Abraham Bar Hiyya -the man and his work between two worlds[1]

The man in the shadow

There is one thing typical of Abraham bar Hiyya among medieval Jewish scholars: he has left behind several written works, yet there is next to nothing that we actually know of his life[2]. From his several scientific works we know of his extensive knowledge of mathematics, astronomy and other sciences, including their practical applications to problems like calendars and land-surveying. Yet, even the few facts that are usually stated of the life of this man of many skills, are usually not much more than guesswork based on isolated expressions in his own writings or in manuscript colophons[3].

Abraham bar Hiyya is assumed to be born either 1065 or 1070, but no justification for either year has been proposed. The birthplace might be Soria; this would be indicated by the fact that his astronomical tables are prepared for this location[4]. Others, however, suggest that he was born in Barcelona[5]. It is fairly certain that he lived and worked in Barcelona and translated scientific works from Arabic into Latin with Plato of Tivoli. He is called by the title Savasorda, which is a Spanish derivation of the Arabic title of

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[1] This article is intended to be the first of a series of two articles. In this first article the emphasis is on the times and environment of Bar Hiyya, who is seen bridging between the Arabic-language scientific world of al-Andalus and the Latin-Hebrew world of western Europe. The second article will concentrate on the first chapter of his Hegyon ha-Nefesh where the same position between two cultures is likewise visible.

[2] This is more or less what B. Sack says of Moshe Cordovero in his The Kabbalah of Rabbi Moshe Cordovero, Jerusalem, 1995, p. 11, quoting M. Benayahu's words about *Gedolei Israel whose Torah is revealed but whose life stories are hidden (*Benayahu is writing about Josef Karo).

[3] See Stitskin, pp. 15-33; see also Freimann's Biografie and Rapoport's Abhandlung, see Bibliography.

[4] Freimann, p. x, stating the view of Filipovski; Stitskin p. 15, p. 19. The well-known town of Soria is located in the upper Duero valley somewhat to the west of Saragossa, in the frontier area between Castile and the *taifa* kingdom of Saragossa. Stitskin however writes about "his early environment in the small southern [sic!] village of Soria", likewise about the possible influence of Baruch ibn al Balia of Cordova on Bar Hiyya. So it seems that Stitskin is locating Soria in the south close to Cordova and assuming that Bar Hiyya spent his youth in the southern part of al-Andalus.

[5] Freimann p. x attributes this view to S.D.Luzzatto and Zunz, who base it on the expression in one of the works by Bar Hiyya: "this work was finished by our Prince Abraham bar Hiyya in Barcelona (literally *medinat Bartselona)"*

Sahib as-Shurta, which literally means something like 'chief of police' but probably indicates a position of a courtier[6]. It has been suggested that he received the title as he worked for Alfonso, the king of Aragon, or for the counts of Barcelona[7]. Opinions have differed as to his living in France towards the end of his life[8]. The year of his death is not known, either –some assume 1136, some as late as 1148.

Because the available facts do not allow us to form a reliable personal biography of Bar Hiyya, it is useful to develop a picture of the historical background and circumstances, and then attempt to view Bar Hiyya within these settings. Such an approach brings us immediately into the age of the Spanish reqoncuista. First we must consider the situation in Spain in the 11th century.

The times of the man

During a period of a half century before Bar Hiyya's birth, the situation in Spain had changed drastically, and the change would continue throughout his lifetime. Before the beginning of the 11th century, the Muslim Spain covered most of the peninsula, only the northernmost area was held by a number of small Christian kingdoms. When the Ummayad caliphate fell apart in beginning of the 11th century, the area held by Muslims in Spain was divided into small petty kingdoms, *taifas*. These kingdoms were characterised by a high level of culture but in general weakness in political level. This is attested by the fact that it became typical during the 11th century for the Muslim kingdoms to pay tribute (called *parias*) to neighbouring Christian states. Shortly stated, the power balance shifted in favor of the Christian states, which towards the end of the century is also attested by the territorial advanced by the Christian states, culminating in the capture of the middle of Spain including the city of Toledo (1085) by Castile.

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[6] Also Moses ibn Ezra is known by this title. (Baer, p. 60)

[7] Sirat, pp. 97-98.

[8] Freimann, p. x, assumes that Bar Hiyya moved from Barcelona to France; J.L.Rapoport strongly opposes this view, p. xxxviii. See also Stitskin p. 21-24. This controversy is actually of little interest for our purposes here. Catalonia was from 1112 united with Provence, with territories extending as far as Nice. (Chaytor, p. 57). If Bar Hiyya has been in the service of the count of Barcelona, it is only natural that he has spent time in Southern France. Furthermore, the significant cultural border of interest here lay to the south of Barcelona, between the Arabic and the Frankish cultures, not between Spain and France.

Life in the *taifa* kingdoms was favorable to Jews. In general, the situation of Jews was dependent on the personal status of Jewish courtiers and the upper class in general, and the Muslim kings usually depended on the services of such Jews. Even in the areas captured by the Christian kings the status of Jews remained favorable because these kings had use for the services of the Jews, especially for the reason that the newly conquered areas had to be administered by competent people and generally Christians trusted Jews more than Muslims for these purposes.
Culturally, the two areas were different. In the Muslim area, the upper class Jews participated in the scientific and cultural life, which flourished at this time. In the Christian kingdoms, city culture was only in its beginnings and whatever scientific learning existed was confined within the Church and monasteries.

In the latter part of the 11th century more and more Jews found themselves in a Christian area. This is of course partly due to large areas being added to the Christian kingdoms, but also to the fact that conditions for Jews worsened in al-Andalus. To be able to defend themselves, the Taifa kings called for help from the Almoravids of North Africa. The Almoravids arrived, stopped the Christian advance, but also established a strong and unified kingdom in stead of the small Taifa kingdoms. The cycle repeated itself in the 12th century, when the Almoravid zeal had passed and Almohads arrived. In both cases the situation of Jews turned to worse and many left for north. From the experiences of Moses Ibn Ezra we can get a glimpse into what kind of culture shock this has implied[9].

Catalonia had been in Christian hands from 801, when it had been conquered from the muslims by the Carolingians. Even if the local nobility had later gained independence from the Franks, the country still had close ties with France. Barcelona in the 11th century was still a small town, and the last outpost of Frankish influence before the frontier just south of Barcelona. Conditions for Jews had been and were good during the period under discussion here[10].

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[9] Baer, p. 60-64

[10] For information on Catalonian Jewry, see Baer pp. 40-58.

The last quarter of the 11th century was the time when the Christian *reconquista* made its fastest advance. Until then, the wars between Christian and Muslim kingdoms had been more motivated by the medieval concept of a king as a warrior rather than any higher ideal. Towards the end of the century, the western Europe was infused with Crusader spirit. In Spain, the conquest of Toledo by Alfonso of Castile in 1085 was the turning-point. However, the Almoravids from Northern Africa were able to stop Alfonso from advancing further south. Neither was he able to penetrate eastwards into the kingdom of Saragossa[11]. However, some decades later the Kingdom of Aragon was able to capture Saragossa in 1118. The fall of Saragossa was then followed by fall of other Muslim strongholds in Eastern Spain. Both Aragon and Catalonia were able to expand significantly to the south (Tarragona, Tortosa), and finally these two kingdoms were united through marriage in 1136[12]. Catalonia had meanwhile extended even north-east by the annexion of Provence in 1112.

During Bar Hiyyas lifetime, the situation in Spain thus shifted completely. By 1136, the area ruled by Muslims was reduced considerably and most of the area of Spain was now ruled by the Christian kingdoms of Castile-Leon and Aragon-Catalonia. Also the focus of Jewish life in the Iberian peninsula had moved to the Christian kingdoms, where even the Arabic learning was now in high demand, as is attested by the large scale of translation activity of scientific works from Arabic to Latin.

The science and culture in Muslim and Christian lands

The fact that Jews had been able to attain a high level of knowledge of science and culture in Muslim Spain is not only due to the high level of cultural and scientific activities in and around the courts of Muslim rulers in Spain. It is of course of prime importance that those rulers often were themselves deeply interested in sciences and arts, and acted as patrons for men of culture. The decisive factor is the secular nature of

[11] This is also the time of El-Cid, the Spanish hero of legendary dimensions. Banished by the king of Castile, he served many years the Muslim king of Saragossa, until he set out to Valencia where he built his own, independent kingdom. The case of Cid illustrates how a Christian warrior could still in those times serve a king regardless of the religion.

[12] Strictly speaking the major southward advances of Catalonia took place only after being united with Aragon: capture of Tortosa in 1148 and Lerida, Fraga ad Mequinenza in 1149. (Lomax, pp. 92-93)

the scientific activity in Muslim Spain, which made it possible to non-Muslims to participate fully in the cultural life. This is in deep contrast to the contemporaneous Christian Europe where whatever level of science existed was confined within the domain of the Church.

There is no questioning that around 1000 the frontier between Muslim Spain and Christian Europe formed a wide cultural gap[13]. Yet already then the demand for scientific knowledge had awakened in Christian Europe and the first steps in the process for transferring the scientific knowledge from Arabic to Latin were already being taken. Monk Gerbert (later Pope Sylvester II) travelled in 967 from Aurillac in France to Catalonia to learn natural science, staying for two years[14]. We know that the Catalonian abbey of Ripoll possessed already then some Latin translations from Arabic on astronomy and surveying[15]. Gerbert wrote in 984 a letter to Gerona and requested for a book by a certain Joseph on multiplication and division.

Apart from these early beginnings, there is not much evidence of scientific activity in northern Spain until the beginning of the 12th century when the major Arabic seats of learning (Toledo, Saragossa) had been captured by the Christians. In northeast Spain, on the Muslim side of the frontier, Saragossa had been the main locus of learning and culture. The petty kings of Saragossa had been philosophers and mathematicians themselves, as well as patrons for scholars. When Saragossa fell to the kingdom of Aragon in 1118, translation activities started almost immediately[16]. These activities spread subsequently to other locations, of which Toledo is the most well known. Yet in fact, the famous Toledo school of translation emerged only after 1165[17].

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[13] Millas-Vallicrosa, 1994, pp. 36-37

[14] Millas-Vallicrosa, 1994, p. 39. That the level of knowledge in Catalonia may have been lacking is suggested by the tradition that Gerbert in fact travelled as far south as Cordova in search of knowledge. There is no doubt that Catalonia benefited from the Arabic science being diffused through the frontier, but a small library in Ripoll (under 200 volumes in 1046, see Chaytor, p. 35) was certainly no match for the 400 000 volumes in Cordova.

[15] Millas-Vallicrosa, 1994, p. 41

[16] MacKay, p. 86

[17] Ibid.

We know that Bar Hiyya co-operated with Plato of Tivoli in Barcelona in translation of Arabic works into Latin. Such co-operation was by no means unusual. The Latin translators of these days probably could not boast of fluent command of Arabic, and it was typical to work in pairs, with one scholar translating from Arabic into Romance, and the other further into Latin[18]. The multi-language skills of many Jews made them well suited for such activities. Furthermore, the translation was not typically a purely linguistic exercise: the translators themselves were scholars often capable of creating even original works. Such, of course, is the case of Bar Hiyya -Plato of Tivoli did even produce a Latin translation on Bar Hiyya's original work on geometry and land surveying.

It is to be noted further, that the translation works were not always, or perhaps even primarily, personally motivated activities, but could also be assignments commissioned by men of power and influence who had realised the importance of astronomy, mathematics and other sciences[19]. Similar motivation can be sensed in Bar Hiyya's Hebrew works, written for the Jews of Southern France, and in the subsequent translations of Judeo-Arabic works into Hebrew by the ibn Tibbon family and others[20].

The work of the man

If what we know of Bar Hiyya's life is scanty, we can get a surprisingly wide view of his intellectual life by considering what has been preserved of his written works:

His scientific works reveal a wide and deep knowledge of science of his days. **Tsurat ha-Aretz ve-Tavnit Kaddurei ha-Raki'a** contains a general description of geography and astronomy. A more detailed work on astronomy, **Heshbon Mahalekhot ha-Kokhavim**, is a handbook on stellar motion and the related calculations –but it also includes descriptions on different calendar systems and gives methods for converting

[18] Glick, pp. 257-8.

[19] MacKay, p. 87.

[20] It is interesting to note how the beginning of the Tibbonide translation wave coincides with the peak of the wave of Latin translations (Toledo school in the 1160s)

between the systems. **Sefer ha-Ibbur** describes in more detail the calendrical issues of particular interest for Jews, such as determining the time of the New Moon and the festivals. **Hibbur ha-Meshihah ve-ha-Tishboret** is a manual on geometry and its applications for land surveying. The preserved parts of his encyclopedic work **Yesodei ha-Tevunah u-Migdal ha-Emunah** deal with geometry, arithmetics, optics and music.

These works cover quite completely the sciences for which there was greatest interest because of their practical applications. Initially, the highest demand for Latin translations was exactly in these fields -not in philosophy.

In addition to the scientific works, Bar Hiyya has left us **Hegyon ha-Nefesh**, an ethical-homiletical work with a marked philosophical content, and **Megillat ha-Megalleh**, an eschatological work partly based on astrology. The latter work to some extent repeats and even further develops the philosophical points made in Hegyon ha-Nefesh[21].

A life reconstructed

The level and extent of Bar Hiyyas learning requires special attention. We must realise that we are dealing with a person which has been held to be one of the brightest minds of his day, and whose name is still found in works of history of both mathematics and astronomy. While in Muslim Spain such learning was not unheard of, in Christian Europe something comparable simply did not yet exist. Bar Hiyya himself played a part in transferring the Arabic science over to the rest of Europe, both with his Hebrew works and through his cooperation with Plato of Tivoli to produce Latin versions of Arabic scientific works. While it is in principle possible that Bar Hiyya had learned from Arabic-speaking persons and books within Christian territory in Catalonia or Aragon, it is much more likely, that he would have obtained his scientific knowledge in an active center of Arabic learning such as Saragossa.

Two facts would justify the assumption that Bar Hiyya has actually lived within some area of Muslim rule. The first reason is the level of learning displayed by Bar Hiyya's

[21] Baron, p. 74 considers Hegyon ha-Nefesh as a work intended for a broad public (for "edification") whereas Megillat ha-Megalleh would have been written for "intellectual enlightment").

writings on astronomy and mathematics –in his days such information was only available in the Arabic language. The second is his title '*Sahib as-Shurta*'[22]. It is true that the Christian rulers continued to employ titles derived from Arabic for any positions which were needed in the new circumstances created by the reconquista, but Barcelona was not one of these newly won areas –it had been quite stable in Christian hands almost all the time, closely tied with the Carolingian world.

The scenario that Bar Hiyya would have spent most of his life in Barcelona, including acquiring his scientific education there, seems thus unprobable[23]. It is more likely, that he has studied in some Muslim center of learning, for instance in Saragossa which is relatively close. Likewise Bar Hiyya could have obtained the title of *Sahib as-shurta* in the court of Saragossa[24], the main Muslim capital and the main center of Arabic learning in the area close to Barcelona -and Soria as well if we would consider that as his birthplace[25]. Saragossa was also one of the foremost seats of Jewish learning -Ibn

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[22] Many works attribute this title for Bar Hiyya having served either the king of Aragon or the counts of Barcelona.

[23] Barcelona was the capital of the then yet small Catalonia. The town was still a small town at the end of the 11th century. In Christian Europe at that time towns were not places of learning; learning was the domain of the church and usually confined to monasteries (in Catalonia the abbey of Ripoll is known to have had scientific interests since the end of the 10th century). A convert from Judaism to Christianity, Pedro Alfonso (1106), testified for the supremacy of Arabic learning over the contemporaneous Latin science (Glick, p. 288). Of course it would have been possible that among the Jews in Barcelona (around 60 families at 1079, Baer vol 1. p.41) there would have been someone capable of teaching Bar Hiyya. Considering the extent and depth of Bar Hiyya's knowledge, it must however be assumed that he has been studying among the major scientific scholars of his time.

[24] Millas-Vallicrosa, 1959, pp. 13-14 assumes that Bar Hiyya would have obtained this title in the court of Banu Hud of Saragossa-Lerida; there is even a record of a Jewish Savasorda there in the beginning of the 12th century. (note: Savasorda is a Romance degeneration of the Arabic term).

[25] The natural route from Soria to the coast would follow the valley of the river Ebro. Benjamin of Tudela, in the 1160s, starting his famous journey to the East, travelled first from Tudela, which is to the northeast of Soria, along the river Ebro to Saragossa and then further to Tortosa on the coast of the Mediterranean, before turning northwards along the coast, through Tarragona to Barcelona and Provence. He says of Barcelona: " Where there is a holy congregation, including sages, wise and illustrious men, such as R. Sheshet, R. Shealtiel, R. Solomon and R. Abraham, son of Chisdai. This is a small city and beautiful, lying upon the sea-coast. Merchants come thither from all quarters with their wares, from Greece, from Pisa, Genoa, Sicily, Alexandria in Egypt, Palestine, Africa and all its coasts." (Adler, p. 2)

Gabirol wrote the most part of his work in this city in the mid-11th century and Bahya ibn Pakuda wrote his Duties of the Heart there in the 1080s.

Stitskin has argued that Bar Hiyya originally lived in al-Andalus and was drawn to Barcelona for two reasons[26]: infavorable conditions during the Almoravid rule and the attraction of Barcelona as a center of learning and scientific activity[27]. If we assume that he lived somewhere within the taifa of Saragossa, the Almoravid rule in the south would not have affected his life. Rather, after the capture of Saragossa (or some other main city in the area) he would have been offered a post, as was customary in case of capable Jews, in the service of king of Aragon or the count of Barcelona.

While Stitskin assumed that Bar Hiyya originally came from al-Andalus, Wigoder[28] has been more cautious and stressed the fact that we know only that Bar Hiyya lived in Barcelona, which Wigoder describes in the following way: "*Catalonia in the tenth and eleventh centuries was the center of considerable activity in the spheres of mathematical and scientific scholarship. In this intellectual ferment, Jews were prominent and excelled in mathematics, physics, astronomy, alchemy, geography, medicine and surgery."*[29] It seems however that his description would much better match the conditions in Saragossa than in Catalonia.

Of course, the attempt to reconstruct the times and environment of Bar Hiyya proves nothing about the actual course of his life. Yet this approach gives something more than sheer guesswork or caution -we can form a picture of what went on in the immediate surroundings of Bar Hiyya, in spheres of lifes directly relevant to his work. We can make out the contours of a bridge carrying a whole civilization over a gap and thus enabling the scientific evolution in western Europe for centuries to come. The bridge existed only during a timeframe of a century or so, and it existed only in a limited area

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[26] Stitskin, p. 19.

[27] At present I am unable to disprove that Barcelona would have been a center of scientific activity before 1118, but neither have I been able to confirm that. What is certain that later, as a result of the cultural bridge activities, Barcelona grows to a major seat of learning.

[28] Wigoder, p.2

[29] Ibid.

in Spain, along the former frontier. This was the times and world of the man we are interested in here.

A bridge between two cultures

We have described here the cultural conditions in both the Islamic Spain and the Christian Spain, and have noted how during Bar Hiyya's lifetime the balance shifts in favor of the Christian kingdoms, not only in military terms but also in the world of science, learning and culture. A bridge is formed, in practice consisting of a number of highly gifted individuals who work in order to transfer the knowledge and learning from Arabic to the languages understood in the western Europe -which means not only Latin but also Hebrew.

The bridge of science and culture over the gap was however but a narrow one -Europe did not adopt the whole culture and science of al-Andalus. Europe did adopt much of the science but rejected -or tried to reject, much of the philosophy. Among the Jews, the secular culture of al-Andalus was alien to the Jews of France. The diffusion of philosophical ideas and works from Judeao-Arabic world into the traditional world of French Jews led, as we know, to many controversies. Hegyon ha-Nefesh, the ethical-homiletical work of Bar Hiyya, shows how deeply rooted he was in the traditional world of French Jewry[30]. Thus we can conclude that while he was extremely knowledgeable in the science of al-Andalus, he fully belonged to the traditionally minded religious world which was dominant for instance in Provence. That Bar Hiyya was proficient in the Arabic-language scientific culture is testified by his scientific works and the references to philosophical ideas in his other works. But we also know that he was writing in Hebrew and that he most probably wrote to an audience he knew[31]. Therefore, with full

[30] Baron, p. 62 calls Hegyon ha-Nefesh and Megillat ha-Megalleh unmistakably works of a Jewish traditionalist. I fully share this opinion as far as I have been able to confirm. That Bar Hiyya was familiar with French communities is shown by his view that those communities were negligent and using guesswork in distributing land property (Baron, p. 156).

[31] See Bar Hiyya, Tsurat ha-Arets, p. 3 where he describes how he had refrained from writing this astronomical work until requested to do so by a *ketsin ha-dor*. See also Stitskin, p. 22. Likewise in his Yesodei ha-Tevunah u-Migdal ha-Emunah p. 10 (Hebr.): "and not of my own will did I enter [this work]

justification, we can say that Bar Hiyya was standing with one foot in both worlds -and his eyes turned to the north.

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and not for my own honor or to attain something good [for myself]. But many of the great men of the generation whose advice I am bound to accept brought me to all this, because there was not a single book in Hebrew in the whole land of France on these sciences...".

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