History of Islam

An encyclopedia of Islamic history

Philosophy and Science

Philosophy and Science in the Classical Age

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The Qur'an bestows upon humankind the keys to the heavens and the earth ("Do you not see that God has made subject to thee all that is between the heavens and the earth", Qur'an, 31:20). In the golden age of their history, Muslims used these keys to unlock the secrets of nature and they created a civilization that was the marvel of the world. Then, they overreached themselves. They tried these keys to unlock the mysteries of revelation itself. In the process, they stumbled. Reaction set in and at times it was violent. The keys were dropped and the door to philosophical inquiry was closed. Those who indulged in natural science continued to be tolerated but only on the fringes of the intellectual society. Nature, in turn, closed its doors on the Muslims. And the riches of the world were bequeathed to other civilizations.

The initial thrust of Islamic thought was comprehensive. It embraced *Fiqh*, *kalam*, logic, t*asawwuf*, politics, sociology, science and technology. The approach was at once rational and empirical but was always based on the over-arching paradigm of *Tawhid*. For more than five hundred years, during the era of the Abbasid Caliphate in Baghdad (750 to 1258), Muslim scientists made fundamental contributions to the understanding of nature and sought to control it through knowledge rather than submit to it through superstition. Some of these contributions changed the basic way humankind related to God's creation. Mathematics and science do not flourish in a vacuum. They develop and are cultivated by intellectual frameworks, which are deeply influenced by religious beliefs. Religious paradigms color the way men and women look at nature. For instance, Muslims came up with the concept of infinity because they believed in the transcendence of the Divine and nature as a continuous unfolding of Divine Will. A civilization, which believed in the finiteness of the Divine, could not have come up with this concept. The Muslims also invented algebra because they believed that the many patterns in nature derived from the principle of movement implicit in the Divine Will to manifest itself. Similarly, the Mayans in the Americas and the Hindus in India independently discovered the concept of zero. The Hindus did so because of their belief in the cycle of birth and death. Between each cycle there is a moment of rest (*su-na-ya* in Sanskrit), which became *sa-fa-ra* in Arabic and zero in English. The Mayan concept of zero is based on the cyclic change of seasons and is expressed implicitly in the zigzag patterns of the earliest Native American tribes, the Anasazis, which may be seen in petroglyphics in the American southwest.

In this article, we pay but a brief tribute to the Muslim thinkers and men of science who made a difference to the onward march of human civilization. These scholars not only nourished the Islamic civilization but also added to the reservoir of human knowledge and passed on the torch to other civilizations.

Muhammed bin Musa al Khwarizmi (d. 840) lived in the heyday of Islamic science during the period of Caliph Mamun. He integrated the mathematical knowledge of the Greek and Indian Schools and made his own first rate contributions. He is best known for a regressive method of mathematical analysis for which the world pays him tribute to this day by calling this method "algorithm". He is known as the father of algebra. He gave analytical solutions to quadratic equations, developed trigonometric sine and tangent functions, invented the concept of differentiation, developed astronomical tables, worked on clocks and astrolabes and was a member of the team that measured the degree of an arc around the earth's circumference that was ordered by Caliph Mamun.

Ali Ibn Rabbah al Tabari (d. 870), born to Jewish parents, embraced Islam and went on to become one of the most distinguished physicians of the classical period. His seven-volume encyclopedia of medicine is the most comprehensive collection of medical knowledge up to his time. In it, Al Tabari covers medical principles, anatomy, diet, diseases of different parts of the body and their causes, taste and color, drugs and medicine and the influence of climate on health. He has included a discussion of Ayurvedic (Indian) medicine.

Yaqub Ibn Ishaq al Kindi (d. 873) was employed at the court of Mamun and made basic contributions to the sciences of music, mathematics, chemistry and astronomy. A Mu'tazilite, he too fell out of favor with the Baghdad court when Al Mutawakkil became the Caliph and suffered at the hands of the Asharites. He analyzed the correspondence between the frequency of notes and their pitch and studied the synthesis of notes to produce musical harmony. He understood the chemical nature of different elements and advanced the position that base metals could not be converted into gold, a position contrary to that of the alchemists of the day. He was the first one to study the proper dosage of medicines for curing diseases of the body.

Muhammed Ibn Zakariya al Razi (d. 930) was one of the greatest physicians of the 10^{th} century. He was the first to identify and compare smallpox and chicken pox and emphasize the importance of diet and stress on health. He made an exhaustive compilation of medical knowledge that was available from Greek and Muslim sources. He was also an applied scientist, discovered numerous chemical reactions, documented the properties of chemicals and founded separate disciplines for organic and inorganic chemistry. He was the first to produce sulfuric acid and used his extensive chemical knowledge to formulate and synthesize compound medicines. Razi was a Mu'tazilite and held space and time to be a continuum. Like most Mu'tazilites, he too was looked upon with suspicion by fellow Muslims of his age.

Abul Hasan Ali al Masudi (d. 957) was the first empirical historian of Islam. A Mu'tazilite philosopher, he served the Fatimid court of Cairo, where the reception for rational ideas was more favorable than in Abbasid Baghdad. He traveled through Persia, India, Sri Lanka, Malaya, China, Madagascar, East Africa and North Africa and documented his observations about these regions and their people in a thirty-volume documentary. He added critical analysis to the historical process and presaged the great philosopher of the Maghrib, Ibn Khaldun, by five hundred years.

Abu Ali al Hussain Ibn Sina (d. 1037), perhaps the greatest scientist of the Middle Ages, was born near Bukhara in the year 980. A brilliant student, he mastered philosophy, medicine, mathematics and the Qur'anic sciences before he was seventeen. His capabilities soon attracted attention from the Seljuk

sultans and emirs who were competing at the time both for political power and intellectual patronage. Ibn Sina found successive employment with the ruler of Bukhara, Khwarazm, Hamadan and Isfahan. He is best known in the world of science for his monumental work *Qanun fi al Tibb*, an encyclopedia of all of the medical knowledge known at that time. The *Qanun* was translated into Latin and was a standard text in the universities of Europe for 600 years. His original contributions include recognition of contagious diseases such as tuberculosis, the propagation of diseases by water and food, the relationship between mental well-being and physical health, identification and cataloguing of medical drugs, identification of meningitis, healthful child care and human anatomy. In addition, Ibn Sina made original contributions to the mathematics of music, invented a calculator similar to a vernier, built a device similar to a thermometer, experimented and ruled out the possibility of transmutation of elements and elaborated on the concepts of force, heat, energy and the speed of light. He also sought to reconcile rational/empirical methods with Qur'anic injunctions. For his rationalist views, he too was looked upon by later Muslims as somewhat of a heretic. Consequently, his impact was felt more in Europe than in Asia and Africa.

Abu Raihan al Baruni (d. 1048) was one of the foremost historians and geographers of Islam. Born in Khorasan, he mastered physics, mathematics and kalam at an early age. Soon he caught the attention of Sultan Mahmud of Ghazna, who took al Baruni along in his campaigns to India. Al Baruni, a keen observer, learned the mathematics, religion, philosophy and sociology of the Hindus and recorded it in his classic masterpiece, *Kitab al Hind*. Almost all of our knowledge of medieval India comes to us from the writings of this scholar. Upon his return from India, he wrote his *Qanun e Masoodi*, in which he combined the mathematics of India with the mathematics of Greece. He discussed the Indian numerical system and pointed out the usefulness of the decimal. He was the inventor of the empirical method in astronomy and insisted on verifying stellar movements through observation. He discussed the rotation of the earth and calculated correctly the latitude and longitude of several important cities. He made observations on the relative velocity of sound and light and applied hydrodynamic principles to transfer water between wells. In a later book, *Kitab al Saidana*, he combined the Indian Ayurvedic medicine with the known Arabic medicine.

Giyasuddin Abdul Fateh Omar al Khayyam (d. 1123) was born in Nishapur in Khorasan. He traveled to and studied at the well-known centers of learning in the Islamic East, including Nishapur, Samarqand, Bukhara and Isfahan. One of the greatest mathematicians and astronomers of his age, his lasting contribution was the compilation of the Jalalian calendar, which was used in the Islamic world until recent years. It is more accurate than the Gregorian calendar used in the modern world. He studied and offered solutions to third degree equations using both algebraic and geometric approaches. Omar Khayyam is the one who developed the binomial expansion and formulated the binomial theorem. He did experiments on the relative weights of materials and correctly measured the specific gravity of several elements. But Omar Khayyam is best known in the world today as the author of the Rubaiyat, thanks to its translation into the English language in the 19^{th} century. The Rubaiyat illustrates the exquisite sensitivity of his keen intellect as well as the spirituality of Islamic *tasawwuf*.

Abu Abdallah Muhammed al Idrisi (d. 1166) was a Spaniard and studied in Cordoba and Seville. He lived at a time when Crusader attacks against Muslim territories in Palestine, North Africa and Spain were at their height. The Crusaders brought the Latins into contact with the more advanced civilization of the Muslims. In particular, Sicily and southern Italy had just changed hands from the Muslims to the Christians. Arabic knowledge was in demand. Roger II, King of Sicily, reached out and employed some of the leading Muslim scientists of the day. Al Idrisi was one of them. For this reason, he won the displeasure of contemporary Muslims who believed that Al Idrisi gave comfort to the enemy. Al Idrisi is noted for his contributions to geography. He compiled all the known information about Asia, Europe

and North Africa and produced a map, which was considered a standard for many centuries. In addition, he was a keen observer of people and their habitat including plants, animals and climate. He studied plants for their medical applications, collected data from Greece, India, Persia and Africa and added to the treatment of diseases using natural drugs.

Abul Waleed Muhammed Ibn Rushd (d. 1198) was the greatest philosopher the world has known since Aristotle. Born into a scholarly family of Spain, he studied under the masters of the age and had access to the extensive libraries in Cordoba. Spain was in turmoil and Ibn Rushd found employment with Abu Yaqub, ruler of Morocco. Some of the rationalist views of Ibn Rushd, however, won the displeasure of his benefactor. His books were burnt and he was banished from the court. The world knows Ibn Rushd for his commentaries on Aristotle. These were written at three levels: a brief summary, an intermediate expose and a detailed commentary. His works were translated into Latin and were a major contributor to the transmission of rational thought to the West. The Muslim East, reeling as it was from a reaction to some of the Mu'tazilite ideas, turned its back on Ibn Rushd. This great man is known instead in the Muslim world for his work *Tahafuz al Tahafuz* (Repudiation of the Repudiated), a dialectic on Al Ghazzali's work *Tahafuz al Filasafa* (Repudiation of Philosophy). Ibn Rushd's attempts to rekindle philosophical and scientific inquiry in the Muslim mind were unsuccessful and Islam was to find its strength as well as its solace in spirituality and *tasawwuf*. In addition to philosophy, Ibn Rushd wrote twenty books on medicine and made major contributions to the science of music.

Nasir Uddin al Tusi (d. 1274) made his primary contributions under the Mongol invader Hulagu Khan. At the order of the Il-Khan, he established the great observatory at Maragha. He was the inventor of the two-axis gimbal, which he used extensively in the study of spherical trigonometry and celestial mechanics. His astronomical tables were standard reference material in Europe and China until the 15th century. Al Tusi was also a philosopher, *mutakallim* and physician. Well known as he is as an astronomer and an applied mathematician, he made his mark on world history through his book *Aqlaq e Nasiri*, an exposition of Islamic ethics. The *Aqlaq* had a profound impact on the Great Moguls of India and Pakistan and was the basis for Mogul governance in the courts of Akbar, Jehangir and Shah Jehan in the 16th and 17th centuries.

Mu'ammar Sinan (d. 1588), one of the world's best known architects and engineer, reminds us that the "golden age of Islam" did not perish with the fall of Baghdad in 1258 but was alive and well into the 17th century. Sinan was born in Keysari in 1494. Drafted into the Ottoman Janissary corps at the age of fourteen, he studied at the palace school in Istanbul as an engineering apprentice. His initial assignments as an engineer attached to the army took him with the Ottoman campaigns towards Vienna in the West and Baghdad in the East. The young Sinan had the opportunity to study not only the Byzantine and Seljuk architecture in his native Anatolia but also the architecture of the mosque-madrassah complexes in Persia and the Cathedrals in the Latin West. Serving successively under three mighty Ottoman sultans, Selim I, Sulaiman the Magnificent and Selim III, he demonstrated his brilliance as an engineer in building bridges and civil works and was promoted to the position of Chief Architect of the Empire in 1537. Sinan is credited with the construction of 400 architectural complexes in lands as distant as Yemen and Bosnia. His design revolved around the concept of the *Kulliye* which was a combination of a mosque, a madrassah, a hospital and a zawiya. Most notable of his existing monuments are the Selimeye complex in Edirne, the Sulaimaniya complex and the Shehzade complex in Istanbul. The skyline of modern Istanbul would not be the same without the contributions of this brilliant man.