THE HONOR OF HUMILITY:

DISCOVERING DIGNITY IN CHALLENGING PRIDE

[MUSLIMS IN SCIENCE]

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Key Discoveries

Taken From
"Muslims Contributions to Science" - http://www.iupui.edu/~msaiupui/contributiontoscinece.htm
"The Origins of Islamic Science" - http://muslimheritage.com/article/origins-islamic-science#sec6
"Islam and Science" - http://www.oxfordislamicstudies.com/Public/focus/essay1009_science.html

BACKGROUND

At the beginning of the 7th century CE, very few Arabs could read, write or calculate. However, an elite group of traders who travelled from such towns as Makkah, Yathrib, Khaybar and from Yemen to the centres of ancient civilizations, including Syria, Mesopotamia and Egypt, were open to outside influences. A handful of traders were familiar with reading and writing of one sort or another. Among them were members of the Quraysh tribe and it was they who brought foreign influences into Arabian trading centres. Nevertheless, most of the population of Arabia were pastoralists who often quarrelled among themselves. It was only during the pilgrimage season to Makkah that fighting was abandoned by common consent. On the whole the Arabian environment did not encourage the growth of civilized values. It is hard to see how such a primitive people could emerge from centuries of backwardness to a level of culture.

The march of the Arabs from darkness to light is one of the conundrums of history and few historians have adequately explained the phenomena. By harnessing their latent physical and spiritual power, the Arabs somehow reconstructed their own lives. Having begun with a tabula rasa (blank slate), they achieved an astonishing advancement in their social, political and intellectual life within a very short time. How did they do this? Incredible though it may seem to any uninitiated student of history, these Arabs not only changed their way of thinking but also their view of the world and their role in it. Hardly had they time to imbibe the teachings of a visionary like the Prophet Muhammad ibn Abdullah then they became a powerful conquering force that had won an empire within fifty years of their mentor's death. How could such a people have made any contribution towards the progress of any science, be it natural, physical or social?

There is a tendency among some modern writers, including Abdulhamid Sabra and Muhsin Mahdi, to describe Islamic Science as 'Arabic Science'. One should not attach any special significance to this new description of an old subject. Is it simply a question of terminology and nothing else? What exactly is Arabic Science?

The science which the early Muslims acquired through the translation of ancient books on scientific texts came to be known as Islamic Science, which is currently being described by some as Arabic science. Sabra and Sarton tried to define Arabic science,which is so called because, first, it owed its beginning to Arab initiative and patronage; secondly, because such science used Arabic as its linguistic medium; and thirdly, because the Arabic language was seen as a unifying factor which enabled the ancient scientific heritage to be carried, which was a fact of specific significance for 'the general history of science and culture as well as for the history of science in Islam. Sabra also acknowledged that premodern translations into Arabic led to 'an accumulation of scientific learning that surpassed anything previously known'. On the other hand, George Sarton compares the Arab acquisition of Greek and Indo-Persian science to the Meiji assimilation of modern science and technology. Islamic rulers of the Abbasid dynasty made the best of Greek knowledge available in Arabic. Pleading for an understanding of the Arab contribution to science Sarton states that 'the scientific books written in Arabic during the Middle Ages were, for a few centuries, the main vehicle of the living science'. Moreover, he notes that some historians tried to minimise the Arab achievements and contributions to science by claiming that Arabic science lacked originality and that the

Arabs were 'nothing but copycats'. Such a judgment, according to Sarton, was wrong.

Sarton justifies his statement by saying that the Arabs created a genuine 'hunger for knowledge' and that they not only translated from the Greek and other sources but before long had begun to transform the knowledge they had gained into something new. For instance, in the field of mathematics, rather than copy Greek and Sanskrit sources they fertilized Greek sources with Hindu ones. Sarton also claims that 'if these were not inventions, then there are no inventions in science. A scientific invention is simply the weaving together of separate threads and the tying of new knots. There are no inventions ex nihilo'.

It is possible that Arab scientists did not realise the value of their discoveries. Thousands of Arabic manuscripts on science are scattered in different collections across the globe. Until these texts are edited and analyzed historians of science cannot know the true extent of the Arab contribution to premodern science.

Professor Muhsin Mahdi explains why the study of Arabic science is desirable: "In the absence of an adequate historiography of the history of Arabic science, a preliminary typology of approaches may prove useful.

'In the Arab world, widespread interest in the history of Arabic science is due to the special status of modern science and the perception that modern science must be acquired if the third world is to modernise itself; the fact that Arabic science existed in the past is meant to prove that the acquisition of modern science is at least possible. In the West, the relative neglect of the history of Arabic science is part of the neglect of the history of science in general... The study of Arabic science in the Western world aims at discovering those aspects of Arabic science in which advances were made or which contributed to the rise of modern science; and the study of Arabic science in the Arab world is meant to prepare the way for the appropriation of modern science and technology. In every case modern science and technology is taken to be the aim of scientific development and the measure by which earlier science is to be judged. History, on the other hand, is thought to be a method to be used in search for, collecting, organizing and presenting the Arabic science of the past.: ....What then is the history of Arabic science -Arabic science and philosophy cannot be separated in the period under discussion without doing violence to each of them; and generally speaking, science should be understood to include the philosophical sciences." These statements are selected at random on account of their relevance to our investigation into Arabic or Islamic science.

Due to shortage of serious studies on Arab science discoveries (at the end of the second millennium CE) our understanding of its origins and achievements must remain incomplete. Some of the relevant facts, however, could be summarised.

ASTRONOMY

Astronomy can be identified by several Arabic terms, such as 'ilm al-Nujum or Science of the Stars; 'ilm al-Hay'ah, or Science of the āure (of the heaven), and 'ilm al-Falak, or Science of the Celestial Orb. The observation of stars and the movement of heavenly bodies is perhaps as old as civilization. To the pre-Islamic Arabs, the division of the solar year into different periods was known as Anwa' (singular naw'). The multiplicity of terms may suggest that astronomy was variously defined. Until foreign books on the subject were translated in the 2nd/8th century, Arab interest was based on the science of Anwa'.

On the whole, this interest was a constant factor in Islamic culture. It has been claimed with some justification that the number of scientists involved in the study of Arabic astronomy was con-

siderably higher than in any other science. Moreover, more books have been written on this subject than on any other branch of science; the number of private or public observatories was also highly significant. Belletrists, philosophers, physicians, mathematicians, geographers, royal princes and ministers showed an equal interest in astronomical topics. One only has to read the biographies of scientists and philosophers in Ibn al-Qifti's Ta'rikh al-hukama' to understand how true this is. Moreover, modern scholars, including Régis Morelon have recognised the fact that astronomy held a pride of place among medieval Arabs and Muslims of diverse ethnic backgrounds.

Muslims who face the sacred mosque of the Ka'bah at their daily prayer and who have oriented all mosques towards this most sacred mosque, called for a scientific method of fixing the qiblah according to precise knowledge of mathematical astronomy. In the light of this fact, the following statement is significant: 'Muslim astronomers from the 9th century onwards also computed tables displaying the qiblah as a function of terrestrial latitude and longitude, some based on approximate formulae and others based on the accurate formula'. Many astronomical tables using geographical coordinates were a feature of astronomical handbooks. Books were written on how to use astrolabes and varieties of quadrants to locate the qiblah. Compass boxes featuring with the qiblah were available from the Mamluk period.

Although an interest in astronomy was an ancient one, it was not until the 8th and 9th centuries CE that any scientific treatise on the subject became known to them. But help was at hand. Shortly after 117AH/735CE, the Zij al-Arkand (an astronomical table of Arkand) was translated. This served as the basis for other astronomical tables (Zijes). Some elements of Arkand were derived from Brahmagupta's Khandakhadyaka of 665 CE, which probably belonged to the Midnight School (Ardharatrika) of Aryabhata. Nearly four decades later, when a traveller from India presented an astronomical treatise to Caliph al-Mansur, it was translated into Arabic at the Caliph's order by Ibrahim al-Fazari. This text became known as Kitab al-Sindhind, a book on Indian Sidhantas relating to astronomy. Some Persian works on astronomy, for instance the Zij-i Shah (Royal Astronomical Tables) of King Yazdijird III (632-52 CE), were translated into Arabic during the latter part of the 8th century. Shortly afterwards, the Zij Shahyaran (Astronomical Table of Anushiravan (written ca 556 CE) was also translated into Arabic. Thus the Indian and Sassanian influence on astronomy preceded that of the Greeks. As a result of the translation of Ptolemy's Almagest (Kitab al-Majisti) into Arabic in the 9th century, the fascination with astronomy became anchored in ancient astronomical science. Such a translation process was completed around 900CE with al-Battani's work Al-Zij al-Sabi'i (Sabaean Astronomical Tables).

These astronomical tables were used by the scholars of the Muslim world to construct tables for their royal patrons in the 9th century. The ancient tools of astronomy, such as the astrolabe (Ar. Usturlab) and sundial, became familiar to the Arabs. One Arabic source claimed that Ibrahim b. Habib al-Fazari (d. 8th century CE), a descendant of the Prophet's Companion Samurah ibn Jundub, was the first Arab to make an astrolabe.

Many astronomers, including Ibrahim al-Fazari, Masha'Allah al-Munajjim al-Yahudi, Habash al-Hasib, Jabir ibn Hayyan, HibatAllah ibn al-Husayn al-Baghdadi, Muhammad ibn Musa al-Khwarizmi and al-Fath ibn Najabah, were credited with writing books on how to construct an astrolabe, including Kitab al-'Amal bi'l-Asturlab al-Musattah and Kitab Sina'at al-Asturlab wa'l-'Amal biha.

Normally, the Arabs would use the planispheric astrolabe (asturlab al-musattah), the most versatile instrument of its type at this time in medieval Islamic lands and in the West. There, the spherical astrolabe (al-asturlab al-kuri) was also used.

During the reign of Caliph al-Ma'mun, an astronomer, Yahya ibn Abi Mansur, became celebrated for recording astronomical observations from Shammasiyah in Baghdad and from the top of the Qasiyun mountain near Damascus in the years 215-217 AH/830-832 CE. Observatories were built in various cities, such as Baghdad, Cairo, Maragha, Tabriz, Samarqand, Istanbul and Delhi.

The extent of Muslim advancement in astronomy was measured by the critical response of Ibn al-Haytham (d.1039) to Ptolemy's books the Almagest (Kitab al-Mjjisti) and Planetary Hypothesis in his famous treatise al-Shukuk 'ala Batlamiyus. His criticism was not limited to Ptolemy's planetary models but extended to other scientific fields, such as the optics. Naturally, Ibn al-Haytham acknowledged Ptolemy's excellence as a scientist and then proceeded to discuss the optical effect of the sun's movement. He noted that the size of the sun varied at different times of the day: it appears larger when on the horizon than it does in the middle of the sky. He also noted Ptolemy's contradictory statements regarding planetary motion and the epicycle of the planets.

According to one analysis, the Greek theories of vision were principally: (i) the object-copy theory, and (ii) the tactile theory. The latter was questioned by al-Razi and Ibn Sina. Ibn al-Haytham (Alhazen) refuted the object-copy theory and concluded that 'we see by refraction'. This theory was expounded in his treatise Kitab al-Manazir (Book of Optics), which remained influential (through a Latin translation) in Europe until the late 16th century. According to Gül Russel, "Ibn al-Haytham showed that the object itself is not sensed at all, but that innumerable points of light deflected from the surface of the object to the eye resulted in the sensing of an image which is formed according to optical principles." In order to prove this theory, Ibn al-Haytham studied the anatomy of the eye and the effect of light on vision. This original theory of vision repudiated the Greek theory of vision. Thus, it was that although Arabic science was initially influenced by Greek theories, in some fields the scientists of Islam subsequently advanced the subject beyond the Greek boundaries.

Among other famous astronomers who made significant contribution to astronomy were al-Biruni and Nasir al-Din al-Tusi.

While visiting Palestine, a 12th century Spanish Jewish traveller, Benjamin of Tudela, recorded the Muslim and Jewish role in astronomy of his time:

"To learn about planetary motions, they [the scholars of the Islamic world] studied Ptolemy's Almagest, which they translated from old Greek into Arabic. The Jews, in turn, translated some works of the Muslim astronomers out of Arabic into Hebrew and Latin and European vernaculars. This was not like the field of pharmacology, where Jews learned by trading in the products; astronomy was a science of ideas, and Jews learned its new ideas by translating. The Muslims built magnificent observatories, of which the best contained the most advanced armillary spheres, quadrants, and astrolabes, supplementing a grand variety of sundials and water clocks, alidades, and double-pointed alidades called compasses. The astronomers among the Jews had to have regarded all this with envy. Few Jews could find a place of work in the Muslims' grand observatories, and for financial and religious reasons the Jews had no equivalent observatories, so Jews interested in astronomy had to work along theoretical lines. Yet the Jews' deemed the Muslim astronomers' calendar seriously deficient, for the Islamic year is significantly shorter than the solar year (just like the calendar of the ancient Hebrews).The Muslim calendar consists of twelve months, into which no month is intercalated, so that their year has 354 or 355 days. It takes 103 Muslim years to measure the same duration as 100 of our years".

MATHEMATICS

Due to its diverse origins, Arabic/Islamic science had a syncretic character. It has been claimed that Muslims inherited a complex set of mathematical ideas, which had been developed in ancient Mesopotamia, Greece, Persia and India. The Greek contribution was mainly in Euclidean geometry; the Persian and Indian influences were detected in trigonometry and in numerals, which came into use from the 2nd century AH/8th century CE; Egyptian ideas related to calendar computation; ancient Babylonia provided the sexagesimal system, which formed the basis of Hisab al-Jummal (i.e. computing with the letters of the alphabet). Writing in his short Encyclopaedia of Sciences (Mafatih al-'Ulum), Abu 'AbdAllah Muhammad b. Ahmad al-Khwarizmi (ca 977 CE) briefly discussed the mathematics of his epoch, citing the Indian numerals, algebra, trigonometry and alphabetical arithmetic or Hisab al-Jummal (also known as Hisab al-Abjadiyah, the abjad system), in which number values were attributed to the letters of the Arabic alphabet. This method of computing was quoted as follows:

Table of Sequential & Gematrical Values of the Arabic Alphabet

Sequential Value	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Arabic Letters	ا	ب	ج	د	ه	و	ز	ح	ط	ي	ك	ل	م	ن
English	elif	be	cim	dal	he	vav	ze	ha	tı	ye	kef	lam	mim	nun
Gematrical Value	1	2	3	4	5	6	7	8	9	10	20	30	40	50
Sequential Value	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Arabic Letters	س	ع	ف	ص	ق	ر	ش	ت	ث	خ	ذ	ض	ظ	غ
English	sin	ayn	fe	sad	kaf	re	şin	te	se	hı	zel	dad	zı	ğayn
Gematrical Value	60	70	80	90	100	200	300	400	500	600	700	800	900	1000

Although this alphabetical arithmetic existed from pre-Islamic to early Islamic times, there were other types of arithmetic used, known as Hisab al-Yad or Finger calculation and Hisab al-'uqud (arithmetic of knots). The art of finger-reckoning was also identified in Arabic works as 'the arithmetic of the Rum (i.e.,the Byzantines) and the Arabs'. When and how it came to the Islamic world has yet to be explained fully, but it is likely that before Islam Arab merchants learnt to count using their fingers. The system afterwards seems to have been spread throughout the civilized world. This type of arithmetic was used in government chanceries during the early Caliphates of Madinah and the Umayyad dynasty of Damascus.

Initially, Islam inspired the Arabs to apply mathematics in order to resolve the Islamic Law of Inheritance ('ilm al-Fara'id), which subsequently was able to outline the formula for assessing how an estate could be divided among the beneficiaries. This process often involved the application of algebra. Thus an incentive now existed for Muslims to learn mathematics. Assessing the shares, or quotas, of female relatives of the first and second degree required specialised knowledge. Usually, all Muslim jurists (fuqaha') or judges were called upon to administer an estate. Hence it was a practical as well as a legal necessity for Muslims to be familiar with mathematics.

Muhammad ibn Musa al-Khwarizmi, a Muslim of Central Asian origin, who lived in Baghdad in the early ninth century, wrote the earliest Arabic works on arithmetic. He was associated with Bayt al-Hikmah (the House of Wisdom), a research library in the Abbasid capital. Between 813 and 833 CE, he composed some original treatises on mathematics and it is to him that we owe the origin of

the term Algebra, which appears in the title of his Hisab al-Jabr wa'-l-Muqabala and which was later translated by Robert of Chester as Liber Algebras et al-Mucabala. Another translation of this work, Liber De Jebra et Almucabola, rendered by Jerard of Cremona (ca 1114-87CE), helped advance European mathematical thought.

Al-Khwarizmi's book laid the foundation of modern algebra and anotrher of his publications al-Jam' wa'l-Tafriq bi-'l-Hisab al-Hindi (Book of Addition and Subtraction in Indian Mathematics) introduced the Indian place-number system into the 10th-century Andalus (Spain). A certain John of Seville made a Latin translation of this book, as Liber Alchorismi de practica arismetrice, which, according to André Allard, is 'the most detailed and complete of all the ancient works stemming from the arithmetic of al-Khwarizmi'. Only this translation has survived, the original Arabic text having presumably been lost.

It was probably this same work that was referred to in a 13th-century Latin manuscript as Dixit Algorizmi, which had a chapter on ordinary fractions and another on sexagesimal fractions.

Finally, another of al-Khawarizmi's works, as indicated by Ibn al-Qifti, was al-Zij al-Sindhind which comprised al-Zij al-Sindhind al-Awwal and al-Zij al-Sindhind al-Thani, both dealing with astronomical tables. This work was translated into Latin around 1142-46 by Adelard of Bath and influenced the Toledan Tables of Gerard. On the whole, al-Khwarizmi's name was associated not only with Algebra but also with the introduction of the term algorism, or Algorithm, into European science.

Al-Khwarizmi was also credited with writing a book on 'the Image of the Earth' (Kitab Surat al-Ard) in which the latitude and longitude of towns, cities, mountains, seas and rivers were given, and the earth was shown to be divided into seven climes following the Ptolemaic system. Due to the originality of his work al-Khwarizmi's work was linked with the origins of astronomy and mathematics in Islamic society. Kramers claimed that al-Khwarizmi was the 'prototype of the Islamic scholar who had a very wide field of interest and at the same time was connected with the traditional Islamic sciences by also being the author of a Ta'rikh or Historical Chronicle'. Secondly, he presented the pre-Islamic sciences in an Islamic literary form. Thirdly, he applied science to the practical legal needs of the Islamic community, such as the question of fixing the qiblah or direction to the Ka'bah in Makkah. Fourthly, his writings contained several pre-Islamic concepts, such as the earth's position in the universe, and the seven climes (aqalim) and his introduction of Indian numerals, which became a permanent feature of science in Islamic societies for centuries.

The many successors of al-Khwarizmi included Abu Kamil, who wrote a celebrated book on algebra ca 880 CE. Other mathematicians who followed the Khwarizmian school of algebra were Sind ibn 'Ali, Sinan b. Fath, Abdul-Hamid Ibn Turk and Abu 'l-Wafa' al-Bujazani. These mathematicians in turn had their disciples who included Abu 'AbdAllah al-Mahani, al-Khujandi and al-Karaji during the 10th century. Although 'Umar al-Khayyam is known in Europe through Fitzgerald's translation of his Ruba'iyat poems, he was better known in his lifetime as a metaphysician, astronomer and mathematician. The Algebra of 'Umar al-Khayyam, according to Nasr, was, on account of his thoroughness and clarity, one of the most outstanding mathematical texts of the medieval period. As an astronomer, 'Umar al-Khayyam will be remembered for helping to construct the Jalali calendar, named after the Saljuq Sultan Jalal al-Din Malik Shah (d.485/1092), which was more accurate than the Gregorian calendar.

The Arab belletrist al-Jahiz rightly stated that members of the royal family ought to acquire the knowledge of genealogy, history and jurisprudence, soldiers should know about warfare (al-Maghazi) and should read biographies (siyar), just as traders ought to be familiar with arithmetic and

bookkeeping. It was the knowledge of geometry that made a profound impact on Islamic art and architecture, especially in the geometric decoration of windows, and domes and the use of mosaic tiles.

MEDICINE

In pre-Islamic Arabia medicine consisted of herbal and natural remedies. The Prophet Muhammad's statements regarding cleanliness, diet, sickness and cure were collected together in books, which came to be known as Tibb al-Nabawi (or the Prophetic medicine) but little is known about how this medicine was practiced. The Shi'ite Muslims added to the medical canon with Tibb al-A'immah or medicine of the Imams (Leaders).

There is also some indication of foreign medical influence reaching Arabia from neighbouring lands, such as Persia, where the Arabian physician al-Harith ibn Kaladah al-Thaqafi studied medicine in Jundishapur, the ancient seat of a hospital and medical college. Persian, Indian and Nestorian physicians were said to have practised at the Jundishapur hospital and to have translated various medical books from Indian and Syriac texts into Pahlavi. However, recent research has questioned whether a hospital and medical school ever existed at Jundishapur in Ahwaz. Instead, it is claimed that Jundishapur had only an infirmary, and no medical school. What interests us here, however, is that al-Harith ibn Kaladah al-Thaqafi studied medicine in Jundishapur. Significantly, Ibn Kaladah was a contemporary of the Prophet Muhammad, and though his existence has recently been doubted, he was a real person. It is known that he originated in Ta'if and belonged to the tribe of Thaqif. His link with the Jundishapur centre suggests a Persian influence in the advancement of the early Arabian medicine. Harith was reported to have met the Prophet during the Farewell Pilgrimage, to have cured a sick Sa'd ibn Abi Waqqas. Harith's conversion to Islam, however, has been questioned. From the little we know of his medical theories, it is possible to conclude that his "main point was the Arab view that excess of diet was the main cause of all disease. He also recommended the simplest possible way of life. Diet should be of the plainest. Water is to be preferred to wine and salt and dried meat to fresh meat. The dietary should include fruit. The hot bath should be taken before meals".

There is also evidence to suggest that a physician, Ibn Abi Rimthah, used surgery to remove a mole from the Prophet's back. For this, according to al-Qifti, Ibn Abi Rimthah was given the title of 'Tabibu-Allah' (literally God's physician), whereas al-Harith b. Kaladah was known as the 'physician of the Arabs' (Tabib al-'Arab), just as al-Kindi was called the philosopher of the Arabs (Faylasuf al-'Arab).

During the Umayyad period (660-750 CE), parts of North Africa, Spain, eastern and northern Persia, and the Indian province of Sind were being conquered. Such conquest started a process of gradual integration of the Arabs with non-Arabs, between Muslims with non-Muslims, and allowed the intrusion of non-Muslim ideas (including Greek, Persian and Indian secular traditions) into the formation of literature and science. It was at Jundishapur that ancient Indian writings on toxicology were translated from Sanskrit into Arabic (e.g. Kitab al-Sumum, according to Hajji Khalifah). Elsewhere, it has been claimed that knowledge of Indian drugs, including poisons, spread from Jundishapur to the Middle East. 'Ali b. Sahl Rabban al-Tabari (d. ca 240/854-5CE), in the first systematic medical work in Arabic, Firdaws al-Hikmah (The Paradise of Wisdom), expounded upon the Arab knowledge of Indian medicine, and Syriac and Greek medical literature during the 9th century CE. Elsewhere, the belletrist al-Jahiz (d.255/869) also acknowledged the advances made by Indians in the sciences of astronomy, mathematics and medicine and pharmacology. Modern research has also discovered that contact existed between the Arabs and the Chinese, and that Chinese medical herbs were used in West Asia. It has been suggested that the Arab polymath al-Kindi indicated

in his pharmacopeia that Arab physicians were already using Chinese herbs during the 9th century CE. A century later, Ibn Sina recorded that seventeen medical herbs imported from China were currently in use and that even the Chinese pulse theory was applied by some physicians. Chinese medical influence reached a peak in Persia and the rest of the Middle East during the era of the Ilkhanids (1256-1335), when Rashid al-Din Fadlullah, the wazir of Ghazan Khan (1295-1304 CE) had some Chinese medical books translated into Persian, including Tansuk-Nama.

Among the earliest notable translations into Arabic during the Umayyad period were the Kunnash (Pandects) of Ahron al-Qass, a Priest of pre-Islamic Alexandria. The translator was a Basran-born Jewish Physician, Masarjis or Masarjawaih who lived, according to Ibn al-Qifti, during the reign of 'Umar II (d. 101 AH/720 CE) and who was credited with writing medical treatises, including Kitab Qawi al-At'imah (a treatise on food) and Kitab Qawi al-Maqaqir (a book on drugs). A book on the Substitution of Remedies (Kitab fi Abdal al-Adwiyah) was also attributed to Masarjawaih, but modern commentators, such as Max Meyerhof, have rejected the claim. Little is known of Masarjawaih's medical practice, but we know that he prescribed eating raw cucumber on an empty stomach for a patient who complained of constipation.

In Damascus, during the Umayyad era, some events of medical significance included the amputation of a leg infected with gangrene. In this rare case the leg belonged to a celebrated Arab, namely 'Urwah ibn al-Zubayr, a brother of 'AbdAllah ibn al-Zubayr ibn al- 'Awwam. While visiting (ca 85 AH/785 CE) the Umayyad prince al-Walid, he became afflicted with gangrene (al-ikla) in his foot. 'Urwah lived for another eight years, after the leg was amputated in the presence of al-Walid b. 'Abd al-Malik, the future Umayyad Caliph (r.86-96/705-15 CE) and died in Madinah in 94 AH/713 CE. This celebrated amputation was also recorded by Abu 'l-Faraj al-Isfahani in his entertaining literature Kitab al-Aghani, and Ibn al-Jawzi in his Dhamm al-Hawa'.

It is clear from our sources that Islamic science and medicine developed rapidly in Baghdad under the early 'Abbasid Caliphs, especially al-Mansur, Harun al-Rashid and al-Ma'mun. Among the prominent medical personalities of this period were members of the Bukhtishu' family who moved from Jundishapur and established a prosperous medical practice in Baghdad. The translation into Arabic by the physician Hunayn ibn Ishaq and his son, Ishaq b. Hunayn, and others, of medical treatises, mainly from Greek, brought Arabic medicine under the Hellenistic medical influence. In particular, the translations of Hunayn made the works of Hippocrates and Galen available and shaped the Arabic medical vocabulary in classical Arabic. Hunayn's original medical treatises include Kitab al-Masa'il fi'l-Tibb (a book on medical problems) and Kitab al-'Ashar Maqalat fi 'l-'Ayn (Ten Treatises on the Eye), both of which became standard works during the 9th and 10th century. The first was used by the Hisbah officers (municipal officials) to assess the professional qualifications of physicians. Hunayn also edited the translation of Istafan bin Basil of the Materia Medica of Pedanius Dioscorides (1st century BCE). This was variously titled as Hayula 'ilaj al-Tibb, Kitab al-Adwiyah al-Mufrada and Kitab al-Hasha'ish, during the 3rd century AH/9th century CE. This translation provoked a number of commentaries and these served as the most valuable works of Arabic pharmacology. Al-Biruni's Kitab al-Saydalah (The Book of Drugs), which records 850 drugs, survives in a modern edition. The most notable Arabic book of this genre is Kitab al-Mughni fi'l-Adwiyat al-Mufradah (a treatise on simple drugs) by the 13th century Andalusian Ibn al-Baytar. This records 1400 drugs of mineral, vegetable and animal origin.

The publication of medical works by Muhammad ibn Zakariyya' al-Razi (Latinised Rhazes) (d. 313 AH/925 CE), Ali b. 'Abbas al-Majusi, the Andalusian surgeon Abu 'l-Qasim al-Zahrawi, the ophthalmologist 'Ali ibn 'Isa, and Abu 'Ali Ibn Sina, hailed by his contemporaries as the prince of the physicians (Ra'is al-atibba'), marked a high point in Islamic medicine.

Between the 9th and 14th centuries, Islamic medicine and pharmacology advanced to such a point that some medical works which were translated into Latin in Toledo and southern Italy influenced the development of medicine in medieval Europe. The achievements of this Golden Age are worth noting.

Al-Razi, the great medical systematiser of all Muslim medical authorities, derived his surname from his native city Rayy, where he became the chief physician of the hospital, later holding the same position in Baghdad. Al-Razi (d. 313 AH/925 CE), was the greatest clinician and pathologist of his time. His notebooks, which comprised 25 volumes of Kitab al-Hawi fi'l-Tibb (The Comprehensive Book of Medicine), were translated into Latin as the Continens by the Jewish physician Faraj bin Salim or Farraguth in 1279 CE. However, al-Razi's magnu opus, according to some, was not al-Hawi, but Kitab al-Jami' al-Kabir (the Great Medical Compendium). Besides this, a treatise on Smallpox and Measles (Kitab al-Jadari wa'l-Hasbah), which was translated into Latin and other European languages as Liber de Pestilentia, earned him international recognition. Other medical works included Kitab al-Hasa fi 'l-Kula wa-'l-mathana (Stones in the kidney and bladder) and Kitab al-Mansuri (Latin Liber Medicinalis ad al Mansorem), which was dedicated to his patron Mansur ibn Ishaq, the Samanid governor of Rayy. He also wrote a book on psychic therapy, Al-Tibb al-Ruhani (lit. Spiritual Medicine), in which he provided insights into the theory and practice of clinical and psychiatric medicine. Like Galen, he believed that a physician should also be a philosopher, but his independence was articulated in his Shukuk 'ala Jalinus (Doubts about Galen). His "clinical records did not conform to Galen's description of the course of fever. And in some cases he finds that his clinical experience exceeds Galen's".

After al-Razi, another influential figure in Islamic medicine was 'Ali b. 'Abbas al-Majusi (Latin Haly Abbas) whose famous Complete Book of the Medical Art (Kitab Kamil al-Sina'ah al-Tibbiyah), also known as Kitab al-Maliki (Latin Liber Regius), was written while he was director of the 'Adhudi Hospital in Baghdad. The work contained important observations on medical theories and diagnoses and was a dominant text throughout the East. A contemporary of Haly Abbas, Abu 'l-Qasim al-Zahrawi (in Latin Abulcasis/Albucasis), who served the Andalusian Caliph Abd al-Rahman III al-Nasir (300-350/912-961) in Cordoba. He wrote Kitab al-Tasrif li-man 'ajiza 'an al-Ta'lif, a medical encyclopaedia, dealing with 325 diseases. The part of this book devoted to surgery described cautery, incisions, bloodletting and bonesetting. All surgical methods together with the tools were illustrated.

In the history of Islamic medicine, Abu Ali al-Husayn ibn Sina (known in the West as Avicenna) was a towering figure. Born at Afshana near Bukhara in 370 AH /980 CE, he died at Hamadhan in 428/1037CE. Like al-Razi, he was a great physician and philosopher and wrote a dozen medical works, although the historian Ibn al-Qifti listed a few more. Among these were A Book of Healing (Kitab al-Shifa'), in 18 volumes, Kitab al-Qanun fi 'l-Tibb (The Canon of Medicine) in 14 volumes, Kitab al-Adwiyah al-Qalbiyah (Medicine of the Heart)), Kitab al-Qawlanj (Book of Colic) and a mnemonic in verse for physicians, al-'Urjuzah fi 'l-Tibb. Ibn Sina's full bibliography includes 270 titles. However, his magnum opus was Kitab al-Qanun fi 'l-Tibb or The Canon of Medicine, which was, according to Goichon, 'the clear and ordered "Summa" of all the medical knowledge of Ibn Sina's time, augmented from his own observations". This Canon (Qanun), through its European translations, became 'a kind of bible of medieval medicine, replacing to a certain extent the works of al-Razi. It was printed in Rome as early as 1593, shortly after the introduction of Arabic printing in Europe.'

It is tempting to compare the stature of Al-Razi and Ibn Sina as medical authorities of the pre-modern world. It has been aptly noted that Al-Razi made his original contribution in the practice of medicine, whereas Ibn Sina gained prominence in medical theory. Despite their greatness, both

were subjected to harsh criticism by al-Ka'bi and 'Abd al-Latif Baghdadi respectively. Islamic medicine declined after the death of Ibn Sina, but many commentaries on and epitomes of the Canon (Qanun) were made by successive generations of physicians. Among the commentaries, the most notable was that of Ibn al-Nafis (d. 687/1288), the chief physician in Cairo, who composed Sharh al-Qanun, a commentary on the entire Canon, and Mujiz al-Qanun and an epitome Sharh Tashrih al-Qanun, which he devoted to comment on its anatomical and physiological aspects, It is in the latter that Ibn al-Nafis described his discovery of the lesser or pulmonary circulation of the blood, which made him famous.

Within a century of his death, Ibn Sina's works began to appear in European translations. Between 1170 and 1187, Gerard of Cremona translated the Canon of medicine at the order of Frederick Barbarossa. Even lesser works of Ibn Sina were translated, including the Sufficientia by Gundisalvus, whilst Armengaud translated Canticum de Medicina (Urjuza fi'l-tibb) with Ibn Rushd's commentary on it; and Arnold of Villanova did the same in De Virivus Cordis. Michael Scot, in collaboration with Andrew the Jew, translated some works of Ibn Sina into Latin between 1175 and 1232 CE. The death in 1285 of Farraguth, the translator of Al-Razis' Continens, brought the era of Latin translations to an end. The Universities of Montpellier and Bologna, taught the works of Al-Razi and Ibn Sina in their medical schools. "From the 12th to the 17th century, Rhazes and Avicenna were held superior even to Hippocrates and Galen". Al-Razi is depicted in the stained glass of the chapel in Princeton University, and in the University of Brussels lectures on Ibn Sina were given until 1909.

Al-Razi's book Diseases in Children may justifiably earn him the title of father of pediatrics. Ibn al-Jazzar (d. 984 CE) of Tunisia also wrote on the care for children from birth to adolescence, though this work was later surpassed by the Cordoban 'Arib ibn Sa'id, whose treatise on gynecology, embryology and paediatrics was published in Andalusia.

In the dusty conditions of the Middle East, eye diseases were common and Muslim physicians developed special skills for treating blindness. Although most medical books devoted a separate chapter to eye diseases, monographs were also written on the subject. One early work on ophthalmology was Hunayn ibn Ishaq's 'Ashar Maqalat fi'l-'Ayn (Ten Treatises on the Eye), which remained a standard for many centuries. However, the most important book was 'Ali ibn 'Isa's (d. 400/1010 CE) Dhakhirat al-Kahhalin (Treasury for Ophthalmologists), which was translated into Latin as Tractus de Oculis Jesu Ben Hali.

Revolutionary Scientists and Scholars

Taken from:
"Muslim Inventions that Shaped the Modern World" - http://www.cnn.com/2010/WORLD/meast/01/29/muslim.inventions/index.html
"Abbas Ibn Firnas – the First Man to Fly and Live to Tell the Tale" - https://www.aertecsolutions.com/2018/05/21/abbas-ibn-firnas-the-first-man-to-fly-and-live-to-tell-the-tale/?lang=en
"Fatima al-Fihri: Founder of the world's first university" - http://www.manchesteruniversitypress.co.uk/articles/fatima-al-fihri-founder-worlds-first-university/
"Fatima al-Fihri: Founder of World's Very First University" - https://www.whyislam.org/muslim-heritage/fatima-al-fihri-founder-of-worlds-very-first-university/

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ABBAS IBN FIRNAS

Throughout the history of mankind there have been memorable people whose contribution to science can be considered exceptional. We know the names of many of them, and in the context of aeronautics, the following illustrious names immediately come to mind: da Vinci, Cayley, Montgolfier, Le Bris, Lilienthal, Ader, Pilcher, Whitehead, Zeppelin, Torres y Quevedo, Santos-Dumont, Wright, Alcock, Forlanini, de la Cierva, Lindbergh, Latécoère and a few dozen more. There are other names which, however, have passed quietly into oblivion, despite the fact that their contribution has been truly remarkable. Such is the case of the scientist, historian, poet, inventor and, of course, aviation pioneer, Abbas Ibn Firnas.

Many are surprised to learn that this man was the first to fly with a heavier-than-air machine, staying in flight for about ten minutes. And he did this more than a thousand years before the Wright brothers, specifically in the year 875. So who was Abbas Ibn Firnas?

He was born Abu al-Qāsim Abbās ibn Firnās and came into the world in the year 810, not far from the city of Ronda (in the province of Malaga, Spain). Relatively little is known about his childhood, except that he acquired an extensive education and came to the fore in various disciplines, which led him inexorably to the city of Cordoba, which at that time was the richest and most influential in Al-Andalus. There he stood out as a scientist, inventor, poet, philosopher, alchemist, musician and astrologer, to such an extent that he became known as Hakim Al-Andalus (the Wiseman of Al-Andalus).

Once in Cordoba, he went on to develop those facets of his knowledge that significantly contributed to the advancement of the sciences and the arts in the courts of the emirs Abderraman II and Muhammad I.

In the scientific field, he was the first in the Iberian Peninsula, and probably in Europe, to use the Sindhind astronomical tables, of Indian origin, which later would prove fundamental to the development of European science and would be studied in medieval universities as a Quadrivium subject (integrating the study of music, arithmetic, geometry and astronomy).

He introduced the Western world to the technique for carving rock crystal and even developed alchemical procedures to create crystals from different minerals. He built an anaphoric clock, a complex mechanism that uses water as a liquid engine (energy). The water flow is closed or opened by a series of valves and the clock serves to show the hour at any time of the day or night, something which was unusual at the time.

He also developed the first armillary sphere (or spherical astrolabe) in Europe, used to perform calculations and approximate astronomical observations, by moving the instrument's rings according to the plane of the celestial rings.

As an example of his advanced knowledge of astronomy, he built a mechanically articulated planetarium at his residence in Cordoba which represented the celestial vault. He even provided it with sound and visual effects that simulated various weather phenomena: storms, lightning and thunder.

In the context of aerospace, Abbas Ibn Firnas is an extraordinary reference point as the creator of the precursor to the parachute and for being the first person to successfully design, build and test artefacts that remained in flight. He did this six hundred years before Leonardo da Vinci developed his designs for flying machines, and more than a thousand years before the Wright brothers made their famous flight.

His first aeronautical milestone was achieved in the year 852, when he jumped into the void from the tower of Cordoba's Mosque, using canvas as an innovative parachute. Nothing like it had ever been attempted before. Or at least, nobody had lived to tell the tale until then. The result was a relatively rapid descent involving a rough landing and several broken bones, but it led to a firm conviction that the method could work. This event is widely considered as the first use of a parachute in history.

Years later, in 875, he designed a glider made of wood and silk (decorated with feathers from several different birds), and he launched himself with it from the La Arruzafa hills, near Cordoba. He was so sure that his invention would work that he had convened hundreds of people to watch along the route. Also present were many members of the court of Muhammad I, Emir of the Andalusi caliphate. The result was a sustained flight using air currents, which lasted anything between two and ten minutes (depending on the historical accounts used as reference). Despite a difficult landing, he not only survived but also became the first man to fly with a heavier-than-air machine.

Even using the most pessimistic figures for his flight, it was much longer in both time and distance to that achieved in 1903 by the Wright brothers.
The name of Abbas Ibn Firnas currently figures in the names of airports, bridges, hills, parks, avenues and scientific bodies, especially in countries with an Arab background, but what will no doubt ensure his immortality is that one of the craters of the moon has also been named after him.

FATIMA AL-FIHRI

Over 1000 years ago, amongst a migrant community in the western districts of Morocco, the vision and investment of one woman paved the way for the founding of the world's first university: the University of al-Qarawiyyin in Fez, Morocco.

Fatima Al-Fihri migrated with her family in the early ninth century from Qayrawan in present-day Tunisia to the city of Fez in Morocco. This was during the rule of Idrees II, an extraordinary ruler and devout Muslim. Fez at that time was a bustling metropolis of the "Muslim West" (known as al-Maghrib), and held the promise in the people's imaginations of fortune and felicity. Having become one of the most influential Muslim cities, Fez boasted a rich combination of religion and culture, both traditional and cosmopolitan. This was the city, on the left bank of the River Fez, where Fatima's family settled and she eventually married.

After much toil and struggle in humble beginnings, the family of Fatima was eventually blessed with prosperity. Her father, Mohammad bin Abdullah Al-Fihri, had become a hugely successful businessman. After the deaths of Fatima's husband, father, and brother in short succession, Fatima and her only other sibling, Mariam, received a sizable inheritance which assured their financial independence. It was in this latter period of their lives that they distinguished themselves. Having received a good education, the sisters in turn hastened to dedicate all of their wealth to benefiting their community. Observing that the local mosques in Fez could not accommodate the growing population of worshipers, many of whom were refugees from Islamic Spain, Mariam built the breathtaking

and grand Andalusian Mosque in 245AH/859CE.

Fatima had grand aspirations, and early on began buying property adjacent to the initial land, thereby significantly increasing the size of the mosque. She diligently spent all that was required of time and money to see the project to completion. She was also extremely pious and devout in worship and made a religious vow to fast daily from the first day of construction in Ramadan 245 AH/859 CE until the project was completed some two years later, whereupon she offered prayers of gratitude in the very mosque she had so tirelessly worked to build.

Masjid Al-Qarawiyyin, one of the largest mosques in North Africa, housed the university which was to become a major center of advanced learning in medieval times in the Mediterranean. Al-Qarawiyyin University is credited with producing many distinguished Muslim thinkers including Abul-Abbas, the jurist Muhammad al-Fasi, and Leo Africanus, the famous author and traveler. Other prominent names associated with the institution include the Maliki jurist Ibn al-Arabi (d. 543AH/1148CE), the historian Ibn Khaldun (d. 808AH/1406CE), and the astronomer al-Bitruji (Alpetragius) (d. 1204CE).

Non-Muslims were welcome to matriculate. In fact, the University's outstanding caliber attracted Gerber of Auvergne who later became Pope Sylvester II and went on to introduce Arabic numerals and the concept of zero to medieval Europe. One of the university's most famous students was a Jewish physician and philosopher, Maimonides.

By the 14th century, the university housed the Al-Qarawiyyin Library which remains one of the oldest in the world, preserving some of Islam's most valuable manuscripts. These include volumes from the Muwatta of Imam Malik inscribed on gazelle parchment, the Seerah of Ibn Ishaq, the premier transcript of Ibn Khaldun's Al-'Ibar, and a copy of the Qur'an gifted to the institution in 1602 by Sultan Ahmed al-Mansur.

Almost 1200 years have passed since the founding of the University of Al-Qarawiyin in 859, and it continues to this day to graduate students in the various religious and physical sciences. This esteemed institution, which already had 8,000 students by the 14th century, is central to the legacy of Fatima Al-Fihri. Her story is one of timeless dedication to the Islamic tradition of learning and academic study, as well as personal devotion to pleasing Allah SWT by serving as a genuine benefactor to humanity. The world is richer as a result.

Center of Knowledge

Taken from:
"The House of Wisdom (Bayt al-Hikmah) and Its Civilization Impact…" - https://www.degruyter.com/downloadpdf/j/mjss.2017.8.issue-5/mjss-2017-0036/mjss-2017-0036.pdf
"The Abbasids' House of Wisdom in Baghdad" - http://muslimheritage.com/article/abbasids-house-wisdom-baghdad

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The Abbasids attained their most sparkling period of intellectual and political life soon after the caliphate was establishment. The Caliphate reached its prime during the time reigns of Hārūn al-Rashīd (149-193 AH) and his son al-Ma'mūn (170-217 AH). The Abbasid dynasty acquired a halo in popular imagination becoming the most celebrated in the history of Islam due to the unparalleled intellectual awakening that culminated the al- al-Ma'mūn's patronage. The house of wisdom was one of the leading libraries that distinguished the Abbasid times, it opened its doors for researchers, scholars and leaders. Bayt al-Hikmah was the preferable destination for intellectuals because it offered everything they needed including hall for reading, classrooms, divisions of binding, translating, authoring, map making etc.

There has been different opinions on the identity of the founder of the Abbasids' House of Wisdom. Some records say that the founder of Bayt al-Hikmah was Abu Ja'far al-Mansūr (95-135 AH) who collected books on medicines, astronomy, engineering and literatures that have been translated in his reign, moreover some other publications on Hadith (prophetic tradition), history, Qura'nic sciences, al-Mansūr has gathered all collections of books in a big room that was the nucleus of the house of wisdom (al-Diyaji, 1975). He was the first caliph who motivated Muslims to study sciences and develop them, he also advised them to translate books from Persian, Greek, and Indian languages. Among the books that al-Mansūr initiated their translations were the book of Al-Sind Hind a book on mathematics and a huge collection of Aristotle, Euclid and of Claudius Ptolemy writings. These collections along with the authored publications on Prophetic tradition (Hadith), literature, and history were gathered in one of palace's big closet that later on was developed becoming the pillar of the house of wisdom (al-Qafti, 1903), we agree upon the above mentioned opinion that Bayt al-Hikmah was founded in the time of the Caliph al-Mansūr.

Scholars of a second opinion saw that the house of wisdom was founded in the time of Hārūn al-Rashīd (149-193 AH) as a result of the civilizational and intellectual progress that characterized his caliphate especially during the era of translation movement whose aim was to enrich the Muslim thought with different knowledge and sciences led by a number of Arabs, Persians and Syriac scholars and scientists (Ma'ruf, 1969). When al- Rashid army opened Ankara he personally took hold of the expedition to preserve the libraries there and to transport every valuable collection of books to the centre of the Abbasid Caliphate Baghdad specifically to the house of wisdom. Ibn al-Nadīm supported this opinion when he mentioned in his book Al-Fihrist "Abu Sahl al-Fadl Ibn Nubakht was present around the closet (book storing place) of Al-Rashīd" (Ibn al-Nadīm, 1964, p.255). Also the saying of Yaqūt al-Hamawī who could confirm that the house of wisdom existed in the time of Al-Rashīd "Al-Warraq used to copy and reproduce in Bayt al-Hikmah during the times of Al-Rashīd and Al-Ma'mūn", this would argue for the presence of the house of wisdom at the reign of Al-Rashīd. (Al-Hamawī, 1966, p.66)

The third opinion argue that the Abbasids' house of wisdom was founded in the time of Al-Ma'mūn the caliph (170-217 AH). De Lacy O'Leary (1872-1957 AD) who is a British orientalist has supported the idea that Bayt al-Hikmah was constructed by Al-Ma'mūn when he says "the caliph Al-Ma'mūn has founded a school he named Bayt al-Hikmah, and he made it an institution that embraces the translation of the Greek books"(O'Leary: 1973, p.327), the same opinion appears in Max Meyerhof and William James Durant writings. It possible to say that the house of wisdom existed long before Al-Ma'mūn but it sparkled during his reign for he was a man of literature, a scientist and a lover of scholars to whom he had given major interest and support for their research, debates and authoring books.(Amin, 1960).

When the Caliphs have had a huge collection of books and a considerable numbers of translations, maps, manuscripts…etc. they have had to construct an appropriate place for these collec-

tions, historians have a consent that the caliphs' most desirable location for the library was the palace itself.

Bayt al-Hikmah of the Abbasids was given some different names, according to some sources it was called closet of wisdom a name that was given by historians like Ibn al-Nadīm who often used the Bayt al-Hikmah to refer to the same store, another scholars like Ibn Sa'id al-Andalūsī and al-Qalaqshandī utilised the term closet of wisdom to refer to the house of wisdom. Haji Khalifa on the other hand gives a different name known as Dar al-Hikmah. The most interesting thing about the naming of house of wisdom is that all labels signify the same meaning that Bayt al-Hikmah was the place of all knowledge and wisdom to be found.

There has not been enough information about the place of house of wisdom, references have spoken about Bay al-Hikmah fairly but they have not said much about its location. According to the norms the closet of books should be part of the palace just like the Cordoba Place and the palace of the Fatimid caliph Al-'Aziz Billah (344-386 AH), and palaces of the kings of India and Persia (Ibn Al-Abaar, 1963).

It is believed that the house of wisdom was part of the palace during the time of Al-Rashīd (149-193 AH), it was a separate house (Dar) within the palace of caliphs, and some historians said that it was an attached large room from the outside. However when the number of translated and authored books has increased in the reign of Al-Ma'mūn (170-218 AD) the house became a large building with a big number of halls and room for translators, authors, scientists, and readers. As a result the library was relocated to Al Rusafa that was the half of Baghdad on the eastern side of the river Tigris and a new Astronomical Observatory has been appended to the new relocated library. (Amin, 1963).

As for the house of wisdom's architecture. Mahmud Ahmad Derwich has found a suitable architectural planning for Bayt al-Hikmah through his studies on the golden castle constructed by Al-Mansur. The house of wisdom composed of a yard surrounded by halls of two floors from its four sides, it was headed by a penthouse on a row of pillars. In the middle of every side among the four sides of the yard there were halls topped by semi-cylindrical dome of 25 cubit. The main hall leads to a square shape room above it there was a big dome with 80 cubit high, the main hall also has a statue of knight holding a spear that spins with the spear. The ground floor contained a number of divisions for book closets and sections for translating, authoring, copying, binding, reading as well as studying in all subjects of knowledge, sciences and literature, as for the upper floor it was devoted to residents from authors, translators, students and employees.(Ghanima, 1953).

THE IMPACT

The house of wisdom had crucial role to play in linking the Islamic world fronts in east and west and in introducing the heritage in its perfect form to all Muslims in order to preserve it from loss and deterioration. As a result, the library had gained a great fame in the Islamic world for it was the first scientific and educational library that assembled scientists, scholars and translators to study and research. The house of wisdom had become an exemplary model for other Caliphs and princes who tried to simulate and to found new libraries and houses of wisdom that can compete with the one in Baghdad, this contest had attained an intellectual and scientific advancements in every sphere in the Islamic world. Here are some libraries that came to exist because of emulating the example of house of wisdom:

1. The Aghlabids House of Wisdom: found by Amir Ibrahim Ibn Mohammad al-Aghlabī (261-289 AH) in Raqqada. Ibrahim was an admirer of knowledge and scholars for he knew the value of

education and knowledge and their role in the progress of societies. He had strived to make his library reach out the fame of Baghdad library, wherefore he brought to Aghlabids library a number of precious manuscripts, books and scientific tools. The prince has two annual expeditions to Baghdad to renew his sovereignty to the Abbasid caliphate in doing so he assigned a group of scholars to borrow and purchase books and literary works from Baghdad that they cannot be found elsewhere (Ismail, 1978).

2. The Andalusian House of Wisdom: it was found by the Umayyad caliph in Andalusia al-Hakam al-Mustansir (302-366 AH) who was often described as the master or scholar (A'lim) of the Umayyad due to his vast knowledge in various sciences categories, he collected the greatest number of books that nobody had collected before (Lévi-Provençal: 1994). Therefore he decided to construct a huge building which he called the Dar al-Hikmah (house of wisdom) that followed the example of the Baghdad library in its artistic and organizational features. During the reign of al-Mustansir Cordoba became one of the eminent centres of human civilization characterized by a remarkable progress in sciences, arts, and architecture.
3. Cairo's House of Wisdom: the beginning of its founding is related to the time of the Fatimid al-Aziz billah (365-386 AH) who also was a lover of books and he attentively collected a great number of them saying that he would have a hold of a copy of every book whether authored or translated in the house of wisdom in Baghdad. The true founder of the Cairo's Dar Al-Hikmah was al-Hākim bi-Amr Allah (386-411 AH) who always assembled scholars from all arts and sciences and he prepared for them everything they needed in order to facilitate for them searching and authoring. He also gifted students and readers with different presents and supply them with free ink and papers. (Ibn al-Jawzī, 1924).

A huge number of new libraries had emerged in the Arab peninsula and in other territories, however it was clear that all newfound libraries have been trying to compete with the Abbasids House of Wisdom in Baghdad. They tried to simulate, innovate and challenge the reputation that the House of wisdom had in the Muslim world.

The libraries that have flourished following the example of the house of wisdom's have had their doors open to scholars from all over the world. Libraries have had almost the same kind of translated books that were culled from scholarships of dozen languages. The house wisdom was a center of knowledge and education, it was a rival of the Constantinople's if it did not exceed it. It was the model for other libraries and similar institutions throughout the soils of Islamic civilization.

The example of the house of wisdom was remarkably followed and its influence appeared when other many public libraries have emerged all the way from Bokhara and Merv, in the heart of Asia, on the route to China through Basra and Damascus, Algiers and Cairo. The famous geographer Y āqut al-Hamawī who had visited Merv in the late 1220s, found more than twelve libraries there opened for public. And the same as the house of wisdom in Baghdad functioned, ten libraries were through endowments (awqaf). He interestingly expressed his admiration for about the lending policies of the libraries there, he noted that libraries in Merv were being liberal enough to lend him more than 200 volumes he could use in his room at the same time. (Al-Hamawī, 1993).

Libraries of The Nizamiyyah School were somewhat similar to the House of Wisdom (Bayt al-Hikmah) for the former had had many facilities to offer for students, including student's scholarships and endowment professorship. The Nizamiyyah School libraries and Cairo libraries were reported to have their own binders, administrators, librarians and even guards, they have shared almost all supported by endowments from governments, caliphs and kings.

One of the most remarkable impacts that the House of Wisdom had had on the other libraries

is that they have helped scholars and authors creativity to flourish. For instance hundreds of volumes were being written in the time of the Fatimid's time. The high authoring process was one of the characteristics of the Egyptian renaissance before the coming of the Mongols and the crusaders. The influence of the House of Wisdom went beyond the Arab peninsula when it reached European soils particularly Spain. Córdoba, Seville and Toledo had a great number of libraries basically because many agents had been sent across the countries and seas to buy books and bring them to the Royal library in Córdoba in which it is believed to have contained more than 400.000 volumes, and amazingly it gave employment to over five hundred people. Ultimately Córdoba had become one of the greatest book markets in the western world during the 10th century AD. (Harris, 1984).

The House of Wisdom (Bayt al-Hikmah) had influenced not only similar public libraries, but a new form of libraries that were for personal use and for show. They were called private libraries which sometimes reached a considerable size. One writer has estimated that some private libraries were bigger and richer than public or private, libraries in Western Europe. However it was not the norm for the well-to-do people to leave their libraries open to public or to endow them for users.

Employees in the House of Wisdom in Baghdad were people of higher intellectual abilities, the same was emulated in every public library across the Muslim world. They often had a staff list that reach sometimes hundreds of copyists, illuminators, binders, translators, and authors. Those whom we can consider librarians were not randomly chosen but they usually were scholars, poets, multilingual and writers who on the other side were well paid by caliphs, rulers or nobles. (Mackensen, 1932).

Many of the Islamic libraries included also not halls for reading and book storing, but they also they contained rooms for meetings and other rooms for discussions and debating that were help sometimes between different libraries and different scholars which implies the competition among libraries for scientific achievements, reputation and glory of the library itself. The Muslim libraries have played a major role in translating and transmitting works of Greek, Persian, Indian and Assyrian physicians and philosophers, works that later became the basic textbooks in European schools of Bologna, Naples and Paris. It is likely that without the Muslim libraries, modern Europe's scientific and intellectual progress would have been remarkably inhibited.

THE END

After the invasion of Baghdad by the Mongols in (656 AH-1258 AD) they wrecked the library's private and public closets of books, manuscripts, maps, observatories…etc. they burned majority of the collections whilst others were thrown into the Tigris river, some say that the Mongols have built their barns using books instead of clay.

Hulagu has ruined almost all books that have been translated or authored by distinguished scholars and scientists, the works that were used to spread culture and knowledge and wisdom among the Muslims and non-Muslims were gone into dust. As a result the world witnessed the fall of one the preserving libraries of human intellect and human civilization of that time which has had a calamitous impact on the Islamic civilizational heritage.

The legacy of the house of wisdom library was wasted and the west did not find except Arabic sources to obtain the heritage of ancient human civilizations. The invasion of the Mongols and the destruction of the library marked the fall of Baghdad and ultimately the collapse of the Abbasid Caliphate that had left the Muslim world in crisis in the years to come.