

## Development and Scope of Islamic Sciences in Medieval Central Asia

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The spread and expansion of Islam in central Asia gave birth to such a scientific temperament which is generally deemed to be a major phase of intellectual activity, initiated in the area. The Holy Qur'an, in fact, stimulated Muslim scholarship to study the universe in its various facets. Seven hundred and fifty verses of the Qur'an exhort the believers to study Nature, to make the best use of reason in their search and to make the acquisition of knowledge and scientific comprehension part of their life with the emphasis that in the natural sciences like cosmology, physics, biology and medicine, there are signs of Allah's power for mankind.

إِنَّ فِي خَلْقِ السَّمَوَاتِ وَالْأَرْضِ  
وَأَخْتِلَافِ اللَّيْلِ وَالنَّهَارِ لَآيَاتٍ  
لِّأُولِي الْأَلْبَابِ

Lo in the creation of the heavens and the earth and (in) the difference of night and day there are indeed signs for men of understanding  
(Al Qur'an; 3:190).

The Qur'an provided a great impetus to inquiry and investigation in the field of both religious and natural sciences. The Muslims, being the inveterate students of Nature, responded positively to the Quranic message. The burning urge of inquiry and investigation was caused by something more than mere curiosity. It

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was due to the conviction that Islam is the religion of God, the Qur'an the Book of Allah and the universe His creation. Thus scientific investigation no longer remained a mere investigation but became a sacred duty. Consequently the stimulation provided by the scientific outlook of Islam produced distinguished administrators, scholars, scientists and other accomplished workers of highest stature. This knowledge was not confined to religion and theology alone, rational and scientific knowledge also came under its ambit<sup>1</sup>. The centres of academic excellence as such grew in Nasaf, Tirmidh, Merv, Tashqand, Bukhara, Samarqand, Husair, Marghinan, Maa-i-Margh and Farab. Due to the development of these centres an unparalleled march of the scholars started and most of the central Asian scholars thronged to Baghdad and other academic seats of the Arab world both in search of knowledge and inspiration<sup>2</sup>.

*Rihla* (to travel on the earth), in fact, was a substitute of higher academic pursuits. There is hardly a biography of a famous traditionist, jurist, literateur or philosopher which does not include a special mention of the countries the biographer visited and the names of the teachers he met and even the books he studied during his journey. It appears that even scholars of average ability could not dispense with making such a "grand tour"<sup>3</sup>. Muhammad bin Musa al-Khawarizmi was one such scientist who while associating himself with *Bayt-ul Hikmah* made significant contribution in the field of mathematics. It was, in fact, in this quest of knowledge that luminaries like Ibn Khurdadhbih, Istakhri, Maqdisi, Idrisi, Ibn Battutah and al-Biruni set out on their wonderful journeys and visited every part of the known world. The mosque as the primary institution of educational activities<sup>4</sup>, was not confined to the study of the Qur'an and *Hadith*. The diverse subjects like elementary mathematics, rudiments of medicine, astronomy, geneology<sup>5</sup>, Arabic language, literature and philosophy were also studied and encouraged.<sup>6</sup> Besides, it was during this period that *maktabs* also contributed to the promotion of academics and were spread in Iraq, Khurasan, Balkh and Bukhara. *Al-Kuttab*, a place of reading and writing was one of the important academic centres of the Muslim society used for imparting knowledge and was deemed as the backbone of the elementary education.<sup>7</sup> Establishment of *Madrasahs* opened new vistas of knowledge and learning in both religious and scientific studies.<sup>8</sup>

A valuable contribution was made in the spread of knowledge by other institutions as well. *Bayt-ul Hikmah* founded by al Mamun (198-202 A. H.) in Baghdad consisted of a library, an astronomical observatory and the dwellings for the scholars.<sup>9</sup> The first state-sponsored academy set up in the first quarter of the 3rd century was not a venture in Islamic learning but concerned itself with systematic translations of Greek philosophy and science which had a far reaching effect on the character of Islamic education throughout the medieval period of Islam. A somewhat similar institution was founded much later by al-Mu'tadid (279-289 A.H.).<sup>10</sup> Some scholars also founded the institutions of similar kind.<sup>11</sup> Private collections of books and houses of learned men were also the places from where literary sparks and intellectual flames illuminated the minds of those who were interested in education and culture. The palace of 'Ali B. Yahya, the astronomer, had a large collection of astronomical books. This library, *Khizanat-al-Hikmah*, was open to everyone. It is said that Abu Ma'shar the astronomer arrived there from Khurasan on the way to Mecca to perform the Hajj. He stayed for sometime in this institution and become so enthusiastic about it that he dropped the idea of performing the pilgrimage.<sup>12</sup> Al Maqdisi gives an account of a library, *Khizanat-al-Kutab*, arranged in Shiraz by Adud al-Dawah (367-72 A.H.) which was attended by all talented scholars of the time. Several notable and powerful officials of the state including the semi-independent rulers and chiefs of principalities in the later Abbasid period had their personal acquired book-collections and put them at the disposal of people of learning and sometimes even donated them for the public use. In al-Rayy there was a library comprising more than 400 camel loads of books.<sup>13</sup> In fact, a number of academic centres developed almost in all parts of Central Asia including Samarqand, Bukhara, Ghazanah, Herat, Marv, Balkh, Tus, Nishanpur, Shiraz etc. where knowledge flourished and scholars were encouraged.<sup>14</sup> These institutions, being independent in nature, were governed as per the wills of founders. However, many of them served the same purpose as the mosques would do.<sup>15</sup> The steady and rapid growth of official mosque-libraries as such is a significant feature of Medieval Islamic education. The large private libraries as well as the public ones were managed by distinguished scientists and scholars.<sup>16</sup>

The promotion of learning in the Muslim world in general and Central Asia in particular accelerated because of the patronage of learning and the encouragement of scholars by the caliphs, rulers, governors and government officials. The intellectual activity was still promoted due to the fact that usually the rulers and their high officials themselves used to be great scholars, and it was not easy for any scholar to have an access to them, unless he was well versed in some discipline of sciences. The rulers used their authority for the progress of learning, and encouraged scholars from every part of the world, irrespective of their religion, race and nationality.<sup>17</sup>

The role of bookshops and booksellers in the promotion of knowledge and education in the Muslim societies can not be underestimated. The bookshops appeared early under the Abbasids and because of their patronage to learning sciences of Islam were spread in almost all major towns of the Islamic world. The booksellers, as is confirmed by *al-Fihrist* of Ibn al-Nadim and *Mu'jam al-Udaba* of Yaqut were usually men of letters who rendered an important intellectual service.<sup>18</sup> The Muslims soon mastered and advanced the sciences of their times, and established their superiority in political as well as religious and intellectual fields. They carried forth learning to every nook and corner of the world of their domination, by establishing schools, universities and libraries for the advancement of education.

It would not be out of place to mention here that no civilization is possible without the advancement of knowledge and learning. The seats of learning, discourse, research and development are those springs which supply a civilization with the axioms of dynamism and development. Islam, provides the most stable set of axioms man could possibly need in his great scientific enterprise of exploration, speculation and shaping the future. This has been demonstrated by the emergence of the Muslims during the European 'Dark Ages'<sup>19</sup> with a set of beliefs provided by Revelation and Prophetic teachings. This civilization spread within a remarkably short span of time in Europe, Africa and Asia giving rise to a body of scientific knowledge as a result of which great seats of learning emerged in almost all parts of the world with special reference to Cordova, Istanbul, Baghdad, Cairo, Damascus, Tashkand, Bukhara and Samarqand<sup>20</sup>. The spread of Islam in Central

Asia gave birth to a highly advanced civilization, which can only be compared with the mode of civilization in 19th century Europe. This civilization excelled all others, resulting in the introduction of the scientific method which revolutionised human history in the subsequent times.

The contribution of Muslims to the development of education and learning, unfortunately, could not receive the measure of recognition it deserved, despite the pioneering and courageous works of scholars who blazed the trail of observation and experimentation as the basis of scientific methodology for modern science. It was, however, by the turn of the 1st century A.H. (the beginning of the 8th century AD), that the faith of Islam, with its value system and its community ideals, had become known to most parts of the central Asia<sup>21</sup>. The impartial power of Islamic justice, ideals of equality, fraternity, learning and education shock the foundations of primitive mores and superstitions, eclipsed earlier creeds and toppled down tyrannical overlords and tribal despots. The conquests of the Muslims as such were not confined to military achievements alone but brought in their wake total socio-economic, moral, scientific and educational changes in favour of the masses<sup>22</sup>. In this regard the contribution of Muslim scholars, scientists, theologians, traditionists, commentators, biographers, historians, jurists, philosophers, physicists and chemists is so vast that their invaluable and voluminous treatises form the basis of modern spiritual and intellectual thought and action.

Committed and competent teachers contributed to the development of pedagogy, theories of learning and teaching, curriculum and methodology. They also produced learned text-books and commentaries on important original works. The pioneering work produced on pedagogy : *Ta'lim al-Muta'lim Tariqat-al-Ta'llum* (Education of the Learner and the Method of Learning) was authored by Burhanuddin Zarnuji, a pupil of the author of *Hidāyah* at the turn of the 12th Century A.D. The establishment of *Bayt-al Hikmah* by caliph al-Mamum was not confined to the process of translations alone but was followed by the production of commentaries and adaptations.<sup>23</sup> The outcome was the multitude of new subjects, such as philosophy, geometry astronomy, music, medicine and alchemy, all of which fell within the scope of educational activity. About education according to *al-Fihrist*, Abu'umar Yuhanna b. Yusuf al-Katib translated a book by *Aflatin*

(Plotinus) entitled, *On the Education of Boys*, *Kitāb Aflātīn fī Adab al- Sibyān*.<sup>24</sup> In Qiftis list of books by Aflatun (Plato), one is 'on the education of the young', *Kitāb Taidīb al-Ahdath* was translated by Ishaq b. Hunain.<sup>25</sup> Besides, encyclopaedic works were produced on the classification of knowledge. It would not be out of place to mention that the list of texts used in the *madrāsahs* of medieval Central Asia is vast and encouraging which by all means demonstrate the serious Muslim concern for education. In Persia and even in the recently independent republic states of Soviet Central Asia, until two or three generations ago there were many *madrāsahs* in which besides religious sciences all other disciplines ranging from medicine to astronomy were taught.

The Islamic sciences, began to develop in Central Asia during the second Century of Hijrah, as a result of which excellence was achieved in the study of the Qur'an and *Hadīth* thereby producing some of the most important expositions of the Qur'an. Al-Tabari's *Tafsīr*, al-Zamakhshari's *al-Kashshāf*, al-Razi's *Tafsīr al-Kabīr* al-Baydawi's *Tafsīr Anwār al-Tanzīl wa Asrār al-Ta'wīl* and Ahmad bin Muhammad Muqaddasi's *Zubdat al-Bayān* are deemed to be the representative works of logical-cum-argumentative approach.<sup>26</sup> These Quranic commentaries are still being studied in the *madrāsahs* of Central Asia. A remarkable contribution was made not only in the codification and compilation of Hadith but also in the development of the science of Hadith as well which is reflected in the works of Ibn-al-Jawzi's *al-Muntazam* and al-Sakhawi's *Al-Ielan bi-t-Taubikh*. The six recognized canons of Hadith, *al-Sihah al-Sittah* were compiled by dedicated scholars of Islam.<sup>27</sup> Books on the subject of the science of Hadith and its history '*ilm ul dirāyah*' were compiled. *Risālat al-Bidāyah fī 'Ilm al-Dirāyah* by Shahid-i-Thani is a distinguished work on the subject. Besides *Tafsīr* and *Hadīth*, a valuable contribution was also made in the subject of Islamic Jurisprudence. During 4th and 5th centuries Hakim Husairi, Imam Sarakhasi and Ibn Hamman left some indellible prints in the field of Islamic Jurisprudence. Imam Sarakshi wrote a book of 30 volumes on the subject, the largest of its kind in Islamic history. The two books which were regarded as an authoritative and standard works on the subject of *usūl-ul-fiqh* were *Manaru-'l-Anwār* of Abu'l Barkat an-Nasafi (d 710 A.H.) and *Kanzu'l-Wusūl-ila-Ma' rifati'l-Usūl* of Ali

ibn Muhammad al-Bazdawi, (400-482 A.H.) generally known as *Usulu'l-Bazdawi*. Of the numerous works produced during the medieval period, Bidaya's exposition *Hidayah* of al-Marghinani (d.593 A.H.) is a masterpiece which remained unsurpassed for centuries to come. Hanafi *fiqh* made a lot of advancement in Central Asia. The Judicial system of the Samanid, the Ghaznavid, the Qarakhanid, the Saljuq and Mongol-Tatar State and Ilkhanid came to be based on Hanifite law. Special distinction between *fiqh* and *usul al-fiqh* was maintained by jurists of high stature. The four sufi-Silsilas - the Suhrawardiyyah, the Qadiriyyah, the Chisttiyyah and the Naqshbandiyyah had their influence in the Central Asian regions. Chisttiyyah order was, infact, a Central Asian order, founded by Shaikh Muinnuddin of Chist from Seistan. This order flourished in Khurasan and Hind. The *Risalah* of Abul Qasim Qushaire (d. 1072 A.D.), *Ihya-al-Ulum* of Ghazali (d. 1111), *Kashf al-Mahjub* of Abu Ali Hujwiri, *Tabaqat-al-Sufiyyah* of Abdul Rahman Sulami and *Fu'ad-al-Fu'ad* of Shaikh Nizamuddin of Delhi were the most important classics of Sufism produced in Central Asian regions. Besides *Awarifu'l Ma'arif* of Shaikh Shihabu'din Suhrawardi provides a detailed material on Sufi ethics and the mystic ways of life. *Fususul Hikam* by the celebrated mystic Muhyuddin Muhammad ibn al-'Arabi (1165 A.D. - 1240 A.D.) is a collection of maxims and aphorisms.<sup>28</sup>

Apart from reviving and advancing upon the Greek tradition in philosophy and logic, the new discipline of dialectics (*al-Kalam*) was developed. Contributions in these areas of knowledge, particularly the new discipline in the context of religious thought and belief (the orthodox and Mutazilite views) represented a significant dimension. Besides the renowned works of al-Razi, al-Ghazali, Ibn Rushd and al-Farabi, Taftazani's *Matn Matin fi ilm al-Mantiq wa Ilm-al-Kalam* (the sound text in the science of logic and science of dialectics) is an important contribution in this respect. In fact in the domain of rational knowledge and philosophy, al-Farabi and Ibn Sina of 4th and 5th century were recognized as the second and third teachers respectively after Aristotle. Al-Kindi (d. 873 A.D) may be considered as the first representative of the movement of the grafting of Islamic culture with the new learning. His mission was to indicate to future philosophers and theologians like al-Farabi and al-Ghazali how to face the challenge of the new learning to

absorb it in or reconcile it with Islam<sup>29</sup>.

History and historiography with scientific approach progressed considerably in central Asia. The Arabs had a natural liking for history and took endless pains to collect historical data and test their accuracy by certain standards that worked all right when applied to their own sources. As such, a gradual development in historiography was achieved in terms of categories, characteristics and methodology. All the main categories of historical writing such as *khbar* (chronicle), *sinin* (annalistic), *tabaqāt* (dynastis) and *ansāb* (geneologies) were developed and used<sup>30</sup>. Other history oriented forms such as *hikayat*, *muktubāt*, *malfūzāt*, *tadhkirah* also became popular. Abul Hassan 'Ali al-Masudi (956 A.D.) was the first to revolutionise the art of writing history. Amongst other writers of history Ibn. Muqaffa (d. 757) who translated from Persian into Arabic History of the Kings of Persia, Al-Baladhuri (d. 893) the author of *Futuh-al-Buldan* and *Ansāb al-Ashrāf*. Ibn-al-Qutaybah (d. 889 A.D.) author of *Kitāb al-Maārif* Al-Dinawari (d. 885 A.D.) author of *Akhbār al-Tīwal*, Hamzah al-Isfahani (d. 961 A.D.) and Wadih al-Yaqubi and Miskawayh (d. 1030 A.D.) also contributed to this discipline. The greatest historian of his century, however, was Abu Jaffar Muhammad Ibn Jarir al-Tabari (838-923 A.D.) whose monumental work *Tārīkh al-Rusūl wal Mulūk* is a treasure of detailed information.

Bukhara, gave birth to the first Persian poet Rodhki in the 4th century. Firdousi's "*Shah-Nāma*" attained the fame as the greatest epic poem of all times in the 5th century Hijrah. Wambre, in his *History of Bukhāra* narrates that in Bukhara and Samarqand seats of learning in astronomy, mathematics, algebra, geography, medicine, astrology, ethics, theology, painting, poetry and literature were established<sup>31</sup>.

Search for knowledge, interest in trade and innate propensity to see the world and explore its marvels led the Arabs to contribute immensely to geographical science. The contribution of Ibn Fadlan, Abu Zaid al-Balkhi, al-Masudi, Ibn Hawqal, Ibn Khurdadbih has been acknowledged in all ages. Besides, al-Istakhari's *Al-Masālik wal-Mamālik*, al-Maqdisi's *Ahsān-al-Taqasīm fi Marifat al-Aqālīm*, al-Yaqubi's *Kitāb al Buldān* and *al-Yaqūt al-Hamawis Mujam al-Buldān* are the treasures of geographical knowledge of middle ages.



Central Asian contribution, as a matter of fact, is not confined to the study of religious sciences alone, within its purview comes the knowledge of sciences in its totality developed by the Muslims. The renowned work contributed in the field of cosmology is, besides Qazwinis *Ajaib-al-Makhlūqat* (The Wonders of Creation) Abu Zaid Balkhi's *Bada-al-Khalq* (The Beginning of the Creation). Sharaf-uz-Zaman *Tahir of Marv* wrote extensively on the subjects of Zoology and Botany during the 11th century A.C. Ibn al-Baitar collected botanical specimen from the Muslim world and compared the floras of India and Persia with those of Greece and Spain. His work consisting of the description of 1400 plants has been considered by Meyer to be a monument of industry<sup>32</sup>. However, Abu Hanifa Dainwari's *Taba'i al-Hayawan* (The natural Properties of Animals), and *Kitab-al-Nabat* (The book of Plants) are the representative works on the subject.

A fresh impetus was given to the pursuit of astronomical studies when the Saljuqs began to dominate over the Abbasid caliphate (on the downfall of Buwayhids) Jalal-al Din Malik Shah for example, summoned at his new observatory at Rayy Omer al-Khayyam (1038-1123 A.D.) to reform the Persian calendar<sup>33</sup>. At the court of Sultan Sanjar flourished Abd-al-Rahman al-Mansur al-Khazini, whose fame chiefly rests on his exhaustive work on the balance, *Mizan al-Hikmah*.<sup>34</sup> The two great minds, al-Razi (865-925 C.E.) and Ibn Sina (980-1037 C.E.) developed the theoretical and clinical dimensions of the science of medicine<sup>35</sup>. Al-Razi is considered to be the greatest physician of the Islamic world and at least one of the great physicians of all times. His greatest medical work and perhaps the most extensive ever written by a medical man, is his *al-Hawi* (The Comprehensive), which includes Greek, Syria and early Arabic medical knowledge in its entirety. Besides, Ibn Sina's gigantic *al-Qanun* (canon) is the culmination and masterpiece of Arabic systematisation. This medical encyclopaedia deals with general medicine, simple drugs, special pathology and pharmacopeia<sup>36</sup>. Ibn-ul-Haitham (965 A.C. - 354 A.H.) was one of the greatest physicist of all times<sup>37</sup>. He made experimental contributions of the highest order in optics<sup>38</sup>. Medicine (*tibb*) was, in fact, occasionally treated in the mosque. Ibn al-Haytham gave lectures upon the subject in al-Azhar in the time of al-Hakim and when Lajin restored the mosque of Ibn Tulun, he ordered lectures on medicine, a subject that otherwise

was taught in the hospitals<sup>39</sup>. Qutb al-Din al-Shirazi (d. 1311 A.D.) one of the renowned scientists of all times presented his views on optics in his work entitled *Nihayat al-Idrāk fi Dirayāt al-Aflāk* (The Highest Understanding of the Knowledge of the Spheres). The 14th century important physicist Kamal al-Din Abul Hassan al-Farisi's *Tanqih al-Manāzir* is an elaborate and original commentary on Ibn al-Haitham's *Kitāb-al-Manāzir* (The Book of Optics). Astronomy was such a favourite recreation with the early Muslims that even private persons with independent means installed observatories at their homes. Astronomers in Shiraz, Samarqand and Nishapur were engaged on celestial observations. At Ghaznah an illustrious exponent of the mathematical and physical sciences, al-Biruni (973-1048 A.D.), a contemporary of Ibn-Sina, wrote *al-Qanūn al-Masūdi*. It is a treatise on astronomy and surveys the entire field explored at the time by the Greeks, Persians and Hindus. One of the contemporaries of Abu Ma'shar, Muhammad Bin Ahad was engaged in astronomic observations and was making up star-tables in Samarqand<sup>40</sup>. Abul-Abbas Ahmad from Ferghana produced a remarkable compendium on astronomy. Muhammad bin Ali Hakimi Tirmidhi from Termidh, wrote a treatise on the calendar system and the great central Asian mathematician and astronomer, Abu Abdullah Muhammad al-Khawarizmi made use of this system as well as of the ptolemaic<sup>41</sup>. Al-Khawasizmi's *Zij* (consisting of astronomical tables) was very popular and remained standard until revised by Maslamah al-Majriti (of Madrid) in the second half of the 10th century.<sup>42</sup>

In arithmetics, algebra, geometry, trigonometry, logarithm, the contribution of such eminent mathematicians as Abdul Hamid Ibn Turk, Abu Jaifar al-Razi, al-Marwazi, al-Biruni, Nasiruddin Tusi, Khwarizmi<sup>43</sup>, al Khujandi, Umar Khayyam, Uleg Beg and al-Kashani was of a pioneering nature. Abu Sa'id al-Darir al-Jurfani (d. 845 A.D.), an astronomer and mathematician wrote a treatise on geometrical problems.<sup>44</sup> Abu Abd Allah Muhammad Ibn Musa al-Khawarizmi (d. 850 A.D.) a renowned mathematician, astronomer and a geographer gathered Greek and Hindu knowledge and through his arithmetic, the Muslims and the Europeans were introduced to the Hindi system of numerals.<sup>45</sup> Abu Yusuf Yaqub Ibn Ishaq al-Kindi, the encyclopaedic scientist and the philosopher is believed to have written 270 works, some of which deal with mathematics.<sup>46</sup> Al-Battani

(d.929 A.D.) devoted the third chapter of his astronomical work to trigonometry<sup>47</sup> 'Umar al-Khayyam, the great Muslim mathematician and astronomer of the Middle Ages discussed the cubic equations. Nasir al-Din Tusi, a Persian philosopher, mathematician, astronomer, physician and scientist wrote on the subject a separate treatise called *Shakl al-Qatta* (The figure of Sector).<sup>48</sup> Besides this, Al-Biruni's *al Qanūn al-Masūdi* established the earth's dimensions and his *Kitāb al-Jawāhir fi Marifat al-Jawahir*, book on precious stones is a significant contribution towards geology. Of al-Biruni it is sufficient to say that he was one of the first Muslim scientists who developed the scientific and empirical methodology for the study of Nature.

Muslim scientists, in fact, fused the practical approach to scientific problems with the abstract thought. Their highly developed scientific techniques, the labelled diagrams of their scientific apparatus, the elaborate discussions of chemical reactions found in their books confirm this thesis.<sup>49</sup> They recognised the physical or qualitative and the mathematical or quantitative aspects of science.<sup>50</sup> They made qualitative as well as quantitative study of numerous scientific problems. For instance, Ibn Khurdadbih determined the latitudes and longitudes of various places in the Muslim world. Al-Biruni ascertained the specific gravity of a number of substances.<sup>51</sup> The experiments in chemistry, physics and medicine used to be performed in the laboratories and those on pathology and surgery in hospitals. Arrangements for the dissection of the corpses were made for the practical teaching of anatomy.<sup>52</sup> Caliph al-Mutasim supplied a physician with apes for this purpose. Besides experimentation and observation attention was paid towards the accuracy of the instruments. The old instruments were improved, and some new ones were invented. The inventors of new instruments Hamid and 'Ali Ibn Isa were compared by a famous astronomer Ibn Yunus, to Galen and Ptolemy. On account of the desire for utmost accuracy in observations and calculations, the valuable records used to be signed on oath in the presence of judges.<sup>53</sup> The Muslim scientists not only made original contribution to science but also to technology. They observed the stars, and prepared star maps for navigation purposes. Ibn Yunus made use of pendulum for the measurement of time. Ibn Sina used air thermometer to find out air temperature.<sup>54</sup> Paper, compass, gun, gunpowder, inorganic acids and alkali

are some of the most important examples of scientific and technological developments of Muslim scientists which brought about an unprecedented intellectual revolution in the human civilization.

The scientific and academic pursuits of the Muslim scholars became the source of inspiration in numerous western academic institutions. Thirty editions of *al-Qanūn fi–Tib* of Ibn-Sina a comprehensive medical work, known to the west by the title of *Canon*, were published in Europe. Many commentaries on it were written in the 15th century. It formed half of the the medical curriculum of the European universities in the later part of the 15th century, and continued as a text book upto about 1950 in the universities of Montpellier and Louvain.<sup>55</sup> *Kitāb-ul-Manāzir* (Book of Optics) of Ibn al-Haitham, who is remembered in European by the name of Alhazen, exerted a great influence on European scientists for about 600 years.<sup>56</sup> *Kitāb-al-Tasrif* of Abul Qasim al-Zahrawi, is an encyclopaedic work related to medicine and surgery held its importance for centuries as the manual of surgery at Salerno, Montpellier and other schools of medicine in Europe. As such the scientific heritage of Islam transferred to Europe finally resulted in the form of the renaissance of modern science.

**References and Notes**

1. S.A. Qudus; *The Challenge of Islamic Renaissance*, Delhi, 1989, p. 99.
2. Barthold quotes an example of the two sons of a poor peasant who were sent to Samarqand and who became qualified in sciences, while their mother supported them by her work at wool weaving. Barthold W; *Turkistan Down to Mongol Invasion*, London, 1928, p. 213.
3. Al-Tibawi; "Muslim Education in Golden Age of Caliphate" *Islamic Culture*, Hyderabad, Vol. XXVIII, 1954, p. 433. Muslim scholars of all the countries in general and Central Asia in particular from the early days of Islam travelled extensively through plains and hills, rivers and oceans, forests and deserts in connection with religious preaching, *Hajj*, *trade* etc. In the course of their travels they collected information on social, political, historical, geographical, economical, agricultural and other conditions of the lands they visited. As a consequence of the collection of such information sciences developed.
4. Pederson; "Some aspects of the history of the Madrasa", *Islamic culture*, Hyderabad, Vol. III, 1929, p. 525.
5. Hameedullah; "Educational system in the time of Prophet", *Islamic culture*, Hyderabad, Vol. XIII, 1939, pp. 48-59; John L. Esposito (ed.), *The Oxford Encyclopaedia of the Modern Islamic World*, Vol. I, p. 408.
6. Pederson; op. cit., p. 525. Mosques continued to be used as places of instruction in not only religious sciences but also in secular subjects. In the year 256 al-Tabari dictated the poems of al-Tirimmah in the "Amr mosque" sitting near the *Bait-ul-Mâl* and some years earlier the great al-Shafi'i spent the most of his time in this mosque. Just after the *Salât-ul-Subh* he taught the Qur'an; at sunrise *Hadith* later the subject of scientific method, at *duhar* came the *ahl-al-Arabî* and learned with him grammar and poetry. The well-known traveller, Ibn Battutah while in Shiraz, attended lectures on Hadith in the city mosque, and before his arrival in Shiraz, he had done the same in Jami'-Mansur of Baghdad even though during his days at Baghdad there were a number of good *madarsas*. Even at Bukhara widely known at that time as *Qubbat-ul-Islam* there were some mosques used for the instruction of sciences related to the *Shari'ah*. Consequently the mosque gradually developed into a full fledged seat of learning in as much as it was considered the first university of Islamic studies and the centre of socio-cultural, political and educational activities. In fact, all branches of Islamic sciences found an asylum in the mosque. This was the meeting place of all learned men, the place of devotion and study of working and discussion, not strictly organised,

open to every Muslim and at the same time many of the students and teachers found lodging in the mosque, appropriate to their humble pretensions. Ziya-ul-Hasan Faruqi; "Some aspects of Muslim Education and Culture, *Encyclopaedic Survey of Islamic Culture*, ed; Mohammed Taher; vol., III, Delhi, 1998, p. 105. Yaqut-al-Hamawi; *Mujam-ul-Udaba*, Vol. I, p. 432.

7. These centres grew in every town and villages of central Asia for the promotion of knowledge of learning. The students were required to acquire full proficiency in reading and writing and to learn elementary mathematics. This was in addition to the study of the Qur'an and its memorisation. In fact, the beginning and spread of Islam in the early days of Islam was centred around individuals rather than schools. Even the content of Islamic thought was also characterized by individual effort. Established scholars attracted students from far and near for the acquisition of knowledge. The chief characteristic feature of learning, as such, which persisted throughout the middle ages of Islam, was the individual importance of the teacher. The teacher, after giving his full course, personally gave a certificate (*ijāza*) to the student who was then allowed to teach. The certificate was sometimes given in an individual subject - *fiqh* or *Hadīth*, sometimes in several subjects and sometimes it was valid for specific books. The dignity and prestige of a teacher can be assessed by the fact that even after the establishment of madrasa, the biographies of illustrious men and scholars usually give the names of their teachers instead of colleges they studied from. Even the certificates were issued often in the name of the teacher rather than that of the school.
8. Nizam al-Mulk, the talented minister of the Malik Shah, one of the Saljuq rulers established *Madrasahs* for the promotion of Islamic learning. The institutions attracted scholars from all parts of the Islamic world. He reorganised and reformed higher religious education by establishing some *Madrasahs* as models for imparting higher religious education. These schools were located in important towns of the empire such as Baghdad, Nisabur, Herat Balkh and al-Mawsil. One of the close associates of Nizamul Mulk was al-Ghazali who formulated the new system of Islamic education by reviving purely Islamic sciences and curbing the heretical ideas of Muslim philosophers, the M'utazilla and the Fatimids. The Samanids of Bukhara also patronised sciences and men of letters. Ibn Sina and al-Biruni lived in their court. Among the Ghaznawids, Sultan Mahmud was the most illustrious patron of sciences. He founded a *madrasah* at Ghazni to which a library was also attached. This Madrasa attracted students from all over central Asia and Persia. Many great scholars flocked to his court such as al-Biruni, Ibn-Sina and al-Firdousi. Consequently, the scholars produced by these *madāris* became the torch

- bearers of culture, civilization and scientific knowledge between 8th and 13th centuries.
9. Yaqut-al-Hamawi; *Mujam-ul-Udaba*, Vol. I., p. 467.
  10. Pederson; *op. cit.*, p. 529.
  11. In fact, a number of academies were established by the rulers at many places in the Muslim world to carry out the work of translation. These academies undertook the translation of the main Greek works on philosophy, astronomy, mathematics, medicine and other sciences. An institution, almost similar to *Bayt ul-Hikmah* was founded by the Fatimi rulers in Egypt. During the regime of the Abbasids, particularly, al-Mansur and al-Mamun extensive activity was shown in the preparation and translation of scientific works. During the reign of the caliph al-Mutawakil, the translation school was refounded. Some other works of Greek scientists were translated into Arabic. As such the translation work which began in the 8th century was, on a significant scale, done by the end of the 10th century. The translators belonged to different ethnic and religious groups. For instance, Naubakht was of Persian origin. Muhammad Ibn Ibrahim al-Fazari was an Arab. Hunain Ibn Ishaq was a Nestorian Christian from Hira. George, Sarton; *Introduction to the History of Science*, Cambridge Institute of Washington, 1950, Vol. I, p. 11; Lewis Bernard; *The World of Islam*, ed, London, 1976, p. 181.
  12. Yaqut-al-Hamawi; *op. cit.*, p. 467; Olga Pinto; "The libraries of the Arabs", *Encyclopaedic Survey of Islamic Culture*, ed. Mohamed Taher, Vol. 3, p. 223.
  13. Yaqut-al-Hamawi; *op. cit.*, p. 315; *The Encyclopaedia of Islam*, Vol. V, p. 1125. With regard to Ibn Sina, it is an established fact that he worked for sometime on an administrative assignment under Shams-al-Dawla, the Buwayid ruler of Hamadan and Kirmanshah. But his evenings were spent in the promotion of learning. He used to sit in his house to read from *al-Shifa* and from *al Qanun* to a large number of groups. The house of Abu Sulaiman al-Sijistani (a leper) was a resort of scholars who devoted themselves to the cause of learning and who flocked to attend his lectures. Imam Ghazali although initially was associated with *Madrasah Nizāmiyah* of Nishapur, finally busied himself in his own house at Tus to teach theology.
  14. The valuable *kutubkhanās* of these centres were widely used by the scholars. In Herat, under the patronage of Sultan Husayn b. Mansur B. Bayqarah, *kutubkhanās* were established for the benefit of scholars. The libraries of Marv have been described by Yaqut al-Hamavi, who used quite a good number of them while compiling his book. Of these libraries, according to him, *Kutubkhanah Nizamiyah* and *Azīziyah* were very important and contained

- precious books. Ziya-ul Hasan Faruqi; "Some Aspects of Muslim Education and Culture", Mohd. Tahir; ed. Vol. 17 pp. 111-112.
15. Besides public and private libraries there were still other possibilities for acquisition of knowledge and higher education, the assemblies (*majālis*) of *'ilm* and *adab*. The assemblies were in actual fact a less formal version of the typical circle, although they were held in mosques and private houses. Assemblies for disputation (*manāzara*) and remembrance (*dhikr*) were held in different places elsewhere. A remarkable example of such assemblies which discussed practically every subject including philosophy is provided in *Kitab-al-Muqabasat* by Abu Hayyan al-Tauhidi.
  16. The historian Ibn Miskawaih (d 421-1030 A.D.) was librarian of the Wazir Abu'l Fadl ibn al 'Amid of Ar-Ray, the historian Ibn as-Sa'i (d 674-1275 A.D.) was director of the Mustansiriyah library at Baghdad, Ibn Sina (Avicena) was librarian of the Samanid Prince Nuh ibn Mansur at Bukhara. It was through them that the ancient and the Islamic sciences were transmitted to Europe. Olga Pinto; "The libraries of the Arabs", Mohammed Tahir; *Encyclopaedic Survey of Islamic Culture* (ed.) Vol. 3, p. 237.
  17. As a result of this encouragement and other factors, great enthusiasm for learning was found among Muslims, the like of which was never seen in their predecessors and contemporaries. The commonly accepted measure of a man's wealth was not his possession of material resources, but his acquisition of good books. For establishing friendly relations with the Caliphs, the non-Muslim rulers used to offer gifts of books. The government servants, the governors, the judges and others hurried to some lecture theatre after being free from their duties. Whenever, the Caliphs travelled, they were accompanied by scholars to quench their thirst for knowledge. Literacy had reached the highest standard of the age among the Muslims. M. Saud; *Islam and Evolution of Science*, Adam Publishers, Delhi, 1994, p. 11.
  18. Mohamed Taher; op. cit., Vol. 17, p. 103.
  19. A.J. Arberry; *Revelation and Reason in Islam*, London, 1957, p. 29.
  20. Ziauddin Sardar; "Islamic Science or Science in Islamic Polity: What is the Difference?", *Journal of Islamic Science*, Aligarh Vol. 1, 1985, p. 40. Muslim contribution to physics, chemistry, medicine, astronomy, navigation, mathematics, geology, geography, botany, zoology, sociology and philosophy is well known to the historians of science and human development.
  21. C.E. Bosworth, "The Historical Background of Islamic Civilization", *Introduction to Islamic Civilization*, ed. R.M. Sovory, 1976, p. 19.
  22. Barthold W, *Turkistan Down to Mongol Invasion*, London, 1928, pp. 180-181. Al-Biruni; *Chronology*, translated by Sachau, p. 210.



23. Ibn-Nadeem; *al-Fihrist*, p. 295.
24. *Ibid*, p. 244.
25. Al-Tabawi, *op. cit.*, p. 428.
26. Seyyed Hossein Nasr, *Traditional Islam in the Modern world*, London, 1987, p. 172.
27. *Sahih* of al-Bukhari however is the most celebrated and authentic collection of *Hadith*. In fact, nothing is more eloquent of the exalted position of *Hadith* in the Islamic community from the third century onwards, and of the prominent position of al-Bukhari among the *Ashāb-ul-Hadith*, than the extravagant homage which was paid to him and his work. A man who laboured sixteen years in the compilation of his corpus, who sought the aid of prayer before committing a *Hadith* to writing, interrogated over one thousand Shaikhs living in places so distant as Balkh, Merv, Nisapur, the principal towns of Mesopotamia, the Hijaz, Egypt and Syria, deserved well of his co-religionists. Imam Bukhari followed sound methodology during the compilation of *Hadith*. He would never accept a *Hadith* unless he was convinced of the reliability of all the translators Guillaume Alfred; *The Traditions of Islam, An Introduction to the Study of Hadith Literature*, Oxford, 1924, pp. 30-31.
28. Mohamed Taher; *op. cit.*, Vol. 3, p. 69.
29. Al-Tabawi, *op. cit.*, p. 429.
30. Forster, Charles, *A Historical Geography of Arabia*, London, 1984, p. 127.
31. A. Wembre, *History of Bukhara*, pp. 2-3.
32. Briffault, Robert, *The meaning of Humanity*, Islamic Book Foundation, Lahore, 1980, p. 193.
33. George Sarton, *op. cit.*, Vol. I, p. 760.
34. *Ibid*, p. 760.
35. Prof. Abdus Salam, "Islam and Science: Concordance or Conflict?" *Review of Religions*, Vol. LXXXI, No. 8, London, 1986, p. 34.
36. S.N. Baher, "Islam and Science", *Islamic Review*, Vol. 39, 1951, p. 13.
37. G. Sarton, *Introduction to the History of Science*, Vol. I, p. 716.
38. H.J.J. Winter, *Eastern Science*, London, 1952, pp. 72-73.
39. Pederson, *op. cit.*, p. 527.
40. A. Asimov; *op. cit.*, pp. 21-22.
41. *Ibid*, p. 22.
42. Al-Qifti, *Tārīkh-al-Hukama*, Leipzig, 1903, p. 265.
43. In the foremost rank of mathematicians of all times stands Muhammad Ibn Musa al-Khawarizmi (780-850). He composed the oldest words on arithmetic and algebra. They were the principal source of mathematical knowledge for

centuries to come both in the east and the west. His work on algebra, *Hisab al-Jabr-Wal-Muqābala* remained an important source of information in the European world.

44. George Sarton, *op. cit.*, Vol. I, p. 531.
45. Ibn Nadeem, *Al-Fihrist*, Cairo, p. 383.
46. *Ibid.*, p. 357.
47. Al-Qifti; *op. cit.*, p. 254.
48. ĀI-Baghdadi Ismail Basha, *Hadiyyat al-Arifin*, Istanbul, 1951, Vol. 11, p. 131.
49. M. Saud, *op. cit.*, p. 9.
50. Ja'far Al-Khazini Abu, *Mizan al-Hikmah*, Hyderabad, 1359 (A.H.), p. 6.
51. Robert Briffault, *op. cit.*, p. 193.
52. G. Browne, *Arabian Medicine*, p. 41.
53. 'Ali Ibn Yusuf Al-Qifti, *Tārīkh al-Hukamā*, Leipzig, 1903, p. 351.
54. Robert Briffault, *op. cit.*, p. 191.
55. Wasti Hakim Nayyar, *Tibb-al-Arab*, Lahore, 1954, p. 51.
56. George Sarton, *op. cit.*, Vol. I, p. 721.