Scholars of Andalusian Origin and their Contribution to Ottoman Science

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Abstract: This survey study reveals hitherto unknown aspects of scientific exchange between Andalusian and Ottoman scholars. The first outcome of these aspects came out during the long years of surveying, compiling and editing of the 18 volumes of Ottoman Scientific Literature which unveiled information about the emigration a number of Muslim and Jewish scholars to the Ottoman Empire after the fall of Granada (1492). Scholars of Arab origin mainly settled in North Africa and the province of Egypt, while the Jewish settled mostly in İstanbul and Salonica. These scholars produced works in order to prove their abilities and to be accepted by scholarly circles. Through these works, Ottoman scholars came into contact with new sources including the tradition of the "*Renaissance*" which was unknown to them. Some of these scholars were encouraged and given imperial patronage and some of the physicians rose to the position of palace physician to Suleyman the Magnificent.

This paper gives a detailed account on life and works of the Andalusian scholars who came to Ottoman Empire in different waves of immigration as well as it tries to shed light on the later comers and their interaction with Ottoman scholars.

Keywords: Ottoman Scientific Literature, Andalusian scholars, Ottoman scholars, Jewish scholars, scientific activities in Ottoman lands.

Introduction

Ever since it was first established, the Ottoman Empire attracted scholars from the other Muslim lands. A number of scholars from the old cultural and scientific centers of the Islamic world came to teach in the first Ottoman *medreses* which

were founded in Anatolia. The first medrese built by Ottomans in the newly administered areas was established in İznik in 1331. Few decades later in Rumelia (the European part of the Empire) the first four medreses were established between 1362 and 1389[1]. These scholars enriched Ottoman scholarly life and scientific literature with their works. Taşköprülü-zāde's (d. 1516) biographical dictionary titled *Şakāyık* and its supplements, which include the biographies of the Ottoman *'ulamā'*, are among the sources that substantiate this fact. However, these examples are mostly related to scholars that travelled between Anatolia and Rumelia and on the axes of Iran-Turan and Damascus-Egypt.[2]

Eighteen volumes on Ottoman Scientific Literature published during the last three decades provides ample evidence for scientific and scholarly exchanges between scholars living in different parts of the Ottoman Empire and the neighboring countries. One discovery made as a result of these detailed surveys of scientific literature concerns the imigration of scholars from Andalusian origin and the contributions they made.[3]

Examples of the contributions made to Ottoman science, as seen in these new sources, will be the main subject of this article. However, as will be shown below, it appears that this tradition of scientific contact between Andalusia and Anatolia also existed in the pre-Ottoman period when the latter was under Byzantine and then Seljukid rule. In this context, three early contacts will be briefly mentioned:

1. Arab scholars in al-Andalus who studied medicine and botany were interested in the *Materia Medica* written in Greek by Dioscorides. An illuminated

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[1] On this subject see Ekmeleddin İhsanoğlu, "Emergence of the Ottoman Medrese Tradition", *Archivum Ottomanicum*, v. 25 (2008), [283]-338. On teaching rational sciences see Ekmeleddin İhsanoğlu, "Institutionalisation of Science in the Medreses of pre-Ottoman and Ottoman Turkey", *Turkish Studies in History and Philosophy of Science,* ed. by Gürol Irzık & Güven Güzeldere.Netherlands: Springer, 2005, 265-283.

[2] *Şakaik-i Nu'maniye ve Zeyilleri*, 1-V, ed. Abdulkadir Özcan, Istanbul, 1989.

[3] For a summary on Ottoman scientific institutitons and literature in English see: Ekmeleddin İhsanoğlu, *History of Ottoman State, Society and Civilization*. Vol. II, 361-512, 519-593. For early contacts with European science and technology see Ekmeleddin İhsanoğlu, "Ottoman Science in the Classical Period and Early Contacts with European Science and Technology", *Transfer of Modern Science & Technology to the Muslim World*, ed. Ekmeleddin İhsanoğlu, İstanbul: IRCICA, 1992, 1-48. Ekmeleddin İhsanoğlu, "Some Remarks on Ottoman Science and its Relation with European Science & Technology up to the End of the Eighteenth Century*", Journal of the Japan-Netherlands Institute III. Papers of the First Conference on the Transfer of Science and Technology between Europe and Asia since Vasco da Gama 1498-1998* (Amsterdam/Leiden, 5-7 June 1991). Tokyo, 1991. Some of the eighteen volumes on Ottoman Scientific Literature used in this article are refered to in abbreviation given in italic letters next to the concerned scholar's name. Abbreviations are listed with others in a table.

manuscript of this work was presented by the Byzantine emperor Constantine VII to Caliph ʿAbd al-Raḥmān III (300/912-350/961). In 340/951, the Caliph invited a Byzantine monk by the name of Nicholas to work on the text with a team of Andalusian physicians, led by Ḥasdāy b. Shaprūṭ, the Jewish vizier, palace physician and treasurer. Their task was to identify the correct Arabic names for simple drugs which the Eastern translator, Iṣṭifan ibn Bāsil, had merely transliterated from their original Greek form. This process was summarised by Ibn Juljul in a book entitled *Tafsīr asmā' al-adwiya al-mufrada min Kitāb Dioscorides* – to which he later added *Maqāla fī dhikr al-adwiya allatī lam yadhkur-hā Dioscorides* – containing information on simple drugs which he had obtained from other sources.[4]

2. Ibn al-Bayṭār al-Mālaqī (d. 646/1248) was educated in Seville and emigrated to the East some time after 617/1220. He crossed North Africa (Morocco, Algeria and Tunisia) and most probably arrived in Anatolia by sea. In a sense, he was reciprocating Nicholas' visit. Whilst there, as Ibn Abī Usaybīʿa wrote, "he contacted people knowledgeable about *Materia Medica* and collected information about numerous plants". He made corrections to Dioscorides' writings based on the new information he had collected, while also writing his own work. Ibn al-Bayṭār travelled to the cities of Antalya, Antakya and Diyarbakır in Anatolia, and visited Syria and Egypt before finally settling in Cairo.[5]

3. Muḥyī 'l-Din b. al-ʿArabī (d. 638/1240) of Murcia (Mursiya) was a contemporary of Ibn al-Bayṭār al-Mālaqī, whose travels to Anatolia had extensive religious and intellectual ramifications. He went to Mecca in 600/1204 where he met pilgrims from the cities of Konya and Malatya. Between the years 600/1204 and 627/1230, he stayed on different occasions in the cities of Malatya, Konya, Aksaray and Sivas and was greatly honoured by the Seljuk sultan, Ghiyāth al-Dīn

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[4] Juan Vernet, "Los médicos andaluces en el 'Libro de las generaciones de los médicos' de Ibn Ŷulŷul" in Vernet, *Estudios sobre Historia de la Ciencia Medieval*. Barcelona-Bellaterra, 1979, pp. 469-486. The works of Ibn Juljul have been analysed in the Ph.D. thesis of Ildefonso Garijo, *La obra científica de Ibn Ŷulŷul*. Universidad de Córdoba, 1991. See also Garijo, "El tratado de Ibn Ŷulŷul sobre los medicamentos que no mencionó Dioscórides" in *Ciencias de la Naturaleza en al-Andalus. Textos y Estudios* I (Granada, 1990), 57-70 (English translation in M.I. Fierro and J. Samsó, eds., *The Formation of al-Andalus. Part 2: Language, Religion, Culture and the Sciences*. Ashgate-Variorum, Aldershot, 1998, 419-430); Garijo, *Ibn Ŷulŷul, Tratado Octavo*. Córdoba, 1992. Albert Dietrich has also published another edition (with German translation) of Book 8 in Dietrich, *Die Engänzung Ibn Ğulğul zur Materia Medica des Dioskurides*, Göttingen, 1993. Finally Garijo has reconstructed Ibn Juljul's explanation of the Greek names of simple drugs in Garijo, *Ibn Ŷulŷul, Libro de la explicación de los nombres de los medicamentos simples tomados del libro de Dioscórides*. Córdoba, 1992.

[5] "Ibn al-Bayṭār", *İA*, V/II, 845.

Kaykhusraw I. During the following years, Ibn al- ʿArabī travelled to Jerusalem, Cairo and Mecca, before returning to Konya in 606/1209-10. There he wrote his work titled *Risālat al-anwār*, and there also, under his leadership at the *khanigah* (dervish convent), his most notable student, Ṣadr al-Dīn al-Qūnawī (d. 673/1274) wrote works that were influential in spreading Ibn al-ʿArabī's doctrine. Learned sufis who fled from the Mongol invasion to Anatolia used to assemble in this *khanigah*, and as a result the influence of his doctrine spread to Iran and thence to India, and also to the Seljuk Turks. Through Qūnawī's students, the doctrine took root and extended to the Ottoman lands, where it continued for many years.[6]

During Ottoman times, the name of the first scholar to arrive from Andalusia, appears during the reign of Bayezid II. During the battles for Granada that began in 883/1478, the scholars of the city sent an envoy to Istanbul on behalf of the Andalusian Muslims to seek the help of the Ottoman State. The envoy presented a eulogy to Sultan Bayezid II written by the famous poet Abū'l-Baqā' Ṣāliḥ b. Sharīf al-Rundī. This poem known as the *al-Qaṣīda al-andalusiyya* (Endülüs Mersiyesi) eloquently expressed the oppression, hopelessness and torture that the Andalusian Muslims faced and their request for aid. Aḥmad al-Maqqārī[7] states that similar *qaṣīdas* and letters were sent to other Islamic lands and statesmen and opines that, among them, this poem by Abū'l-Baqā' al-Rundī was the most famous and beautiful.[8]

The Granada Sultanate, which was the last center of resistance for the Andalusian Muslims, fell in 1492. Thus, the emigration of Muslims and Jews began and scholars had to flee their country. Some of these scholars, who were protected by the Ottomans, came to Istanbul and Salonica, while others settled in North Africa. This allowed these scholars to make important contributions to Islamic and particularly to Ottoman science, and it is these contributions that need to be studied in more details. Until such a study is conducted the research presented in this article can help to shed some light on aspects of the subject. As shown below, some of the scholars protected by the Ottoman state became famous, with sultans appreciating and favoring them. The tradition of undertaking scholarly journeys, seen in the early periods of Islamic history, continued in the 9th/15th, 10th/16th and 1lth/17th centuries and spread over a vast geographical

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[6] Ahmed Ateş, "Ibn al-ʿArabī, Muḥyī'l-Dīn", *EI*, III, 707-711; Ahmed Ateş, "Muhyiddin Arabi", *İA*, VI/II, 533 ff.

[7] Abū'l-ʿAbbās A. al-Maqqārī, *Nafḥ al-ṭīb min ghusn al-Andalus al-raṭīb*, ed. Iḥsān ʿAbbās, Beirut 1968, IV, 479-495.

[8] *Ibid*, IV, 486-489.

area. The following examples have been gathered after an extensive survey of sources and manuscripts.

1. ʿAbd al-Salām al-Muhtadī (living in 918/1512) - *OALT,* no. 39, p. 71*; OTTBLT,* no. 18, p. 20*; OTIBLT,* no. 58, pp. 97-98.

ʿAbd al-Salām al-Muhtadī al-Muḥammadī, also known as Khodja Ilyā al-Yahūdī, was a scholar who lived during the reigns of Sultan Bayezid II and Sultan Selim I.[9] He knew the Torah by heart and had a vast knowledge of astronomy, calendar-making, arithmetic and geometry. It is assumed that Ilyās b. Ibrāhīm (Abram) al-Yahūdī, who travelled from Andalusia and settled in Istanbul during the reign of Bayezid II, and ʿAbd al-Salām al-Muhtadī are the same person. After converting to Islam and taking the name ʿAbd al-Salām al-Muhtadī, he wrote a refutation in Arabic addressed to the Jews, titled *al-Risāla al-Hādiya* and dated Saturday, 19 Jumādā II 902/ 22 February 1497.[10] The date of this work verifies that ʿAbd al-Salām was one of the Jewish emigrants who arrived from Spain in 1492. He entered the service of Sultan Bayezid II after already having embraced Islam.

ʿAbd al-Salām wrote works particularly in the fields of medicine and astronomy. In one of his medical works, titled *Mijannat al-ṭā'ūn wa'l-wabā'*, he describes the treatment that should be used against the plague.[11]

In the introduction to his work, ʿAbd al-Salām al-Muhtadī states that God gave him knowledge of the science of medicine by means of his travelling in famous countries and examining the reliable books of the old and new physicians. Among the books he examined are: *Kitāb Epidemia (Kitāb al-amrāḍ al-wāfida), Kitāb al-amrāḍ al-ḥādda* and *Kitāb taqdimat al-maʿrifa* by Hippocrates; *Kitāb aṣnāf al-ḥummayāt, Kitāb ṣināʿat al-kabīr* and *Kitāb al-aghdhiya* by Galen; *Kitāb al-ḥummayāt* by Işḥāq b. Ḥunayn; *al-Hāwī* by Abū Bakr Zakariyyā' al-Rāzī; *al-Rasā'il* by Marwān b. Zuhr; *al-Qānūn* by Ibn Sīnā and *al- Kulliyyāt* by Ibn Rushd. [In addition to the above, the author also quotes from the works of other physicians and scholars such as Isidore[12], Plato, Pythagoras, Angzy Gvry[13], Cenzv (Cydr)[14], Ptolemy and Musa].

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[9] Bursalı Tahir Bey, *Osmanlı Müellifleri*, İstanbul 1342, III, 214.

[10] Katib Çelebi, *Kashf al-Zunūn*, Ankara, Maarif Vekâleti, 1941,1943, II vols, I, 900, II, 2027; Brockelmann, *GAL*, Suppl., II, 990, no. 10.

[11] A copy of this work is located in Es'ad Efendi, no. 24833, fols. 28-53. See Ramazan Şeşen, Cemil Akpınar, Cevad izgi, *Catalogue of Islamic Medical Manuscripts in the Libraries of Turkey*, ed. Ekmeleddin Ihsanoğlu, Istanbul: IRCICA, 1984, 41.

[12] This scholar is known as İsidore from Seville. His work is one of the sources used by Konrad von Megenberg, a German scholar of the XIIIth century, for his *Das Buch der Natur*. This latter work

ʿAbd al-Salām reports that he thoroughly studied other widely read books written by Muslim authors, as well as works written by Jews and Christians. He examined the related passages in the light of his experience and sagacity, and he engaged in discussions and experiments with specialists in the *medreses*. In this way he learnt almost all of the medical sciences.

The author realized that several experiences were necessary for learning the essence of medicine. He exerted great efforts in treating illnesses and wished to write "a few folios" so that both the noble and common people could learn and benefit from his writings. He states that the plague was mentioned in almost all books of medicine, but due to dull, unclear and lengthy passages, they did not serve the purpose, and so he compiled a treatise titled *Mijannat al-Ṭāʿūn wa'l-Wabā'* and submitted it to Sultan Bayezid II.

This treatise consists of an introduction, four chapters and ten subjects. Chapter one defines and explains the reasons for the plague, which appears as a swelling on the body. Chapter two focuses on the symptoms of the illness. Chapter three mentions the preventive health measures which should be taken when the illness becomes apparent. Chapter four is about the medication used against the plague, which is accompanied by fever. The author states that his objective in writing this book is not to prove his superiority over other physicians or to demonstrate his skills in medicine. Instead, he claims he is doing it for the sake of God and in consideration of people's welfare and to reduce the suffering of those infected by the disease.

ʿAbd al-Salām identifies the great earthquake (14th September 1509) as the cause of the plague epidemics which spread in Istanbul, supporting this opinion with Aristotle's famous viewpoint: 'The earthquake is caused by the underground vapors that are pushed towards the surface of the earth'. ʿAbd al-Salām states that he was in touch with most of the medical experts engaged in combating this illness, who had applied the necessary preventive measures "over and over again" in their treatment. ʿAbd al-Salām does not claim his book to be a source of treatment for every patient, but states that, even if one patient in a thousand is saved because of his treatise, he will receive the grace of God.

The author gained considerable experience during his travels. He became aware of the novelties and discoveries in medicine which took place in Europe during this period. For example, he mentions some of the measures which were

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draws largely on *De natura rerum* by Thomas of Cantimpré. (Adıvar, p. 56).

[13] The name of this physician is spelled as انکزی غوری in the text. His identity, however, is not known.

[14] The name of this physician is spelled as جئزو in the text. His identity, however, is not known.

taken against the plague by experienced Christian physicians. In Naples, burning trees were found to be a great remedy against the illness. He also notes that in the region of Herbel[15] in Spain, they burned incense twice a day in order to get rid of the foul air. The author also mentions a salve used to combat the plague that was popular among European physicians, stating that he personally witnessed its benefits.

Another aspect of *Mijannat al-ṭāʿūn,* which deserves mention*,* is ʿAbd al-Salām's criticism of Ibn Sīnā's *al-Qānūn.* According to ʿAbd al-Salām, Ibn Sīnā gives detailed explanations of illnesses which occur very rarely and cause little harm, while only giving brief and insufficient information about infectious diseases which frequently break out, such as the plague. He does note, however, that skilled and capable European physicians come to Ibn Sīnā's defence on this issue. In their words: Ibn Sīnā is to be excused in this instance, because he naturally gave long explanations for the treatment of illnesses and the preventive measures with which he was experienced and familiar.

Sultan Bayezid II charged ʿAbd al-Salām al-Muhtadī with combating and treating the plague epidemics that occured in Istanbul, and the above work in Arabic was written on this occasion. The book was twice translated into Turkish. The first translation was made in 1209/1795 by Gevrek-zāde Ḥāfiẓ Ḥasan Efendi (d. 1216/1801), who also made some of his own additions.[16] Gevrek-zāde recounts the great earthquake that struck Istanbul during the reign of Sultan Bayezid II. The plague broke out after this catastrophe, and most of the physicians in Istanbul were unable to prevent or treat the disease. However, ʿAbd al-Salām's successful efforts at curing the majority of patients who caught the disease were much appreciated. He is said to have penned a treatise in Arabic about the subject. As most people did not know this language, Gevrek-zāde took it upon himself to translate *Mijannat al-Ṭāʿūn* into Turkish. He states that, while he was undertaking his translation, he examined the above treatise and compiled additional information on the subject, detailing the experiences of old and new physicians. He also added his own experiences and the new developments seen in the treatment of the disease. A translation of the author's introduction is also included in the book.

The second translation of *Mijannat al-ṭāʿūn* was made in 1311/1893-94, during the reign of Sultan ʿAbd al-Ḥamīd II. Sanayi Alayı Müftüsü (Muftī of the Industrial Regiment) Aḥmed-i ʿUmārī al-Shāmī translated the work under the title

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[15]This place is written as هربل in the text. However, there is no information about it.

[16] The only copy of this work is located in İ.Ü. Ktp, *TY*, no. 1299.

al-Tawfīqāt al-ḥamīdiyya fī daf' al-amrāḍ al-wabā'iyya.[17] In his introduction, Muftü Aḥmed Efendi states that, although cholera had almost disappeared from the Ottoman lands, it emerged again in Istanbul and in some other Ottoman provinces. Various health and medical institutions discussed the emergence and source of this dreadful disease as well as methods of treating it. He states that the Ottoman press referred to Western newspapers, which claimed that the existence of a great number of flies and insects in summer, as well as earthquakes, causes cholera to appear. The Western newspapers corroborated this viewpoint by reference to scientific studies. He adds that, although some regions were safe, in cities such as Malatya, cholera surfaced after continuous and severe earthquakes. The translator also states that information about cholera was not confined to works containing recent scientific research and medical studies. Indeed, in Islamic libraries, one would find many works on health and philosophy, as well as numerous books and treatises about medicine. He mentions that the earthquakes and insects that appear in the summer, such as flies, are among the causes of cholera. He also notes that the treatment of this disease is mentioned in the work titled *Mijannat al-ṭā'ūn wa'l-wabā'*, written by Jewish physician Ilyās al-Yahūdī, who arrived in Istanbul from Spain and submitted his work to Sultan Bayezid II, son of Meḥmed II. Ilyās wrote many useful works as well as a commentary on *al-Qānūn fī 'l-ṭibb* by the famous Muslim physician Ibn Sīnā. The translator notes that *Mijannat al-ṭā'ūn wa'l-wabā'* has been kept in Islamic libraries for centuries. He points out that the methods and the botanical and chemical substances used in the treatment of cholera, conform to contemporary medical knowledge. In this way he drew the attention of Ottoman physicians to this book.[18] The fact that this work was translated twice in the interval of a century, shows that the old medical literature was still held in favor.[19]

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[17] The only copy in the translator's handwriting is located in Cerrahpaşa Tıp Tarihi, no. 105.

[18] Cerrahpaşa Tıp Tarihi, no. 105, fols. 1b-3b.

[19] A similar example showing the demand for old medical literature is the fact that the work titled *al-Shifā' li-adwā' al-wabā'* by Taşköprülü-zāde (d. 968/1561) was also translated twice. It was first translated by 'Abd al-Ghanī Efendi in 988/1580 under the title of *Tarjamat al-Shifā' li-adwā' al-wabā'* (İ.Ü. Ktp., *TY*, no. 20372, fols. 16b-33a). Then, more than two and a half centuries later, Ahmed Tevhid Efendi (d. 1286/1870) translated Taşköprülü-zāde's work under the name *Bazl al-Mā'ūn fī Jawaz al-Hurucc'an al-Tā'ūn* (Cerrahpaşa, no. 225). This was at a time when the Ottomans started to use quarantine measures against contagious diseases and physicians such as Şâni-zāde Mehmed Ataullah (d. 1242/1826), Mustafa Behcet (d. 1248/1832) and Miralay Hüseyin Remzi (d. 1313/1895) translated works on medicine from the West. Indeed, the number of these translations increased in this period. However, the above example indicates that the old medical tradition still continued in this period.

At the end of *Mijannat al-ṭāʿūn* we find the following: "Details about this subject can be found by examining our explanations about the fourth book of Ibn Sīnā's work titled *al-Qānūn*." This and other passages in the translation indicate that ʿAbd al-Salām wrote a commentary on the fourth book of *al-Qānūn*.[20] However, we were unable to find a copy of this commentary during our research.

In 908/1503 ʿAbd al-Salām al-Muhtadī wrote a book on Astronomy in Hebrew. He also translated it into Arabic under the title *Risāla fī ālat al-dābid waʾl-ʿamal bi-hā*. He organized the work into an introduction and two parts. The introduction mentions the characteristics of the instrument called *al-dābid* and explains the markings (*al-ishārāt*) on it. The first part, concerning astronomical observations, fills forty chapters. The second part comprises thirty chapters and clarifies problems related to this kind of astrolabe. In the introduction, ʿAbd al-Salām states that, with the support he received from Sultan Bayezid II, he invented this instrument which explains the truth about the positions of the fixed stars and planets to the precision of minutes and seconds, and about astronomical observations and the use of the astrolabe all over the world. He says that the instrument he invented, called *al-dābid*, in many respects, is superior to Ptolemy's *Dhāt al-ḥalaq* (armillary sphere), as it is easier to use and more accurate.[21]

ʿAbd al-Salām also dedicated his work titled *al-Risālat al-hādiya* to Sultan Bayezid II. The work consists of three parts: (i) "Refutation of the evidence put forth by the Jews"; (ii) "Proof of the Prophethood of Muḥammad (p.b.u.h.) according to the Torah which was later distorted"; and (iii) "Distortion of the Torah". In order to prove his claim, the author wrote his quotations in Hebrew but using Arabic script and also used vowel marks so that the expressions in Hebrew could be read correctly.[22]

2. Mūsā Jālīnūs al-Isrāʾīlī (first half of the 10th/16th century) - *OALT, no. 102, pp. 224-225;* Rosenfeld & İhsanoğlu, no. 948.

Mūsā Jālīnūs b. Yahuda al-Ṭabīb al-İsrāʾīlī's original name in Hebrew is Mosheh Galliano ben Yehudah. We do not have extensive information about his life and scholarly activities, although we know that one of his teachers was Elijah Mizrahi, who served as rabbi in Istanbul in the first quarter of the sixteenth century. His

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[20] Cf. *Mijannat al-ṭāʿūn* and the last parts of its translation.

[21] The only copy of the work in the author's handwriting is located in Topkapı Palace Museum Library (III. Ahmed, no. 3495).

[22] *Al-Risālat al-hādiya* Katib Çelebi, I, 900. The only copy of the work, dated 19 Jumāda II 902/23 February 1497 and written in the author's handwriting, is located in Topkapı Palace Museum Library (III. Ahmed, no. 1735).

book in Hebrew, *Taʿlumot Ḥokhmah* contains information about his experiences in the court of Bayazid II (1481-1512). He seems to have been in Istanbul most of his life, but this book mentions a visit to Venice and the colophon states that he finished the book in Candia in 1536.[23] His nickname Jālīnūs must have been given because of his skills and expertise as a physician. He compiled his work titled *Risāla fī ṭabāʾiʿ al-adwiya waʾstiʿmāli-hā* in Turkish upon the instruction of the Ottoman Chief Physician, Aḥmad b. Kamāl al-Tabrīzī (d. 930/1523-24), who was known as Ahi Çelebi. Therefore, he must have lived during the first half of the 10th/16th century. A document located in the Topkapı Palace archives mentions a physician called "Mūsā" who later "became a physician among the community of Jewish physicians, who received 12 *akçes* per day". It is possible that this physician is Mūsā Jālīnūs.[24]

Though his field of interest and specialization was medicine, Mūsā Jālīnūs also studied astronomy. He translated several Arabic astronomical works into Hebrew and wrote a summary in Arabic of Abraham Zacut and José Vizinho's *Almanach Perpetuum* (see this study no. 9), extant in ms. Escorial 966. This work, dated 912/1506-7, was commissioned by a certain ʿAbd al-Raḥmān, who held the important post of Judge of the Army (*al-Qāḍī bi ʾl-ʿaskar*).[25] Much more important is his *Dhikr baʿḍ al-maḥallāt al-lāzima li-aṣl waḍʿ falak al-tadwīr wa-khārij al-markaz wa-bayān luzūm kawn ḥarakat al-samāʾ wa-jamīʿ ajzāʾi-hi ilā nāḥiya wāḥida*. The author gives his name as Mūsā Jālīnūs al-Ṭabīb in the only extant copy of this book.[26] The work is a cosmological treatise, which tries to get rid of eccentrics and epicycles, and explains that all celestial motions must take place in the same direction, from East to West. The anomalies (*ikhtilāfāt*) in the motions of stars and planets are the result of variations in the rotations of the poles of its spheres (*ikhtilāf quṭūb aflāki-hā*). This interest in cosmology (*hayʾa*) is consistent with the personage of Mūsā Jālīnūs who, according to Langermann,

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[23] Y. Tzvi Langermann in "From my Notebooks: a Compendium of Renaissance Science: Taʿlumot Ḥokmah by Moses Galeano", *Aleph* 7 (2007), 285-318, and in "From my Notebooks: Medicine, Mechanics and Magic from Moses ben Judah Galeano's Taʿlumot Ḥokmah", *Aleph* 9 (2009), 353-377.

[24] Topkapı Palace Archives, D. 7843, p. 10.

[25] This work was edited by María José Parra for her Ph.D. thesis entitled *Estudio y edición de las traducciones al árabe del* Almanach Perpetuum *de Abraham Zacuto*. University of Barcelona. Barcelona, 2013. The thesis is accessible at http://hdl.handle.net/10803/133448 . See also Juan Vernet, "Una versión árabe resumida del *Almanach Perpetuum* de Zacuto" in Vernet, *Estudios sobre Historia de la Ciencia Medieval*, 333-351.

[26] This unique copy of the work, which was copied towards the end of the 10th/15th century or at the beginning of the 10th/16th century, is located in Topkapı Palace Library, III. Ahmed, no. 33022, fols. 101-107.

was knowledgeable about the planetary models of Ibn al-Shāṭir, and as he was in Italy towards the beginning of the 16th century, could possibly be one of the channels through which these models reached Copernicus.

Mūsā Jālīnūs' work in Turkish titled *Risāla fī ṭabā'iʿ al-adwiya wa'stiʿmāli-hā* is about the characteristics and compositions of different drugs. In the introduction to the work, the author states that medicine has two aspects: one spiritual and the other corporeal. According to him, the science of medicine can be considered as worship, and medical and religious sciences have a very important place among other sciences. He later adds that an illness may be cured by preparing medicines that are contrary to its nature – sometimes medicines are made by mixing substances. For this reason, it is important to know the dose of the composition, as many objections are made about the composition of drugs. He states that, upon the order of Ahī Çelebi and in the light of the saying "the best person is he who does good deeds for others", he compiled a brief and understandable treatise from Islamic, European, Greek and Jewish sources.

In his work, Mūsā Jālīnūs deals with the following topics: the diagnosis of the illness, composition of the medicines, the doses to be given, and the effectiveness of the compositions before their period of expiry. He also stresses the medical rule, which states that where simple medicines are sufficient, compound medicines should not be used. Mūsā Jālīnūs arranged the types of compositions into different diagrams so that they could be memorized easily. He divided the compositions into three categories "those which are neither harmful for friends, nor beneficial for enemies". A later physician by the name of Shifāʿī, who introduces himself as *mudarris al-aṭibbā'*[27] [Professor of Physicians], wrote a note in the *hāmish* (margin) of the only surviving copy of this treatise, dated 966/1558-59.[28] In this note he severely criticizes Mūsā Jālīnūs because of this division. He states that, "the misleading information which is mentioned in this diagram is far beyond the rules of medicine, because the aim of this science is surely to protect health and cure illnesses. To whatever nation he may belong, the physician should treat his patients with affection and mercy. It is thus wrong to classify medicines as those which are meant for friends and enemies."

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[27] This physician must have been Shaʿban Shifā'ī al-Ayashī (d. 1117/1706) who also taught courses while he served as a physician in the medical medrese of Süleymaniye, *OALT*, nr. 236, p. 367; *OTIBLT*, nr. 213, pp. 329-333.

[28] The only copy of this manuscript is located in İ.Ü. Ktp., *TY*, no. 7120.

In compiling the work, Mūsā Jālīnūs quotes from the works of the following physicians: Galen, al-Kindī[29], Ibn Rushd[30], Ibn Zuhr[31], Ibn al-Nafīs[32], Isḥāq al-Isrā'īlī and Arnald of Vilanova (1234-1310).[33]

When citing the views of the above-mentioned physicians, Mūsā Jālīnūs states that he compiled his treatise according to the method of Arnauld "because in general his method is correct and free from mistakes" (3a). When quoting the views of other physicians, he uses the phrases: "according to Muḥammad b. Rushd" (3b), "according to Ṣaḥib-i Muʿjez" (3b), "put forth by al-Kindī" (4a), "following the method of al-Kindī" (4b), "in the opinion of al-Kindī" (11a).

It is interesting to see that Mūsā Jālīnūs uses words showing characteristics of old Anatolian Turkish. For example, he used the word "idevüz" instead of "idelüm" (lb, 3a).

Lastly, we should mention one other work which belongs to Mūsā Jālīnūs al-Isrā'īlī. David King, in his book titled *Islamic Mathematical Astronomy* states that Moshe Galliano ben Yehudah translated into Hebrew a treatise titled *Risāla fī'l-rubʿ al-mujayyab* by Muḥammad b. Muḥammad about the sine quadrant.[34] On the basis of information provided by M. Steinschneider, he states that the above-mentioned Muḥammad b. Muḥammad could be Shams al-Dīn Muḥammad b. Muḥammad al-Khalīlī (d. 811/1408).[35] However, it is more likely that this

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[29] In the text, the author refers to al-Kindī on four occasions. Twice, the name is written as "al-Kandı", once as "Kendü" and once as "al-Kindī" (4a, 4a, 4b, 11a).

[30] On three occasions, the author quotes from the fifth book of *al-Kulliyyāt* by Ibn Rushd (3a, 3b, 4a).

[31] On two occasions, the author quotes from Ibn Zuhr's book (3a, 11a).

[32] There are two quotations from *Muʿjaz al-Qānūn* by Ibn al-Nafīs (2b, 3b).

[33] There are three quotations from the work of this physician in the text (3a, 3a, 4a). According to the modern sources, even now, Arnald is considered as the main figure who attempted to unite the systematic philosophy of medicine of the Greeks and Arabs and the empirical Western tradition in Montpellier. After King Jaume I recaptured Valencia, Arnald learnt Arabic there. Around the 1280s he translated Ibn Sīnā's *De viribus cordis* and Galen's *De rigore* from Arabic into Latin in the palace of the king of Aragon. Besides these works, he also translated a work on medicine by *Albuzal*e (Abū l-Ṣalt Umayya al-Dānī) and a work by Ibn Zuhr on diet. Arnald greatly developed practical and theoretical medicine in his work *Alphorismi de gradibus*. In this work he quoted from al-Kindī and Ibn Rushd. *De gradibus* was held in great favor for over 50 years in Montpellier. In this work he presented an empirical law which was based on quantitative pharmacy. Arnald's work titled *Speculum Médicine* synthesizes the recent theories of medicine. This work was also greatly favored among professional scholars. *DSB*, I, 289-291; *Biographie Universelle* II (Paris 1811), 492-495.

[34] David King, *Islamic Mathematical Astronomy*, London: Variorum Reprints, 1986, XIII, 108, note 28.

[35] M. Steinschneider, *Die hebraischen Übersetzungen des Mittelalters und die Juden als Dolmetscher*, facsimile, Graz 1956, 575-577.

person is the Muḥammad b. Muḥammad known as Sibṭ al-Mardīnī (d. 912/1506). Indeed, the most widespread book in the Islamic world about the sine quadrant is Sibṭ al-Mardīnī's *al-Risāla al-fatḥiyya fī'l-aʿmāl al-jaybiyya*. It is much more likely that Mūsā Jālīnūs would translate an extremely well-known work by a scholar who was his contemporary rather than a work by al-Khalīlī that is far less well-known.

3. Mūsā b. Hāmūn (d. 961/1554) - *OTIBLT,* no. 79, pp. 133-136, 149.
Moses Hamon is the Hebrew name of Mūsā b. Jozef Hāmūn al-Mutaṭabbib al-Isrā'īlī. He is the son of a Jew by the name of Jozef Hamon who emigrated from Granada to Istanbul in 1493. Over time, Mūsā b. Hāmūn rose to the position of palace physician to Suleyman the Magnificent. Information about his life is quite limited.[36]

In his book *Navigations*, the French traveler Nicolas de Nicolay, who came to Istanbul in 1551, devoted a section to the physicians who practiced medicine in Istanbul. Herein he mentions a sixty year old physician by the name of Amon, whom he says he met in the Levant. De Nicolay describes Amon as a competent physician who was highly respected among other physicians and known for his good deeds, knowledge and imposing appearance. This person must have been Ibn Hāmūn. Thus it appears that Amon was merely a new-born baby when his father Joseph Hamon immigrated to Istanbul from Granada in 1493 (see footnote 94).

According to our findings from the Ottoman sources, the names "Hamanoğlu" and "Ibn-i Hāmān" appear only indirectly in ʿAtā'īs work *Tekmilet el-Şakāyıq* under the biography of the physician Maḥmūd b. Muḥammad al-Kusūnī al-Miṣrī.[37]

According to a document located in the Topkapi Palace Archives, Ibn Hāmūn received 45 *akçes* per day.[38] The names and salaries of the other imperial physicians are also included in the document, and based on these Ibn Hāmūn must have been of a higher rank as his daily pay was higher than the other physicians.

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[36] Uriel Heyd, "Moses Hamon, Chief Jewish Physician to Sultan Suleyman the Magnificent", *Oriens*, XVI (1963), 152-170; Feridun Nafiz Uzluk, "Kanunî Sultan Süleyman'ın Yahudi Başhekimi", *Ankara Üniversitesi Tıp Fakültesi Mecmuası*, XXII (1970), 306-327; ArslanTerzioğlu, *Moses Hamons Kompendium der Zahnheilkunde aus dem Anfang des Jahrhunderts*, München 1977; Terzioğlu, "Kanuni Sultan Süleyman'ın Saray Hekimi Musa b. Hamun'un Diş Tababetine Dair Türkçe Eseri ve Bunun Avrupa Tababeti Tarihi Bakımından Önemi", *Bifaskop*, II (1981), 15-20.
[37] ʿAta'ī, 196-197.
[38] Topkapı Palace Archives, D. 7843, p.10.

ʿAta'ī asserts that Sultan Süleyman the Magnificent suffered from gout (*nikris*) in his leg and that it was Mūsā b. Hāmūn, known as Hāmān-oğlu, who treated him. The Sultan's pain increased, however, at which point *Bâbüssaade Ağası* (head eunuch of the Sultan's harem) Ca'fer Ağa expressed his opinion that, while there was a pious, skillful and learned physician like Kaysūnī-zāde, why should the Sultan trust Ibn Hāmūn. The Sultan then ordered Ibn Hāmūn and Kaysūnī-zāde to work together. Kaysūnī-zāde asked to be excused, stating that he does not trust his rival. Then he also requested an examination before a committee of scholars to distinguish the true physician from the fake one. The Sultan accepted his wish and these two people were examined in the presence of Chief Physician (*Hekimbaşı*) Mehmed Çelebi and other physicians. Kaysūnī-zāde asked to be excused and told the examination committee that Ibn Hāmūn had prepared the wrong medicine and proved his claim by rational evidence and information which he quoted from reliable medical books. He subsequently prepared a medicine that cured the Sultan.

According to ʿAta'ī, when Ibn Hāmūn touched Sultan Süleyman's feet during the examination, the pain immediately ceased. On another day, when he was about to touch the Sultan's feet again, Kaysūnī-zāde told Ibn Hāmūn to wash his hands first. Ibn Hāmūn washed his hands thoroughly with soap and then touched the Sultan's feet, but this time the pain did not stop immediately. When Kaysūnī-zāde was asked to explain why, he answered that, before touching the Sultan's feet, Ibn Hāmūn had rubbed his hands thoroughly with opium. As opium is a pain-killer, the pain ceased upon his touch.[39]

Mūsā b. Hāmūn wrote a book about dentistry in Turkish. According to Arslan Terzioglu, this work is one of the oldest in the world devoted solely to dental diseases.[40] It is based on information collected from a number of sources, including ancient Greek works, Galen and other Western sources, Uighur Turks, the Muslim physicians Ibn Sīnā, Abū Bakr al-Rāzī and Abū'l-Qāsim al-Zahrāwī, and the Ottoman physician Sabuncuoğlu Şerefeddin.[41] Terzioğlu also mentions

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[39] ʿAta'ī, 196-197; for information about the event which occurred between Kaysūnī-zāde and Ibn Hāmūn see Uzel, Rusçuklu Hakkı, "Kanuni Süleyman Zamanında Bir Tibbî Müşavere: Kaysūnī-zāde ve Hāmān oğlu", *Türk Tıp Tarihi Arşivi*, vol. 6, nos. 21-22 (1943), 54-58.

[40] Arslan Terzioğlu published this work in facsimile form under the title of *Moses Hamons Kompendium der Zahnheilkunde aus dem Anfang des Jahrhunderts*, Munchen 1977. The work includes a foreword and an introduction and consists of 101 folios. Sadly, this unique manuscript has been lost. In this publication, Terzioğlu notes that shortly before 1977, this work was located in Istanbul Cerrahpaşa Tıp Fakültesi, Tıp Tarihi Enstitüsü (p. IX).

[41] Adnan Adıvar, Osmanlı Türklerinde İlim, (ed. by Aykut Kazancıgil & Sevim Tekeli), İstanbul 1982, 95, Supplement 25.

that this work was penned in Turkish by Ibn Hāmūn in Istanbul, without receiving any assistance.[42]

4. Nūr al-Dīn al-Mālaqī (10th /16th century) - *OALT,* no. 104, pp. 226-227.
Nūr al-Dīn al-Mālaqī, who originally hailed from the city of Malaga in Andalusia, was the student of Shams al-Dīn Muḥammad b. Dallāl al-Suyūṭī al-Wafā'ī, himself a student of the prominent astronomer Muḥammad b. Abī 'l-Fatḥ al-Ṣūfī (d. 950/1543). It is presumed that Nūr al-Dīn al-Mālaqī emigrated from Andalusia and settled in Egypt. His teacher's work about sundials *al-Jawāhir al-nayyīrat* was abridged by him under the title *al-Waḍʿ ʿala'l-jihāt fī'l-basā'iṭ* and arranged in three chapters. There are several manuscripts of this abridged work.[43]

5. Ibrāhīm b. Muḥammad al-Andalusī (living in 990/1582) - *OALT*, no. 94, pp. 192-194; Rosenfeld & İhsanoğlu, no. 1032.
Ibrāhīm b. Muammad al-Andalusī al-Shāṭibī al-Maghribī was originally from the city of Shāṭiba (now called Xàtiva) in the region of Valencia.[44] There is no information about him in the biographical sources. However, as indicated below, Ibrāhīm al-Shāṭibī, at the end of his book titled *Risāla fī masā'il ʿilm al-waqt*, gives the names of four scholars from whose books he benefited. These scholars are al-Shaykh al-ʿUmda al-Khaṭṭāb, al-Ustādh al-Shaykh al-Tājūrī, al-Shaykh Ibn Abī'l-Qāsim al-Andalusī and Abū ʿAbd Allāh Muḥammad b. Abī'l-Khayr al-Sharīf al-Ḥasanī. Among these, the individual named al-Shaykh al-ʿUmda al-Khaṭṭāb is the same person as Abū ʿAbd Allāh Muḥammad b. Muḥammad, known as al-Khaṭṭāb al-Ruʿaynī. He was born in Mecca in 902/1496 and died in 954/1547 in Tripoli (North Africa). The scholar called al-Ustādh al-Shaykh al-Tājūrī is the astronomer Abū Zayd ʿAbd al-Raḥmān b. Muḥammad al-Tājūrī (d. ca. 960/1552; the date of his death is also given as 999/1590-91). He was born in Tripoli and came to Istanbul during the reign of Suleyman the Magnificent. The third figure, al-Shaykh Ibn Abī'l-Qāsim al-Andalusī is the same person as Shihāb al-Dīn Aḥmad b. Qāsim al-Andalusī (living in 1048/1632), who translated the work on gunnery by the Andalusian sailor and gunnery expert Ibrāhīm b. Aḥmad al-Andalusī, also known as al-Ribash (see this study, no. 9). Abū ʿAbd Allāh Muḥammad b. Abī'l-Khayr al-Sharīf al-Ḥasanī, whom al-Shāṭibī calls "my teacher and master", is the astronomer by the name of al-Armayūnī (living in

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[42] Terzioğlu, *Moses Hamons*, p. X.
[43] Ramazan Şeşen, *Nawādir al-makhṭūṭāt* II, Beirut 1980, 246.
[44] *GAL*, II, 615; al-Zirikli, *al-A'lam*, Beirut 1980, I, 67; Kaḥḥala, *Muʿjam al-Mu 'allifīn,* Beirut 1957-1961, I, 106; Şeşen, I, 19.

1019/1610), who flourished in Egypt. Thus, in compiling his work Ibrāhīm al-Shāṭibī referred to the works of two Andalusian scholars, from Egypt and Tripoli respectively.

As stated below, one of the works of al-Tājūrī was copied twice by Ibrāhīm al-Shāṭibī. This brings to mind the possibility that he might have also studied with him. Moreover, under the fifteeenth mathematical problem mentioned in the *khātima* of the work titled *Tuḥfat al-Aʿdad li-Dhawī'l-Rushd wa'l-Sadād* by ʿAlī b. Walī b. Ḥamza al-Maghribī (d. 1022/1614) (see this study, no. 10) Muʿallim Ibrāhīm is cited as: "The person by the name of Muʿallim Ibrāhīm". This person could well be Ibrāhīm al-Shāṭibī.[45]

Three astronomical works of Ibrāhīm al-Shāṭibī have survived to the present day: *Gharīb al-nāqilayn fī aḥwāl al-nayyirayn*,[46] which he compiled in 981 A.H. /1573-74 A.D.; *Risāla fī masā'il ʿilm al-waqt bi-ghayri āla*, which he arranged in the form of an introduction, eleven chapters and a *khātima* in 986 A.H. /1578 A.D; and a third work, titled *Risāla fī taʿyīn al-awqāt wa aḥwāl al-azmina wa tawārīkh al-sinīn*,[47] which he compiled in 990 A.H./1582 A.D. At the end of *Risāla fī masā'il ʿilm al-waqt*, he writes that he referred to the works of the following scholars: al-Shaykh al-ʿUmda al-Khaṭṭāb, al-Ustādh al-Shaykh al-Tājūrī, al-Shaykh Ibn Abī'l-Qāsim al-Andalusī and Abū ʿAbd Allāh Muḥammad b. Abī 'l-Khayr al-Sharīf al-Ḥasanī al-Armayūnī. Ibrāhīm al-Andalusī copied al-Tājūrī 's work titled *Risāla fī'l-fuṣūl al-arbaʿa wa ajzā' al-layl wa awqāt al-ṣalāt wa'l-jihāt al-arbaʿ* twice, in the years 979/1571 and 984/1576.[48] While compiling *Risāla fī masā'il ʿilm al-waqt bi-ghayri āla*, he also benefited from al-Tājūrī 's work titled *Risāla fī'l-fuṣūl al-arbaʿa*.[49]

Muḥammad b. Ibrāhīm al-Ḥulwānī al-Ḥiṣni al-Shāfiʿi (d. 1053/1643), one of the astronomers of the llth/17th century, wrote a work titled *al-Fawā'id al-ḥulwāniyya fī sharḥ al-Ādhariyya*. As he explains in the preface, this work is a commentary on Ibrāhīm b. Muḥammad b. Muḥammad al- Andalusī al-Maghribī's

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[45] ʿAlī b. Ḥamza states that one Muʿallim Ibrāhīm, who came from Andalusia, wrote the above problem on a piece of paper in the Great Mosque of Algeria in Shawwāl 994/September 1586. He indicates that the problem is very difficult, stating: "The accountant who solves this problem will shed so much blood instead of sweat that only a *qanṭar* of soap and the waters that flow from the gate of Gurun can clean it." (Es'ad Efendi, no.31512).

[46] One copy of this work is located in Zahiriyye, Hey 'et, no. 31.

[47] One copy of this work is located in Murad Buhârî, no. 262 (fols.184b-197a). It is copied in 1007 A.H. (Şeşen, I, 19).

[48] Şehid Ali Paşa, no. 27767-8.

[49] The only copy of this work is located in Cairo, Darülkütüb, Halim, Mikat, no. 13

work titled *al-Ādhariyya fī maʿrifat taʿyīn al-awqāt*. It is possible that *al-Ādhariyya* could be the same work as *Risāla fī taʿyīn al-awqāt*.

Among the works copied by Ibrāhīm al-Shāṭibī, one should cite *al-ʿAmal bi'l-asṭurlāb* by Ibn al-Ṣaffār al-Andalusī (d. 426/1035), which he copied in 984/1576.[50]

6. Koca Dāwūd (ca. beginning of 11th/17th century) - *OALT,* no. 188, pp. 328-329; Rosenfeld & İhsanoğlu, no.1098.

This scholar was also known by the names "Dāwūd al-Riyāḍī"[51] and "al-Ḥibr Dāwūd (Haham Dāwūd)".[52] Koca Dāwūd was a Jewish scholar who lived in Salonica around the beginning of the 11th/17th century.[53] Based on the fact that he knew Arabic and had a vast knowledge of Islamic scientific literature. He would belong either to the second generation of the first wave of imigrants who came from Andalusia to the Ottoman lands in 1492 or to the first generation of the second wave that came in 1536.

According to the Ottoman sources, there was some scientific communication and exchange between Takiyyüddin al-Rashīd (d. 993/1585) and Koca Dāwūd. Foremost among the sources that shed light upon this relationship is Takiyyüddin's *zīj* titled *Sidrat muntahā'l-afkār*. In this work Takiyyüddin mentions the observation of three eclipses. The first one was observed [Sunday, Rajab 15, 984 / 8 October 1576] from the house of Khoca Saʿdeddin Efendi (d. 1008/1599) and the second from the Observatory (Dar el-Raṣad el-Cedīd el-Sultānī) [Tuesday Muharrem 14, 985 / 3 April 1577]. As for the third [Thursday, Rajab 14, 985 / 26 September 1577], it was not possible for Takiyyüddin to observe it personally because the sky was cloudy. He did, however, hear about it from his friends in Cairo and from Dāwūd al-Riyāḍī, who was in Salonica.[54]

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[50] Şehid Ali Paşa, no. 27769.

[51] Aydın Sayılı, *The Observatory in Islam*, Ankara 1960, 297.

[52] El-Hafājī, *Habâya'z-zevâyâ*, Laleli, no. 1720, fol. 45a; el-Hafājī, *Rayḥānat al-alibbā' wa zahrat al-ḥayāt al-dunyā*, ed. ʿAbd al-Fattāḥ Muḥammad al-Hilw, 1273, II, 330.

[53] Stephan Gerlach, *Türkisches Tagesbuch*, Frankfurt 1674; Salomon Schweigger, *Reisebeschreibungen nach Konstantinopel*, XXIII, Nürnberg 1608, 90; al-Hafajī, Habaya'z-Zevâyâ, Laleli, no. 1720, fol. 45a; al-Hafajī, *Rayḥanat al-alibbā'*, 1273, II, 330; Mizancı Mehmed Murad, *Tarih-i Ebu'l-Faruk*, IV, Istanbul 1328, 36; *İA*, VI, 63; A. Sayılı, "Alâuddin Mansur'un Istanbul Rasathanesi Hakkındaki Şiirleri", *Belleten*, XX, 79, (Temmuz 1936), 420; Sayılı, *The Observatory in Islam*, 297; Mordtmann, J.H. "Des Observatorium des Taqî ed-dîn zu Pera", *Der Islam*, XIII, (1923); 86, 87, 96; Adıvar, 107, 109.

[54] *Sidrat al-Muntahā al-Afkār,* Topkapı Hazine, 86b-87a; Sayılı, *The Observatory in Islam*, 297.

After *Sidrat muntahā'l-afkār*, the next work which shows the exchange of ideas between Takiyyüddin and Koca Dāwūd is *Habāya'z-zevāyā* by Aḥmad b. Muḥammad b. ʿOmar (d. 1069/1659), who was also known as al-Hafājī. In this work, al- Hafājī states that he went to Salonica in the prime of his youth and there met a Jewish rabbi by the name of Koca Dāwūd, a well-known scholar whose advice was sought by the Jews. Al-Hafājī states that he had not yet met a scholar as good as Koca Dāwūd in the mathematical sciences and none could reach his level in astronomy. He was knowledgeable about several sciences, his observations were highly reliable and the instruments, which he made, were accurate.[55]

In his biography, which was included in his work *Rayḥānat al-alibbā'*, al-Hafājī states that Istanbul was full of notable teachers such as Ibn ʿAbd al-Ghanī,[56] Muṣṭafā b. ʿAzmī[57] and al-Ḥibr Dāwūd. However, the greatest of the teachers was Hoca Saʿdeddin Efendi, whose *icâzet* had been handed down through Ebussuūd, Mü'eyyed-zāde, and Jalāl al-Dīn al-Dawwānī (d. 908/1502). Al-Hafājī studied Euclid's *Geometr*y (*Kitâb al-Uṣūl*) and other books with Koca Dāwūd for one year and learned how to solve the problems it contained. He describes Koca Dāwūd as a unique and unprecedented personality.

The above indicates that al-Hafājī met Koca Dāwūd in Salonica and in Istanbul. According to this information, Koca Dāwūd definitely lived in Istanbul for some time. Al-Hafājī in his *Habāya'z-zevāyā* refers to Takiyyüddin and says that Takiyyüddin told him that Koca Dāwūd did not know the *Almagest* well; sometimes he mixed it up, making some accurate and some wrong interpretations.[58]

In addition to the information about Koca Dāwūd given by Takiyyüddin and al-Hafājī, the memoirs of two successive Austrian priests at the Austrian embassy are also worthy of mention. When Takiyyüddin's observatory was founded, these two priests were in Istanbul. They describe a very different view of the

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[55] *Habāyā'z-zevāyā*, fol. 45a. al-Hafājī was born in 977/1569-70 and met Koca Dāwūd in Salonica during the early years of his youth. Thus, el-Hafājī must have studied with Koca Dāwūd around the year 999/1590-91.

[56] He is Mehmed Efendi (d. 1036/1627), the son of Geredeli Abdülganî Efendi (d. 995/1586-87). Mehmed Efendi was known as Ganī-zāde Nadirī. This scholar served as *mudarris* in the Süleymaniye Medreses, as well as *kadıasker* of Anatolia and Rumelia. He is famous for his divan, collection of literary compositions and epics (ʿAta'ī, 702-704).

[57] The name of this scholar was Muṣṭafā (d. 1040/1631), but he was known as Azmi-zāde Hāletī. He served as a *mudarris* in the Vefa Medresesi and also as *kadıasker* of Anatolia and Rumelia (ʿAta'ī, 739-741).

[58] *Habāya'z-zevāyā*, fol. 45a.

relationship between Takiyyüddin and a Jewish astronomer who was brought from Salonica.

In his memoirs, Priest Stephan Gerlach (1546-1612), according to a record dated 13 November 1577, mentions a tower built on the orders of the Sultan in an area near the house of Andreas Gritt of Venice, which was situated on a hill on the outskirts of Galata. This tower was made for an astronomer who was brought from Egypt. A well, a few fathoms deep, was dug under the tower. Gerlach also mentions that the astronomer was paid 3000 gold ducats per year and that when the observatory was completed he was to receive 6000 gold ducats. A Jew who had knowledge of astronomy was brought from Salonica in order to help the astronomer and to teach Hoca Saʿdeddin Efendi's son.[59] Gerlach states that this observatory would be used only for determining the Sultan's fortune and propitious moments.[60]

Salomon Schweigger was the priest at the embassy following Stephan Gerlach. Schweigger stayed in Istanbul between 1578 and 1581. In his memoirs, Takiyyüddin's observatory is mentioned at length under the title of "the useless expenses incurred by the Sultan's worthless astronomer". In this section, the priest states that at one time, this person (Takiyyüddin) became a servant to a mathematician in Rome. There he secretly secured the assistance of a Jew and had him translate the works of Greek astronomers and mathematicians such as Euclides, Proclos and Ptolemaios, which he later read. Schweigger also says that a tower was built for this astronomer outside of Galata and twelve Christian slaves were employed for its construction. He wrote that Takiyyüddin made the earth globe, a celestial sphere and the meridian circle. However the Sultan and the *muftī* subsequently had the observatory destroyed.[61]

Schweigger's claims directly contradict Gerlach's assertion that the Jewish astronomer who was brought from Salonica would help Takiyyüddin and teach Hoca Saʿdeddin Efendi's son. However, neither Gerlach nor Schweigger give the name of the Jew who helped Takiyyüddin.

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[59] Hoca Saʿdeddin Efendi had five sons, all of whom joined the *ilmiye* class like their father. Mesʿud Efendi (d. 1005/1596-97), the third one among them, died before his father, while he was a *mudarris* in the *Sahn medrese*. The elder son Meḥmed (d. 1014/1605-1606) and the second son Esʿad Efendi (d. 1004/1595-96) both rose to the rank of *şeyhülislam*. The fourth and the fifth sons by the names of Abdülaziz (d. 1010/1601-1602) and Salih Efendi (d. 1031/1621-22) rose to the rank of *kadıasker*, (*İA*, X, 30). Bearing in mind the birth dates of the above-mentioned sons of Hoca Saʿdeddin Efendi, one may guess that Koca Dāwūd might have taught either Meḥmed or Esʿad.

[60] Stephan Gerlach, *Türkisches Tagesbuch,* Frankfurt 1674, (Adıvar107).

[61] Salomon Schweigger, *Reisebeschreibungen nach Konstaninopel*, Nürnberg 1608, 90 (Adıvar, 107).

Adnan Adıvar criticizes the opinions of both Stephan Gerlach and Salomon Schweigger. In his view, since Schweigger narrates the account of Takiyyüddin living and receiving his education in Rome from a single person, this narrative needs verification. Adıvar states: "To the best of our knowledge, this Ottoman astronomer was educated in Egypt".[62] Naturally, the claims of the two Embassy priests to the effect that Takiyyüddin was a simple astrologer who was a liar and a swindler are completely nonsensical and false. Takiyyüddin's works indicate that he was an astronomer of high caliber who was thoroughly knowledgeable in the astronomical sciences of his time.[63]

Mizanci Mehmed Murad Bey (1854-1917), who was an Ottoman chronicler of the late period, notes that cliques were formed by high state officials of the time. He also states that some scholars, with Shaykh al-Islām Hamīd Efendi being the forerunner of the movement, established a "national party" among themselves. Their purpose was to appoint Ottomans to high ranks and thus protect the government from the influence of converts. Without referring to any sources, he gives the following information:

"A short while ago, a comet appeared. The plague appeared in 986 and many people died. Among them were Mihrimah Sultan, Shaykh al-Islām Hamīd Efendi and Piyale Pasha. The complaints of the populace increased and the converts in the palace took advantage of this situation. An observatory was built in Tophane under the auspices of Hoca Saʿdeddin Efendi, the Sultan being interested in the stars. In order to observe the heavenly bodies during the day, the instruments were placed inside a deep well. Takiyyüddin Efendi, who was renowned for his knowledge of astronomy, was called from Egypt. He became the director of the observatory and received 3000 gold coins a year. A Jewish astronomer was appointed as his assistant. The converts considered this observatory a means of falsification. They attempted to prove with alleged historical examples that wherever such an observatory was built, a catastrophe followed. They claimed that the comet and the plague were the forerunners of this event. The Sultan was afraid and ordered the demolition of the observatory, which had been built with the approval of Saʿdeddin Efendi and the Sultan. The target of the palace intrigues was Saʿdeddin Efendi. These *aghas* and *kalfas* and even a great number of high officials in the Sultan's harem were jealous of Saʿdeddin Hoca's influence over the Sultan. However, in the end, this plot against Saʿdeddin Hoca turned against Sokollu..."[64]

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[62] According to the petition, which Takiyyüddin presented to Sultan Murad III, it is obvious that he completed his education by studying with great scholars in Istanbul.
[63] Adıvar, 108.
[64] *Ta'rīkh-i Abī'l-Farūk*, IV, 45-47.

The "Dāwūd al-Riyādhī who was in Salonica" (mentioned in Takiyyüuddin's *Sidrat muntahā 'l-afkār*) and Haham Dāwūd (mentioned by al-Hafājī in his *Rayḥānat al-alibbā'* and *Habāya'z-zevāyā*, where he states that he met him in Salonica in his early youth and later taught him mathematics in Istanbul) must be the same person. In the above mentioned quotation from Gerlach's memoirs it is evident that the unnamed Jewish scholar would be the same Koca Dāwūd.[65]

Al-Hafājī in his *Habāya'z-zevāyā* mentions a dispute between Takiyyüddin and Koca Dāwūd. The information furnished by al-Hafājī, Stephan Gerlach and Salomon Schweigger could lead to new interpretations about the destruction of the Dār al-Raṣad al-Jadīd and what happened to Takiyyüddin in the last years of his life. In addition to his own rivals in the palace, this information shows that the rivals of Hoca Sa'deddin Efendi and Sokollu Meḫmed Pasha, who were his supporters, as well as the Europeans in Istanbul and the embassy priests disliked him.

Meanwhile, the sources also give information on Daniel Ben Peraḫyah ha-Kohen (d. 982-83/1575), a Jew who emigrated from Rome to Salonica. He published the work titled *She'erit Yosef* by Joseph b. Shem Tov in 975-76/1568 in Salonica; and also a Ladino (the Spanish dialect used by Jews) version of the *zīj* of the Jewish astronomer Abraham Zacut[66] as an addendum to the book. He was also mentioned in the sources as joining forces with the rabbis of Salonica in 1573 and signing the proclamation denouncing physician Dāwūd, who was known as one of the opponents of Don Joseph Nasi.[67]

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[65] Mordtmann, J.H who wrote an article on Istanbul observatory does not give definite information about the Jewish astronomer from Salonica. Mordtmann states that Franz Babinger wrote a letter to him where he mentioned a scientific movement among the Jews of Salonica in the 10th/16th century. According to Babinger, this astronomer could be Daniel Perachja Ha-Kohen who published the astronomical works of Joseph ben Schemton in that city in l568. "Das Observatorium des Taqî ed-dîn zu Pera" *Der Islam*, XIII, (1923), 82, 96.

[66] The *zīj* of Zacut is the *Almanach Perpetuum* prepared by his disciple José Vizinho. See José Chabás and Bernard R. Goldstein, *Astronomy in the Iberian Peninsula: Abraham Zacut and the Transition from Manuscript to Print*. American Philosophical Society. Philadelphia, 2000, 164.

[67] Daniel b. Perahyah ha-Kohen was the head of the Jewish religious school and an author. He was the son of a family which claimed descent from Josephus and which was originally from Rome. His father moved from Rome to Salonica, where, until his death in 954-55/1548, he was the head of the religious school of the Jewish community of Italian origin. Owing to Daniel, this community was well off. In addition to Talmudic learning, Daniel studied philosophy, mathematics, medicine and astronomy. All his books and most of his writings were destroyed as a result of a fire that broke out in 951-52/l545 in Salonica. Of his writings, only his commentary on *She'erit Yosef* by Joseph b. Shem Tov Hai has been published, this being in Salonica in 975-76/l568. He made additions to this work on various subjects as well as including the commentary by Abraham Zacuto and a *zīj*. In 980-81/1573, together with the rabbis in Salonica, Daniel signed a ban against the physician Dāwūd,

According to Schweigger, a Jew had secretly translated the works of the Greek astronomers and mathematicians Euclides, Proclos and Ptolemy. It is possible that this Jew was Daniel Ben Peraḫyah ha-Kohen of Rome. There may have been some communication between Takiyyüddin and Daniel. Takiyyüddin might have obtained the newly printed works of some Greek mathematicians from Daniel and asked the assistance of his colleague Dāwūd in reading them. However, it is presumed that Euclides' *Elements* (*Kitāb al-Uṣūl*) and Ptolemy's *Almagest* were not among the books he wished to be translated, as these works had already been translated into Arabic and were widely used in the Islamic world.

Here, Takiyyüddin's words about Koca Dāwūd are noteworthy. He claims that Koca Dāwūd did not know the *Almagest* well, and sometimes mixed up and misinterpreted the information given. In the author's copy of Takiyyüddin's *Sidrat muntahā 'l-afkār*, no. 2081, fols. 6a-53, which is located in the Kandilli Observatory, there is a line on folio 6a (*ẓahriyya*) which is written in the Latin script. Considering the characteristics of the ink in which these letters were written, it is possible that they were written by the author himself. If the information about Koca Dāwūd translating some Greek works for Takiyyüddin is trustworthy, then Takiyyüddin may have been eager to learn Latin.

Regarding the demolition of the observatory, the Grand Vizier Sokollu Mehmed Pasha, who was one of the two chief protectors of Takiyyüddin, died on 20 Shaʿbān 987/12 October 1579. Two and a half months later, on 4 Dhū l-Hijja 987/23 January 1580, the imperial decree of Sultan Murad III ordering the destruction of Dār al-Raṣad al-Jadīd was issued. Karaçelebi-zade in his *Rawḍat al-abrār* mentions that the observatory was destroyed in Ṣafar 988/March 1580.[68] According to these dates, the observatory was actually demolished approximately two months after the decree was issued.

We have not come across any works by Koca Dāwūd. However, there is a commentary in Greek on the *Eisagoge* (*Isagoci*) of Porphyrius, which was attributed to David Thessalonicensis, was published by Adolf Busse in the collected works titled *Commentaria in Aristotelem Graeca*.[69] It is worth considering the possibility that David Thessalonicensis is Selânikli Davud (Dāwūd of Salonica).

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who was an opponent of Don Joseph Nasi. (*Encyclopaedia Judaica*, Jerusalem 1971-1972, V, 1293-94); for extensive information see M. Molho, *Essai d'une Monographie sur la famille Perahia à Thessaloniki*, Salonica 1938, 14-20.

[68] Karaçelebi-zāde Abdülaziz, *Rawḍat al-Abrār*, Bulak 1248, 462.

[69] G. Sarton, *Introduction to the History of Science*, repr. New York 1975, I, 335.

7. Ibn Jānī al-Isrā'īlī (beginning of the 11th /17th century) - *OTIBLT,* no. 109, pp. 187-188. There is no information in the Ottoman sources about Shaʿbān b. Isḥāq, who was known as Ibn Jānī al-Isrā'īlī al-Mutaṭabbib.[70] Ibn Jānī translated the work of the Spanish physician Nicolás Monardes[71] about the use of tobacco leaves in the treatment of illnesses into Arabic under the title of *Risāla fī'l-muʿālaja* (*al-mudāwāt*) *bi-waraq al-ṭābāq.*[72]

In his work, Monardes mentions that New India, i.e. America, was conquered by the Spanish ruler in 988/1580-81, (*sic*, according to Ibn Jānī). Thus, Ibn Jānī must have lived around the beginning of the 11th/17th century.

At the the beginning of the book, Ibn Jānī states that he decided to translate this work when he saw that everyone, including women, smoked tobacco, known as "tobako". He says that smokers did not know whether it was useful or harmful for health and added that smokers used tobacco for enjoyment, when the smoke rose into the brain, rather than as a protection for their health. In Ibn Jānī's view, smoking tobacco helps to dry the humidity of the stomach and strengthens this organ. He states that he has seen a treatise in verse form, which praises tobacco, but the treatise does not mention the characteristics of this plant. He adds that anyone who is specialized in medicine should be acquainted with the characteristics of tobacco and asks: "How can anyone who does not know this be a perfect person?" He then criticizes some of the author's views on tobacco. Ibn Jānī states that, according to the author, tobacco cleans the phlegm and eliminates the bile, but that this is not true. He notes that phlegm can best be purged by inciting vomiting with laxatives - which is the best way - or by dissolving (*al-taḥlīl*), flow of mucus (*al-taqṭīʿ*), or drying (*al-tajfīf*). He then asks: How can this plant, which is not a laxative, serve as a laxative?" Ibn Jānī states that tobacco is a substance that comes from the earth and has a strong drying and some warming effects. Thus, it is possible to clean the phlegm only by dissolving or drying. Ibn Jānī says: "How can the author's words that 'it eliminates bile' be correct?" He then puts forward a contrary view, saying:

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[70] This name appears as "Ibn Ḥāfī" in *Kashf al-Ẓunūn*, I, 863; "Ibn Khānī" in *GAL*, Suppl., II, 1031, no. 46, according to the copy located in Iskenderiye, Tıp 42; "Ibn Jānī" in the copy located in Köprülü Library, I. Kısım, no. 1581.

[71] Nicolás Monardes (ca. 1493-1588), author of a *Historia Medicinal de las cosas que se traen de nuestras Indias occidentales* (1574, with partial editions in 1565 and 1571) in which he analyses the medical applications of new plants which arrive from America, tobacco being one of them. A PDF of the edition published in Seville in 1574 can be found in https://play.google.com/books/reader?id=pEHeQNiTzA0C&printsec=frontcover&output=reader&hl=es&pg=GBS.PP2. The passage on tobacco is on pp. 41r – 50v.

[72] Katib Çelebi cites this work under the title of *Risāla fī'l-Dukhān* (Kashf al-Zunun, I, 863).

"The remedy for bile is the exact opposite, namely, cooling (*al-tabrīd*) and moistening (*al-tarṭīb*). It may be that the author of the above-mentioned treatise did not examine the books of medicine. Without doubt, tobacco is hot and dry, although the degree of its heat and other powers and characteristics are not yet known. There are even cases where some people died because they used this medicine frequently. Therefore, I set out to learn the nature and qualities of this plant. Despite my own mental abilities, which are weak and unequipped to totally grasp this subject, I began to examine the books of medicine and scientific treatises. Although my knowledge of this field was insufficient, I was unable to find anyone among the old and the new scholars who mentioned this medicine. Then, among the works of the new scholars, I found a treatise about the characteristics and the qualities of this plant, written in a European language by a physician called Motaridis from Spain. I subsequently made an attempt at translating this treatise into Arabic."

Ibn Jānī then quotes the views of Motaridis, the author of the treatise:

"The plant, presently known as 'tobako', was one of the old medicines used in New India, i.e., America. It was well-known among the public. People would use this plant to heal general and specific wounds caused by swords and spears. But, those who used this method kept it a secret and never revealed it to any outsider. When an incomprehensible incident took place in their country, for which it was difficult to find a remedy, they began to smoke this plant. They also discussed the fact that tobacco would dry the moisture of the stomach and the brain. These people felt the need to overcome humidity which caused laziness, dullness and forgetfulness. Indeed, smoking this plant dries the moisture of the stomach and the brain, eradicates laziness and increases the power of the memory.

When New India (America) was conquered by the Spanish king in 988/1580, we found this medicine and tried it several times. Evidently, it has delicate and exclusively beneficial qualities. Among the Indians this plant is called "*Feyşiyalat*"[73]. In our country, it is known by the name of the island of 'Tobako' where it grows in ample quantities."

In the following pages, Motaridis enumerates, one by one, the names of the ailments which are cured by tobacco. He also gives prescriptions indicating how tobacco should be used in the treatment of these ailments. Among the illnesses cured by tobacco are: aches caused by sputum and flatulence; headaches, particularly chronic migraines, and chronic pulmonary and respiratory diseases caused by excessive sputum and breathlessness (the author states that he has experimented with tobacco in this case and benefited greatly). In the author's view, tobacco clears the respiratory passages from harmful substances, heals stomach aches caused by the cold and lowers high black bile levels; it also soothes the aches caused by bladder stones and lumbago, as well as curing uterus

[73] The actual word used by Monardes is *picielt.*

disorders and the illness called "*al-tahma*", seen in small children, which is similar to epilepsy. (The author relates that he has seen old women in New India prepare the medicament for the treatment of this illness).

According to Motaridis, tobacco is also useful for curing the following: worms, arthritis (painful joints), cases of tuberculosis that are difficult to cure, and swollen hands and feet observed in children and young people during winter. He also notes that Indians use tobacco to heal wounds that are caused by toxic injuries such as poisonous arrows (the author states that he has experimented with the use of tobacco and felt its benefits after just a short time). Tobacco is also used to heal knife and sword cuts that do not need some other kind of treatment.

8. Al-Ra'īs Ibrāhīm b. Aḥmad al-Andalusī (living in 1042/1632) - *OASLT,* no. 15, pp. 19-21.

He is the author of the famous work on artillery titled *Kitāb al-ʿizz wa'l-manāfiʿ* and was known as *al-Ribash*[74] and *al-Muʿajjam*.[75] An Andalusian sailor and expert of artillery, al-Ra'īs Ibrāhīm b. Aḥmad b. Gānim b. Muḥammad b. Zakariyyā' al-Andalusī[76] was born in the village of Nigüelas[77] in Granada. Given that he was almost 80 years old when he wrote his work on artillery in 1047-48/1638, he must have been born around the years 957/1550 - 967-68/1560. When the Muslims were expelled from Andalusia, he emigrated from Granada to Seville with his family. Ibrāhīm Reis began his long sea voyages working in the galleons that carried silver from America to Spain over the Atlantic Ocean. Thus,

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[74] David James, who wrote an article about Ibrāhīm Reis and his work, states that this word is the same as the Spanish words "Rivas" or "Rives" (See "The *Manual de artillería* of al-Raʾīs Ibrāhīm b. Aḥmad al-Andalusī with particular reference to its illustrations and their sources", *BSOAS*, XLIII (1978), 250, note 31).

[75] On the basis of the same source, David James states that this word which often appears as "al-Miʿjam" in the manuscripts should be written as "al-Muʿajjam" (*Ibid*., 250, note 30).

[76] About the author and this work see James, "*The Manual...", BSOAS*, XLIII, (1978), 237-257; Flügel, *Die arabischen, persischen, türkischen Handschriften der k.u.k. Hofbibliothek zu Wien*, II, 477-480 (no. 1412); Brockelmann, *GAL*, II, 466; al-Zirikli, *al-Aʿlām*, Beirut 1980, I, 30; *Fihris al-makhṭūṭāt al-muṣāwwara*; IV, 19-20; *Catalogue of Manuscripts in the Köprülü Library*, part I, no. 1122, 574; Şeşen, *Nawādir al-makhṭūṭat*, II, 432.

[77] This name appears as "Levleş" in the manuscripts. It does not appear, however, in the Tunisian and Algerian manuscripts. Flügel, in the catalogue of manuscripts of Vienna, read this name as Naulasch, but did not give an explanation. ʿAbdülmecid el-Turkî thinks that this word could be "Velez". The name of this locality is mentioned by Ibn al-Khaṭīb, in *al-Lamḥa al-badriyya*, as "Navalash". According to Simonet (*Descripcion del reino de Granada sacadas de los autores arábigos*, Granada 1873) Navalash is the village of Nigüelas in the Alpujarra, which is situated between Durcal and Talara (see Ḥusayn Mu'nis, *Tarīkh al-Jughrāfiyya va'l-Jughrāfiyyīn fī'l-Andalus*, Madrid 1967, 567; James, "*The Manual...*", 250, note 38.

he travelled to America several times. During these journeys, he learned some theoretical and practical information about gunnery. On the galleons, in the military units, there were men who were knowledgeable about firearms, and they sometimes held meetings with statesmen on the art of gunnery. During one of these customary meetings, Ibrāhīm Reis had the chance of examining several books on gunnery which were brought to the meeting. When those people who were theoretically and practically interested in this science realised that monarchs valued gunnery craftsmen, they started writing books about this science. Ibrāhīm Reis participated in these meetings regularly, and he was always on good terms with the other members. He learned the main problems and conducted research on all kinds of cannons.

The Spaniards did not consider him a Muslim convert. When the Spanish king ordered the expulsion of all Andalusian Muslims from Spain, Ibrāhīm Reis was imprisoned because he had clashed with some Christians. Fortunately, a prominent Christian befriended him and helped to free him. After his release from prison, Ibrāhīm Reis wanted to travel to the Muslim lands with the Andalusians but was not permitted to do so. He was only set free after giving a bribe of some silver coins, making his way to Tunisia in 1018/1609 or 1019/1610. There he met several friends of Andalusian origin. Osman Dayı (1002-1003 /1594-1018-1019 /1610), the Ottoman Bey of Tunisia welcomed him warmly and assigned him to lead 200 Andalusians. Ibrāhīm Reis was also given 500 sultani akçes, 200 pistols, 200 daggers and the necessary equipment for a sea campaign, and he set to sea in Osman Dayı's ships. Less than six months later, however, Osman Dayı died, Ibrāhīm Reis returned to Tunisia with some booty a short while after his death. He was seriously wounded during this campaign, but after his wounds had healed, he set out to sea once again. On one occasion, he came across eleven enemy ships on the shore of the Small Sea near the city of Málaga.[78] Both sides suffered heavy casualities during the battle. Ibrāhīm Reis lost a number of men, and finally he and the remaining crew were taken prisoner. The enemy lost 600 men, twenty of whom were of high rank. Ibrāhīm Reis, who was heavily wounded, was imprisoned and only freed after seven years. When he and his men returned to Tunisia, the Bey of Tunisia, Yusuf Dayı (1018-19/1610 - 1046-47/1637) allocated a place for them in the castle of Ḥalq al-Wādī (La Goulette). Here, Ibrāhīm Reis developed his knowledge on cannons and artillery, studying works on this subject written in Spanish.

[78] The name of the sea appears as “al-Baḥr al-Ṣaghīr” in the text.

Ibrāhīm Reis decided to write a book on cannons and gunnery since he knew that the crew who used these cannons did not have practical knowledge of the subject. Each cannon was manufactured separately, with great difficulty and at great expense, and those who fired the cannons often damaged them after their first or second use. It was also a known fact that the men who repaired cannons did not survive long. Ibrāhīm Reis started writing his book in 1040/1630 in Ḥalq al-Wādī. It was written in Aljamiado, i.e. Spanish language written in the Arabic script,[79] and was arranged in fifty chapters. He completed the work on 22 Rabīʿ I 1042/8 October 1632. He states that he covered useful subjects including the duties of defenders in his book and that in writing it he did not seek any worldly benefit. He says that he prays to God that his work can be translated into Arabic and copies of it be sent to different Muslim countries. The original copy, which Ibrāhīm Reis wrote in Aljamiado, has not survived.

The author compiled his work on the basis of his own personal experiences and observations accumulated over thirty years. While writing the book, he referred extensively to contemporary Spanish sources, foremost among these being: Luis Collado's *Platica manual de artilleria* (Milan 1592), Cristoval Lechuga's *Discurso de la artilleria* (Milan 1611) and Diego Ufano's *Tratado de artilleria* (Brussels 1613). Of these, Ibrāhīm Reis most often refers to *Platica manual de artilleria*[80] by Luis Collado, a Spanish officer who served in Italy. This book in Spanish is one of the best works on gunnery written during the 10th/16th century. It was in great demand shortly after its publication. Several chapters of Ibrāhīm Reis' work are either full or abridged translations of Collado's work.[81]

Ibrāhīm Reis' book was translated into Arabic in 1048/1638 by Shihāb al-Dīn Aḥmad b. Qāsim b. Aḥmad b. al-Faqīh Qāsim b. al-Shaykh al-Ḥajarī al-Andalusī, who was a translator for the Marrakech sultans. The translation is titled *Kitāb al-ʿizz wa'l-manāfiʿ li'l-mujāhidīn fī sabīl Allāh bi-ālāt al-ḥurūb wa'l-mādāfiʿ* (for more on the translation of this work, see this study, no. 9). When the translation was completed, the translator's son Muḥammad Khoca b. Aḥmad b. Qāsim b. Aḥmad b. al-Faqīh Qāsim b. al-Shaykh al-Ḥajarī al-Andalusī made a number of copies and sent them to different Muslim countries.[82] A copy of this work was submitted to the Ottoman Sultan Murad IV.

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[79] For the term Aljamiado see *İA*, I, 359-360.

[80] The first edition of this work was published under the title of *Prattica manuele de I 'artigleria* in Venice in 1586. Later it was published in Milan in the years 1606 and 1641. The first publication in Spanish was made in Milan in 1592 (Palau y Dulcet, *Bibliografia hispanica* 57575). For Collado see Almirante, *Bibliografia militar*, Madrid 1876, 179.

[81] Cf. James, "*The Manual...*", 242-245.

[82] The following sixteen copies of the work were found: 1. Rabat, Cela, no. 87 (copied on 10 Rabīʿ II

The Egyptian scholar Aḥmad Zeki Bey presented *Kitāb al-ʿizz wa'l-manāfiʿ* as a paper in the XIIIth Congress of Orientalists, held in Hamburg in 1902. Following this presentation, the work became widely known. According to David James, the true value of *Kitāb al-ʿIzz wa'l-manāfiʿ* lies in the fact that it transferred the technical knowledge of seventeenth century Europe to North Africa in an Islamized form. This work is one of only a few North African manuscripts comprising illustrations that are appreciated by art historians. On the subject of the history of technology and its transfer, this important work is still in need of a comprehensive study.

9. Aḥmad b. Qāsim al-Andalusī (living in 1048/1632)

Shihāb al-Dīn Aḥmad b. Qāsim b. Aḥmad b. al-Faqīh Qāsim b. al-Shaykh al-Ḥajarī al-Andalusī was a translator for the Marrakech sultans.[83] He was called "Afukay" or "Afkay" which means lawyer in Hebrew.[84] He was one of the first translators to play an extremely important role in transferring Western science and techniques to the Muslim world, through the books he translated from Spanish.

Aḥmad b. Qāsim translated above mentioned book compiled by al-Raʾīs Ibrāhīm b. Aḥmad al-Andalusī into Arabic on 13 Rabīʿ I 1048 / 26 July 1638 under the title of *Kitāb al-ʿizz wa'l-manāfiʿ li'l-mujāhidīn fī sabīl Allāh bi-ālāt al-ḥurūb wa'l-mādāfiʿ*. At the end of the book, in the *khātima*, he writes his life story at length.

According to the information in the *khātima*, Aḥmad b. Qāsim, travelling from Andalusia, arrived in the Moroccan town of Salé, at its *ribāṭ*, on 1007

1048/22 August 1638); 2. Köprülü Ktp., I. Kısım, no. 1122 (copied in Dhū l-Qaʿda 1048/March 1639 in Tunisia); 3. Algeria, National Library, no. 1511 (copied in Dhū l-Qaʿda 1050/February 1641 in Tunisia); 4. Vienna, National Library, no. 1412 (Dhū l-Qaʿda 1050/February 1614 in Tunisia); 5. Tunisia, National Library, no. 3433 (probably copied in the XIth/XVIIth century); 6. Dublin, Chester Beatty, no. 4107 (copied in Muḥarram 1062/September 1651 in Tunisia); 7. Cairo, National Library, Furūsiyya, no. 97 (copied in 1064/1653); 8. Dublin, Chester Beatty, no. 4568; (some excerpts; there is no date of copying); 9. Cairo, Taymūriyya-Furūsiyya, no. 86 (copied in 1198/1783); 10. Algeria, National Library, no. 1512 (copied in 1198/1783); 11. Rabat, al-Khizāna al-Malikiyya, no. 2646; 12. Rabat, no. D. 1342; 13. Hüsrev Paşa, no. 2601, fols. 1b-86b (copied by Mustafa Khoca al-Ra'is in 1198/1783); 14. Arīf Hikmet, no. 2978 (copied in 1204/ 1789-90); 15. Ḥasan Ḥusnī ʿAbd al-Wahhāb, no. 18488 (date of copying unknown); 16. Hasan Husni ʻAbdulvahhab, nr. 18120 (date of copying unkonow). The first four copies were produced by Muḥammed Hoca, the son of the translator.

[83] *Kitāb al-ʿizz wa'l-manāfiʿ*, Köprülü Library, Fazıl Ahmed Paşa, no. 1122, fols. 137b-142a; Ibn Suda, *Dalīl mu'arrikh al-Maghrib al-Aqṣā*, 1st ed., Tiṭwān 1369/1950, 382; *Aʿlām Marrākush*, II, 69; al-Ziriklī, *al-Aʿlām*, I, 198-199; Muḥammed at-Mannūnī, *Majallat Maʿhad al-ʿUlūm al-Islamiyya*, Madrid, XI (1963-64), 335-353.

[84] Ibn Suda, 382.

A.H./1598-99 A.D. He then went on to Marrakech, where he spent many years serving as translator for the Marrakech Sultan Zaydān b. al-Sulṭān Aḥmad b. Muḥammad al-Shaykh al-Sharīf al- Ḥusaynī. He also became his private secretary for Spanish matters. Following this period, he went on pilgrimage by the sea route. Having fulfilled the sacred duty of ḥajj, he went to Medina on foot, before travelling back to Tunisia. In Tunisia, al-Ra'īs Ibrāhīm b. Aḥmad asked him to translate the above-mentioned book from Aljamiado into Arabic. After examining the book and deciding it would be useful for the Muslims, he began his translation. Being unable to find the Arabic equivalents for the terms used in gunnery and artillery, he was on the point of giving up when he saw a dream where he was reciting a verse from the Qur'ān. This made him begin his translation again. This time, when he came across difficult passages, he sought the assistance of its author, al-Ribash, who made the necessary explanations. During these sessions, he realized that al-Ribash had both theoretical and practical knowledge about what he wrote.

Anticipating the possibility that people might want to know how he learned to read Spanish, Aḥmad b. Qāsim clarifies the matter. He states that before the Christian invasion Andalusian Muslims only spoke Arabic, but after it the Christians pressured them into learning Spanish. Aḥmad b. Qāsim had planned to travel from Andalusia to the Muslim lands but had heard that the Christians were searching for Andalusians on the border and preventing their escape. For this reason, he stayed in Andalusia for many years. He read books in Spanish so people would think he was Spanish. On his way to the Muslim lands, he stopped in a place near the sea which was closely guarded. Assessing his speech, manners and writing, the locals did not suspect him and from there he set out for the Muslim lands. On his arrival, owing to the sciences he had studied and the books he had read, the gates of the palace were opened for him.

With the permission of the sultan of Marrakech, Aḥmad b. Qāsim traveled to different European countries. During this travels, he discussed Christianity and Islam with monks and priests, visiting them several times. He also read the Bible, all for the purpose of refuting their beliefs. He also travelled to the land of Jawfiyya[85] in the North, situated on the 52nd parallel. He observed that the Jews were praising their own religion. He also saw a Torah which was written in Aljamiado. In addition to the Torah, he also read twenty books, and then later met

[85] The name of this place appears as جوفيه in the text. We were unable to verify the name of this place. But, if this word is read as "Jawfiyya" it could be the Netherlands which is situated on the 52nd parallel. This country is also known as the "low countries".

a number of Jewish scholars (rabbis) in France and Flanders.[86] When later in Egypt, a scholar by the name of ʿAlī al-Ujhūri asked Aḥmad b. Qāsim to write a book about his debates in Europe.[87] Similarly, ʿĪsā b. ʿAbd al-Raḥmān, the *Qāḍī* of Marrakech, advised him to write a refutation of the forgeries and lies directed against Islam, stating that this would be equal to waging holy war. In response to these requests, Aḥmad b. Qāsim wrote a book titled *Nāṣir al-Dīn ʿalā'l-qawm al-kāfirīn* in 1047/1637.[88]

When Aḥmad b. Qāsim translated the work by al-Ribash under the title of *Kitāb al-ʿizz wa'l-manāfiʿ*, his son made a few copies, one of which was sent to Sultan Murad IV. In this copy, Murad IV is addressed as "Sultan of the Muslim sultans", "the sultan of the two continents, the two seas, Egypt, Damascus, Persian Iraq and Arabian Iraq" and "servant of Mecca and Medina". This copy also includes prayers for the sultan. The translator states that the Christians were afraid of the Ottoman sultan and that he had personally witnessed their fear in many countries. He adds that this fear existed even in their books and their hearts. He states that from the words of Yūḥanna al-Ḥūrī (John the Apostle), who wrote one of the four Gospels, the Christians inferred that after the reign of the 16th sultan, the Ottoman State would start to decline; Yūḥanna's book titled *Yukalibş* (Apocalypse), which is full of symbols, was also held to confirm this belief. He adds that this claim did not prove to be true, however, as the present Ottoman sultan, Murad IV, was the 17th in line and had achieved victory over his enemies. The translator then writes his prayers for the Ottoman State. The translator also wrote the *khātima* of the translation and made a number of contributions to the text, foremost among them being the traditions of the Prophet about the virtues of *jihād*, which he quoted from books of *ḥadīth* such as *Mishqat al-Maṣābīḥ*.

The translator states that there had been eighty cannons in Marrakech, the capital city of the sultanate of the Maghrib, during the reign of Sultan Zaydān, but that these were carried to some other place in 1015/1606. He also adds that a Christian (European) captain and an engineer, who were knowledgeable about military techniques, were in the service of the sultan. When the translation was complete, he gave it to al-Muftī al-Sayyid Aḥmad al- Sharīf al-Ḥanafī and ʿAbd

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[86] The name of this place appears as فلنفس in the text. This could possibly be Flanders, the Dutch speaking part of Belgium.

[87] Nūr al-Dīn Abū'l-Irshād ʿAlī b. Muḥammad b. ʿAbd al-Raḥmān al-Ujhūrī al-Māliki (d. 1066/1656) is an Egyptian scholar of *fiqh*, theology, *ḥadīth* and logic (Kaḥḥāla, *Muʿjam al-Muʾallifīn*, Beirut 1957-1961, VII, 207).

[88] P.S. van Koningsveld, Q. al-Samarrai and G.A. Wiegers (eds.), *Aḥmad ibn Qāsim al-Ḥajarī (d. after 1640), Kitāb Nāṣir al-Dīn ʿalā 'l-Qawm al-Kāfirīn (The Supporter of Religion against the infidel)*. Madrid, 1997.

al-Raḥmān b. Masʿūd al-Jibālī for them to examine the work and write a eulogy. Aḥmad al- Sharīf in his eulogy briefly states that the book is useful for the Muslims, for those who teach and leam the art of artillery and for Muslim marksmen.

Aḥmad b. Qāsim also wrote a book of travels by the name of *Riḥlat al-shihāb ilā liqā' al-aḥbāb*, but only one section of this book has survived to the present day.[89]

Aḥmad b. Qāsim also translated into Arabic the *zīj* of Abraham Zacut b. Samuel (d. 920-21/1515)[90], who was from the city of Shalamank (Salamanca) in Spain. Zacut compiled the original *zīj* (*Ha-Ḥibbur ha-Gadol*) in Hebrew in 877/1472. It was later resumed by José Vizinho (called, in Arabic sources, *muʿallim Yūsuf* or *Yūsuf al-Andalusī*), who prepared a Latin and a Spanish text of the canons and published it under the title of *Almanach Perpetuum*, printed in both languages in Leiria (Portugal) in 1496. This was the text translated into Arabic by Aḥmad b. Qāsim."[91] Other authors made some additions to this *zīj*. The Cairo manuscript of the *zīj* contains three treatises related to Zacut and Aḥmad b. Qāsim's work. The unknown commentator [92] of the third treatise in his introduction states that, when learning the science of calculating the true positions

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[89] Al-Zirikli, *al-Aʿlām*, Beirut 1980, I, 199. Ibn Suda mentions this book of travels, (op. cit., p. 382).

[90] This *zīj* is Zacut's *Almanach Perpetuum*. On this source see the aforementioned study by Chabás and Goldstein, *Astronomy in the Iberian Peninsula: Abraham Zacut...* An edition of Aḥmad b. Qāsim's translation has been made by María José Parra in her PhD thesis also mentioned previously. On the importance of this translation and its wide diffusion from Morocco to the Yemen see three papers by Julio Samsó: "Abraham Zacut and José Vizinho's *Almanach Perpetuum* in Arabic (16th – 19th c.)" in *Centaurus* 46 (2004), 82-97 (reprinted in Samsó, *Astronomy and Astrology in al-Andalus and the Maghrib*. Ashgate-Variorum, Aldershot, 2007, no. XIV); "In pursuit of Zacut's *Almanach Perpetuum* in the eastern Islamic world" in *Zeitschrift für Geschichte der Arabisch-Islamischen Wissenschaften* 15 (2002-2003), 67-93 (reprinted in Samsó, *Astronomy and Astrology...* no. XVI); "On the Arabic translation of the colophon of the *Almanach Perpetuum*" in Samsó, *Astronomy and Astrology...* no. XV.

[91] One of the available copies of the *zīj* is located in Cairo, Dār al-Kutub, Mīqāt, no. 1081 and consists of 326 folios. It was probably copied in the first half of the 11th/17th c. by two copyists, one of them Maghribī and the other Mashriqī. In this manuscript, the Arabic text of Aḥmad b. Qāsim's translation has been revised, due to the fact that his Arabic was not very proficient. Interestingly, the Cairo manuscript contains marginal notes in Ottoman Turkish: about this copy see King, *Fihris al-Makhṭūṭāt al-ʿIlmiyya*, I, 141. Other manuscripts are located in Rabat, Malikiyya Library, Majmūʿa, no. 1433; Milan Ambrosiana 338 (dated in 1086/1675); Vatican 963 (apparently a copy of the Ambrosiana ms.) and Rabat Malikiyya 8184. The Ambrosiana and Vatican manuscripts were copied in Yemen.

[92] Identified, conjecturally, by J. Samsó as ʿAbd al-Raḥmān al-Fāsī (1631-1685). See Samsó "*Almanach Perpetuum* in Arabic", 86-87.

of planets (*taʿdīl*), he came across some tables compiled by Zacut that could be easily used without the need for calculations. He mentions that, in comparison, tables compiled by Ibn al-Bannā' (ca. 1260 – ca. 1340) required numerous calculations. The commentator states that he later examined a treatise which the author had compiled in Hebrew and which was subsequently translated into Latin and from Latin into Romance language (i.e. Spanish). The author's student *Muʿallim* Yūsuf (= José Vizinho) copied this treatise.[93] According to the commentator, Aḥmad b. Qāsim translated this treatise from Romance language into Arabic. He states that he saw a copy of this translation, which was copied by ʿAbd Allāh b. ʿAbd al-Qādir Abi'l-Shaykh al-Lakhmī and was very surprised to find many mistakes in some significant parts of this *risāla*. He likewise came across a treatise compiled by al-Faqīh al-Muʿaddil al-Shaykh ʿAbd Allāh al-Marrākushi, which also included significant mistakes. Thus, he compiled another *risāla* that comprised these two *risālas*. He made some additions so that Christian dates would be known, corrected the two treatises, arranged the new *risāla* in eight chapters and titled it *Tuḥfat al-muḥtāj fī ʿilm al-taʿdīl waʾl-azyāj*. The note at the beginning of the third treatise states that it belongs to ʿAbd al-Raḥmān al-Fāsī (1631-1685).

10. ʿAlī b. Walī b. Ḥamza al-Maghribī (d. 1022/1614) - *OMLT*, no. 67, pp. 118-123; Rosenfeld & İhsanoğlu, no.1051.

ʿAlī b. Walī b. Ḥamza al-Maghribī[94] was a prominent Ottoman mathematician. Born in Algeria, and having undertaken his elementary education there, he came to Istanbul to complete his studies. There he studied with a number of well-known scholars, some of whom he assisted. For a while, he served as *mudarris* in the *Hāşiye-i Tecrid* and *Miftāḥ medreses* in Istanbul. He was subsequently appointed *Qāḍī* of Algeria and Tripoli and was given permission to issue *fetvas*. On his return to Istanbul, he was promoted to the *Dahil medrese*. In 994/1586, he again went to North Africa and was in Algeria in Shawwāl 998/August 1590. After receiving permission to initiate others into his Sufi order, from the Shadhili Shaykh Isa-i Düneydunī, whom he calls "Shaykh al-Islām" and "Quṭb al-anām", he stayed in Algeria for sometime. He then went to the Ḥijāz on pilgrimage. While in Mecca, he wrote his book on mathematics titled *Tuḥfat al-Aʿdād*

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[93] This kind of information has been analysed by J. Samsó in "On the Arabic translation of the colophon of the *Almanach Perpetuum*."

[94] ʿAta'ī, *Ḥadāʾiq al-ḥaqāʾiq*, p. 567; Katib Çelebi, *Sullam al-wuṣūl*, Şehid Ali Paşa, no. 1987, fol. 163b; *SO*, III, 508; *OM*, III, 284; *JA*, series IX, vol. XI (1898), pp. 35-52; Salih Zeki, *Āthār-ı Bāqiya*, 98-99; *GAL*, Suppl., II, 536; Kaḥḥāla, *Muʿjam al-Muʾallifīn*, Beirut 1957-1961, VII, 258.

li-Dhawi'l-Rushd wa'l-Sadād in Turkish, completing it, after three months and nine days, on Monday, 16 Jumādā II 999/1591. He wrote another copy of this work on 16 Ramaḍān 1002/5 June 1594 in the city of Ṣanʿa in Yemen. In Ramaḍān 1022/1613, he was made *mudarris* in the *Ṣaḥn medrese* in Istanbul, replacing Ebussuûd-zāde Mehmed Efendi. He was later appointed *Qāḍī* of Tunisia, where he passed away during the same year.

In compiling his work, Ibn Ḥamza referred to the works of prominent mathematicians like Sinān b. al-Fatḥ al-Ḥarrānī, Ibn Yūnus al-Miṣrī, Ibn al-Hā'im, Ibn Ghāzī al-Osmānī and Ibn al-Ṣaffār. In the *khātima* of the work, Ibn Ḥamza presents the solutions to some problems which he says "could not be solved in the vast Islamic geography extending from India to North Africa." He mentions that, while he was in Algeria on Shawwāl 944/March 1538, the fifteenth problem, called *mas'ala jazā'iriyya* (the Algerian problem) was written on a sheet of paper by someone who went by the name of *Muʿallim Ibrāhīm* from Andalusia and hung on the wall of the Great Mosque of Algiers, seeking a solution. Ibn Ḥamza states that when he was in Mecca for the pilgrimage, towards the end of the month of Dhū'l-qaʿda 998/September 1590, the sixteenth problem was posed by Molla Muḥammad-i Balkhī, who arrived from India.

To criticize those who did not like his mentioning Imām Ḥaṣṣār's (Ibn al-Ḥaṣṣār) solution to the fourteenth problem, he quoted a couplet by the famous poet al-Mutanabbī. This shows that Ibn Ḥamza was also familiar with Arabic literature.

At the end of the fourteenth problem, Ibn Ḥamza mentions the city of Sabta (Ceuta) in Morocco, which today belongs to Spain.[95] This city was the place where all scholars gathered (*Majmaʿ al-ʿulamā'*). It was also the source of all sciences and a stopping place of all tribes.[96] Ibn Ḥamza also benefited from the knowledge and experience of those in the scholarly circles of Andalusia and North Africa. He played a great role in transferring their ideas and views by referring to their works.

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[95] The city of Sabta is situated in Northwestern Africa on the shore of the Straits of Gibraltar. It is currently one of the territories on the Mediterranean coast of Morocco which belongs to Spain. (*İA*, "Sebte", X, 295). Sabta changed hands among the North African sultans, Umayyads of Andalusia, the Portuguese and the Spaniards.

[96] "In all ages, Sabta has been one of the scientific centers!" (*İA*, "Sebte", X, 297). This sentence from the work titled *al-Rawḍ al-miʿṭar fī akhbār al-aqṭār* by the Muslim geographer Ibn ʿAbd al-Munʿim al-Ḥimyarī (d. 900/ 1494) corroborates that this city was an important scientific center.

In addition to the above mentioned ten individuals, the following two scholars also came to the Ottoman lands from Andalusia: the *ṣūfī* Abū'l-Ḥasan ʿAlī b. Maymūn b. Abī Bakr b. ʿAlī b. Maymūn al- Hāshimī al-Qurashī al-Gumarī al-Andalusī al-Maghribī al-Fāsī (d. 917/1511)[97]and ʿAlī b. Muḥammad al-Lakhmi al-Andalusī al-Ishbīlī al-Maghribī al-Dimashqī (living in 923/1517),[98] the author of *Selim-name*,[99] *al-Durr al-mūsān fī sīrat al-Muẓaffar Selim*, written for Sultan Selim I in 923/1517. As these scholars did not produce works in the fields of mathematics or natural sciences, they have not been included in this research.

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On the basis of the above-mentioned examples, the following findings can be presented:

As stated at the beginning of this study, after Muslim rule in Spain ended in 1492, several Andalusian Muslims and Jewish scholars emigrated to the Ottoman lands. Those of Arab origin mainly travelled to North Africa and the province of Egypt, while the Jews settled mostly in the East, particulary in Istanbul and Salonica. With this migration, new sources enriched the Ottoman scientific world during that period. The scholars who emigrated to the Ottoman lands produced works in order to prove their abilities and to be accepted by scholarly circles. The above examples also indicate that these scholars wrote treatises in order to be connected with the palace and produced works upon the personal orders of sultans and statesmen.

Through these works, Ottoman scholars came into contact with new sources, which were different from those they were familiar with. The emigration that started during the last years of the 15th century continued in the 16th century and its effects were still felt into the 17th century. The scholars who arrived from Spain made important contributions to classical Islamic science. They also introduced the scientific tradition of the "Renaissance" which was unknown to the Ottomans before their arrival. In the above examples, a new scientific tradition called the "European-Christian" or "Hebrew-Jewish" tradition, which was different from the Islamic scientific literature, is mentioned, and for the first time, Ottoman science was introduced to the science of the "Renaissance": As seen in the examples of Mūsā b. Hāmūn and most probably Koca Dāwūd, a more active

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[97] Taşköprülü-zāde, *al-Shaqā'iq al-Nuʿmaniyya fī ʿulamā' al-dawla al-ʿOsmaniyya*, ed. by Aḥmed Ṣubḥī Furat, Istanbul 1985, 352-353.
[98] Al-Ziriklī, *al-Aʿlām*, Beirut 1980, V, 11.
[99] Author's copy, located in Topkapı Palace Library, Bağdat Köşkü, no. 197.

scientific life and a movement in writing was observed which continued to the next generation of scholars, those born in the Ottoman lands.

With the introduction of these new sources, discussions began on the old and new traditions, and scholars reported new information and developments that emerged from Europe. While reading about ʿAbd al-Salām al-Muhtadī, we saw that in the discussions that took place among European physicians, great Muslim scholars were held in high esteem, as was the case with Ibn Sīnā, who excelled in the field of medicine.

Mūsā Jālīnūs al-Isrā'īlī, in addition to Muslim scholars, also availed himself of the works of Arnald of Vilanova, who advanced his scientific career by learning Arabic and making translations from Arabic medical sources into Latin. At this stage Ottoman scientific circles were not particularly impressed by the achievements of the Europeans. The primary scientific sources were still in Arabic and Europeans still accepted the superiority of Islamic science during this period.

Jewish physicians who travelled to the Ottoman Empire in various waves of immigration settled in Istanbul and Salonica. The medical tradition, which they introduced, was different in certain aspects from the Islamic medical tradition and helped them to make swift progress in their profession. Some of them were associated with the palace and rose to the position of private physician to the sultan. Others rose to alternative high positions, which saw them, receive high salaries. They were also given concessions such as exemption from taxes and were allowed to ride horses. Various sources give different figures for the number of Jewish physicians in the Ottoman State. The traveler Nicolas de Nicolay, who accompanied the French ambassador to Istanbul in 958-59/1551, devotes a section of his travel book to the physicians of Istanbul. He makes the following remarks about the Jewish physicians:

"The number of Jews who teach and practice medicine in Turkey, especially in Constantinople, is greater than that of Turks. Among them are those who obtained vast theoretical knowledge and acquired experience in practice. In general, they are superior to the other nations in medicine because they know Greek, Arabic, Aramaic and Hebrew. Well-known scholars who wrote the books of medicine, natural philosophy and astronomy, which were necessary for the study of medicine, used these languages. Those who were called "*hekim*" by the Turks, received high salaries from the sultan. Jewish and Turkish physicians jointly participated in the entertainments. When I was in the Levant, I met a Jewish physician by the name of Amon who was about sixty years old. He was a

well-known and capable person who was greatly respected among his colleagues and was famous for his good deeds, knowledge and imposing appearance."[100]

As seen from the biography of ʿAbd al-Salām al-Muhtadī, who was himself an immigrant Jewish scholars, some of them adopted the Ottoman world view completely. This becomes clear from the fact that they not only adapted themselves to Ottoman society and culture and embraced Islam, but they also wrote works criticizing their previous religion. On the other hand, some of them kept their religious identity owing to the concessions given by the Ottoman State and the fact that Ottomans never forced people to convert. However, as seen in the case of Mūsā b. Hāmūn, who belonged to the second generation, there were some sensivities and difficulties in social adaptation.

This study indicates that in the first half of the 17th century, Muslim scholars clearly admitted that Europe was technologically more advanced than the Muslim world, particularly militarily. The studies of Ibrāhīm b. Aḥmad al-Andalusī and Aḥmad b. Qāsim al-Andalusī on firearms present one of the first examples of "technological espionage" by the Muslim world on Europe. Some Muslim scholars, who had to accept European superiority in the field of military technology, set about defending Islam against theological attacks they thought might be initiated by Europe. An example is Aḥmad b. Qāsim al-Andalusī's trip to Europe. Throughout his travels, he engaged in discussions with Christian monks and priests. He tried to learn the Jewish religion and finally wrote the work titled *Nāṣir al-Dīn ʿalā ʾl-qawm al-kāfirīn*. This work, which reflects his reaction and his efforts to prove the spiritual superiority of the Islamic world, is a distinct example of its period.

Those who arrived from Andalusia made some translations and transfers from Spanish books. A distinct example is the treatise on tobacco and its medical uses, which was brought to the old world around the middle of the 16th century. Ibn Jānī translated this treatise, written by the Spanish physician Nicolás Monardes, from a European language into Arabic. According to the information given at the beginning of this treatise, around the beginning of the seventeenth century addiction to tobacco became widespread in Istanbul to such an extent that it became the subject of literary works. One would infer that books kept arriving to

[100] Nicolas de Nicolay, *Les quatre premiers livres de navigations et pérégrinations orientales*, Lyon, 1568, book 3, part 7: "Les Médecins de Constantinople", fols. 105, 115, translated into English by T. Washington, the Younger, *The Navigations, peregrinations and voyages, made into Turkie by Nicolas de Nicolay* (G.A. Russell, "Physicians at the Ottoman Court", *Medical History*, 34, (1994), 256, quoted from footnote 78).

Ottoman lands even after the waves of Jewish immigration from Iberia came to an end.

Another feature shown by this study relates to the history of Ottoman science and culture. For the purpose of scientific education and discussions, travels and correspondence between scholars continued vigorously. The correspondences related to Takiyyüddin, al-Ḫafajī and Ibn Ḥamza are sufficient examples.

The information concerning the authors and their works indicates some remarkable findings about the development and use of Ottoman Turkish. It is clear that in the 16th century, Ottoman Turkish developed as a scientific language in addition to Arabic. From the 14th century onwards, the development of Anatolian Turkish as a scientific language began, and simple translations were produced for beginners and those who did not know Arabic in the medreses. In the following period Turkish language developed and was enriched by adequate terminology and became capable of expressing different scientific diciplines. In the 16th century, there are three important examples for the usage of Turkish by Anadalusian and North African Arab scholars:

1) The treatise by Mūsā Jālīnūs al-Isrā'īlī, who belonged to the first generation of immigrants from Andalusia and who was alive in 1524. This treatise in Turkish is about medications.

2) The Turkish treatise on dentistry by Mūsā b. Hāmūn who was born in Istanbul and died in 1554 and belonged to the second generation of immigrants.

3) The mathematical work in Turkish by Ibn Ḥamza al-Maghribī, who was born in Algeria in the second half of the 10th/16th century. He received his elementary education in Algeria and completed his studies in Istanbul.

These three works were written in Turkish. This indicates the importance of Ottoman Turkish as a scientific language. Another noteworthy point is that the native tongue of these scholars, two of which were Jewish, was not Turkish. Ibn Ḥamza's native language must have been Arabic. This is an indication of the level of development and usage of Ottoman Turkish.

At the end of this study, let us make another important remark about the general development of Ottoman science and its relationship with the connection between the old Islamic scientific tradition and the modem Western one. During the reign of Bayezid II (1481-1512), ʿAbd al-Salām al-Muhtadī wrote a book about the plague in Arabic. Approximately three centuries later, in 1795, Gevrek-zāde Hāfiz Hasan Efendi translated this work into Turkish with some additions. Thus, we see that at the end of the 18th century old medicine was still practiced, with some new additions. Interest was shown in the same work again during the reign of Sultan

Abdülhamid II (1876-1909) when there were extensive initiatives by the state to spread modern medical education and health services. The work was translated into Turkish again during this period. This is clear from the introduction given to the work by Sanayi Alayı Müftüsü (*Muftī* of the Industrial Regiment) Ahmed-i Omeri al-Şami, the translator. This last example shows that dispate the vast expansion of modern medical education and health services in the last decades of the 19th century, the interest in classic literature in medicine was still there. This interest, however, did not aim to refute the new science and replace it with the old. On the contrary, in our opinion, this interest was aimed at turning attention to the existence and importance of a cultural legacy, which was about to be forgotten, and to prove that the 'old' science would be assessed by the 'new' science vis-à-vis its importance.

Acknowledgements:
This article, which is the first contribution to its topic, is the outcome of a long period of research undertaken many years ago. In preparing the first Turkish version of the article [published in Belleten, 58 (223), (Aralık 1994): pp. 565-605] and the book form [Osmanlılar ve Bilim: Kaynaklar Işığında Bir Keşif. İstanbul: Etkileşim Yay., 2010, 4th ed.], the contributions of my former students the late Cevat İzgi and Cemil Akpınar were highly useful. My gratitude goes to my dear former colleague the late Dr. Semiramis Çavuşoğlu for her major contribution in translating the Turkish text. My appreciation also goes to Dr. Didar Bayır for her help in finalizing the English text. As I was preparing the English to be published in *Suhayl*, Prof. Julio Samsó's in depth knowledge of the Andalusian scientific legacy and his editorial skill helped considerably in enriching the text and in making useful amendments. I acknowledge with great appreciation his substantial contribution. Also my thanks go to Hüseyin Şen for sharing his precision on Takiyüddün's eclipse observations.

List of abbreviations

BSOAS	*Bulletin of the School of Oriental and African Studies*
DSB	*Dictionary of Scientific Biography* (New York, 1981. I-XVI)
EI	*The Encyclopaedia of Islam* (New ed. Leiden: Brill, 1960-1996)
GAL	Carl Brockelmann, *Geschichte der arabischen Litteratur* (Leiden: Brill, 1937-1949.)
GAL, Suppl.	Carl Brockelmann, *Geschichte der arabischen Litteratur*, Supplementbände 1-3 (Leiden: Brill, 1937-1942)
IRCICA	Research Centre for Islamic History, Art and Culture, Istanbul
İA	*İslam Ansiklopedisi* (İstanbul: TDV, 1988-)
İ.Ü. Ktp., TY	Istanbul Üniversitesi Kütüphanesi, Tarih Yazmaları
JA	*Journal Asiatique*
OM	*Osmanlı Müellifleri* (Bursalı Mehmed Tahir, İstanbul, 1334-1343. 3 vols.)
OALT	*Osmanlı Astronomi Literatürü Tarihi (History of Ottoman Astronomy Literature)*, ed. by Ekmeleddin İhsanoğlu, 2 vols., 1997 by IRCICA
OASLT	*Osmanlı Askerlik Literatürü Tarihi (History of Ottoman Military Art and Science Literature)*, ed. by Ekmeleddin İhsanoğlu, 2 vols., 2004 by IRCICA

OMLT	*Osmanlı Matematik Literatürü Tarihi (History of Ottoman Mathematics Literature)*, ed. by Ekmeleddin İhsanoğlu, 2 vols., 1999 by IRCICA
OTIBLT	*Osmanlı Tıbbi Bilimler Literatürü Tarihi (History of Ottoman Medical Sciences Literature),* ed. by Ekmeleddin İhsanoğlu, 4 vols., 2008 by IRCICA
ROSENFELD& IHSANOĞLU	Boris A. Rosenfeld & Ekmeleddin İhsanoğlu. *Mathematicians, Astronomers, and Other Scholars of Islamic Civilization and Their Works (7th – 19th c.)* (İstanbul: IRCICA, 2003)