The Spirit of Scientific Enquiry in the Early Islamic world*

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Abstract:

This article reviews and documents how the spirit of scientific enquiry started and developed during the early Islamic World with an emphasis on the very early beginnings during the lifetime of the Prophet from the year 610 when the Quranic revelations started in Makkah, up to the year 622 the time of migration to Madinah, until the time of his death in the year 632. It was during that period, that the seeds of scientific enquiry were first sown. The Quran and the tradition of the Prophet (Sunnah) was the stimulus and inspiration for the spirit of scientific enquiry to develop in the hearts and minds of people and then to flourish and spread with the fast and vast spread of the new faith. Love for the search for knowledge, a call to think and contemplate in the whole universe around as well as discrediting intellectual stagnation and condemning blind imitation of the forefathers were all factors that helped in launching a new era of scientific methodology that began in the time of the Prophet and continued to grow and yield fruits during the time of Rightly-Guided Caliphs, the Umayyad and then the Abbasid periods. The passion for truth and objectivity, the general respect for fully corroborated empirical evidence, and a mind skilled in the classification of things were some of the most outstanding features of early Muslim religious scholarship, as can clearly be seen in their studies of jurisprudence, and its source methodology, as well as in the documentation of Prophetic traditions. This scientific attitude and scientific frame of mind lead to the early development of the scientific method that was soon applied to the study of natural sciences. Furthermore, the strong feeling of brotherhood-in-humanity that emanated in the hearts and minds of people from the teachings of Quran and Sunnah helped to establish tolerance, open mindedness and friendly ties between Muslims and non Muslims in the lands to which Islam spread. This gave a boost to the spirit of scientific enquiry and interchange of knowledge in the early Islamic World. It helped also in the process of preserving the remaining literature of all previous civilizations being a heritage for all mankind.

Introduction:

The line of progress of history of science is continuous and uninterrupted. It has gone through several phases, accumulating contributions of different civilizations and numerous nations. Indeed the science of today is a joint global contribution of the whole world. Phase after phase, the progress circles of medical and science theory and practice continued to expand (Figure 1). As Durant put it, *"civilizations are units in a larger whole, whose name is: history"; they do nonquit disappear. The past always rolls into the present"*[1].

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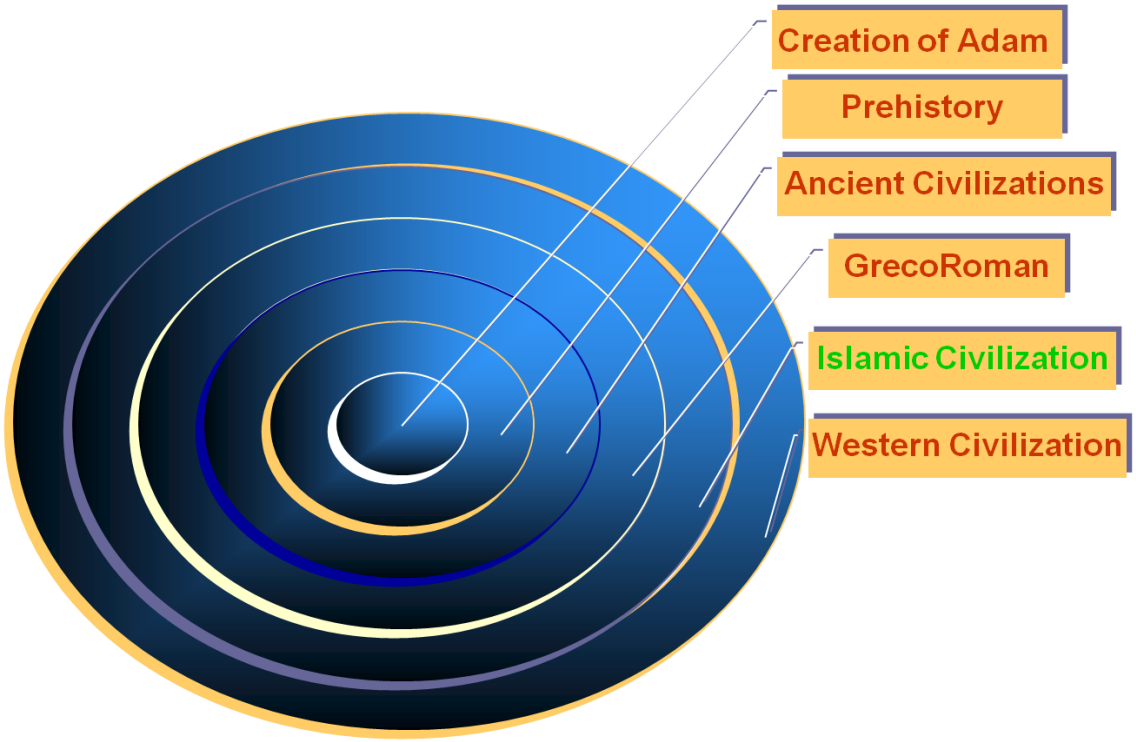


Figure 1: A diagrammatic representation of the progress circles of successive phases of history of science.

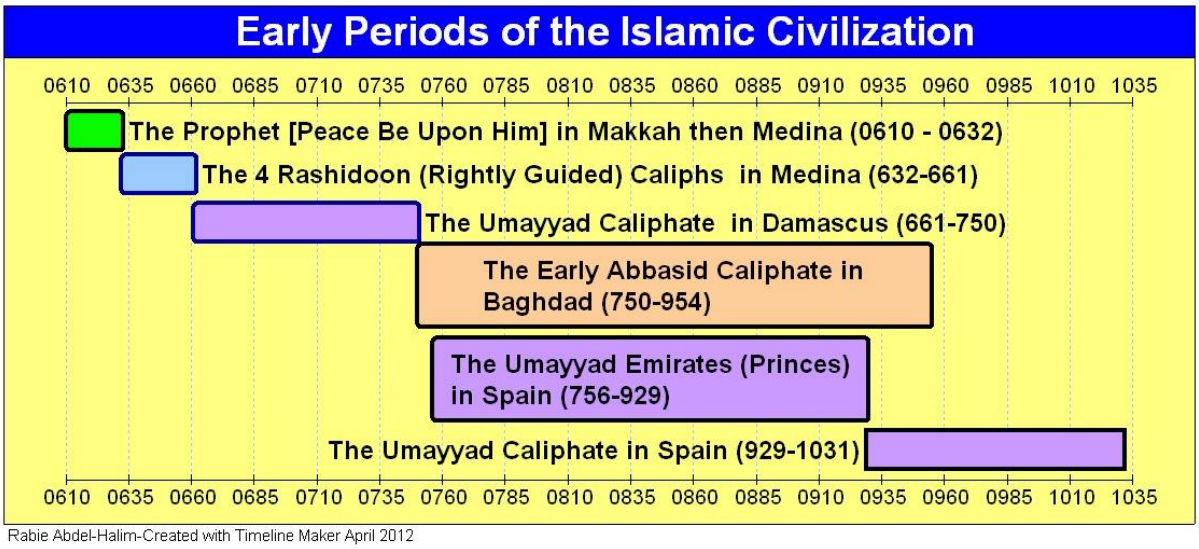


Figure 2: A timeline of the early periods of Islamic civilization.

This article reviews how the spirit of scientific enquiry started and developed during the early Islamic World (Figure 2) with an emphasis on the very early beginnings during the life of the Prophet from the year 610 when the Quranic revelations started in Makkah, up to the year 622 the time of migration to Madinah, until the time of his death in the year 632. The map in Figure 3 shows the spread of Islam, to the whole of Arabia during the time of the Prophet,

then to**: Al-**Sham, Mesopatamia , Persia and North Africa during the time of the rightly guided Caliphs Abu Bakr, Omar, Othman and Ali followed by more spread into Asia, North Africa and Spain during the Umayyad era, then more and more afterwards.

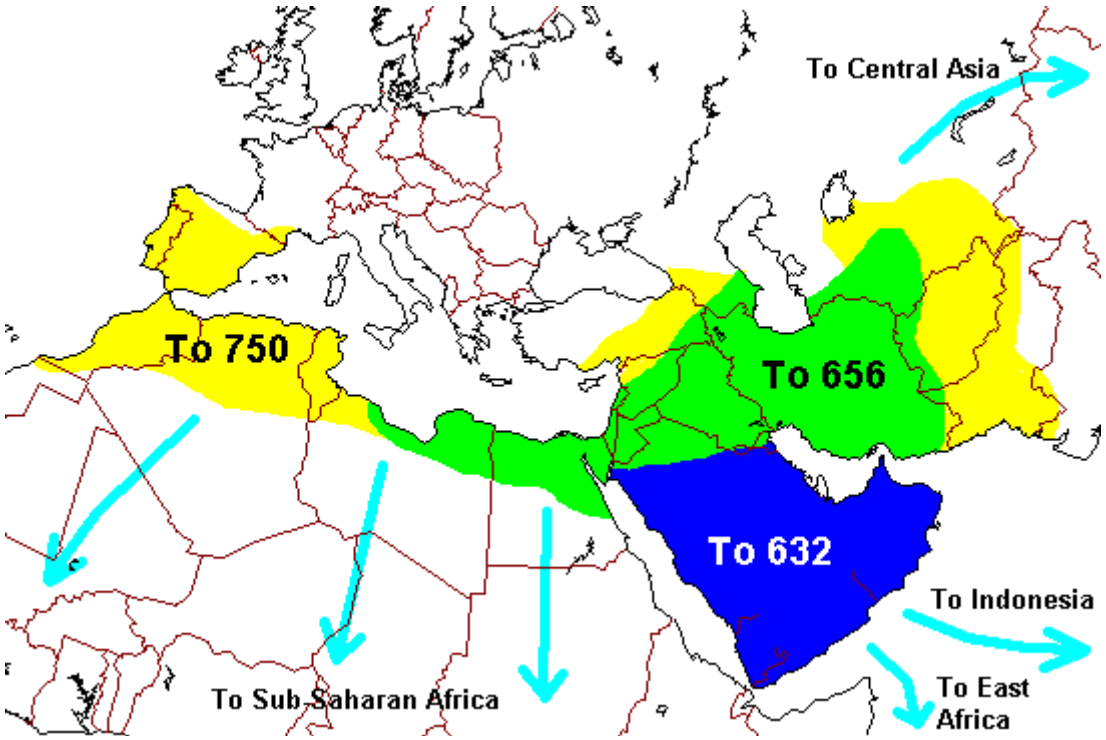


Figure 3: A map showing the spread of Islam during the early periods shown in Figure 2. (Courtesy of Steven Dutch's website: http://www.uwgb.edu/dutchs/westtech/xislam.htm).

The Spirit of Scientific Enquiry in Islamic World during the lifetime of the Prophet:

It was during that period, that the seeds of scientific enquiry were first sown. The Quran and the tradition of the Prophet (Sunnah) was the stimulus and inspiration for the spirit of scientific enquiry to develop in the hearts and minds of people and then to flourish and spread with the fast and vast spread of the new faith.

Sow a seed, reap a harvest. Seeds of Scientific enquiry, love for the search for knowledge and launching of a new era of scientific methodology, began in the time of the Prophet and continued to grow and yield fruits during the time of Rightly-Guided Caliphs, the Umayyad and then the Abbasid periods. It all happened through the motivating and inspiring effect of the Quran and the Prophetic tradition.

How did the Quran and Prophetic tradition motivate the spirit of scientific enquiry?

I. Through the call to search for knowledge:

Figure 4 is a calligraphic rendering of the first revealed Quranic verses the meaning of which is hereby translated:

"Read! In the name of thy Lord and Cherisher, Who created. Created man, out of a (mere) clot of congealed blood. Read! and thy Lord is Most Bountiful, He Who taught (the use of) the Pen, Taught man that which he knew not" [2].

In these first revealed verses, the words " read" and 'taught' are repeated twice, also, the 'pen' the tool for reading and writing is directly mentioned. Moreover, "elm" meaning knowledge is clearly affirmed.

Figure 4: A calligraphic rendering of the first revealed Quranic verses starting with: *"Read! In the name of thy Lord and Cherisher".*

On the other hand, surprisingly enough, the verses did not directly proclaim the new faith, or denounce polytheism as expected. According to Al-Wakeel**,** such emphasis only on the knowledge and its tools, in this first revelation, is meant to indicate two important points[3]:

1. Firstly, the true and sound faith would not be realized by imitation or by being told by others, but, indeed, it can only be achieved through reasoning and definite evidence, usually reached through learning using the learning methods, most famous of which is reading and writing.
2. Secondly, with that form of approach the first Quranic revelation highlighted the vital importance of learning and search for knowledge as one of the essential virtues of the new faith.

This Quranic motivation for the search for knowledge was further confirmed in the second revelation, in which God took an oath by the "*Pen, and by What is Written"*[4], thus emphasizing its great significance for mankind as the means for recording knowledge, writing contracts, regulating transactions and documenting treaties.

Out of the many other verses in the Quran which call mankind to acquire knowledge, here are few other examples: *"God will exalt in degree those of you who believe and those who have been granted knowledge. And God is Well-Acquainted with what you do"*[5]. And also this verse: "*…and say: My Lord! Increase me in knowledge"*[6], a guidance which call mankind not to be satisfied with a certain amount of knowledge, but to keep always striving for more and more. This Quranic praise for knowledge and scholars is further emphasized in the verse saying: *"Are those who know equal to those who know not?"*[7].

The high esteem that knowledge and education is granted in Islam, is also evident in many maxims of the prophetic tradition such as:
"*To acquire knowledge, is an obligation on every Muslim*".
"*Seek knowledge from the day of your birth until the day of your death";* and
"Seek knowledge even from as far as China".
"Wisdom is like a precious commodity that is lost. A believer must always be in search of it. Wherever he finds it, he must act upon what it dictates".

This guidance of the new faith was soon put in action in the time of the Prophet. An intense movement for learning started. Saeed Ibn Al Aas, an efficient scribe, was given the task by the Prophet to teach the Muslims reading and writing. Ubaidah ibn al-Samit also participated in this teaching mission[3].

The eagerness for literacy was so thriving that, in dealing with the prisoners of war who attacked Madinah, a unique form of ransom assumed an educational dimension; many of the Makkans, unlike the Madinese, were literate and so each prisoner who could not afford the monetary ransom was entrusted with ten children to teach them the art of writing and reading. Once the child had been proficient enough, the instructor would be set free[3].

That intense learning activity which started in the time of the prophet also included women. The lady Al Shifaa bint Abdelellah Al Adaweyyah was asked by the Prophet to teach them reading and writing and they used to regularly attend the knowledge classes given by him. At first they used to sit behind men lines. But when their number increased and the place became crowded, a special session allocated for them was organized[3].

Scribes for writing the Quranic revelations kept increasing in number. Also, learning foreign languages to communicate with other nations started. Envoys of the Prophet were sent to Yemen, Bahrain and other parts of Arabia, to teach Islam and spread knowledge; consequently laying the foundation for a scientific stimulation that widely spread very fast.

The second way by which guidance from the Quran and the Prophetic tradition motivated the spirit of scientific enquiry was:

II. Through the call to think and contemplate in the whole universe around:

Since the dawn of Islam, the Quran not only inspired people to learn and spread knowledge, but also motivated them to think and contemplate in the whole universe around them, in order to unravel its secrets:

"And *He has subjected to you, as from Him, all that is in the heavens and on earth: Behold, in that are Signs indeed for those who reflect"*[8].

This universal call for reflection was further emphasized by specifying in several other Quranic verses, the objects and phenomena to reflect upon: in the universe, in the sky, in oceans, on earth, in the plant kingdom, animal kingdom and in the environment; calling, again and again, those who reflect, those who consider, those who give thought, those who understand!- calling them to ponder, study and investigate those multitude of signs; a stimulating call upon people to reflect on the life around them, to consider and to think in order to understand. That was an effective way of motivating their spirit of scientific enquiry.

As noted by Tim Wallace-Murphy, "the Surahs of Quran teach Muslims to glimpse the Divine in the 'signs' of nature, the Quran urges all true believers to view the world as an ongoing epiphany; one in which they need to be constantly aware, in order to perceive the divine reality that unites everything in the diverse and complex world of God's creation"[9]. "The new scripture instructed Muslims to use their God-given powers of reason, to decipher these 'signs' or divine messages, an instruction that imbued all Muslims with a healthy attitude to both intellectual endeavor and curiosity; one that led to a remarkable development of the study of natural science, that was fully in keeping with God's will"[9].

Emphasizing the religious context of medieval Islamic science, George Sarton said: "How could we reach a correct understanding of Muslim science if we did not fully grasp its gravitation around the Qur'an?"[10].

On a similar note, Michael Hamilton Morgan describing the events during the dawn of Islam stated that: "The Quran's recommendations will help drive the coming intellectual flowering of Muslim civilization, and spark a quest for knowledge and discovery"[11].

Many other Western authorities on history of medicine and science have also acknowledged and documented, the close relation and integration of medicine and other natural science, with the religion of Islam. This relation stems from the unique nature of Islam, and its underlying unity in all domains of knowledge. Islam, as a religion is also, distinguished by being a way of life, that goes beyond the mere performance of rituals. It provides a holistic approach to existence, it does not differentiate between the sacred and the secular and neither does it place a distinction between the world of mankind and the world of nature. The motivation provided by Islam, for the study of natural phenomenon and pursuit of empirical knowledge is, thus tremendous.

Both forms of revealed knowledge, Quran and Sunnah and their value system of Islam, strongly support observation, inductive reasoning and experimentation in the study of natural phenomenon. Search of truth is the method of Islam and, therefore, pursuit of scientific knowledge strengthens the faith of the believer. The quest of knowledge, creativity and innovation has a sanction of the Quran, and is extolled by the Prophet. It must, therefore, be pursued vigorously, and with full commitment and dedication. One of the Prophet's main prayers was "O God, increase me in my knowledge".

According to Sarton[10], Cumston[12], Sedillot[13], and other Western medical and science historians; with the spread of Islam in the seventh century, a great revival of the sciences took place in the Islamic world; knowledge of medicine flourished and acquired a truly scientific spirit and doctors were highly esteemed. As stated by Douglas Guthrie[14], the progress in medical knowledge during the Islamic era was, motivated and inspired by Divine Revelation. In documentation for that statement, Guthrie cited the translation of an authentic Prophetic tradition saying:*"O, servant of God, use medicine because God has not created a pain without a remedy for it".* He stated that Islamic medicine, was stimulated by the concepts of faith. Learning and practicing medicine is an act of worship. Wisdom is highly appreciated and always sought-for[14].

Furthermore, again in relation to medical sciences, In Islam, the human body is a source of appreciation, as it is created by God. Hence, all activities contributing to the well-being and preservation of health, as well as the relief of sufferings of individuals and societies, are virtuous acts of worship and essential religious duties.

The Quran itself, sanctioned that zeal displayed for the study of medicine and says:, *"he who saves a life shall be as if he had given life to all mankind..."*[15].

Another example of the unity of medical sciences with Islamic faith, is the statement of the 12th century Ibn Rushd (known in Latin as Averroes) that: "*Anyone who practices anatomy will increase his faith in God"*[16]. This is of particular importance, because he was, at the same time, the Grand Qadi (Chief Magistrate) of Cordova and a well known authority on Islamic jurisprudence in the whole Muslim world; then, and up till now. Accordingly, contrary to several contemporary medical historians, the practice of dissection for medical teaching was not prohibited in the religion of Islam[17].

III. Discrediting intellectual stagnation and condemning blind imitation .

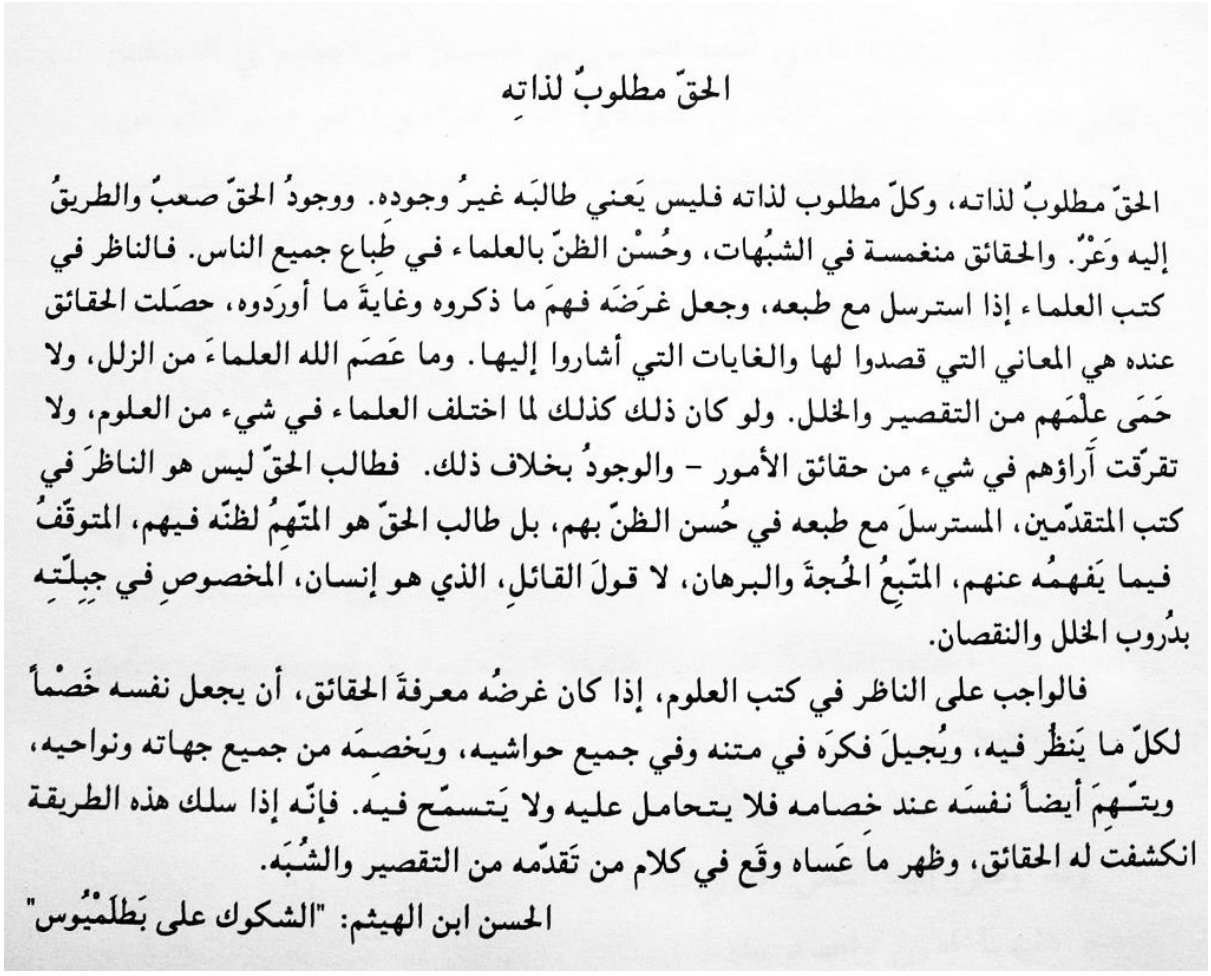
Another way in which the Quranic guidance helped to cultivate the scientific spirit and develop the free-thinking scientific attitude in the minds of people, was to intensely discredit the state of intellectual stagnation and blind imitation that prevailed in Arabia before Islam.

An example of Quranic verses carrying that guidance is:
"When it is said to them: "Follow what God hath revealed:" They say: "Nay! we shall follow the ways of our fathers." What! even though, their fathers were void of wisdom and guidance?"[18]

The translation of the meaning of another verse emphasizing the same guidance is:
"Therefore give good tidings to My worshipers who listen to what is said and follow what is best in it. These are the ones God has guided; these are the people endowed with understanding[19]*".*

Thanks to this guidance, also stressed upon in the prophetic tradition, the state of intellectual stagnation was overcome, an essential step forward in the stimulation of scientific enquiry and the creation of a critically-thinking scientific mind.

This critical attitude is well illustrated by the tenth-century pioneer developer of the experimental method Ibn Al-Haitham in his preface to his book "Doubts on Ptolemy" (Figure 5) quoted in the edition of his masterpiece on optics (Figure 6) and hereby partly translated:
"...Therefore, the seeker for truth is not the one who looks into the books of the predecessors, with an unrestrained tendency to believe them. But, he is the one who accuses his trust in them and pauses to check what he understood. He only follows proof and evidence not just what is said by a person who, by his nature can fall into various kinds of errors and forgetfulness.
If a person studying books of science want to learn facts, it is indeed essential to make himself a critic or reviewer of all what he looks into, or thoughtfully read in a text or marginalia, and criticize all its various aspects and different parts. He also ought to accuse himself in his criticism, to avoid being neither prejudiced nor lenient...[20]*".*



الحقّ مطلوبٌ لذاتِه

الحقّ مطلوبٌ لذاته، وكلّ مطلوب لذاته فليس يَعني طالبَه غيرُ وجوده. ووجودُ الحقّ صعبٌ والطريقُ إليه وَعْرٌ. والحقائق منغمسة في الشبُهات، وحُسْن الظنّ بالعلماء في طِباع جميع الناس. فالناظر في كتب العلماء إذا استرسل مع طبعه، وجعل غرَضَه فهمَ ما ذكروه وغايةَ ما أورَدوه، حصَلت الحقائق عنده هي المعاني التي قصدوا لها والغايات التي أشاروا إليها. وما عَصَم الله العلماءَ من الزلل، ولا حَمَى علْمَهم من التقصير والخلل. ولو كان ذلك كذلك لما اختلف العلماء في شيء من العلوم، ولا تفرّقت آراؤهم في شيء من حقائق الأمور – والوجودُ بخلاف ذلك. فطالب الحقّ ليس هو الناظرَ في كتب المتقدّمين، المسترسلَ مع طبعه في حُسن الظنّ بهم، بل طالب الحقّ هو المتّهِمُ لظنّه فيهم، المتوقّفُ فيما يَفهمُه عنهم، المتّبِعُ الحُجةَ والبرهان، لا قولَ القائلِ، الذي هو إنسان، المخصوصِ في جِبِلّتِه بدُروب الخلل والنقصان.

فالواجب على الناظر في كتب العلوم، إذا كان غرضُه معرفةَ الحقائق، أن يجعل نفسه خَصْماً لكلّ ما يَنظُر فيه، ويُجيلَ فكرَه في متنه وفي جميع حواشيه، ويَخصِمَه من جميع جهاته ونواحيه، ويتّـهِمَ أيضاً نفسَه عند خِصامه فلا يتحامل عليه ولا يَتسمّح فيه. فإنّه إذا سلك هذه الطريقة انكشفت له الحقائق، وظهر ما عَساه وقَع في كلام من تَقدّمه من التقصير والشُبَه.

الحسن ابن الهيثم: "الشكوك على بَطلَمْيُوس"

Figure 5: A quotation from Ibn Al-Haitham's preface to his book "Doubts on Ptolemy" (Reference No. 20).

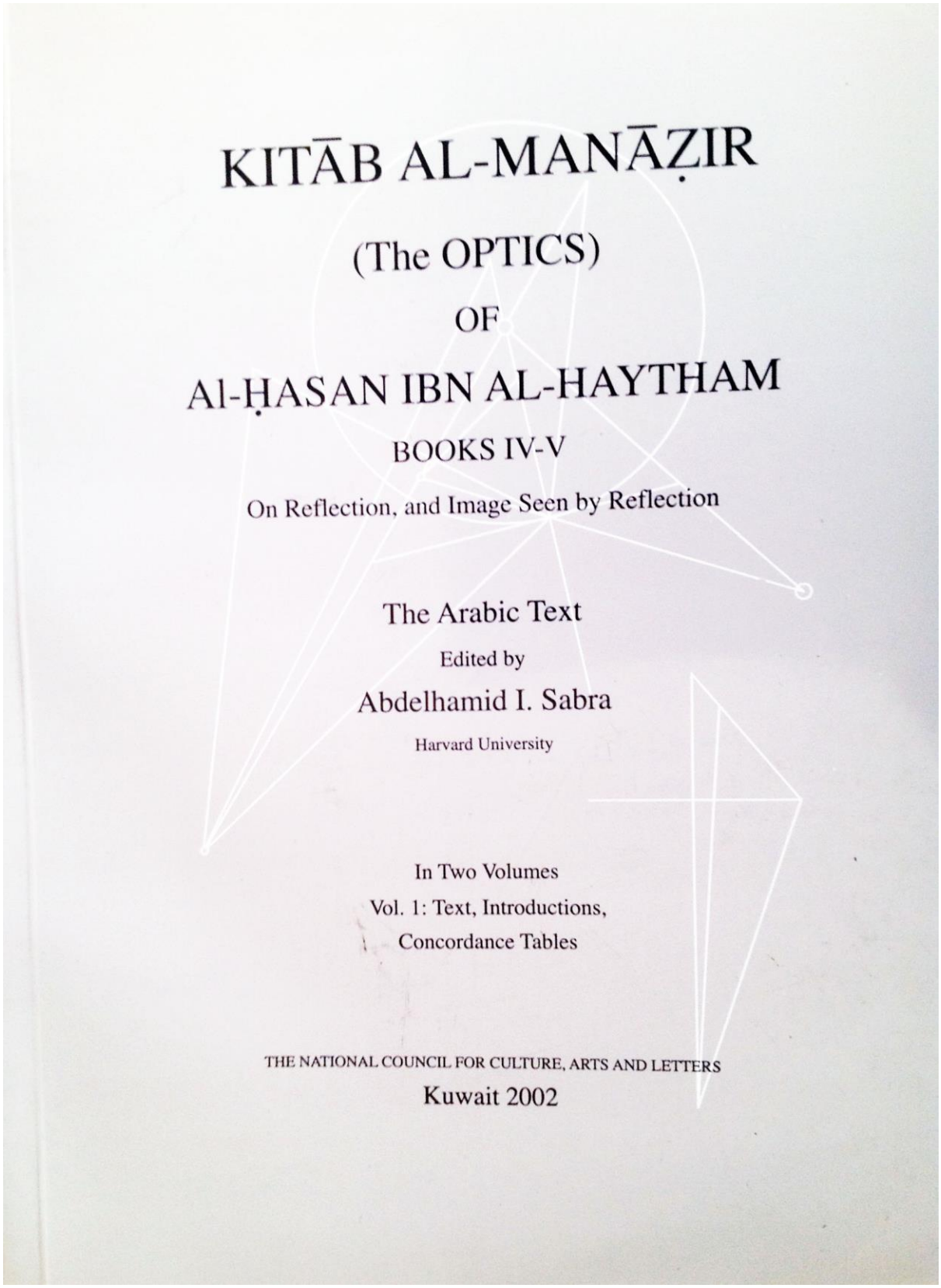


Figure 6: The English cover page of Kitab Al-Manazir (The Optics) of Ibn Al-Haitham (Reference 20).

In this context, one of the important features of science and medicine during the medieval Islamic era was that as soon as the spirit of scientific enquiry was inspired by Quranic guidance, it developed in a logical and scientific way, starting first with a thorough review of the literature collected from all over the world. Then, Islamic scholars critically appraised the translated heritage of previous civilizations, rejecting what is superfluous and accepting only what proves to be true, in the light of their own observations, experience and experimentation; a mode of analysis that constitutes the basis of scientific research.

This mental attitude of being critical in their appraisal of the literature did help the medieval Islamic scholars, not only in checking the validity of the previous knowledge, but also in adding original contributions.

In the field of medicine, the critical appraisal of knowledge, even if it came from famous authorities was obvious in the Medieval Islamic era, as early as the 9th century. A recently documented example[21], is shown in the statement by Al-Razi in the opening section to his book on diet therapy. The statement is hereby translated:
"..I decided to author a complete and wide-ranging book on how to keep away the side effects [harm] of nutrients. I decided to make the book, more self-explanatory and comprehensive, than the work compiled by the honorable Galen. That is because Galen in his book on the same topic, overlooked, went wrong and failed to cover the subject fully in many areas..[22] "

The same scientific method of reliance on direct observation, experience, and experimentation is also evident in works of other Islamic medical scholars the subject of an ongoing study[23]. As an example, in his book Sharh Tashrih Al-Qanun (Commentary on the Anatomy of the Canon), the 13th century Ibn Al-Nafis , stated that: *"..However, as regard the function of organs, we rely only on what is dictated by investigative observations and accurate research; not caring whether it conformed with, or differed from, the opinions of those who came before us.*[24] "

IV. The divine reward for spreading 'Useful Knowledge'.

The spirit of scientific enquiry was also further stimulated and flourished by the high esteem held by Quran and Prophetic tradition for scholars who provide "Elmun Nafei" that is to say useful knowledge to mankind. This has stimulated an intensive movement of studying, researching and authoring in the early Islamic World.

As an example, the 9th century Al-Khwarizmi the father of Algebra, in the Introducction to his pioneering book "Algebr wa AlMuqabala", says as translated by Frederick Rosen (1830):
"*That fondness for science, by which God has distinguished the Imam al Mamun, the Commander of the Faithful (besides the caliphate which He has vouchsafed unto him by lawful succession, in the robe of which He has invested him, and with the honours of which He has adorned him), that affability and condescension which he shows to the learned, that promptitude with which he protects and supports them in the elucidation of obscurities and in the removal of difficulties,—has encouraged me to compose a short work on Calculating by (the rules of) Completion and Reduction, confining it to what is easiest and most useful in arithmetic, such as men constantly require in cases of inheritance, legacies, partition, law-suits, and trade, and in all their dealings with one another, or where the measuring of lands, the digging of canals, geometrical computation, and other objects of various sorts and kinds are concerned.. ".*[25]

Figure 7: The introductory page from a manuscript of Abu al Hasan Al-Qarashi's book "Selections from the Comprehensive Book on Medicine". The page contains the book title and a statement by the author describing his incentive to compile the work. (Reference No. 26).

And in the field of medicine, in a manuscript of the book "Selections from the Comrehensive Book on Medicine", the author Abu al Hasan Al-Qarashi, in the introductory page (Figure 7), points out that his incentive to compile the work, was to benefit the people, an act in obedience to God who said: *"and if any one saved a life, it would be as if he saved the life of the whole people"*[15] and also in obedience to the Prophet who said *"The best among people is the one who benefit them most"*[26].

The spirit of scientific enquiry was also further inspired and stimulated by:

V. The scientific methodology used in the religious sciences.

As stated by Bakar[27], nothing better illustrates the religious origin of the scientific spirit in Islam, than the fact that, this spirit was first demonstrated in the religious sciences. Muslims

did not begin to cultivate the natural sciences in earnest, until the third century of the Islamic era (the ninth century of the Common Era). But when they did so, they were already in possession of a scientific attitude and a scientific frame of mind, which they had inherited from the religious sciences. The passion for truth and objectivity, the general respect for fully corroborated empirical evidence, and a mind skilled in the classification of things were some of the most outstanding features of early Muslim religious scholarship, as can clearly be seen in their studies of jurisprudence, and its source methodology, as well as in the documentation of Prophetic traditions.

A love for definitions and conceptual or semantic analysis with great emphasis on logical clarity and precision was also very much evident. Logic was never conceived as being opposed to religious faith[26].

Speaking of the school of Baghdad then, Louis-Amelie Sedillot the French 19th Century scholar says, as translated and quoted by Cumston in 1928,: "what specially characterized the Baghdad school at its beginning, was the truly scientific spirit which presided over all. To go from the known to the unknown, then from the effects to the causes, and only to admit as true what had been demonstrated by experimental work; such were the principles taught by the masters"[13.]

The spirit of scientific enquiry was also further stimulated and flourished by the emphasis of the Quran and the Prophetic tradition on:

VI. The Unity and Equality of Mankind:

"*O mankind! We have created you male and female, and have made you nations and tribes that ye may know one another. The noblest of you, in the sight of God, is the best in conduct. God is All-Knower, All-Aware.*[28]"

The strong feeling of brotherhood-in-humanity that emanated in the hearts and minds of people from that verse, and many other Quranic and Prophetic teachings, helped to establish tolerance, open mindedness and friendly ties between Muslims and non Muslims in the lands to which Islam spread. This gave a boost to the spirit of scientific enquiry and interchange of knowledge in the early Islamic World. It helped also in the process of preserving the remaining literature of all previous civilizations being a heritage for all mankind; a heritage that should be collected, translated and looked into for wisdom and useful knowledge for the benefit of future generations of all nations.

So, in conclusion, we have been made nations and tribes so that we may come to know one another. History conferences, like that to which this proceedings belongs, are an important means for achieving that noble aim. Their outcome will be rewarding, not only at academic, scientific and educational levels, but also in the social and cultural environments. The thoughtful study and documentation of the transmission and translation of science heritage of various nations will highlight the universality of knowledge and unity of mankind. This will boost cultural inter-appreciation around the world and help to strengthen mutual understandings between the West and the East and, thus, nurture the interaction between different faiths and various civilizations.

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