḥa*, 316: *al-nasr al-wāqi' wa-huwa al-sulaḥfāh* = "the Falling Eagle which is the tortoise." The second occurrence of the double name (in an expression virtually iden- tical to Bar Ḥiyya's) is in *ECh*22, §4:8: "*al-sulaḥfāh*, which is the Falling Eagle". See

also *Ṣu*, 75. *Ba*, 248, mentions the Falling Eagle but omits the tortoise, and the same applies to *Bi*, 1031 and *Mk*, II:1 [7]:38.

[9] 9: **The <Woman> … *dhāt al-kursīy***. Cassiopeia (Κασσιόπεια), the tenth northern constellation in *Pc*, 310–313. Here Bar Ḥiyya uses two names that combine two separate traditions: (1) "The Woman Sitting in a Chair," the Hebrew translation of *dhāt al-kursīy* (<the woman> with the chair), which is the name given to Cassiopeia in *Is*, 313; *Ba*, 246; *Mk*, II:1 [7]:39; *Ṣu*, 55 and *Bi*, 1019; (2) the Woman with the Dyed Hand, a name used first in *Ḥa*, 312: dhāt *al-kaff al-khaḍīb* = the woman with the dyed hand, a name of the indigenous Arabic tradition. Note that *al-kaff al-khaḍīb*, is the Arabic name of β Cas (*Ṣu*, 83; no. 12 in Cassiopeia). Aside from Bar Ḥiyya, only *ECh*22, §4:10, combines these two separate traditions: "<the Woman> with the Chair … the dyed hand is here." This implies that *ECh*22 was Bar Ḥiyya's source.

[10] 10: **The constellation of the Hen**. Cygnus (Ὄρνις), the ninth northern constellation in *Pc*, 312–315. Here Bar Ḥiyya uses a translation of *al-dajāja*, the hen, the common name for Cygnus in the Ptolemaic Arabic tradition: *Ḥa*, 314; *Is*, 315; *ECh*22, §4:9; *Ba*, 149; *Mk*, II:1 [7]:38; *Ṣu*, 78; *Ta*, §160, 71.

[11] 11: **The Carrier … *ra's al-ghūl***. Perseus (Περσεύς), the eleventh northern constellation in *Pc*, 306–311. Here Bar Ḥiyya translates and transliterates the common Arabic name of Perseus (*ḥāmil ra's al-ghūl*) in the Arabic Ptolemaic tradition: *Ḥa*, 310; *Is*, 311; *ECh*22, §4:9: the Carrier of the Head of *al-ghūl*; *Ba*, 250: *mumsik li-ra's al-ghūl*; *Mk*, II:1 [7]:39: *ḥāmil ra's al-ghūl*; *Ṣu*, 86; *Bi*, 1036. Al-ghūl, "the desert demon," is an Arabic rendering of the Greek Gorgoneion, "Gorgo's Head".

[12] 12: **<The Man> … *al-'ayyūq***. Auriga (Ἡνίοχος = charioteer), the twelfth northern constellation in *Pc*, 304–307. Two sources in the Arabic Ptolemaic tradition assign Auriga a name translated from Greek denoting a man holding the reins and mention *al-'ayyūq*, an old Arabic name (which cannot be translated), as a star inside this constellation. One of them is *ECh*22, §4:12: "The Shepherd who Holds the Reins … *al-'ayyūq* is here." The other is *Ḥa*, 306, which mentions both the "shepherd who holds the reins" and *al-'ayyūq*: *mumsik al-a'inna* [or al-'inān] *wa-huwa al-'ayyūq* = "the shepherd who holds the reins, which is *al-'ayyūq*." Other sources do not mention *al-'ayyūq* in this context: *Is*, 307, *Ba*, 251; *Mk*, II:1 [7]:39; *Ṣu*, 91; *Bi*, 1039. Al-'ayyūq is α Aur, the brightest star in the constellation Auriga, which is mentioned again together with a man holding the reins as item no. 7 in the list of stars of the first magnitude. See §8:8 and note.

[13] 13: **The One … *ḥāmil al-ḥayya***. Ophiuchus (Ὀφιοῦχος = the snake-holder), the thirteenth northern constellation, which represents a snake charmer holding a snake in *Pc*, 300–303. Here Bar Ḥiyya translates and transliterates the Arabic name of Ophiuchus used in *Ḥa*, 302; *Is*, 303; *ECh*22, §4:13; *Ba*, 251; *Mk*, II:1 [7]:40; *Ṣu*, 95; *Bi*, 1041: *al-ḥawwā' ḥāmil* [or *mumsik* or *alladhī yumsik*] *al-ḥayya* = the snake charmer

holding the snake. Bar Ḥiyya employs the Hebrew word *ḥayyah*, "animal," for "snake," because it is homophonous with the Arabic *ḥayya* "snake".

[14] 14: **The constellation … carrier <of the snake>.** Serpens ('Ὄφις 'Οφιούχου = the snake of the snake-holder), the fourteenth northern constellation in *Pc*, 296–299. Here Bar Ḥiyya translates the common Arabic name of Serpens used in *Ḥa*, 298; *Is*, 299; *ECh*22, §4:14; *Ba*, 251; *Šu*, 95; *Bi*, 1044: *ḥayyat al-ḥawwā'* = the snake of the snake charmer. As in the case of Ophiuchus, and for the same reason, Bar Ḥiyya uses the Hebrew word *ḥayyah* to denote "snake".

[15] 15: **The constellation … name in Arabic.** Sagitta ('Οϊστός = arrow), the fifteenth northern constellation in *Pc*, 296–297. Here Bar Ḥiyya offers only a Hebrew translation without specifying the Arabic name behind it. This is because his Hebrew translation, *ha-nul* (= the loom) is not only semantically but also phonetically very close to *al-nawl*, which is one of the names of Sagitta in the Arabic Ptolemaic tradition. *Nawl*, "loom," was the result of an Arabic misreading of 'Οϊστός, "arrow," as όϊστός, "loom". See Paul Kunitzsch, *Der Almagest: Die Syntaxis Mathematica des Claudius Ptolemäus in arabisch-lateinischer Überlieferung* (Wiesbaden: Otto Harrassowitz, 1974), 184–185. See *Ḥa*, 296; *Ba*, 252; *Mk*, II:1 [7]:40; *Bi*, 1046. *ECh*22, (§4:15) has an unclear reading for Sagitta.

[16] 16: **The constellation … *al-nasr al-ṭā'ir*.** Aquila ('Αετός = eagle), the sixteenth northern constellation in *Pc*, 292–295. Here Bar Ḥiyya translates into Hebrew (*ha-neṣer ha-me'ofef* = the flying eagle) and transliterates the common Arabic name of Aquila in the Arabic Ptolemaic tradition: *al-nasr al-ṭā'ir* = the flying eagle. See *Ḥa*, 294; *Is*, 295; *ECh*22, §4:16; *Ba*, 202; *Mk*, II:1 [7]:41; *Šu*, 105.

[17] 17: **The constellation … Sea Fish.** Delphinus (Δελφίς = dolphin), the seventeenth northern constellation in *Pc*, 290–293. Here Bar Ḥiyya had recourse to the strange compound expression *nunei ha-yam*, which combines the talmudic Aramaic *nun* or *nun'a*, meaning fish, with the Hebrew *yam*, meaning sea. See Marcus Jastrow, *A Dictionary of the Targumim, the Talmud Babli and Yerushalmi, and the Midrashic Literature* (Leipzig: Drugulin, 1903), 888. It stands to reason that Bar Ḥiyya did so because he could not find an adequate Hebrew translation for *al-dulfīn*, the common name of this constellation in the Arabic Ptolemaic tradition, which transliterates the Greek name, and accordingly refers to it as a sea fish. See *Ḥa*, 292: *al-dulfīn wa-huwa min al-samak al-baḥrī* = "*al-dulfīn* which is one of the sea fish"; *ECh*22, §4:16: "*al-dulfīn*, namely, the sea lion." Note that the word *dolphin* is not found in the biblical, talmudic Aramaic, or midrashic lexicons.

[18] 18: **The First Horse.** Equuleus ('Ίππου προτομή = forepart of the horse), the eighteenth northern constellation in *Pc*, 290–291. Here Bar Ḥiyya offers only the Hebrew translation (*ha-sus ha-riṣ'on* = the first horse) of one of the common names of Equuleus in the Arabic Ptolemaic tradition: *al-faras al-awwal* = "the first horse". See *Ḥa*,

290; *ECh*22, §4:18; *Mk*, II:1 [7]:41–42. Other names are used in *Ba*, 254: *al-faras*; *Ṣu*, 111 and *Bi*, 100: *qiṭ'at al-faras*.

[19] 19: **The Second Horse**. Pegasus (Ἵππος = horse), the nineteenth northern constellation in *Pc*, 286–289. Here Bar Ḥiyya offers only a Hebrew translation, which follows *Ḥa*, 288: *al-faras al-thānī* = the second horse, or some subsequent source based on this translation.

[20] 20: **The Barren Woman, who is called Andromeda**. Andromeda (Ἀνδρομέδα), the twentieth northern constellation in *Pc*, 282–287. Bar Ḥiyya uses here a double expression: (a) *'aylonit*, a Mishnaic Hebrew word denoting a barren woman, which succinctly supplants the long common Arabic name: *al-mar'a allatī lam tara ba'lan* = the woman who did not see a husband; (b) the transliteration of the Greek name. Only *Ba*, 254, refers to Andromeda by using the double name used by Bar Ḥiyya: *'ndrwmydhs wa-hiya al-mar'a allati lam tara ba'lan* = Andromeda, the woman who did not see a husband. Other sources either transliterate the Geek name or refer to the woman who did not see her husband; *Ḥa*, 286; *Is*, 287; *ECh*22, §4:20; *Mk*, II:1 [7]:42; *Ṣu*, 116 and *Bi*, 1052.

[21] 21: **The constellation Triangle**. Triangulum (Τρίγωνον), the twenty-first northern constellation in *Pc*, 282–283. The Hebrew name of Triangulum here, *ha-mešulaš* = the triangle, is both a translation and phonetically close to the Arabic *al-muthallath* = the triangle, the common name in the Arabic Ptolemaic tradition for this constellation: *Ḥa*, 282; *Is*, 283; *ECh*22, §4:21; *Mk*, II:1 [7]:43; *Ba*, 254; *Ṣu*, 123; *Bi*, 1055.

§6

[1] 1: **The constellation … Greek *cetus***. Cetus (Κῆτος = whale); the first southern constellation in *Pc*, 228–231. Here Bar Ḥiyya gives a triple name: the Hebrew translation (*ḥayat ha-yam* = the sea animal) of the Arabic name, and the transliterations of the Arabic name (*ḥayawān al-baḥr*) and the Greek name (*cetus*). Only *Is*, 231, refers to Cetus this way: *qayṭus wa-huwa ḥayawān baḥrī* = "cetus, which is a sea-animal." Other sources use variant expressions for the marine creature, such as *sabu' al-baḥr* (sea-lion or sea-animal) in *Ba*, 266 ; *Bi*, 1092, or *dābbat al-baḥr* (the marine beast) in *Ḥa*, 230.

[2] 2: **The constellation … the Twins**. Orion (Ὠρίων), the second southern constellation in *Pc*, 224–227. The two names used here are Hebrew translations of *al-jabbār* (the mighty one) and *al-jawzā'* (the twins). These two Arabic names are used in the Arabic Ptolemaic tradition to refer to Orion. Thus, whereas *Ḥa*, 226; *Is*, 227; *Ṣu*, 204–207; *Bi*, 1094 and *Ta*, §161, 72, use both *al-jabbār* and *al-jawzā'*, *Ba*, 168 and *Mk*, II:1 [9]:49, use only *al-jabbār*. Note that in the Arabic Ptolemaic tradition *al-jawzā'* is applied to both Orion and Gemini, which explains why Bar Ḥiyya translates *al-jawzā'* as "the Twins" in a reference to Orion. The same applies to Bar Ḥiyya's translation of the name of the star β Ori. See §7:3 and note.

[3] 3: **The constellation of the River**. Eridanus (Ποταμός), the third southern constellation in *Pc*, 218–223. The Hebrew name here, *ha-nahar*, is both a translation and phonetically close to the Arabic *al-nahr* (both = the river), the common name in the Arabic Ptolemaic tradition: *Ḥa*, 222; *Is*, 223; *ECh22*, §6:3; *Ba*, 170; *Mk*, II:1 [9]:49; *Ṣu*, 210; *Bi*, 1098; *Ta*, §161, 72.

[4] 4: **The constellation of the Hare**. Lepus (Λαγωός), the fourth southern constellation in *Pc*, 216–219. The name used here for Lepus, *ha-arnevet*, the hare, is both a translation and phonetically close to the Arabic *al-arnab*, the common name of this constellation in the Arabic Ptolemaic tradition: *Ḥa*, 218; *Is*, 219; *Ba*, 269; *Mk*, II:1 [9]:49; *Ṣu*, 215; *Bi*, 1101; *Ta*, §161, 72.

[5] 5: **The constellation … *al-ši'rā al-'abūr***. Canis Major (Κύων = dog), the fifth southern constellation in *Pc*, 212–215. Only two sources in the Arabic Ptolemaic tradition use together the double name assigned here by Bar Ḥiyya to Canis Major: (1) *al-kalb al-akbar* = the greater dog, the Arabic name of Canis Major translated here by Bar Ḥiyya as *ha-keleb ha-gadol* = the greater dog; (2) *al-ši'rā al-'abūr*, which is the indigenous old Arabic name of α CMa, the brightest star in Canis Major. One is *ECh22*, §6:5, which refers explicitly to the greater dog and also mentions *al-ši'rā al-'abūr* (although this star in *ECh22* is erroneously swapped with *al-ši'rā al-ghumayṣā'* = α CMi). The other is *Ḥa*, 214, which mentions α CMa and the dog, tout court: *al-kalb wa-huwa al-ši'rā al-'abūr* = the dog, which is *al-ši'rā al-'abūr*. *Ba*, 270, mentions only the dog: *al-kalb*. Bar Ḥiyya mentions again *al-ši'rā al-'abūr* as item no. 6 in the list of stars of the first magnitude. See §8:7 and note.

[6] 6: **The constellation … *al-ši'rā al-ghumayṣā'***. Canis Minor (Προκύων = the preceding dog), the sixth southern constellation in *Pc*, 210–211. Only *ECh22*, §6:6, uses the double name assigned here by Bar Ḥiyya to Canis Minor: (1) the lesser dog; (2) *al-ši'rā al-ghumayṣā'*, which is the indigenous Arabic name of α CMi, the brightest star in Canis Minor (although in *ECh22* this star is erroneously swapped with *al-ši'rā al-'abūr*). *Ḥa*, 210, identifies Canis Minor with *al-ši'rā al-ghumayṣā'* but mentions the first dog, not the lesser dog: *muqaddam al-kalb wa-huwa al-ši'rā al-ghumayṣā'* = the first dog, which is *al-ši'rā al-ghumayṣā'*. *Ba*, 270, mentions only the first, not the lesser, dog: *muqaddam al-kalb*. Bar 'Ḥiyya again mentions *al-ši'rā al-ghumayṣā'* as item no. 5 in the list of stars of the first magnitude. See §8:5 and note.

[7] 7: **The constellation of the Ship**. Argo (Ἀργώ = <the ship> Argo), the seventh southern constellation in *Pc*, 206–211. The name of Argo Navis here, *ha-sefinah*, is both a translation and phonetically close to *al-safīna* = the ship, the common name in the Arabic Ptolemaic tradition: *Ḥa*, 210; *Is*, 211; *ECh22*, §6:7; *Mk*, II:1 [9]:50; *Ṣu*, 224; *Bi*, 1107; *Ta*, §161, 72.

[8] 8: **The constellation of the Southern Snake**. Hydra (Ὕδρος), the eighth southern constellation in *Pc*, 200–203. The name Southern Snake used here for Hydra is unu-

sual in the Arabic Ptolemaic tradition. The only source where a similar name occurs is *ECh*22, §6:6: "the Snake … its face is towards the southern pole." Note that here too Bar Ḥiyya uses the Hebrew word *ha-ḥayya*, "animal," to mean snake, because the Hebrew *ḥayyah* is phonetically virtually identical to the Arabic *ḥayya*, snake.

[9] 9: **The constellation … Arabic *al-ka's***. Crater (Κρατήρ = jug), the ninth southern constellation in *Pc*, 198–199. The name of Crater here, *ha-kos* = the goblet, is both a translation and phonetically close to the Arabic *al-ka's*, used in *Ḥa*, 198, *ECh*22, §6:7, *Ba*, 270 and *Mk*, II:1 [9]:51. By contrast, *Is*, 199, *Ṣu*, 238 and *Bi*, 1114, have *al-bāṭiya*.

[10] 10: **The constellation of the Crow**. Refers to Corvus (Κόραξ) = crow, the tenth southern constellation in *Pc*, 196–199. The name of Corvus here, *ha-'oreb* = the crow, is both a translation and phonetically close to *al-ghurāb*, the Arabic term for this constellation in the Arabic Ptolemaic tradition; *Ḥa*, 198; *Is*, 199; *ECh*22, §6:11; *Mk*, II:1 [9]:51; *Ba*, 271; *Ṣu*, 240; *Bi*, 1115.

[11] 11: **The constellation … man and a horse**. Centaurus (Κένταυρος), the eleventh southern constellation in *Pc*, 192–197. Only two sources in the Arabic Ptolemaic tradition refer to Centaurus by transliterating the Greek name and pointing out that the constellation has the combined shape of a man and a horse. One is *ECh*22, §6:12: Centaurus (distorted) … half of it is a man and half of it is a horse. The other is *Ba*, 271: *qinṭāwurus wa-huwa ṣūrat insān wa-faras* = Centaurus, which is the shape of man and horse.

[12] 12: **The constellation of the Wolf**. Lupus (Θηρίον = beast), the twelfth southern constellation in *Pc*, 190–191. The Hebrew name used here, *ha-ze'eb*, the wolf, is probably Bar Ḥiyya's rendering, probably influenced by the phonetic similarity, of the common name of Lupus in the Arabic Ptolemaic tradition: *al-sabu'*, the beast of prey: *Ḥa*, 190; *Is*, 191; *ECh*22, §6:13; *Ba*, 272; *Mk*, II:1 [9]:51; *Ṣu*, 245; *Bi*, 1120. Note that Gerard of Cremona's choice of Latin *lupus* for this constellation (*Pc* [Latin part], 160), corresponds exactly to the Hebrew *ha-ze'eb*, Bar Ḥiyya's name for Lupus. But Bar Ḥiyya could not have drawn on Gerard, because he was no longer alive when the latter translated the *Almagest* (after 1150).

[13] 13: **The constellation … Arabic *al-mijmara***. Ara (Θυμιατήριον = incense burner), the thirteenth southern constellation in *Pc*, 188–189. Here Bar Ḥiyya translates with the biblical name *maḥtah* (Ex. 26:3) and transliterates the common Arabic name *al-mijmara* used in the Arabic Ptolemaic tradition for the constellation Ara: *Ḥa*, 188; *Is*, 189; *ECh*22, §6:14; *Ba*, 273; *Mk*, II:1 [9]:52; *Ṣu*, 250; *Bi*, 1122.

[14] 14: **The constellation … *al-iklīl al-janūbī***. Corona Australis (Στέφανος νότιος), the fourteenth southern constellation in *Pc*, 186–187. Here Bar Ḥiyya translates and transliterates the common Arabic name (*al-iklīl al-janūbī*) in the Arabic Ptolemaic tradition for Corona Australis: *Ḥa*, 186; *Is*, 187; *ECh*22, §6:15; *Ba*, 273; *Mk*, II:1 [9]:52; *Ṣu*, 252.

[15] 15: **The Southern Fish**. Piscis Austrinus ('Ιχθὺς νότιος), the fifteenth southern constellation, with 12 stars inside and six stars outside the constellation, in *Pc*, 184–185. The Hebrew name here is Bar Ḥiyya's translation of the common name of Piscis Austrinus in the Arabic Ptolemaic tradition: *al-ḥūt al-janūbī* (or *al-samaka al-janūbī*ya): *Ḥa*, 184; *Is*, 185; *ECh*22, §6:16; *Ba*, 274; *Mk*, II:1 [9]:52; *Ṣu*, 254.

§8

[1] 1: **The eye of the bull ... Mars and the Moon**. α Tau (*Aldebaran*); no. 14 in Taurus, in *Ḥa*, 278 and *Is*, 279: long. Tau 12 40', lat. S 5° 10', 1st magnitude. Bar Ḥiyya incorporates the same star, with the same Hebrew and Arabic names, as item no. 1 in *Ln* (57a: long. 57° 10' = Tau 27° 10'; lat. S 5° 10'; 1st magnitude). This corresponds to item no. 8 in Taurus, with the same Arabic name, in al-Battānī's star catalogue (*Ba*, 252: long. 53° 50' = Tau 23° 50'; lat. S 5° 10'; 1st magnitude), and to item no. 2, with the same Hebrew and Arabic names, in *ECh*22, §2:2. This means that regarding the change in longitude of α Tau due to precession, there is a difference of 14° 30' between Ptolemy and Bar Ḥiyya, 11° 10' between Ptolemy and al-Battānī, and 3° 20' between al-Battānī and Bar Ḥiyya. Unless otherwise noted, as already remarked by B.R. Goldstein ("Star Lists in Hebrew," 188), the longitudes of the stars in the first- and second-magnitude stars lists in *Ln* consistently agree with those of al-Battānī with a precession of 3° 20', and with those of Ptolemy with a precession of 14° 30'. Ibn Ezra (*Rḥ*, §2.2:47), in a reference to *al-dabarān*, says that this is one of the stars "causing death," which is analogous to the remark in the current locus that *al-dabarān* indicates the destiny of human beings. This means that this star fulfills the role of one of the *anaeretic points*, which signify threats to the native's life, and ultimately death, as part of an astrological procedure intended to determine the native's lifespan. For this procedure, see *Sefer ha-Moladot*, ed. and trans. Sh. Sela (Leiden: Brill, 2013), 45–57. This star also appears as item no. 1 (fulfilling the function of a death star) in the fourth star list in Bar Ḥiyya's *Ln* (59a), in a table bearing the following title: "These stars truncate life when the progression of the 'witnesses of life' reaches them [the stars] in the nativities or give testimony about a disease or some bodily event." See Appendix. In contrast to *Ch*17, *Ik*, §3, and *Os*, XXII, associate this star with Mars alone and *Rḥ*, §2.2:47, with Mars and Venus.

[2] 2: **The leg of the twins ... Saturn and Jupiter**. β Ori (*Rigel*), the star in the left foot of Orion (not Gemini); no. 35, in *Ḥa*, 224 and *Is*, 225: long. Tau 19° 60', lat. S 31° 30', 1st magnitude. Note that as in the reference above to Orion (see §5:3), here too Bar Ḥiyya translates *al-jawzā'* as "the twins," despite the fact that al-jawz×' refers here to Orion. This is so because in the Arabic Ptolemaic tradition *al-jawzā'* is used for both Orion and Gemini. The same star appears with the same Hebrew and Arabic names as item no. 2 in *Ln* (57a: long. 64° 20' = Gem 4° 20'; lat. S 31° 30'; 1st magnitude). This

corresponds to item no. 18 in Orion, with the same Arabic name, in *Ba* (268: long. 61° 0'; lat. S 31° 30'; 1st magnitude), and to item no. 4, with a similar Hebrew name, in *ECh*22, §2:4. *Rḥ*, §2.3:45, and *Os*, XXXIV, ascribe to β Ori the planetary nature of Saturn and Jupiter, the same as *Ch*17 here.

[3] 3: **The end of the river … power of Jupiter**. θ Eri (*Achernar*); no. 34 in Eridanus, in *Ḥa*, 218 and *Is*, 219: long. Ari 0° 10', lat. S 53° 30', 1st magnitude. The star here cannot be α Eri or *Achernar* (a name derived from the Arabic *ākhir al-nahr* "end of the river"), the brightest star in Eridanus, because it is not listed in Ptolemy's star catalogue and is not recorded before the beginning of the modern era, when it was observed by European seafarers who ventured south of the equator. See P. Kunitzsch, "On the Medieval Knowledge of the Star Alpha Eridani," in *The Arabs and the Stars* (Northampton: Variorum Reprints, 1989), pp. 263–267. Bar Ḥiyya incorporates θ Eri with the same Hebrew name (*aḥarit ha-nahar*) but adding the transliterated Arabic name as item no. 3 in *Ln* (57a: long. 14° 40' = Ari 14° 40'; lat. N 53° 30'; 1st magnitude). This corresponds to item no. 2 in Eridanus, with the same Arabic name, in *Ba* (268: long. 11° 20'; lat. S 53° 30'; 1st magnitude), and to item no. 1, with the same Hebrew and Arabic names, in *ECh*22, §2:1. As *Ch*17 in the current locus, Jupiter is associated with θ Eri in *Ik,* §1, and *Os*, XXXV, but *Rḥ*, §2.1:51, assigns to the same star the planetary nature of Jupiter and Venus.

[4] 4: **The right side … *al-jawzā' <al-ayman>***. α Ori (*Betelgeuse*), the reddish star on the right shoulder of Orion (not of Gemini); no. 2 in Orion, in *Ḥa*, 278 and *Is*, 279: long. Gem 2° 0', lat. S 17° 0', 1st magnitude. The same star, with the same Hebrew and Arabic names, reappears as item no. 4 in *Ln* (57a: long. 81° 30' = Gem 21° 30'; lat. S 17°; 1st magnitude). This corresponds to item no. 2 in Orion, with the same Arabic name, in *Ba* (267: long. 73° 10'; lat. S 17°; 1st magnitude), and to item no. 5, with the same Hebrew and Arabic names, in *ECh*22, §2:5. *Rḥ*, §2.3:50, and *Os*, XXXIV, associate α Ori with Mars and Mercury, whereas *Ch*17 does not associate any planetary nature with this star.

[5] 5: **The lesser dog … Mercury and Mars**. α CMi (*Procyon*); no. 2 in Canis Minor, in *Ḥa*, 210 and *Is*, 211: *al-ši'rā al-ghumayṣā' wa-aš-šāmiya*; long. Gem 29° 10', lat. S 16° 10', 1st magnitude. Note that Bar Ḥiyya, following the Arabic Ptolemaic tradition, assigns the same Hebrew and Arabic names to the entire constellation of Canis Minor. See §5:7 and note. This star, with the same Hebrew and Arabic names, appears as item no. 5 in *Ln* (57a: long. 103° 40' = Can 13° 40', lat. S 16° 10; 1st magnitude). This corresponds to item no. 2 in Canis Major, but with a different Arabic name (*al-ši'rā aš-šāmiya*), in *Ba* (270: long. 100° 20'; lat. S 16° 10; 1st magnitude), and to item no. 8, with a similar Arabic name, in *ECh*22, §2:8. *Ik*, §11, *Rḥ*, §2.4:50 and *Os*, XXXVIII, ascribe to α CMi the planetary nature of Mercury and Mars, as does *Ch*17 in the current locus.

[6] 6: **The greater dog … Jupiter and Mars**. α CMa (*Sirius*); a star of the 1st magnitude, no. 1 in Canis Major, in *Ḥa*, 214 and *Is*, 215: long. Gem 17° 40', lat. S 39° 10', 1st magnitude. Note that Bar Ḥiyya, following the Arabic Ptolemaic tradition, ascribes the same Hebrew and Arabic names to the entire constellation Canis Major. See §5:6 and note. This star, with the same Hebrew and Arabic names, appears as item no. 6 in *Ln* (57a: long. 92° 10' = Can 2° 10'; lat. S 39° 10; 1st magnitude). This corresponds to item no. 3 in Canis Major, with a different Arabic name (*al-ši'rā al-yamāniya*), in *Ba* (270: no. 3 in Canis Major; long. 88° 50'; lat. S 39° 10; 1st magnitude), and to item no. 6 in *ECh*22, §2:6. *Ik*, §8, *Rḥ*, §2.3:46, and *Os*, XXXVII, ascribe to this star the same planetary nature (Jupiter and Mars) as Bar Ḥiyya does.

[7] 7: **The one holding … Mars and Mercury**. α Aur (*Capella*); no. 3 in Auriga, in *Ḥa*, 304 and *Is*, 305: long. Tau 26° 0', lat. N 22° 30', 1st magnitude. Note that Bar Ḥiyya, following the Arabic Ptolemaic tradition, ascribes the same Hebrew and Arabic names to the entire constellation of Auriga. See §4:13 and note. The same star, with the same Hebrew and Arabic names, appears as item no. 7 in *Ln* (57a: long. 69° 30' = Gem 9° 30'; lat. N 22° 30'; 1st magnitude). This corresponds to item no. 2 in Auriga, with a different Arabic name (*al-'anz*), in *Ba* (251 [cf. p. 150 Latin part]: long. 66° 10'; lat. N 22° 30; 1st magnitude), and to item no. 3, with a similar Arabic name, in *ECh*22, §2:3. Just like *Ch*17, *Rḥ*, §2.15:13, and *Os*, XXXVII, associate this star with Mars and Mercury, but *Ik*, §5, ascribes to α Aur the nature of Venus and Mercury.

[8] 8: *Kesil*, **in Arabic** *suhayl* **… Saturn and Jupiter**. α Car (*Canopus*); no. 44 in Argo Navis, in *Ḥa*, 206 and *Is*, 207: *suhayl*; long. Gem 17° 10', lat. S 75° 0', 1st magnitude. Saadia Gaon, in his Arabic translation of the book of Job (*Saadia's Commentary on Job*, 1973, 70–71, 189), was the first to identify the biblical star *kesil* (Job 9:9, 38:31, Amos 5:8) with the indigenous Arabic star *suhayl*. Bar Ḥiyya followed suit and identified *kesil* with *suhayl* in the current locus and also in item no. 14 in the list of stars of the 2nd magnitude of *Ln* (57b: "כסיל והוא סהיל מהערך מהראשון" = "*kesil*, which is *suhayl*, of the 1st magnitude"; long. 91° 40' = Can 1° 40'; lat. S. 75°). The stars of Argo Navis are not included in the only extant manuscript of al-Battānī's *al-Zīj al-Ṣābi'*, but α Car appears with a similar Arabic name as item no. 7 in *ECh*22, §2:7. *Rḥ* §2.16:10 *et passim* continues the same tradition upheld by Bar Ḥiyya and calls *suhayl* by the biblical name *kesil*. *Rḥ*, §2.16:10 and *Os*, XXXIX associate α Car with Saturn and Jupiter, but *Ik*, §7, associates this star with Saturn.

[9] 9: **The heart of the lion … Mars and Jupiter**. α Leo (*Regulus*); no. 8 in Leo in *Ḥa*, 266 and *Is*, 267: long. Leo 2° 30', lat. N 0° 10', 1st magnitude. This star, with the same Hebrew and Arabic names, appears as item no. 12 in *Ln* (57a: long. 137° 20' = Leo 17° 20'; lat. N 0° 10'; 1st magnitude). This corresponds to item no. 6 in Leo, with the same Arabic name, in *Ba* (258: no. 6 in Leo; long. 134°; lat. N 0° 10'; 1st magnitude), and

to item no. 9, with the same Hebrew and Arabic names, in *ECh*22, §2:9. Like *Ch*17, *Ik*, §13, *Rḥ*, §2.5:43 and *Os*, XXV, associate α Leo with Mars and Jupiter.

[10] 10: **The one leaning … Jupiter and Mars**. α Boo (*Arcturus*); no. 23 in Boötes, in *Ḥa*, 324 and *Is*, 325: *al-simāk al-rāmiḥ*; long. Vir 27° 0', lat. N 31° 30', 1st magnitude. This star, with the same Hebrew and Arabic names, appears as item no. 8 in *Ln* (57a: long. 191° 30' = Lib 11° 30'; lat. N 31° 30'; 1st magnitude). This corresponds to item no. 11 in Boötes, with the same Arabic name, in *Ba* (247: long. 188° 10'; lat. N 31° 30'; 1st magnitude), and to item no. 12, with the same Arabic name, in *ECh*22, §2:12. *Ik*, §16, Rḥ §2.7:46, and *Os*, V, assign to this star the planetary nature of Jupiter and Mars, as *Ch*17 in the current locus.

[11] 11: **The unarmed … Venus and Mercury**. α Vir (*Spica*); no. 14 in Virgo, in *Ḥa*, 260 and *Is*, 261: *al-simāk al-aʿzal*; long. Vir 26° 40', lat. S 2° 0', 1st magnitude. This star, with the same Hebrew and Arabic names, appears as the 14th lunar mansion (see §10:14 and note), and as item no. 9 in *Ln* (57a: long. 191° 14' = Lib 11° 14'; lat. N 2°; 1st magnitude). This corresponds to item no. 12 in Virgo, with the same Arabic name, in *Ba* (249: long. 187° 50'; lat. N 2° 0'; 1st magnitude), and to item no. 11, with the same Arabic name, in *ECh*22, §2:11. Just as *Ch*17 here, *Ik*, §17, *Rḥ*, §2.7:45, and *Os*, XXVI, associate this star with Venus and Mercury.

[12] 12: **The foreleg … Venus and Jupiter**. α Cen (*Rigil kentaurus* or *Toliman*); no. 35 in Centaurus, in *Ḥa*, 192 and *Is*, 193: long. Lib 8° 20' [Ḥa] or Sco 8° 20' [Is], lat. S 41° 10', 1st magnitude. This star, with the same Hebrew and Arabic names, appears as item no. 13 in *Ln* (57a: long. 202° 20' = Lib 22° 20'; lat. N 41° 10'; 1st magnitude). This corresponds to item no. 22 in Centaurus, with the same Arabic name, in *Ba* (222: long. 199° 30' = Lib 19° 30'; lat. N 41° 10'; 1st magnitude). This means that regarding the change in longitude of α Cen due to precession, there is a difference of 2° 50' between al-Battānī and Bar Ḥiyya. The same star appears with the same Arabic name as item no. 13 in *ECh*22, §2:13. *Rḥ*, §2.16:11, and *Os*, XLIII, associate this star with Venus and Jupiter, as *Ch*17 here. Concerning the wrong position of the longitude by one in sign in the *Almagest*, see *Ibn al-Ṣalāḥ, Zur Kritik der Koordinatenüberlieferung im Sternkatalog des Almagest*, ed. Paul Kunitzsch (Göttingen: Vandenhoeck & Ruprecht, 1975), star no. 83, pp. 71–74.

[13] 13: **The falling eagle … Venus and Mercury**. α Lyr (*Vega*); no. 1 in Lyra, in *Ḥa*, 316 and *Is*, 317: long. Sgr 17° 20', lat. N 62° 0', 1st magnitude. The same star is recorded with the same Hebrew and Arabic names as item no. 10 in *Ln* (57a: long. 271° 50' = Cap 1° 50'; lat. N 62°; 1st magnitude). This corresponds to item no. 1 in Lyra, with a similar Arabic name (*al-nasr*), in *Ba* (248: no. long. 268° 30'; lat. N 5° 62'; 1st magnitude), and to item no. 14, with the same Hebrew and Arabic names, in *ECh*22, §2:14. As *Ch*17 here, *Ik*, §24, *Rḥ*, §2.10:42; §2.15:9, and *Os*, VIII, associate this star with Venus and Mercury.

[14] 14: **The end … Venus and Mercury**. The identification of this star is problematic. See Goldstein. "Star Lists in Hebrew," 189–190. A star with the same Arabic and Hebrew names appears as item no. 11 in *Ln* (57a: long. 277° 18' = Cap 7° 18'; lat. S 6° 30'; 1st magnitude). Taking into consideration a difference of longitude due to precession of 3° 18', the coordinates and name of Bar Ḥiyya's star correspond rather well to no. 16 in Sagittarius in *Ba* (262: long. 274° = Sgr 4° [= 277° 18' - 3° 18']; lat. S 6° 30', 1st magnitude). This star bears a double name: (1) *aṣl alyatihi* = root of his [the horse's] tail, which is close to Bar Ḥiyya' name: *aṣl dhanab al-faras* = the root of the horse's tail; and (2) *'urqūb al rāmī*, which does not correspond to Bar Ḥiyya's name. Although Nallino has proposed to identify this star with ω Sgr (*Ba*, 163), a difficulty arises when one tries to locate this star in Ptolemy's star catalogue. Taking into consideration the first name (*aṣl alyatihi*), al-Battānī's star may correspond to no. 28 in Sagittarius, called *aṣl al-dhanab <al-faras>* = the root of the tail <of the horse> in *Ḥa*, 246–247 (corresponds to ω Sgr), a name virtually identical to the one given by Bar Ḥiyya. However, the ecliptical latitude and magnitude of the latter star in *Ḥa* (long. Sgr 27° 40' = 267° 40', lat. S 4° 50', 5th magnitude) and in *Ln* do not correspond. Taking into consideration the second name (*'urqūb al rāmī*), al-Battānī's star may correspond to no. 23 in Sagittarius in *Ḥa*, 246–247 (corresponds to β Sgr), which has a similar name (*al-'urqūb*). However, neither the name nor the coordinates of this star in *Ḥa* (long. Sgr 17° 40' = 257° 40', lat. S 23° 0', 2nd magnitude) and in *Ln* correspond. Goldstein ("Star Lists in Hebrew,",187, 189–190) proposed identifying Bar Ḥiyya's star with no. 22 in Sagittarius in *Pc*, 248–249; corresponds to ζ Sgr; long. Sgr 16° 20' = 256° 40', lat. S 6° 45', 3rd magnitude). However, neither the name nor the magnitude of ζ Sgr and Bar Ḥiyya's star corresponds. Neither *ECh22* nor Rḥ mentions Bar Ḥiyya's star. In any event, all the aforesaid proves Bar Ḥiyya's reliance on al-Battānī's star catalogue.

[15] 15: **The mouth … Saturn and Mercury**. α PsA (*fomalhaut*); no. 1 in Piscis Austrinus (and no. 42 in Aquarius), in *Ḥa*, 236 and *Is*, 237: long. Aqr 7° 0', lat. S 23° 0', 1st magnitude. The same star is recorded with the same Hebrew and Arabic names as item no. 14 in *Ln* (57a: long. 321° 30' = Aqr 21°; lat. N 20° 20'; 1st magnitude). This corresponds to item no. 18 in Aquarius, with a similar Arabic name, in *Ba* (261: long. 318° 10'; lat. S 20° 20'; 1st magnitude), and with the same Hebrew name in *ECh22*, §2:15, no. 15. *Ik*, §27 (Mars and Mercury), *Rḥ*, §2.11:42 (Venus and Mercury) and *Os*, XXXVI (Venus and Mercury) associate this star with divergent planetary natures.

§9

[1] 1: **The dyed hand … Mars and Mercury**. The identification of this star arises some difficulties. See Goldstein, "Star Lists in Hebrew," 190. The expressions used by Bar Ḥiyya here to designate the current star and above (§4:10 and note) to refer to the constellation Cassiopeia are very similar: both speak of a "woman sitting on a chair," a clear reference to Cassiopeia, and a "dyed hand," which may be either a reference to a star in Cassiopeia or an alternative reference to Cassiopeia. In fact, the same Arabic expression used here for the current star (*al-kaff al-khaḍīb*, the dyed hand) was used in astrolabe star lists (P. Kunitzsch, *Arabische Sternnamen in Europa* [Wiesbaden: Otto Harrassowitz, 1959], 66) and in *Su*, 83, for β Cas, item no. 12 in Cassiopeia in Ptolemy's star catalogue. However, the coordinates and magnitude of β Cas, as they appear in *Ḥa*, 310 and *Is*, 311 (long. Ari 7° 50', lat. N 51° 40', 3rd magnitude) and Su (85: long. Ari 20° 32', lat. N 51° 40', 3rd magnitude), do not match the coordinates and magnitude of the current star, as they appear in item no. 1 of *Ln* (57b: long. 2° 0' = Ari 2° 0'; lat. N 26° 0'; 2nd magnitude). Taking into consideration the coordinates of the current star in *Ln*, and precession constants of 14° between Ptolemy and Bar Ḥiyya and of 3° 30' between al-Battānī and Bar Ḥiyya, the current star corresponds closely to α And, which is item no. 1 in Pegasus in *Ḥa*, 288 and *Is*, 289 (long. Psc 17° 50', lat. N 26° 0', 2nd magnitude); and item no. 5 in Equuleus in *Ba* (253: long. 358° 30' = Psc 28° 30'; lat. N 26° 0'; 2nd magnitude). However, whereas Bar Ḥiyya designates the current star with an expression clearly evocative of Cassiopeia (the dyed hand of the Woman Sitting on a Chair), the Arabic-Ptolemaic tradition refers to α And with expressions reminiscent of Andromeda (i.e., *Ḥa* and Is: the star on the navel of the horse that is common to the woman's head; Ba: <the star> on the head of Andromeda, the woman who did not see a husband). It emerges, then, that Bar Ḥiyya was certainly referring to the coordinates and magnitude of α And, but probably confused Cassiopeia with Andromeda and referred to α And with an expression appropriate to the brightest star in Cassiopeia. Confirming this hypothesis is that the Old Spanish version of Ptolemy's star catalogue associates α And with Mars and Mercury, as Bar Ḥiyya does here, but gives α And a name reminiscent of Andromeda: *la que es en la verna es en comun al caballo et al la mugger encadenada* = <the star> in the navel, which is common to the horse and to the chained woman.

[2] 2: **The left side … Saturn and Jupiter**. γ Ori (*Bellatrix*); no. 3 in Orion, in *Ḥa*, 226 and *Is*, 227: long. Tau 24° 0', lat. S 17° 30', 2nd magnitude. The same star, with the same Hebrew and Arabic names, appears as item no. 2 in *Ln* (57b: long. 68° 30' = Gem 8° 30'; lat. S 17° 30'; 2nd magnitude). This corresponds to item no. 3 in Orion, with a similar Arabic name, in *Ba* (248: long. 65° 10'; lat. S 17° 30'; 2nd magnitude). *Rḥ*, §2.3:46; §2.16:4, and *Os*, XXXIV, associate γ Ori with Mars and Jupiter, unlike the current locus.

[3] 3: **The head of the devil … Mars and Mercury**. β Per (*Algol*); no. 12 in *Ḥa*, 308 and *Is*, 309: long. Ari 29° 40', lat. N 23° 0', 2nd magnitude. This star, with the same Hebrew and Arabic names, appears as item no. 3 in *Ln* (57b: long. 44° 10' = Tau 14° 10'; lat. N 23° 0'; 2nd magnitude). This corresponds to item no. 6 in Perseus, with a similar Arabic name, in *Ba* (250: long. 40° 50' = Tau 10° 50'; lat. N 23° 0'; 2nd magnitude). *Rḥ*, §2.2:46 and *Os*, XI, associate β Per with Saturn and Venus, differently from the current locus.

[4] 4: **The tail of the lion … Saturn and Mercury**. β Leo (*Denebola*); no. 27 in Leo, given a different Arabic name in *Ḥa*, 264 and *Is*, 265: *ṭaraf al-dhanab* = long. Leo 24° 30', lat. N 11° 50', 1st magnitude. This star, with the same Hebrew and Arabic names, appears as the 12th lunar mansion (see §10:12 and note), and with a longer Arabic name (*dhanab al-asad al-ṣarfa*) as item no. 4 in *Ln* (57b: long. 159° 0' = Vir 9° 0'; lat. N 11° 50'; 2nd magnitude). This corresponds to item no. 12 in Leo, with the same Arabic name (*al-ṣarfa*) but assigned to the 1st magnitude (not the 2nd magnitude as it ought to be here), in *Ba* (258: long. 155° 40' =Vir 5° 50'; lat. N 11° 50'; 1st magnitude). This star is included with the same Hebrew and Arabic names in the list of stars of the 1st magnitude of *ECh*22, §2:10: no. 10. It is not clear why Bar Ḥiyya assigned β Leo to the 2nd magnitude (both in *Ch*17 and in *Ln*), while the Arabic-Ptolemaic tradition consistently makes it of the 1st magnitude. *Ik,* §16, and Rḥ §2.6:40, associate β Leo with Saturn and Venus, unlike the current locus, but *Os*, XXV, associates β Leo with Saturn and Mercury, as here.

[5] 5: **The bright <star> … Venus and Mercury**. α CrB (*Alphecca*); no. 1 in Corona Borealis, in *Ḥa*, 324 and *Is*, 325: long. Lib 14° 40', lat. N 44° 30', 2nd magnitude. The same star, with the same Hebrew and Arabic names, appears as item no. 5 in *Ln* (57b: long. 209° 10' = Lib 29° 10'; lat. N 44° 30'; 2nd magnitude). This corresponds to item no. 1 in Corona Borealis, with a similar Arabic name, in *Ba* (248: long. 205° 50' = Lib 25° 50'; lat. N 44° 30'; 2nd magnitude). *Ik*, §19, Rḥ §2.7:47, and *Os*, VI, associate α CrB with Venus and Mercury, like *Ch*17 in the current locus.

[6] 6: **The heart of the scorpion … power of Jupiter**. α Sco (*antares*); no. 8 in Scorpio, in *Ḥa*, 252 and *Is*, 253: long. Sco 12° 40', lat. S 4° 0', 2nd magnitude. The same star appears with the same Hebrew name, but with the addition of the Arabic name (*qalb al-ʻaqrab*), as item no. 6 in *Ln* (57b: long. 237° 10' = Sco 27° 10'; lat. S 4° 0'; 2nd magnitude). This corresponds to item no. 5 in Scorpio, with its corresponding Arabic name (*qalb al-ʻaqrab*), in *Ba* (260: long. 233° 50' = Sco 23° 50'; lat. S 4° 0'; 2nd magnitude). *Ik*, §23, Rḥ §2.8:46, and *Os*, XXVIII, associate α Sco with Mars and Jupiter, like *Ch*17 in the current locus.

[7] 7: **The bright <star> … Mars alone**. η UMa (*Alkaid*); no. 27 in Ursa Major, in *Ḥa*, 336 and *Is*, 337: long. Leo 29° 50', lat. N 54° 0', 2nd magnitude. As above (§4:3), an asterism within Ursa Major is called here the *daughters of ʻayiš*, but in the current

locus Bar Ḥiyya makes the significant remark that the biblical Hebrew expression *benot* *'ayish* (the daughters of *'ayish*; Job 38:32) is the counterpart of the Arabic name *banāt na'š* (the daughters of the bier). Bar Ḥiyya proceeded in this manner because he was following a tradition established by Saadia Gaon (882–942), who, in his translation of Job 9:9 (*Saadia's Commentary and Translation of the Book of Job*, ed. and trans. Y. Qafiḥ; [Jerusalem, 1973], 70–71) explicitly rendered the biblical star or constellation *'aš* (or *'ayiš* or daughters of *'ayish*) as *banāt na'š*. The latter is the Arabic name for the Greater and the Lesser Wains, two asterisms in Ursa Major and Ursa Minor, respectively. For an account of the asterism *banāt na'š*, see *Ṣu*, 36, 45, 49–50. Ibn Ezra (*Rḥ*, §2.15:3) adheres to the same tradition and uses the same biblical name to designate Ursa Major. For a study of this tradition and how it was implemented in Bar Ḥiyya's and Ibn Ezra's work, see Sh. Sela, "Biblical Stars in Medieval Jewish Thought (Tenth-Twelfth Centuries)," *Journal of Jewish Studies* 66.2 (2015): 317–340. Bar Ḥiyya includes the same star with a somewhat similar Hebrew name (*ha-me'ir mi-benot 'ayiš ašer be-sof ha-zanav* = the bright <star> in the daughters of *'ayiš* at the end of the tail) as item no. 7 in *Ln* (57b: long. 164° 18' = Vir 14° 18'; lat. N 54° 0'; 2nd magnitude). This corresponds to item no. 5 in Ursa Major, with an Arabic name that partly corresponds to the Hebrew name used by Bar Ḥiyya in *Ln* (*ṭaraf al-dhanab* = end of the tail) in *Ba* (246: long. 161° 0' = Vir 11° 0'; lat. N 54° 0'; 2nd magnitude). *Os*, XXVIII, associates η UMa with Mars alone, like *Ch*17 here, but *Rḥ* §2.15:3, associates all the stars in Ursa Major with the Moon and Venus.

[8] 8: **The flying eagle … Mars and Jupiter**. α Aql (*Altair*); no. 3 in Aquila, in *Ḥa*, 294 and *Is*, 295: long. Cap 3° 50', lat. N 29° 10', 2nd magnitude. The same star, with the same Hebrew and Arabic names, appears as item no. 8 in *Ln* (57b: long. 287° 20' = Cap 17° 20'; lat. N 29° 10'; 2nd magnitude). This corresponds to item no. 3 in Aquila, with the same Arabic name, in *Ba* (252: long. 285° 0' = Cap 15° 0'; lat. N 29° 10'; 2nd magnitude). This means that regarding the change in longitude of α Aql due to precession, there is a difference of 13° 30' between Ptolemy and Bar Ḥiyya, 11° 10' between Ptolemy and al-Battānī, and 2° 20' between al-Battānī and Bar Ḥiyya. Goldstein ("Star Lists in Hebrew," 191) argues that the deviation from the usual constants of precession between Ptolemy and Bar Ḥiyya and between al-Battānī and Bar Ḥiyya are due to a confusion in the reading of the Arabic numerals. *Rḥ* §2.15:15, and *Os*, XV, associate α Aql with Mars and Jupiter, like *Ch*17 here.

[9] 9: **The tail of the hen … Venus and Mercury**. α Cyg (*Deneb*); no. 5 in Cygnus, in *Ḥa*, 314 and *Is*, 315: long. Aqr 9° 10', lat. N 60° 0', 2nd magnitude. Bar Ḥiyya also lists this star, with the same Hebrew and Arabic names, as item no. 9 in *Ln* (57b: long. 323° 40' = Aqr 23° 40'; lat. N 60°; 2nd magnitude). This corresponds to item no. 4 in Cygnus, with the same Arabic name, in *Ba* (249: long. 320° 20' = Aqr 20° 20'; lat. N 69° 0'; 2nd magnitude). *Ik,* §28, *Rḥ,* §2.11:43; §2.15:10, and *Os*, IX, associate α Cyg with Venus and Mercury, like *Ch*17 here.

[10] 10: **The knee of the hen … Venus and Mercury**. The identification of this star is prob-
lematic. See Goldstein, "Star Lists in Hebrew," 191. Bar Ḥiyya includes this star, with the
same Hebrew and Arabic names, as item no. 10 in *Ln* (57b: long. 321° 30' = Aqr 21° 30';
lat. N 44°; 2nd magnitude). Taking into consideration these coordinates, and the usual
difference in precession of approximately 14° 30' between Bar Ḥiyya and Ptolemy, Bar
Ḥiyya's star corresponds rather well to ζ Cyg, item no. 12 in Cygnus in *Ḥa*, 314, and *Is*,
315: long. Aqr 6° 40', lat. N 44° 0', 3rd magnitude. However, in addition to the mismatch
in magnitude, the names of this star in *Ḥa* (*ṭaraf rīš al-janāḥ al-aysar* = end of the feath-
ers of the left wing) and Is (*ṭaraf al-ʿāšira min al-janāḥ al-aysar* = end of the wing
feather of the left wing) do not match the name of this star in *Ch*17 or in *Ln* (*rukbat al-
dajāja* = the hen's knee). On the other hand, Bar Ḥiyya's name for this star (*rukbat al-
dajāja*) is close to that of ξ Cyg, item no. 14 in Cygnus (*al-rukba al-yusrā* = the left knee)
in *Ḥa*, 314 and *Is*, 315 (long. Aqr 14° 30', lat. N 57° 0', 4th magnitude), although the co-
ordinates and magnitude of ξ Cyg in *Ḥa* and Is differ considerably from those of Bar
Ḥiyya's star in *Ln*. Al-Battānī's catalogue of stars, for its part, does not list ζ Cyg at all,
but includes, as item 10 in Cygnus, which corresponds to ξ Cyg (= item 14 in Cygnus in
Ḥa and Is), a star with a similar name (*al-rukba al-yusrā* = the left knee) but a latitude and
magnitude (*Ba*, 249: long. 325° 40' = Aqr 25° 40'; lat. N 57° 0'; 4th magnitude) that are
quite different from those of Bar Ḥiyya's star. This clear lack of correspondence between
Bar Ḥiyya and al-Battānī, as well as the fact that Bar Ḥiyya associates this star with Venus
and Mercury, strongly suggests that at least here Bar Ḥiyya drew on a source other than
al-Battānī. Its identity is unknown, but the Old Spanish version of Ptolemy's star cata-
logue appears to have drawn on it: item 14 in *Os*, IX, devoted to Cygnus, includes a star
called "la que es en la rodiella siniestra" = "<the star> in the left knee," which is associ-
ated with the planetary nature of Venus and Mercury, just like *Ch*17 here. This star, how-
ever, has the same coordinates and magnitude as ξ Cyg in the Arabic-Ptolemaic tradition.

[11] 11: **The shoulder of the horse … Mars and Mercury**. β Peg (*Scheat*); no. 3 in
Pegasus, in *Ḥa*, 288 and *Is*, 289: long. Psc 2° 10', lat. N 31° 0', 2nd magnitude. This
star, with the same Hebrew and Arabic names, appears as item no. 11 in *Ln* (57b: long.
345° 40' = Psc 15° 40'; lat. N 31°; 2nd magnitude). This presumably corresponds to
item no. 7 in Equuleus, with the same Arabic name, in *Ba* (252: long. 343° 20' = Psc
13° 20'; lat. N 31° 0'; 2nd magnitude). This means that regarding the change in longitude
of β Peg due to precession, there is a difference of 13° 30' between Ptolemy and Bar
Ḥiyya, 11° 10' between Ptolemy and al-Battānī, and 2° 20' between al-Battānī and
Bar Ḥiyya. The deviation from the usual constants of precession between Ptolemy
and Bar Ḥiyya (14° 30') and between al-Battānī and Bar Ḥiyya (3° 20'), may be due,
as noted by Goldstein ("Star Lists in Hebrew," 191), to a misreading by Bar Ḥiyya. Rḥ
§2.12:45, and *Os*, XVIII, associate β Peg with Venus and Mercury, like *Ch*17 here.

[12] 12: **The head of the lion's ... Saturn and Venus**. δ Leo (*Zosma*); no. 20 in Leo, with a different Arabic name, in *Ḥa*, 266 and *Is*, 267: long. Leo 14° 10', lat. N 13° 40', 2nd magnitude. This star, with the same Hebrew and Arabic names, appears as item no. 12 in *Ln* (57b: long. 117° 40' = Can 27° 40'; lat. N 13° 40'; 2nd magnitude). *Ba*, 258, includes δ Leo, with a different Arabic name, as item no. 8 in Leo (long. 145° 20' = Leo 25° 20'; lat. N 13° 40'; 2nd magnitude). The three sources above agree with respect to the latitude and magnitude of δ Leo (N 13° 40'; 2nd magnitude). It emerges, then, that regarding the change in longitude of δ Leo due to precession, there is a standard difference of 11° 10' between Ptolemy and al-Battānī, but the differences between Ptolemy and Bar Ḥiyya and between al-Battānī and Bar Ḥiyya do not correspond to the expected values. This suggests that here Bar Ḥiyya used a different source. Moreover, Bar Ḥiyya's Arabic name for δ Leo, *faqār al-asad*, the lion's spine, does not match the name of this star in any of the prominent catalogues of stars in the Arabic-Ptolemaic tradition prior to Bar Ḥiyya's time. *Rḥ*, §2.5:44, and *Os*, XXV, associate δ Leo with Saturn and Venus, like *Ch*17 here.

[13] 13: **The bright <star> ... power of Venus**. Identification of this star presents some difficulties. See Goldstein, "Star Lists in Hebrew," 191. Bar Ḥiyya includes this star with a similar Hebrew expression, but with an additional Arabic name, *al-dhu'āba* (= the lock of hair, meaning the "plokamos" = lock of hair of Berenike), as item no. 13 in *Ln* (57b: long. 158° 47' = Leo 28° 47'; lat. N 30° 0'; 2nd magnitude). This seems to correspond to 15(c) Com, which is (a) the 6th star outside Leo in *Ḥa*, 264 and *Is*, 265 (long. Leo 24° 50', lat. N 30° 0', luminous), and (b) the 1st star outside the constellation Leo *Ba*, 258 (long. 156° 0' = Leo 26° 0'; lat. N 30° 15'; conspicuous). The three sources above agree approximately regarding the latitude of this star (N 30°). As for the longitude, whereas al-Battānī has a corrupted value, Bar Ḥiyya adds the constant due to precession to al-Battānī's erroneous value. As for the name of this star, *Ḥa* explicitly uses *al-dhu'āba*, just like Bar Ḥiyya in *Ln*. Al-Battānī, for his part, omits *al-dhu'āba* but brings the transliteration in Arabic script of the Greek word behind *al-dhu'āba*: بلقامس = *plokamos*, meaning the lock of hair of Berenike. In addition Al-Battānī offers the precise Arabic expression behind Bar Ḥiyya's Hebrew name: *baina dhanab al-asad* wa-*al-simāk al-rāmiḥ* = <the star> between the lion's tail and *al-simāk al-rāmiḥ*. This means that Bar Ḥiyya drew on al-Battānī for the Hebrew part of the name of this star, but used a source directly drawing on al-Ḥajjāj's translation (or used this translation itself) for the Arabic part of the name. Regarding the magnitude of this star, whereas al-Ḥajjāj's translation describe it as *muḍī'*, luminous, al-Battānī designates it as *mašhūr*, conspicuous. This seems to be why Bar Ḥiyya described a faint star as a "bright" one. *Os*, XXV, associates this star with Saturn and Venus, like *Ch*17 here.

§11

[1] 1: **The ram's horns … third-magnitude stars**. *ECh*22 §8:1 gives the same Arabic
name and number of stars. *Kn* I, 13a, and *Kn* II, 193b, in addition to the same Ara-
bic name and number of stars, offer a similar Hebrew explanation of the name. By
contrast *Ba*, 188, lines 20–21, omits the name *al-naṭḥ* and mentions only the alternative
name *al-šaraṭān* in a reference to the number of stars in Aries. As explained in *Cn*, 343,
al-naṭḥ means "goring" or "horn," because the stars of *al-šaraṭān* (βγ Arietis), an alter-
native name of the first lunar mansion, are placed at the base of the two horns of Aries.

[2] 2: **The ram's entrails … sort of triangle**. *ECh*22 §8:1, *Kn* I, 13a, and *Kn* II, 193b,
mention the same Arabic and Hebrew names and number of stars. By contrast, *Ba*,
188, lines 20–21, mentions only the name *al-buṭayn*. *Cn*, 343, explains that the term
al-buṭayn means "little belly" and refers to Aries' belly.

[3] 3: *Kimah* … **fifth magnitude**. *ECh*22 §8:2 uses the same Arabic name and refers to
the small size of the stars of this mansion. *Kn* I, 13a, lists not only the same Arabic and
Hebrew names but also says that this mansion consists of 20 stars. By contrast, *Ba*,
188, line 22, says only that *al-thurayyā* are on Taurus's horn. Here Bar Ḥiyya explic-
itly identifies the biblical *kimah* (Job 9:9, 38:31–32 and Amos 5:8) with *al-thurayyā*,
which is the classical Arabic rendering of the group of the Pleiades in Taurus, as well
as the name of one of the lunar mansions. Actually, Bar Ḥiyya follows closely in the
footsteps of Saadia Gaon, who first identified *kimah* with *al-thurayyā* in his Arabic
translation of the book of Job. See *Saadia's Commentary on Job*, 1973, 70–71, 189.
Kn I, 13a and *Kn* II, 193b, too, identify *al-thurayyā* with the biblical *kimah* as the
name of the third lunar mansion. See Sela, "Biblical Stars," 317–340.

[4] 4: **The eye of the bull … shock of grain**. Corresponds roughly to *ECh*22, §8:4, which
includes the Arabic name of the bright star and mentions the small stars around it. *Kn*
I 13a, and *Kn* II 193b, list the Arabic name and its Hebrew translation (= the one that
comes later) and mention the small size of the stars around it. By contrast, *Ba*, 188,
line 22, mentions only *al-dabarān* as a star on Taurus' back. *Al-dabarān*, α Tau, has
been already mentioned (§7:1) as item no. 1 in the list of first-magnitude stars.

[5] 5: **The head of the twins … second-magnitude stars**. *ECh*22, §8:5 has the same Arabic
name and explanation (i.e., the head of the twins), but says that it consists of three stars
that are small and close to one another. *Ba*, 188, line 22, mentions only the name *al-
haqʿa*. *Kn* I, 13a and *Kn* II, 193b, use the alternative name *al-maysān* for this lunar man-
sion, indicating that Ibn Ezra drew on a different source. This lunar mansion is identical
with the nebula in the head of Orion, which Ptolemy took to be a single stellar object (*Ḥa*
and *Is*, 226–227: λ Ori), but which *Ṣu*, 204, and *Cn*, 344, identified as three small stars
close to each other in the head of Orion. *Ch*17 identifies here *al-haqʿa* with the head of
the twins, not of Orion. This is because *al-jawzāʾ* can mean either Gemini or Orion.

[6] 6: **The hand of the twins … shape of an arrow**. *ECh*22 §8:6 mentions the same Arabic name and number of stars but locates them between the feet of the twins. *Kn* I, 13a and *Kn* II, 193b, use the alternative name *al-taḥāyī* for this lunar mansion, indicating that Ibn Ezra drew on a different source. *Ba*, 188, line 22, mentions only the name *al-han'a*. *Cn*, 344, says that the Arabs consider *al-han'a* and six other stars to be the bow of Orion, with which he shoots at the Lion.

[7] 7: **The arm … head of the twins**. *ECh*22 §8:7 has the same Arabic name, number of stars, and description of their shape. By contrast, *Ba*, 188, line 22, uses the alternative name *muqaddam al-dhirā'ayn* and mentions it as the fifth lunar mansion (between *al-dabarān* and *al-haq'a*). *Kn* II, 193b, erroneously identifies this lunar mansion with *al-taḥāyī*, an alternative name for *al-han'a*.

[8] 8: **The lion's nose … sixth magnitude**. Corresponds to *ECh*22, §8:8, which has the same Arabic name, number of stars, and description of their shape. *Kn* I, 13a and *Kn* II, 193b, offer a different (but correct) translation of the same Arabic name (*al-nathra* = dispersion), and a similar description of the stars' shape. *Ba*, 188, line 22, mentions only *al-nathra* as the name of the first lunar mansion in Cancer.

[9] 9: **The eyes of the lion … third magnitudes**. *ECh*22 §8:9 mentions the same Arabic name, explanation of the name, and number of stars. *Kn* I, 13a and *Kn* II, 193b, offer the same Arabic name and explanation of the name, but a different number of stars. *Ba*, 189, line 1, mentions only the name *al-ṭarf* in a reference to the number of stars in Leo.

[10] 10: **The forehead of the lion … third magnitudes**. *ECh*22 §8:10, *Kn* I 13a and *Kn* II 193b, have the same Arabic name and explanation of the name, and say that it consists of four stars. *Ba*, 189, line 1, mentions only the name *al-jabha* in a reference to the number of stars in Leo. *Ṣu*, 154 and *Cn*, 345, report that *al-jabha* consists of four stars (ζγηα Leonis), of which the last is the heart of Leo.

[11] 11: **The side of the lion … fifth magnitudes**. *ECh*22 §8:11 offers the same Arabic name and number of stars. *Kn* I 13a and *Kn* II 193b use the alternative name *al-kharātān* and offer a different explanation of this name, i.e., the shins. *Ba*, 189, line 1, mentions only the name *al-zubra* in a reference to the number of stars in Leo. According to *Cn*, 346 (cf. *Ṣu*, 154–155), *al-zubra* consists of two stars on the shoulder of Leo, which are called *al-khartān*, meaning the two holes: δθ Leonis.

[12] 12: **The tail of the lion … called *al-ṣarfa***. The same star, with the same Hebrew and Arabic names, appears as item no. 4 in *Ch*17, §9:5, and in *Ln*, 57b. *ECh*22, §8:12 mentions the same Arabic name. Whereas *Kn* I, 13a, omits this lunar mansion, *Kn* II, 193b, mentions only *al-ṣarfa* and the meaning of this name. *Ba*, 189, line 1, mentions only the name *al-ṣarfa* in a reference to the number of stars in Leo.

[13] 13: **The howler … sixth-magnitude stars**. The number of stars for this lunar mansion in the manuscripts appears to be corrupted. See *variae lectiones*. *ECh*22 §8:8

gives the same Arabic name and a count of five stars. According to *Ṣu*, 159 and *Cn*, 346, *al-'awwā'* consists of five stars in a line, the last of which is not in a straight line with the others: βηγεδ Virginis. *Kn* I, 13a and *Kn* II, 193b, use the same Arabic and Hebrew names, and mention four stars. *Ba*, 189, line 1, mentions only the name *al-'awwā'* in a reference to the number of stars in Virgo.

[14] 14: **The unarmed … bright star**. This star was already mentioned in *Ch*17, §8:12. *ECh*22, §8:14, *Kn* I, 13a, *Kn* II, 193b and *Ba*, 189, line 2, mention the same Arabic name of this star for the name of this lunar mansion.

[15] 15: **The beam of the scale … fourth-magnitude stars**. *ECh*22 §8:15 offers the same Arabic name and number of stars. *Kn* I, 13a and *Kn* II, 193b, use the same Arabic name (but translate it differently), and mention the same number of stars. *Ba*, 189, line 4, mentions only the name *al-ghafr* in a reference to the number of stars in Libra. Arabic interpretations are: the coat of mail (of Scorpio) or the hair at the end of the lion's tail.

[16] 16: **The pans of the scale … second-magnitude stars**. *ECh*22 §8:15 uses the same Arabic name, along with the same translation and number of stars. *Kn* I, 13a and *Kn* II, 193b, use the same Arabic name (translated differently) and mention the same number of stars. *Ba*, 189, line 4, mentions only the name *al-zubānā*yāni in a reference to the number of stars in Scorpio.

[17] 17: **The crown … sixth-magnitude stars**. *ECh*22 §8:17 has the same Arabic name and number of stars. *Kn* I, 13a and *Kn* II, 193b use the same Arabic name but mention five stars. *Ba*, 189, line 4 mentions only the name *al-iklīl*.

[18] 18: **The heart of the scorpion … second magnitude**. *ECh*22 §8:18 has the same name and number of stars and a similar description of the asterism. *Kn* I, 13a and *Kn* II, 193b, mention the same name and number of stars. *Ba*, 189, line 5, mentions only the name *al-qalb*.

[19] 19: **The sting of the scorpion … fourth magnitude**. *ECh*22 §8:19 has the same Arabic name and explanation of the name, and the same number of stars. *Kn* I, 13a and *Kn* II, 193b, offer the same Arabic name and explanation of the name, but a dissimilar number of stars. *Ba*, 189, line 5, mentions only the name *al-šawla*.

[20] 20: **The flock … fourth magnitudes**. *ECh*22 §8:20 has the same Arabic name and explanation of the name, and the same number of stars and description of the asterism. *Kn* I, 13a and *Kn* II, 193b, have the same Arabic name but a different translation of the name (= beams) and a different number of stars. *Ba*, 189, line 5, mentions only the name *al-na'ā'im*. *Ṣu,* 179, and *Cn*, 348, describe the eight stars of *al-na'ā'im* (γδεησφτζ Sagitarii = ostriches) in similar terms, comparing the two groups of four stars each with ostriches descending and ascending from the water and lying, respectively, inside and outside the Milky Way.

[21] 21: **The town … al-balda**. *ECh*22 §8:21 says only that this lunar mansion is a patch of sky without stars that follows the ostriches. *Kn* II, 193b, offers the same translation of the Arabic name and the same description as *Ch*17. *Ba*, 189, line 5, mentions only the name *al-na'ā'im*. Ṣu, 179, and *Cn*, 348, describe *al-balda* as a region void of stars in Sagittarius, between the twentieth and twenty-second lunar mansions.

[22] 22: **The luck of the slaughterer … other two**. *ECh*22 §8:22, *Kn* I 13a, and *Kn* II 193b, offer the same Arabic name and its translation, and the same three stars. *Ba*, 189, line 6, mentions only the name *sa'd al-dhābiḥ*. Ṣu, 183, and *Cn*, 349, give a similar account of the two main stars of this lunar mansion (αβ Capricorni), the third being a small star considered to be the sheep that the slaughterer immolates.

[23] 23: **The luck of the swallower … the other**. *ECh*22 §8:23 offers the same Arabic name and translation, and the same number of stars. *Kn* II, 193b, offers the same translation of the Arabic name and the same number of stars. *Ba*, 189, line 6, mentions only the name *sa'd al-bula'*.

[24] 24: **The greatest luck … forming a triangle**. *ECh*22 §8:24 has the same Arabic name and translation, and the same number of stars. *Kn* I 13a, and *Kn* II 193b, have the same translation but a different number of stars. *Ba*, 189, lines 6–7, mentions only the name *sa'd al-su'ūd*. Ṣu, 189, and *Cn*, 349, offer a similar account of the three stars (βξ Aquarii and c1 Capricorni) of *sa'd al-su'ūd*.

[25] 25: **The luck of the tents … light on them**. *ECh*22 §8:25 has the same translation and the same number of stars. *Kn* I 13a, and *Kn* II 193b, display only the second part of the Arabic name and its translation, and mention only two stars. *Ba*, 189, line 7, mentions only the name *sa'd al-akhbiya*. Ṣu, 190, and *Cn*, 349, give a description of the four stars (γπζη Aquarii) of *sa'd al-su'ūd* that is analogous to that given here.

[26] 26: **The spout … fourth magnitude**. *ECh*22 §8:26, and Ibn Ezra (*Kn* I, 13a; *Kn* II, 193b) use the aforementioned alternative name and its corresponding translation, and mention the same number of stars. *Ba*, 189, line 7, mentions only the name *al-fargh al-muqaddam*. Ṣu, 113–114, and *Cn*, 349, have similar descriptions of the two stars of *al-fargh al-awwal* (αβ Peg), to which is assigned the alternative but similar name *fargh al-dalw al-muqaddam*.

[27] 27: **The second spout … towards the south**. *ECh*22, §8:27, and Ibn Ezra (*Kn* I, 13a; *Kn* II, 193b) use an alternative but slightly different name (*al-fargh al-mu'akhkhar*) and its corresponding translation, and mention the same number of stars. *Ba*, 189, line 7, mentions only the name *al-fargh al-mu'akhkhar*. Ṣu, 114, and *Cn*, 350, have a similar description of the two stars of *al-fargh al-thānī* (γ Peg and α And).

[28] 28: **The belly of the fish … close to the ecliptic**. *ECh*22, §8:28, offers a simplified account that only mentions the fish between Pisces and Cancer. *Kn* I, 13a, and *Kn* II, 193b, use the same Arabic name and its corresponding translation and mention 12 stars.

The Arabic text of chapter 51 of Al-Battānī's *al-Zīj al-Ṣabi'* (*Ba*, 189) does not mention this lunar mansion. With the Arabs this mansion is only one star, β Andromeda.

Appendix: Star Lists in *Ln*

Bar Ḥiyya's astronomical tables include five lists devoted exclusively to the fixed stars. The first two are virtually identical to the two star lists of *Ch*17, although they are accompanied by different parameters and in a few cases offer slightly different names. The other three lists in *Luḥot ha-nasi'* are closely related to astrology and have not been studied so far. A brief description of these five lists follows:

(a) The first is a list of 14 first-magnitude stars, with the following title: מעמד הכוכבים המאירים מכוכבי שבת אשר בערך הראשון בראש מחזור רנ״ט = "Position of the bright stars of the fixed stars of the first magnitude for the first year of the 257th <Metonic> cycle (i.e., 4865 AM = 1004/5 CE)". See MS Berlin OR. QU. 649 (IMHM: F 1774), fol. 57a. Each item in this list is accompanied by the Hebrew translation of the name, the Arabic name transliterated in Hebrew characters, the ecliptical longitude calculated for the beginning of the 257th Metonic cycle (= September 1004 CE); the ecliptical latitude; the equatorial declination; and the mediation, that is, the point of the ecliptic that crosses the meridian at the same time the star does. This list was edited and studied by Goldstein, "Star Lists in Hebrew," 186–190.

(b) The second is a list of 14 second-magnitude stars, with the following title: מעמד הכוכבים המאירים מכוכבי שבת אשר בערך הראשון בראש מחזור רנ״ט = "Position of the bright stars of the fixed stars of the second magnitude for the first year of the 257th <Metonic> cycle". See MS Berlin OR. QU. 649, fol. 57b. Each item in this list is accompanied by the Hebrew translation of the name, the Arabic name transliterated in Hebrew characters, and the same coordinates as in the list of first-magnitude stars. This list was edited and studied by Goldstein, "Star Lists in Hebrew," 188–195.

(c) The third is a list of 31 stars, with the following title: מקומות כוכבי השבת המעידים על מארעי בני אדם בהיותן עומדין על חלקי יתדות הגלגל או שיהיה אחד מן המאורות עמהם, ותהיה נמיכותו או מרחבו מן האופן בפאת מרחב הכוכב המיושב = "Positions of the fixed stars that indicate human events when they are located at the degrees of the cardines of the circle [the zodiac], or when one of the luminaries conjoins them, when its declination or latitude with respect to the circle [the celestial equator] is in the side where the fixed star has <some> latitude." See MS Berlin OR. QU. 649, fols. 58–58b. Each item in this list is accompanied by the Hebrew translation of the name (but without transliteration of the Arabic name), the ecliptical longitude and latitude, the magnitude (most of the stars are of the fifth or sixth magnitude, nebulae, or dark stars), and the planetary

nature. The following rubric appears above the names of the stars: אלו מהם כוכבים מעידים על כהות מאור העיניים בהיותן על היתדות ובהיות המאור לזמן המולד חונה עמהן בפאת מרחבן = "These stars give testimony about poor vision [lit. the dimming of the light of the eyes] when they are in the cardines and when the Sun or Moon is located in the same side as <the star> at the time of birth."

(d) The fourth is a list of 17 stars, with the following title: ואלו כוכבים שהם חותכים את החיים = "These stars בהגעת תהלוכות עידי החיים אליהן במולדות או נותנין עדות על חולי ומאורע בגוף truncate life when the progression of the 'witnesses of life' reaches them [the stars] in the nativities or give testimony about a disease or some bodily event." See MS Berlin OR. QU. 649, fol. 59a. This means that these stars play the role of *anaeretic points*, i.e., zodiacal position that signify threats to the native's life, and ultimately death, in the astrological procedure designed to determine the native's lifespan. For this procedure, see *Sefer ha-Moladot*, ed. and trans. Sh. Sela (Leiden: Brill, 2013), 45–57. Each item in this list is accompanied by the Hebrew translation of the name (without transliteration of the Arabic name) and by the same coordinates as the stars in the previous list.

(e) The fifth is a list of 16 zodiacal asterisms, presented in two columns. See MS Berlin OR. QU. 649, fol. 59b. The first column presents the Hebrew translation of the name together with the zodiacal sign in which the asterism is located, and has the following title: שמות הצורות שעל כהות העינים מעידות לדברי חכמי הנסיון ואין המעלות האלה מתגלגלות לדבריהם = "Names of the asterisms that give testimony about poor vision [lit. the dimming of the light of the eyes] according to the scholars who rely on experience [the astrologers]; in their opinion these degrees do not move." For each entry, the second column lists the range of the asterism in the degrees of the corresponding sign; in a few cases it also presents the planetary nature and ecliptical latitude. The second column is titled: ערך מעלות הצורות אשר בוחן להעיד על הכהות האור בהיות המאורות עומדות לנכחם = "Range of degrees of the asterisms that were found to give testimony about poor vision [lit. the dimming of the light <of the eyes>] when the luminaries are in opposition to them."