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Islamic Civilization's Contribution to Science and Technology

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ABSTRACT

Many European scholars who study the subject of Muslim contributions to science and technology do it with prejudice against the Muslims.

The Muslims have really achieved great things in science; they taught the use of ciphers (sc. Arabic numerals), although they did not invent them, and thus became the founders of the arithmetic of every day; they made algebra an exact science and developed it considerably and laid the foundations of analytical geometry; they were indisputably the founders of plane and spherical trigonometry which, properly speaking, did not exist among the Greeks. In astronomy they made a number of valuable observations. Al Ma'mun, the Abbassid Khalif, had founded at the beginning of the ninth century "the house of Wisdom" (bayt el Hikmah) especially for translations. The Muslims assimilated these works of the ancient and developed them. Philosophy, Mathematics, Astronomy and Medicine were the first subjects to attract the interest of Muslims. We will give an idea of Islamic civilization's contribution to science and technology, the Islamic origins of modern science and civilization and the influence of Islamic science for about 600 years in the world.

Therefore, we will mention a few Muslims scholars who have marked the history of universal science by their discoveries and innovations in the humanities science, mathematics, medicine and technology.

Keywords: Islamic civilization, science and technology, Muslims scholars.

Islamic Civilization's Contribution to Science and Technology

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I. Introduction

In this paper, we would give an idea of the cultural contributions of Islamic civilization to the West, the Islamic origins of modern science and civilization and the influence of Islamic science and learning for about 600 years in the world.

A few scholars who have marked the history of universal science by their discoveries and innovations in the humanities, mathematics, medicine and technology will be mentioned.

Many European scholars who study the subject of Muslim contributions to science and philosophy do it with prejudice against the Muslims.

Bernard Carra de Vaux in his chapter "Astronomy and mathematics", in *Legacy of Islam* felt compelled to begin by disparaging the Arabs.

He said:

"We must not expect to find among the Arabs the same powerful genius, the same gift of scientific imagination, the same "enthusiasm", the same originality of thought that we have among the Greeks.

The Arabs are before all else the pupils of the Greeks, their science are a continuation of Greek science which it preserves, cultivates, and on a number of points develops and perfects."

This is what Carra de Vaux began by saying on the Muslims but a moment later he elaborated and conceded that: the Arabs have really achieved great things in science; they taught the use of ciphers (sc. Arabic numerals), although they did not invent them, and thus became the founders of the arithmetic of every day;

"they made algebra an exact science and developed it considerably and laid the foundations of analytical geometry; they were indisputably the founders of plane and spherical trigonometry which, properly speaking, did not exist among the Greeks. In astronomy they made a number of valuable observations."

The Muslims, with a great open mind went through a gigantesque translation movement from Greek, Indian, and Syriac [1] [2].

Al Ma'mum, the Abbassid Khalif, had founded at the beginning of the ninth century "the house of Wisdom" (bayt el Hikmah) especially for translations.

The Muslims assimilated these works of the ancient and developed them. Philosophy, Mathematics, Astronomy and Medicine were the first subjects to attract the interest of Muslims.

II. Avenues of Transfer of Muslim's science and technology

We give below an outline of the transfer of Islamic science and technology to the West was affected through various avenues [3].

Al-Andalus

There was a remarkable flow of scientific and technological knowledge from the Muslim east to al-Andalus and that was central to its cultural and economic vitality.

Sicily

Sicily was part of the Muslim Empire and did not lag behind in the cultivation of a high standard of civilization including the founding of big institutions for teaching sciences and arts and after Spain, it was a bridge between the Arabic-Islamic civilization and Europe.

Byzantium

The proximity of Byzantium to the Islamic lands and the common borders between them resulted in active

commercial and cultural contacts. Some Arabic scientific works were translated into Greek. Technology was transferred from Islamic lands to Byzantium and from thence to Europe.

The Crusades in Spain

The Crusades against the Muslims in Spain resulted in various kinds of technology transfer to the Christians of Spain.

Arabic Manuscripts in European Libraries

In his research into the avenues through which Copernicus became acquainted with the Arabic theorems on astronomy George Saliba indicated that these theorems were circulating in Italy around the year 1500 and thus Copernicus could have learned about them from his contacts in Italy. Saliba demonstrated that the various collections of Arabic manuscripts preserved in European libraries contain enough evidence to cast doubt on the prevailing notions about the nature of Renaissance science, and to bring to light new evidence about the mobility of scientific ideas between the Islamic world and Renaissance Europe [4].

III. Muslims Scholars

We give some examples of Muslim scientists who marked their time by the genius of their minds and innovations and discoveries in the humanities sciences, mathematics, medicine and technology [5]. Therefore we will mention just one Muslim scholar by specialty or field

***Abdu Rahmn bin Muhammad bin Khaldun* 1332 AD -1406 AD عبد الرحمن بن محمد بن خلدون**

Ibn Khaldun was born on 27 May 1332 /1 Rama n 732. He received a traditional education that was typical for one of his family's rank and status. He learned first at the hands of his father, who was a scholarly person, and not involved in politics like his ancestors. He memorized the Qur'an, learned grammar, jurisprudence, *ad th*, rhetoric, philology, and poetry. He reached a certain proficiency in these subjects and received certification in them. In his autobiography, he mentions the names of the scholars with whom he studied [6].

He is best known for his Muqaddimah as shown in Figure 1 and Figure 2 (known as Prolegomenon in English), which was discovered, evaluated and fully appreciated first by 19th century European scholarship, although it has also had considerable influence on 17th-century Ottoman historians like ajj Khal fa and Mustafa Naima who relied on his theories to analyze the growth and decline of the Ottoman empire. Later in the 19th century, Western scholars recognized him as one of the greatest philosophers to come out of the Muslim world

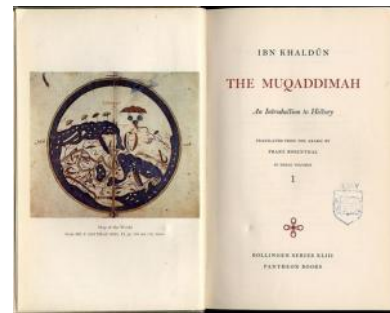


Fig.1 Frontispice of the English translation from Arabic of the *Muqaddima* of Ibn Khaldun in 3 volumes by Franz Rosenthal: *The Muqaddimah: An Introduction to History* (New York: Pantheon Books, 1958).



Fig.2 Autograph of Ibn Khaldun (upper left corner) on a manuscript of the *Muqaddima*

Ibn Khaldun acknowledges that there are turning points in history. He wrote that in his time, he believed the Black Death and Mongol invasions were turning points, as was the development of Europe. His observations and research focused on the etiology of civilizational decline, "the symptoms and the nature of the ills from which civilizations die."

Ibn Khaldun's thesis, that the conquered race will always emulate the conqueror in every way, and his theory about '*abiyya* (group feeling/party spirit) and the role it plays in Bedouin societies is insightful. The genius of this work is his study of the science of human culture, the rise and fall of empires;

Ibn Khaldun termed this the science of '*umr n* (civilization), and it contains many pearls of wisdom. His "Introduction" is his greatest legacy, left for all of humanity and generations to come.

***Muhammad Ibn Musa Al-Khwarizmi* 780 AD-850 AD محمد الخوارزمي بن موسى**

Some words reflect the importance of al-Khwarizmi's contributions to mathematics. "Algebra" is derived from *al-jabr*, one of the two operations he used to solve quadratic equations. *Algorism* and *algorithm* stem from *Algoritmi*, the Latin form of his name. His name is also the origin of (Spanish) *guarismo*- and of (Portuguese) *algarismo*, both meaning digit [7] [8].

Al-Khwarizmi's method of solving linear and quadratic equations worked by first reducing the equation to one of six standard forms (where *b* and *c* are positive integers)

squares equal roots ($ax^2 = bx$)

squares equal number ($ax^2 = c$)

roots equal number ($bx = c$)

squares and roots equal number ($ax^2 + bx = c$)

squares and number equal roots ($ax^2 + c = bx$)
 roots and number equal squares ($bx + c = ax^2$)
 by dividing out the coefficient of the square and using
 the two operations *al-jabr* (Arabic: "restoring" or
 "completion") and *al-muq bala* ("balancing"). *Al-jabr*
 is the process of removing negative units, roots and
 squares from the equation by adding the same quantity
 to each side. For example, $x^2 = 40x - 4x^2$ is reduced to
 $5x^2 = 40x$. *Al-muq bala* is the process of bringing
 quantities of the same type to the same side of the
 equation. For example, $x^2 + 14 = x + 5$ is reduced to
 $x^2 + 9 = x$.

Abu Al-Qasim Al-Zahrawi 936 AD–1013 AD أبو القاسم الزهراوي

Abu al-Qasim al-Zahrawi, known also by his Latin
 name Albucasis, was born near Cordoba in 936 CE. He
 was one of the greatest surgeons of his time. His
 encyclopaedia of surgery was used as standard reference
 work in the subject in all the universities of Europe for
 over five hundred years [9].

His outstanding contribution to medicine is his
 encyclopaedic work *Al-Tasrif li-man 'ajaza 'an al-ta'lif*,
 a long and detailed work in thirty treatises depicted in
 Figure 3 and Figure 4. The *Al-Tasrif*, completed about
 1000 CE, was the result of almost fifty years of medical
 practice and experience [10]. Here is how the author
 expressed his credo in this book:

*"What ever I know, I owe solely to my assiduous
 reading of books of the ancients, to my desire to
 understand them and to appropriate this science; then I
 have added the observation and experience of my whole
 life."*

Figure 5 shows a copper spoon used as a medical
 implement to press down the tongue preserved at the
 Museum of Islamic Art in Cairo. This tool demonstrates
 that the physicians of the Islamic medical tradition
 attached much importance to medicine and medical
 tools in various areas of treatment and how they
 developed them. A detailed description of these tools
 can be found in the book *Al-Tasrif* of al-Zahrawi.



Fig. 3 The beginning of the first article of Part I of a manuscript of "Kitab Al-Tasrif Liman Aajaz an Al-taaleef" authored by Abul Qasim Khalaf ibn Abbas Al-Zahrawi (Albucasis, Bucasis, Zahravius, 936-1013 AD). The page shows his definition of medicine, quoted from Al-Razi, as the preservation of health in healthy individuals and its restoration unto sick individuals as much as possible by human abilities

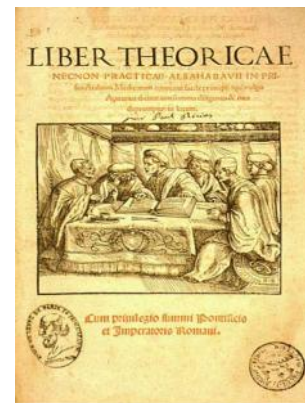


Fig. 4 The 300 pages of the book on surgery represent the first book of this size devoted solely to surgery, which at that time also included dentistry and what one may term surgical dermatology. Here, Al-Zahrawi developed all aspects of surgery and its various branches, from ophthalmology and diseases of the ear, nose, and throat, surgery of the head and neck, to general surgery, obstetrics, gynaecology. Military medicine, urology, and orthopaedic surgery were also included.



Fig. 5 A copper spoon used as a medical implement to press down the tongue (dated from the 3rd century H/ 9th century CE, Abbasid period) preserved at the Museum of Islamic Art in Cairo. This tool demonstrates that the physicians of the Islamic medical tradition attached much importance to medicine and medical tools in various areas of treatment and how they developed them. A detailed description of these tools can be found in the book *Al-Tasrif* of al-Zahrawi

Ab al-Q sim specialized in curing disease by
 cauterization. He invented several devices used during
 surgery, for purposes such as inspection of the interior
 of the urethra, applying and removing foreign bodies
 from the throat, inspection of the ear, etc. He is also
 credited to be the first to describe ectopic pregnancy in
 963, in those days a fatal affliction

Figure 6 shows a page from a 1531 Latin translation by
 Peter Argellata of El Zahrawi's treatise on surgical and
 medical instruments.



Fig. 6 Page from a 1531 Latin translation by Peter Argellata of El Zahrawi's treatise on surgical and medical instruments.

Abu Alizz Ismail Ibn Al Razaz Al-Jazari
1136AD–1206 AD
أبو العز بن إسماعيل بن الرزاز الجزري

The kitab fi ma rifat al-hiyal al-handasiyya (the book of ingenious mechanical devices) by Al-Jazari was completed in 1206.

It was arguably the most comprehensive and methodical compilation of the most current knowledge about automated devices and mechanics.

The work systematically charted out the technological development of a variety of devices and mechanisms that both exemplified and extended existing knowledge on automata and automation.

Al-Jazari constructed a variety of water clocks and candle clocks. These included a portable water-powered scribe clock, which was a meter high and half a meter wide, reconstructed successfully at the Science Museum (London) in 1976, Al-Jazari also invented monumental water-powered astronomical clocks which displayed moving models of the Sun, Moon, and stars.



Fig. 7 One of al-Jazari's candle clocks.

The elephant clock was described by al-Jazari in 1206 is notable for several innovations. It was the first clock in which an automaton reacted after certain intervals of time (in this case, a humanoid robot striking the cymbal and a mechanical robotic bird chirping) and the first water clock to accurately record the passage of the temporal hours to match the uneven length of days throughout the year [11] [12].

Figure 8 shows two photos of the fascinating reproduction of the 8.5 meters high elephant clock of Al-Jazari in Ibn Battuta Mall, Dubai



Fig. 8 Two photos of the fascinating reproduction of the 8.5 meters high elephant clock of Al-Jazari in Ibn Battuta Mall, Dubai

IV. Conclusion

We want to emphasize the Islamic origins of modern science and civilization, and the ascendancy of Islamic science and learning in the world for over 600 years.

The West has generally maintained a conspiracy of silence about its rejuvenation through medieval Islam (imitative-innovative assimilation of Islamic culture by non-Muslims - Islam is the adoption of Islamic culture ideal religion and culture in behavioral).

In more recent times a number of Western scholars and Muslim scholars writing in Western languages, have been bringing to the dissemination of Islamic science, philosophy, and other aspects of Islamic culture medieval West.

This fact of medieval Islamicization of the West must be fully documented, accepted and integrated into the literature and instructional materials of schools and colleges around the world and in the promotion of international understanding and cooperation development and peace in the world.

V. REFERENCES

- [1] El Diwani, Rachida. "Islamic Contributions to the West." Lecture. Web. 25 June 2011.
www.lssu.edu/.../jswedene/FULBRIGHT_FILES/Islamic%20Contributions%20to%20the%20West.doc.
- [2] Arnold, T., Guillaume, A. (ed) *The Legacy of Islam*, Oxford, Clarendon Press, 1931.
- [3] History of Science and Technology in Islam.
<http://www.history-science-technology.com/articles/articles%207.htm>
- [4] Saliba, George, "Mediterranean Crossings: Islamic Science in Renaissance Europe", an article on the Internet:
<http://ccnmtl.columbia.edu/services/dropoff/saliba/document/>
- [5] Islamic contributions to Medieval Europe.
http://en.wikipedia.org/wiki/Islamic_contributions_to_Medieval_Europe
- [6] Briffault, *The Making of Humanity*, London, 1928.
- [7] Boyer, Carl B. (1991). "The Arabic Hegemony". *A History of Mathematics* (Second ed.). John Wiley & Sons, Inc.. ISBN 0471543977.
- [8] Berggren, J. Lennart (1986). *Episodes in the Mathematics of Medieval Islam*. New York: Springer Science+Business Media. ISBN 0-387-96318-9
- [9] Ahmad, Z. (St Thomas' Hospital) (2007), "Al-Zahrawi - The Father of Surgery", *ANZ Journal of Surgery* **77** (Suppl. 1): A83, doi:10.1111/j.1445-2197.2007.04130_8.x
- [10] Al-Zahr w , Ab al-Q sim Khalaf ibn Abb s; Studies, Gustave E. von Grunebaum Center for Near Eastern (1973). *Albucasis on surgery and instruments*. University of California Press. ISBN 978-0-520-01532-6.
- [11] C. G. Ludlow and A. S. Bahrani, 1978, "Mechanical Engineering during the Early Islamic Period", I. Mech. E, The Chartered Mechanical Engineer, pp. 79-83.
- [12] Hill, Donald R., Studies in Medieval Islamic Technology, edited by David King, Ashgate, U.K., 1998, Article II, p. 229.