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Roscoe C. Hinkle

The term “civilizational bridge” is basic to this study. It involves an inter-linkage of the two historical periods of late European antiquity and early modernity or more especially Iberia of the 7th to 15th centuries.

In the noun form, a civilization designates a larger or more comprehensive socio-cultural entity than either a single social or cultural entity, yet is inclusive of both. However, it entails a differentiation and complexity not found among “simpler” or “primitive” peoples: larger populations in extended settlements; a system of communication of more than direct face-to-face speech; and graphic representation, (such as cuneiform, glyphs, or hieroglyphs) and quasi or actual alphabetic “writing” on more or less permanent material, such as clay or papyrus.

The institutional structures are also more or less formal and impersonal. Some persons travel outside of a given society-culture (e.g., for trading or diplomacy). An identifiable economy involving an exchange of goods and services exists. Occupational specialization and a graded hierarchy of statuses (a social stratification) have emerged. Concurrently, organized force as centered in the (political) state has emerged with a king or emperor. Religion, with a professional priesthood, has become established. All of these are to be found exemplified in Muslim Spain.

Pre-Islamic Spain

For several centuries before the Islamic conquest, the Iberian Peninsula was ruled by Visigoths (Western Goths), except for the Basques in the northwest. Even earlier, ancient pagans remained, as did the Roman settlers (who called the area

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“Hispania”), the Celts, the Vandals (from whose occupancy the Arabic “al-Andalus” is derived), the Germanic Suevi and Alamani, and smaller numbers of Jews (who added to the ethnic and religious heterogeneity).

The Visigoths arrived in the 5th century A.D. Initially, they were adherents of a brand of Christians who followed Bishop Arius, who held that Jesus “was not quite divine..., but not quite human” either (Lowney, pp. 22-30). In 589 A.D., they became Roman Catholic (Menocal, pp. 132-133). In Lowney’s view, the Visigoths were important in keeping Spain together and in avoiding a reversion to a pre-Roman patchwork of small fiefdoms (pp. 22-25).

The Advent of the First Arabs

In 711 an Islamic invasion headed by Tariq ibn Ziyad overwhelmed the Visigothic (the then Spanish) King Roderick, spilling over the Pyrenees to imperil France, and to move within 200 miles of Paris. But Charles Martellus (i.e., Latin for Charles the Hammer) repulsed the Islamic invaders in 732 A.D. Martellus was the grandfather of Charlemagne, who endeavored to ensure, two generations later, that France would never again “suffer such an incursion” (Lowney, p. 124). Thus, a first Muslim invasion had occurred between C.E. 711 and 732 (cf. Michael Morgan, pp. 4, 26-34).

The Second or Main Arabic Muslim Invasion

Begun in the early 8th century (C. E.) this invasion was led by Abd al-Rahman, who was the only member of the Ummayad dynasty to escape murder by the Abassids in the caliphate capital of Damascus in 750. He and his brother fled successfully across Egypt and North Africa to Spain, arriving five years later. With the assistance of émigré Syrians and Berbers, who recognized his claims, he defeated, displaced, and replaced the then caliph, to (re-found) an Umayyad dynasty that endured for 11 generations in Andalus (756-1031 C.E.).
Abd al-Rahman (fourth generation, 822-852) was able to consolidate Umayyad power throughout Muslim-held territories and to establish a court in Cordoba in a style that quickly rivaled any within the then contemporary Islamic world. Abd al Rahman III (eighth generation, 922-961) spent his first 14 years in consolidating power lost to other Muslim caliphates. In 926 he proclaimed himself caliphate of al-Andalus and “commander of the faithful.”

During his lengthy 40-year reign, Spain attained its peak: territorial expansion, political and economic stability, and cultural efflorescence (which continued under al Hakm II (961-976), but afterwards declined and disintegrated under the invading (Muslim Berber) Almoravid and Almorad conquerors.

**Economic, Social, Cultural, and Demographic Changes (900-1000 C.E.)**

For Cordoba and *al-Andalus* generally, the changes that followed were extraordinary. A participant in a Mediterranean-wide trading economy, the city had astonishing wealth. This was evidenced in a large number of public baths, tens of thousands of shops, hundreds (perhaps thousands) of mosques, running water from aqueducts, paved and well-lit streets. Astounding technological innovations occurred, one of which was a paper factory at Jativa, near coastal Valencia. The use of paper immensely facilitated intellectual activity in Cordoba and the Caliphate.

The contents of its numerous libraries and voluminous holdings included translations of ancient Greek works, which were continuing in Baghdad and with which Andalusians had contact. And Cordoba’s prestige rose accordingly.

By the beginning of the early to mid-9th century, the Muslim population of *al-Andalus* had vastly expanded (Huff claims by the 10th century; see page 47, footnote 2). Some came from new immigrants, but most came from conversions of Christians by the scores, if not hundreds. The loss to Christianity included
children of many mixed marriages. Even if brides remained steadfast in their earlier faith and reared children in their maternal tongue, the language of the local community would no longer be Christian Latin but something different (later termed Mozarabic). In the eyes of Islamic law, they were considered and reared as Muslims. Latin was being abandoned for the dominant and prestigious Arabic—the key to an emerging and invigorated culture. Christianity and its Latin language were becoming passé.

To understand such an occurrence requires an understanding of the Quranic notion of “Peoples of the Book” and “dhimmi,” the ascendancy of the Arabic language among Jews and Christians in al-Andalus and the relatively liberal and open-minded policy of the Umayyad emirs and caliphs. For the prophet Mohammed and Muslims, the Quran is their sacred book of scriptures, just as the Bible is the book for Christians and the Torah for the Jews. In other words, all are children of Abraham and have scriptures or sacred books, i.e., they are “Peoples of the Book.”

For the Muslims, the “dhimmi” are Jews and Christians. They were granted religious freedom, i.e., to retain their beliefs and could share in much of Muslim economic and social life. In return for this freedom of conscience, they were required to pay taxes (which Muslims were not) and to accept certain restrictive regulations. They were forbidden to proselytize Muslims, from building new places of worship, or from display of their religious rituals in public (Fletcher, p. 35).

For a time, a minority of Christians attempted to rebel, but they were beheaded (Fletcher, p.35). Eventually, a majority of Christians did accept Muslim requirements. Some, such as Mozarab Christian Bishop Racemuno, attained a major position in the court and diplomacy of al-Rahman III. Certainly, he felt no disloyalty to his Christian faith in using Arabic (as opposed to Latin). Arabic had become the language of government, commerce, and faith (Fletcher, p. 35).

Yet, the importance of the attitudes of the Umayyad dynasty itself must be noted. Unlike other versions of Islam, the
Umayyads had a relatively liberal version of the dhimmi and a generous open-mindedness and egalitarianism as part of a general social and political ethos. Moreover, this stance was reflected in their interest in the philosophical legacy of ancient Greece and translation of key works.

And thus attention now turns especially to Arabic falsfah, (philosophy), which means “love of wisdom.” But originally (in Greek) it really meant “friend of wisdom,” from jilia or “friend” and sui or “wisdom” (Rosenthal, p. 74, see footnote 156). In classical terms, it is linked to Aristotelianism. More specifically, it includes the school of al-Kindi, ibn Sina, and al Ghazali. On the latter, see F. E. Peters, pp. 188-193, 194-200, and in relation to “kalam,” see Peters, chapter 7. Further, on Ibn Rushd, see also Peters, pp. 215-220.

Generalizations on Arab Philosophy and Science

From the 8th to 14th centuries, Arab Science was probably the most advanced in the world (Toby Huff, p. 48). The great movement from the 12th to 13th centuries had full access to the works of Greece and other cultures; these were rendered into Arabic. Though the works translated were selective, they were thoroughly typical of Greek scientific and philosophic thought as a whole. The borrowing of the Hindu numerical system was an important, if not crucial, addition. (See Michael H. Morgan, pp. 106, 129-138.) The system involving decimal place had been available in al-Khwarismi’s work since C.E. 825 (Huff, p. 49).

In addition, the West had begun to use the abacus in the 11th and 12th centuries, along with the Arabic-Hindu numerical system. After 1202, the Europeans began a transition away from the use of the abacus and to paper and pen calculations (Huff, p. 50).

The Arabs also had invented trigonometry, so essential for astronomy (also Huff, p. 50). By the 15th century Europeans began the use of +, -, x, % (Huff, p. 50, footnote 10).
Arabs were the founders of plain and spherical geometry (also Huff, p. 50, footnote 13).

Furthermore, Arab mathematicians in the 11th and 12th centuries achieved innovations that Europeans attained only in the 15th and 16th centuries. Thus, in the realms of mathematics, astronomy, optics, physics, and medicine the Arabs were the most advanced of anyone (Huff, p. 52).

According to Huff, what the West has termed "natural science," the Arabs called "foreign sciences." Islamic sciences were devoted to the study of the Quran, the tradition of the Prophet Mohammed called hadith, legal knowledge, fiqh, theology kalam, and Arabic language (Huff, p. 53). In brief, inspired by curiosity and religion, the Arab-Muslim world attained significant advance by the 8th to 14th centuries, and thereafter (perhaps as early as the 12th) declined and even regressed (Huff, p. 53).

Returning now to Muslim Spain (al-Andalus), it must be noted that by the 10th and 11th centuries, sufficient numbers of scholars had been enticed from the far ends of the Muslim world by wealthy stipends from the Umayyads to make Cordoba competitive with any rivals. But the major astronomer and mathematician from al-Andalus was Maslama al-Majriti (i.e., known today as Madrid; he died circa C.E. 1007).

His work also constitutes the beginning of science as an organized activity in al-Andalus. He dedicated himself to the observation of stars and to the study of Ptolemy's Almagest. He summarized al-Battani's astronomical tables (or zij) and attempted to refine al Khwarizmi's works (C.E. 825). His students and students of his works (as specified by Glick, p. 254) who worked only in mathematics did so in the sense of al-Khwarizmi's or al-Farabi's classification of the sciences as subsumed within the rubric of mathematics (ibid., p. 254; also Morgan, pp. 130-131).
In addition, the Jewish physician Hasdai ibn Shiprut headed a multi-personal undertaking with a primary interest in botany and pharmacology in a study of Discoride’s *Materia Medica* in C.E. 948-49. Their concern lay mainly in expanding an Andalusi nomenclature, including Romance variations of plant names, in order to adapt Hunayn’s revised text of ibn Basil’s Arabic translation of Iberian biogeography.

At the request of Caliph Abd al-Rahman III, the translators included a Byzantine Monk, Nicholas (from Constantinople); a Greek-speaking Sicilian; four Andalusi; Christian Bishop Racemundo; and a Jewish scholar, Hasdai ben Shiprut. Roughly, the same group was still operating during the reign of al-Hakim, but with the addition of one physician-pharmacologist, ibn Jujul. Ben Shiprut continued to work on material medica, producing a *Treatise (Maqala)* on Dioscorides containing a personal synthesis (Glick, pp. 256-7).

Another early figure in translation was Pedro (Peter) Alfonso, whose original name was Moshe Sefardi, a Spanish Jew who converted to Christianity, was baptized, and took the name of his godfather, King Alfonso of Aragon. He moved from one household to another.

Before or after he moved to England, he translated into Latin the astronomical tables of al-Khwarismi (but not on the basis of Maslama’s revision (Fletcher, p. 149). Eventually, he moved to England, to become Henry I’s physician. In addition, he had manifest capabilities in mathematics and astronomy.

Two other authorities (each from northern Spain) are also to be noted. The first is the Hispano-Jewish philosopher, mathematician, astronomer, Abraham bar Hiyya (often called Savasorda). He lived in Barcelona and possibly Provence; he died in or after C.E. 1136. He was one of the leaders of the movement which persuaded Jews to become transmitters of Muslim science to the Christian West.
He was aided by two foreigners, living in Toledo, as he translated works from Arabic to Latin. One was an Hispanic Muslim, Ibn Bajja (known in Europe as Avempace), who was a philosopher, scientist, and commentator on Aristotle. He was born in Zaragosa sometime before C.E. 1106 and lived there as well as Granada and Fez, where he died in C.E. 1138-1139. He wrote many small treatises on geometry, natural science, astronomy, alchemy, philosophy, and medicine. His criticism of some of Ptolemy’s assumptions prepared the ways for Ibn Tufail and al-Bitruji (second half of the 12th century). He had a substantial influence on al Rushd and Arthur the Great. However, he was persecuted during his life for (alleged) “atheism” and died perhaps from poisoning.

As the archbishop of Toledo, Raymundo laid the foundation of translation activity during his episcopate (C.E. 1126-1151). His Episcopal seat was a city filled with books. As a representative of a class of churchmen with expanding intellectual horizons, such as Abelard and Peter the Venable, he was responsible for the initial patronage and organization of a body of scholars known as the Toledo circle, a loose aggregate of men. He sought, thus, to create a translation center to recruit the best scholars to be found among Christians, Jews, or Muslims, and Latin, Greek, or Slavonic speakers.

But the major force for undertaking a comprehensive program of translation was an archdeacon resident in Toledo, Dominicus Gundissalinus, or Domingo Gonzalez. His On the Sciences describes each science in turn, based largely on al-Farabi’s Classification of the Sciences as translated by Gerard of Cremona. This classification was a “template” for Gerard’s patterning of his own program of translations, several of which were used in turn by Domingo to adapt al-Farabi’s text to write a comprehensive account of philosophy and its parts as entitled On the Division of Philosophy. That in turn also reflected the schemata developed by Thierry of Chartres and his pupils (Charles Burnett in Gerli, p. 802).
From Cremona (Italy), Gerard came to Toledo about C.E. 1140 and stayed until his death in 1187. He was probably the most prolific of all translators. (Pupils attributed 70 works to him.) His procedure in translation involved his assistant Ghalib the Mozarb, who translated the Arabic orally into the vernacular (by word of mouth) to Gerard who translated and wrote it out in Latin (Fletcher, p. 151; Glick, p. 57; and Morgan, p. 216). One of the most famous works, which Gerard translated from Arabic in (about) 1160, was Ptolemy’s *Mathematike Syntaxis* or *al Majistij*, the Almagest in the West (Rosenthal, pp. 31-32).

Another but perhaps marginal figure was Marc of Toledo, a Spanish physician, translator and Canon of the Cathedral in Toledo. Although not well known, his professional-scholarly activity occurred towards the end of the 12th century C.E. He translated parts of the Quran and parts of Hippocrates and Galen.

In the Toledan circle of translators, Domingo Gonzalez’s assistant was John Avendruth. Also active were Herman of Carinthia (or Dalmatia), Robert Ketton of Chester, Michael the Scott, Alfred of Seneschel and Hugo of Santilla—all translating participants in the network (Anthony Carenas in Gerli, pp 365-366; Glick, p. 256).

The first on the list is from Spain, the second from what was earlier southern Austria, and the third seems to stem from Britain, the fourth from Scotland, and the fifth from Britain and the sixth a little known town of northern Spain. By virtue of their predominance from outside *al-Andalus* and Toledo (Spain), a pervasive utilitarian objective in or to translations on the part of northern Europeans may seem to be present.

John of Seville, who had originally been Domingo’s interpreter and assistant, was primarily an astrologer. He translated works by Abu Ma’shar, Al Farghani, Al-Qabisi, and Ibn Qarra, among others. They included the most important Arabic texts and apparently established astrology on a firm footing. He added his own *Epitome of Astrology* (C.E. 1135).
He ventured into medicine, translating medical portions of Pseudo-Aristotle and Kaqa. His astrological and medical texts were popular in the Middle Ages (Burnette in Gerli, p. 401). Hennan of Carinthia and Robert Ketton both sent works to other major figures of this period. Hennan sent a translation to Ptolemy’s *Planispher*, prefaced by a sketch of a history of astronomy and a reference to basic textbooks to Thierry of Chartres, the foremost educator in France at that time.

Robert Ketton sent the first translation of the Quran to Peter the Venable, Abbot of Cluny in C.E. 1142. Michael Scot was in the entourage of archbishop Rodrigo Jimenez (about C.E. 1215) when he translated some of Aristotle’s works with Averroes’ commentaries, and about 1217 he translated al Bitruji’s *Book of Astronomy* (Fletcher, pp. 149-150; also see also Glick, p. 268). Later Michael went to Sicily to join the court of Emperor Frederick II, becoming his astrologer, alchemist, and counselor (Fletcher, p. 152).

Another figure, less known and probably associated with Toledo, was Alfred of Sareschel, an English philosopher and scientist, the dates of whose birth and death are unknown. He flourished the end of the 12th and beginning of the 13th centuries. As in the case of Michael Scot, he was trained in Spain (Sarton, II, see footnote 2 on page 491). He translated the Aristotelian treatise ascribed to Demascenos and the alchemical part of Ibn Sina’s Shifa, the so-called Avicenna *Mineralia*. He composed commentaries on Aristotle’s *Meterology*, which Roger Bacon later used (Sarton, II, footnote 2, p. 561).

Hugo of Santallo was a translator of scientific texts from Arabic into Latin. Coming from one of the several Leonese villages with the name of Santalla, he apparently spent his life in Aragon. His principal interests lay in astronomy, astrology, and divination. Apparently, he was the first to translate a text on “sand divination,” for which he coined the term “geomancy.” He translated Apollonius of Tyana’s cosmogony
and a set of questions on nature, which became a key text for alchemists (Burnett in Gerli, p. 401).

Although the ones cited above are most commonly known, several others seem to warrant brief comment. First among them is Rudolf of Bruges, a Flemish astronomer and translator from Arabic into Latin and the only known pupil of Herman the Dalmatian. Apparently, the dates of his birth and death are unrecorded. But he did live in the second quarter of the twelfth century and partly in northern Spain. He translated a treatise on the astrolabe and wrote some original astronomical works that Sarton didn’t specify (Volume II, Part 1, p. 177).

Another is Plato of Tivoli, an Italian mathematician, astronomer, astrologer, and translator from both Arabic and Hebrew into Latin. His birth and death dates are lost but he is known to have lived in Barcelona about C.E. 1134-1145. He was assisted in his work by the Jewish scholar Abraham bar Hiyya. Sarton listed and commented on five such translations (ibid., pp. 177-9).

The last two and most eminent figures requiring consideration are the Muslim ibn-Rushd and the Jewish thinker Musa ibn Maimum (known in Christendom respectively as Averroes and Maimonides) each born in Cordoba and within less than a decade of one another. The former was a grandson and son of distinguished Cordoban judges and the latter the son of a rabbi. Both were educated in Cordoba, the first in Muslim law and the second in medicine and theology (the rabbinate). They both grew to maturity with the tolerant ideals of al-Andalus. But they also experienced the radical changes imposed by the Almohad rulers in the late 12th century.

It is most important to recognize that these two intellectuals also lived at a time when the Toledan translation movement was fully engaged and fully reflected a pervasive Aristotelian philosophy. Indeed, the point bears reiteration that ancient Greek science and philosophy were indissolubly a whole so that when translators worked, they necessarily translated what now seem to be branches or fields of science and with what is
now regarded basically as philosophy. Understandably, then, almost invariably a particular translator's activity (as above) reveals what are now instances of both.

Furthermore, it is also noteworthy that much of what was translated as an aspect of a field of science need not necessarily be only a "pure" or "rigorous" translation. Because a fully understood translation may require explanatory addenda or comments, careful scrutiny of what translators have also provided often involves an added phrase "Comments" (or "commentary") of a particular figure, sometimes the original author but perhaps more often someone else! Hence, it is only a step from "narrow" translation to comment or commentary.

In the case of both Averroes and Maimonides, this author has found many instances of references to particular selections (already translated into Arabic), along with comments or commentary by another "expert" (also translated into Arabic).

In the case of Averroes, his work was apparently found in six fields: philosophy, theology, law, astronomy, grammar, and medicine. Philosophy, medicine, and law were the three fields with the greatest number of contributions.

For Maimonides, his works are classifiable primarily into philosophy, theological-rabbinical commentaries, and medicine. The three fields with the greatest number of contributions are medicine, theological-rabbinical commentaries, and philosophical.

Interestingly, the Western world has tended to esteem both men for their one major work each on philosophy: for Averroes, his Incoherence of Incoherence; and for Maimonides, Guide for the Perplexed.

Sarton remarks that both "were the greatest philosophers of their time. They developed to a large extent independently but used the same philosophical sources" (II, 1, p. 369). Both men were committed to Aristotelianism; and as Menocal observes, "they were both seeking to establish a model for the relationship between philosophy, which meant not just
speculative thought but rational and scientific thought, on the one hand, and theology, or faith-bound thought, which accepted the teachings of Scripture and its official interpreters, on the other. Neither faith nor reason was to have precedence of the other" (Menocal, pp. 204, 209).

What is of supreme importance is that the writings of these two Andalusians provoked an unusual stir among Parisian intellectuals—most often part of the Church hierarchy—both at the University and its surroundings in the last quarter of the 13th century. This was because the commentaries included "various refutations of the notion that faith had unique access to truth," stemming from an Aristotelianism that was so central then to controversy at the University of Paris. But its appeal was unique by virtue of the 400-year study of the Aristotelian heritage in the Arabic tradition (i.e., in Baghdad and al-Andalus; see Menocal, 212).

At the very peak of its power, Cordoba was overthrown (in C.E. 1090) by fundamentalist invaders from North Africa, the Almoravids, who sought to cleanse "the free-thinking and free-wheeling society of the Umayyads" (Morgan, p. 69). The fall of the caliphate led to a gradual fracturing of the unified Muslim state into a series of city-states (or taifa, ibid. p. 69). An even more ascetic and fundamentalist set of invaders-conquerors (also from North Africa followed in C.E. 1145-1232. They were known as Almohads (Morgan, pp. 69-70; see also Lowney, pp. 145-146).

At this point, Huff's summary comments are useful to note. He remarks that in the Muslim world astronomy developed from al-Battani (d. 919) to its peak in the work of Ibn al-Shatir (d. 1375). The tradition included such impressive figures as Ib-al-Haytham (d. ca. 1040), al-Biruni (d. ca. 1050), Ma’yard al-Urdi (d. 1266), Nasr al-Din al Tusi (d. 1274) and his students Qut al-Din al Shirazi (d. 1311), Yahya Ibn Mohammad al-Magribi (d. 1238), and Ibn-Shatir, among others (pp. 57-58). Biruni, Haytham, Tusi, and Shirazi were all Persians, only a few who gravitated to al-Andalus to work.
What all had in common was an adherence to Ptolemy’s *Almagest* (p. 58). They believed that Ibn-al-Haytham offered a true astronomical description of the world in which the planets maintain a uniform circular motion (p. 57). By the early 12\textsuperscript{th} century, Arab thinkers, a century after Ibn al-Haytham, independently led a revolt against Ptolemaic astronomy. Al-Bitruji’s book, *The Principles of Astronomy*, tried to develop new mathematical models, though they failed (p. 57). But there was no real leap to a heliocentric world view (p. 60).

Yet Huff argues that the problem was not one of mathematical modeling but of a conceptual or metaphysical break, a break with the traditional cosmology as understood by religious scholars, the *umma*. Continuing with Huff, he notes that “The Arabs were perched at the forward edge of one of the greatest revolutions ever made” but they failed to move further (p. 62). Arab science had generally been more advanced than the science of the West. “But modern scientific knowledge as episteme is knowledge about how the world works—without being absolute!” (Huff, p. 62).

**The Intellectual Foundations of a Cultural-Civilizational Bridge: *Al-Andalus*, Cordoban and Toledan Translators and Translations**

For this study it is of crucial significance that the University of Paris in the 13\textsuperscript{th} century was not only the central focus of a controversy between Aristotelianism and the Church, but also because it attracted an international student body. Amongst this study body were people who would become major intellectual figures in their own right, individuals such as Roger Bacon, Albert Magnus, and Thomas Aquinas (Menocal, pp. 213-215).

Reflecting the controversy of his own era, Roger Bacon—as one of the earliest founding fathers of natural science—was occasionally “confined for his heretical writings and the rest of the time in spiritual retreat as a good Franciscan” (Menocal, p. 213). Further illuminating are the entries on “Roger Bacon,” “Robert Grosseteste” and Optics” in the *Dictionary of the*
Hackett and Sabra agree that Bacon has assimilated Euclid, Ptolemy, al Kindi, and al Hazm and attempted to reconcile them with the traditions of Aristotle, Avicenna, and Averroes (also in the above Dictionary, but in Vols. II, p. 39; Vol. VI, p. 1, (and, on “Optics) Vol. IX, p. 248).

Except for the two names (al Kindi and al Hazm), the names just associated with Roger Bacon and those cited as authors of works translated by the Toledan school (above) are noticeably similar. It is a similarity that should exist if the translations are to be regarded as an indispensable knowledge component in the al-Andalus civilizational bridge (between the Ancient and Modern Worlds).

In addition, such eminent figures as Michael Scot, Albert the Great (also at Paris) and (English) Robert Kilwardby are claimed to reflect Domingo Gonzalez’s influence. (See both Cardenas in Medieval Iberia, p. 366, and Sarton, Vol. 2, Part 1, pp. 167-181).

Further but even more indirect evidence of the al-Andalus’ import for modem science, especially for astronomy, is to be found in the adoption and use of Arabic (i.e., Hindu or Indian) numeration, continuing development of accurate measurements, compilation and revision of astronomical tables (Arabic zijes), refining of instruments for astronomical observation, with the stress on prediction from related astrology.

Paradoxically, the “safe” status of associated astrology allowed the slow and gradual development of Arabic-Andalusian astronomy (from the Greeks) until such time as the revolutionary implications of Copernican heliocentrism could be sustained without religious objections (Cardenas in Medieval Iberia, p. 120-1). See, also, in the same encyclopedia, Samso’s detailed supporting data, pp. 123-125, and Burnett’s study of Arabic (Andalusi) translations, including mathematics,
Medicine is, of course, also relevant to the contributions of al-Andalus. Note, for instance, that Averroes composed his medical encyclopedia *Coliget* in the early years of the 12th century. Avicenna (C.E. 980-1037) wrote his *Canon*, which provides complete coverage of medical science of the age. Al-Zahrawi (known as Abulcasis in the 9th century) was the author of the *Book of Surgery*, which Gerald of Cremona translated into Latin and which could be studied by top surgeons of the 14th and 15th centuries. See Herrara’s article on “medicine” in the previously noted encyclopedia *Medieval Iberia*, pp. 553-557.

What the above paragraphs on the University of Paris suggest is that, although the legacy of al-Andalus was dimming, its consequences for learning, humanism, and the Renaissance were still evident. The bridging function of al-Andalus in the period between late Antiquity and early Modernity is thus evident. (For a convenient summary, see David C. Lundberg and his chapter 2, “The Transmission of Greek and Arabic Learning to the West, in Science and the Middle Ages, 1978). Finally, Huff argues vigorously that the failure of Arabic science to give birth to modern science as in the West was due substantially to its inability to meet the stipulations (or tenets) of what of the American sociologist Robert Merton has termed a normative ethos of (modern) science:

- Its failure to develop universalism, *i.e.*, to adopt a set of standards applying equally to all actors as participants in the activities of the relevant domain (Huff, pp. 220-223, with examples from Arabic sciences).
- Its failure to develop autonomous corporate bodies (also with examples from Arabic science (pp. 224-227).
On the other hand, instances of particularism (or personalism) in Arab institutions of higher learning were condoned and legally accepted (again with examples, pp.227-229).

Its failure to accept communalism and its commitment to elitism (i.e., in effect to enshrine or limit only to a very few, or thus to exclude “the common man or masses” (with instances, pp. 229-232).

Its failure to require disinterestedness and organized skepticism. Science demands that its practitioners in a given domain or sphere be equally held accountable to their peers—even religion is not excluded, with instances of acceptance and violations. Note that Maimonides in his The Guide of the Perplexed recommends a method of discourse which will seem tortuous, evasive, unending, and opaque to many (Huff, pp. 232-239).

Whether in Medieval Spain (al-Andalus) or elsewhere in the Muslim World, what had been open became closed. As a bridge to modernity, it had a limited existence, but it did provide access up to the 15th century and the exclusion of non-Christians.

Spain under the Christian Monarchs Ferdinand and Isabella: After 1492

Under their joint reigns, neither Muslims nor Jews could remain. Both were expelled and forced to flee what had been their homeland. Even the pleas of the eminent Abravanel could secure only a temporary reprieve for his Sephardic countrymen. A final date was set in 1492. Then they sailed across the Mediterranean to North Africa, Egypt, and Ottoman Turkey, to find new homes. (See Lowney, pp. 239-246).
Selected Bibliography


