

**MUSLIM CONTRIBUTION TO CIVILIZATION**

**CONCEPTUAL FOUNDATIONS AND  
HISTORICAL MANIFESTATIONS**

**BY**

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# I. INTRODUCTION

In his book, The Making of Humanity, Rob Briffault states:

"It is highly probable that but for the Arabs, modern European civilization would never have risen at all.... There is no single aspect of European growth in which decisive influence of Islamic culture is not traceable... what we call science arose in Europe as a result of a new spirit of enquiry, of new methods of investigation, of the methods of experimentation, observation, measurement, of the development of Mathematics in a form unknown to the Greeks. That spirit and those methods were introduced into the European world by the Arabs [meaning Muslims]" <sup>1</sup>

The roots of this "new spirit" was the rise of Islam and the new world view it offered, a relevant element of which is that reason is neither irrelevant to the strengthening of one's faith, nor is it the antithesis of faith. Indeed, the use of power of intellect and reason is not only accepted, it is also urged in the Qur'an.

"Do they not reflect in their own minds? Not but for just end, and for a term appointed, did Allah create the heavens and the earth, and all between them. .."  
[Qur'an, 30:8]

"Do they see nothing in the domain of heavens and the earth and all that Allah has created?" [Qur'an, 7:185]

The Qur'an states that Allah breathed His spirit into every human. It is that "breath" which endows the human with the innate spiritual and moral qualities. It also establishes the unique position of the human as the crown of creation

"We have honored the children of Adam; provided them with transport on land and sea; given them for sustenance things good and pure; and conferred on them special favors above a great part of Our creation." [Qur'an, 17:70]

This position of honor is closely tied to the **fulfillment of one's role** as 'trustee' of Allah and as a free agent; to worship Allah [51:56] in the broad meaning of worship which includes all useful and constructive endeavors on earth.

It is that challenge which qualifies the human race as the *Khalifah* (trustee) of Allah on earth. It also makes earthly life a 'test' or trial. "He [Allah] Who created Death and Life, that He may try which of your is best in deeds and He is Exalted in Might, Oft-Forgiving." [67:2]

One's conception of human nature and his/her understanding and acceptance of the purpose of creation and the role of *Khalifah* determine how one sees his/her relationship to the natural and social order.

## Resources and Trusteeship

As the human is created to be the trustee of Allah on earth, it follows that the resources made available to him/her in the universe are to be regarded as **tools** to fulfil the responsibilities of this trusteeship. The Qur'an made it clear that all things on earth are made subservient to human use (not abuse). It goes beyond that to remove any notion that exploration of the Universe outside the earth is encroachment on Allah's domain.

"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." [45:13]

The Qur'an lays the **foundation of understanding and harnessing** the God-given resources in numerous areas of economic pursuits

## Conditions of the Trust

As the **human is the trustee of Allah on earth**, it follows that his/her actions in the social order must be in accordance with the conditions of that trust. *Tawheed* upholds the exclusive sovereignty of Allah as the real owner of the universe and His foil rights to determine how His "property" should be used. As such, the concept of property in Islam is qualified by the condition of "trust" of the **Real Owner**.

The attributes of property in the Qur'an vary depending on the related level of abstraction. On one level all property is attributed to Allah alone.

"To Allah belongs the dominion of the heavens and the earth, and all that is therein, and it is He who has power over all things." Qur'an (5:123)

## Work is Worship

As all acts are potential acts of worship as explained earlier, it follows that work is not only a means of survival, but also a rewardable act of worship. Properly understood, this concept can be instrumental in **motivating productivity** as the time scale, the reward expected, and the Ultimate One to please by productive work are far beyond any finite concept or person. This may be illustrated by the instructions of Prophet Muhammad (P) that if the Day of Judgment begins while one is planting a tree, he should complete his task first. One may wonder as to what is the point of planting something that cannot immediately benefit the planter, and why plant a tree whose "fruits" may never be reaped? It is probably

the inculcation of the attitude of working on the basis of a longer scale of time, **consideration of future generations**, and above all the anticipation of Divine reward. It is the same spirit that the Prophet also taught that if one plants a tree of which a human, and animal or bird eats, he/she will get a reward for all who benefit from it.<sup>10</sup> Likewise, one's attitudes toward ecology are the prudent use of the infinite time scale and the most lofty objective, to reach for God. This results in greater sensitivity to the needs of the future generations. An example of this was the prophet's critical reaction to a companion who was using an **excessive amount of water** to make his ablution for prayers. When the companion responded "is there excess in the use of water?" the Prophet replied, "Yes, even if you're (making ablution) from a running river."<sup>11</sup>

Islam teaches one's responsibility before Allah and the belief in resurrection and eternal life, whose nature depends upon one's actions while on earth. Tawheed also means belief in the absolute perfection of Divine Attributes, one of which is perfect knowledge, even of the most secret thoughts of the heart. The result of such belief is that self-policing becomes the primary motive to avoid "evil" or "wrong", more so than mere social controls which are incapable of policing everything. Properly implemented, one's **sense of responsibility before Allah** avoids the attitudes of "get away with whatever you can so long as you don't get caught", or even the attitude of taking advantage of legal or administrative gaps or flaws to maximize one's utility at the expense of society. The sense of fairness in the social contract are greatly enhanced both by the infinite time scale and by the keen sense of *Taqwa* (being Allah-conscious) realizing that nothing can be hidden from Allah, who will hold each person responsible for his/her deeds.

## V. QUR'ANIC INDUCEMENTS TO STUDY AND EXPLORE

Following are a few examples from the Qur'an which clearly stimulate research, discovery, development and improvement of the quality of life.

"And in the earth are tracts (diverse though) neighboring and gardens of vines and fields sown with corn and palm trees growing out of single roots or otherwise: watered with the same water yet some of them We make more excellent than others to eat. Behold, verily in these things are signs for those who understand!" Quran (13:4)

"See you not that Allah sends down rain from the sky and leads it through springs in the earth? Then He causes to grow therewith produce of various colors: then it withers; you will see it grow yellow; then He makes it dry up and crumble away. Truly in this is a message of remembrance to persons of understanding." Qur'an (39:21)

“It is Allah Who has subjected the sea to you that ships may sail through it by His command that you may seek of His bounty and that you may be grateful.” Qur’an (45:12)

“It is He who made the sea subject that you may eat thereof flesh that is fresh and tender and that you may extract therefrom ornaments to wear; and you see the ships therein that plough the waves that you may seek (thus) of the bounty of Allah and that you may be grateful.” Qur’an (16:14)

“And cattle He has created for you; from them you derive warmth and numerous benefits and of their (meat) you eat. And you have a sense of pride and beauty in them as you drive them home in the evening and as you lead them forth to pasture in the morning. And they carry their heavy loads to lands that you could not (otherwise) reach except with souls distressed: for your Lord is indeed Most Kind, Most Merciful. And (He has created) horses, mules and donkeys for you to ride and use for show; and He has created (other) things about which you have no knowledge.” Qur’an (16:5-8)

It is noted that the above quotes deal with the fundamental resources: agricultural, water, fisheries and animal resources.

In a sweeping statement, the Qur’an indicates that everything on earth, and even in the heavens was created for the benefit of mankind:

“It is He who has created for you all things that are on earth; moreover His design comprehended the heavens for He gave order and perfection to the seven firmaments; and of all things he has perfected knowledge.” Qur’an (2:29)

“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.” Qur’an (45:13)

The Qur’anic exhortations do not limit themselves to physical resources. They do encourage the study and understanding of natural laws such as the alternation of day and night, forecasting rainfall and astronomical phenomena.

“It is Allah Who alternates the night and the day: verily in these things is and instructive example for those who have vision!” Qur’an (24:44)

“Behold! In the creation of the heavens and the earth and the alternation of night and day there are indeed signs for persons of understanding. Those who celebrate the praises of Allah standing, sitting and lying down on their sides and contemplate the

(wonders of) creation in the heavens and the earth (with thought): ‘Our Lord! Not for naught have you created (all) this! Glory to thee! Give us salvation from the penalty of Hell fire.’  
Qur’an (3:190-191)

“See you not that Allah makes clouds move gently, then joins them together, then makes them into a heap? Then will you see rain issue forth from their midst. And He sends down from the sky mountain masses (of clouds) wherein is hail: He strikes therewith whom He pleases and He turns it away from whom He pleases. The vivid flash of His lightning well-nigh blinds the sight.” Qur’an [24:43]

“And a sign for them is the night: We withdraw therefrom the day and behold they are plunged in darkness; And the sun runs its course for a period determined for it: that is the decree of the Exalted in Might the All-knowing. And the moon We have measured for it mansions (to traverse) till it returns like the old (and withered) lower part of date-stalk. It is not permitted for the sun to catch up to the moon, nor can the night outstrip the day: each (just) swims along in (its own) orbit (according to law).”  
Qur’an [36:37-40]

### **Role of Learning**

The above Qur’anic exhortation necessitates a positive attitude toward learning and acquisition of knowledge. This is grounded in the Qur’an also. The very first word of the Qur’an revealed to Prophet Muhammad (P) was *iqra’*, literally read:

“Proclaim! (or read) in the name of your Lord and Cherisher Who created.”  
Qur’an (96:1)

The Qur’an also praises those who combine faith with knowledge:

“...Allah will raise up to (suitable) ranks (and degrees) those of you who believe and who have been granted knowledge: and Allah is well-acquainted with all you do.”  
Qur’an (58:11)

A distinction and preference is given to those who are endowed with knowledge:

“...Say: Are those equal who know and those who do not know? It is those who are endowed with understanding that receive admonition. Qur’an ([39:9)

Knowledge in itself is neither a threat to faith nor is it inconsistent with piety and fear of Allah. In fact, unbiased and correct knowledge leads to piety.

“Indeed those who are endowed with knowledge fear Allah” Qur’an (35:28)

Generally speaking, the Qur’an considers it a sin not to use senses and reason as legitimate means of searching for truth and admonishes those who make claims that are not based on knowledge, and those who blindly imitate their ancestors.

“For the worst of beasts in the sight of Allah are the deaf and the dumb, those who understand not.” Qur’an (8:22)

“Those who give partners to Allah will say: If Allah had wished we should not have given partners to Him, nor would our father, nor should we have had any taboos. So did their ancestors argue falsely until they tasted of Our wrath. Say: Have you any (certain) knowledge? If so produce it before Us. You follow nothing but conjecture, you do nothing but lie.” Qur’an (6:148)

“Many are the Jinns and mankind We have made for Hell. They have hearts wherewith they understand not, eyes wherewith they see not and ears wherewith they hear not. They are like cattle, nay more misguided; for they are heedless (of warning).” Qur’an [7:179]

The attitude toward learning is reiterated in numerous sayings of Prophet Muhammad (P) <sup>12</sup>

“Seeking knowledge is a mandatory duty on every Muslim.”

“Whoever pursues a way in search for knowledge, Allah will make an easy way for him/her to paradise.”

“The priority of a scholar over a worshipper (without understanding) is like the superiority of the moon over other stars.”

“Scholars are the heirs of prophets.”

## **The Experimental Method**

One aspect of learning encouraged in the Qur’an is the experimental approach. A few examples may illustrate this. Explaining how Allah inspired the honey bees, the Qur’an states:

“Then eat of all the produce (of the earth) and find with skill the spacious paths of your Lord: there issues from within their bellies a drink of varying colors wherein is healing for people: verily in this is a sign for those who give thought.” Qur’an (16:69)

The mention of healing connected with honey is an open invitation to examine the medicinal or healing properties of honey. Similarly, in drawing our attention to study the properties of metals, we read:

“We sent aforetime our apostles with clear signs and sent down with them the Book and the balance (of right and wrong) that people may stand forth in justice. and We sent down iron in which is (material for) mighty war, as well as many benefits for mankind, that Allah may test who it is that will help His cause and help Its messengers though unseen, for Allah is full of strength, exalted in Might (and able to enforce His will).”

Qur’an (57:25)

In a clear and amazing reference to embryonic development of the human, we read:

“We did create the human from a quintessence (of clay); then We placed him as (a drop of) sperm in a place of rest firmly fixed; then We made the sperm into (something that) clings (or clot); the of that clot We made a (fetus) into (a chewed-like) lump; then We made out of that lump bones and clothed the bones with flesh; then We developed out of it another creature; so blessed be Allah the Best to create!”<sup>13</sup> Qur’an (23:12-14)

The above quotes from the Qur’an lay down the foundations of the experimental approach and the replacement of conjecture with truth based on firm knowledge, factors which were crucial and decisive in bringing about scientific development. This call stands in contrast to the philosophical speculations and conjecture.

“Conjecture is not substitute for truth.” Qur’an (53:28)

It follows that the common notion that Roger Bacon was the father of the experimental method is not accurate. Born in 1214 (CE) Bacon came nearly six centuries after the Qur’an clearly called for this approach to learning. According to Rob Briffault, Roger Bacon was one of the apostles of Muslim science to Europe.<sup>14</sup>

According to Encyclopedia Brittanica:

“It is beyond all doubt that Roger Bacon was profoundly versed in Arabian learning and derived from it many of the germs of his philosophy.”<sup>15</sup>

So far the discussion has focused on the conceptual roots of Muslim contribution to civilization. Whether those conceptual roots were manifested historically is the theme of the next section of this paper.

## **Historical Manifestations**

It is obvious from the first part of this paper that the Qur'an and the Prophet's teachings (hadeeth) are responsible for generating a new spirit of research, creativity and progress. In this part, an attempt is made to show how that “new spirit” manifested itself in history. The first section briefly reviews the emergence of Islamic civilization and its impact on Europe, while the second provides specific examples of contributions to science and civilization.

## **Emergence of Islamic Civilization**

Progress began in the later part of the seventh century and the beginning of the eighth century (CE) under the Umayyad rule. Yet its golden age occurred under the Abbassid rule (750-1258) and in Muslim Spain (755-1492). For at least five centuries, Islamic civilization was the most prominent in the world. This is longer than the period in which European civilization has been prominent.

Schools and libraries were parts of mosque complexes. Endowments for colleges and bursaries for students were common. Scholars and researchers were respected and appreciated, regardless of their religious affiliations. An example of this attitude was manifest in the “House of Wisdom” in Baghdad in the 9<sup>th</sup> century under the patronage of the Caliph Al-Ma'moon. It served as a huge academic center, library and translation center. In the Western part of the Muslim world, the most important research center was in Toledo (Spain) where Muslim works were translated from Arabic into Latin; especially in the fields of Astronomy, Mathematics, Medicine, Chemistry, Botany and Philosophy. It is said that Pope Sylvester spent three years in Toledo studying Astronomy, Mathematics, Chemistry and other subjects under Muslim scientists.<sup>16</sup>

## **The Term “Dark Ages”**

These advancements show that the common expression “The Dark Ages” should in fact be qualified as the “European Dark Ages”, at least in the period coinciding with the emergence of Islamic civilization.

John Draper describes how science was suppressed and not tolerated in Europe and how physical and natural phenomena were attributed to the will of spirits. A person who came down with a fever had to go to the nearest shrine of saint seeking a miraculous cure.<sup>17</sup> In contrast to this, Muslim scientists and physicians were busy developing ways of diagnosing and treating diseases. As such the unqualified term “The Dark Ages” seems to be based on the subtle assumption that the history of Europe is the history of the world.

## **Restoration and Originality**

Another common misconception is that Muslim scholars merely restored the Greek Classics, which would have been lost without them. This notion belittles their original contributions, in addition to restoration. According to H.G. Wells, the Greeks did not know much about human history, their knowledge was “based on rudimentary speculations” and they were very poor in experimental apparatus.<sup>18</sup> This assessment is shared by A.N. Whitehead who states that the Greeks were over-theoretical and that for them, science was an offshoot of philosophy.<sup>19</sup> This assessment applies as well to their heirs, the Romans.

However, it would be equally incorrect to say that there were no contributions to civilization by other nations. Science is a shared and cumulative undertaking. The above discussion indicates that Greek and Roman contribution were not based upon experimentation which was the hallmark of Islamic civilization and which was a prerequisite to modern science. As such, the assumption that the European renaissance was based on a newly restored Greek and Roman heritage is inaccurate. It seems to imply that there was a sudden “blank” for several centuries between the fall of the Roman empire and European renaissance which restored the ancient heritage. It also conceals the inevitable fact that the renaissance was based on the then established and flourishing Islamic civilization. For several centuries, the language of the Qur’an (Arabic) was the international vehicle for scientific research and advancement (as English is today). Europeans who wanted to study Physics, Chemistry, Mathematics, Astronomy or Medicine had to flock to Muslim universities especially in Muslim Spain. Those Europeans who tried to popularize “Muslim science” in Europe were accused of being “Mohammedans” an accusation that was made against Roger Bacon for which he was imprisoned for fourteen years.<sup>20</sup>

A historian of science, George Sarton in his massive work, “An Introduction to The History of Science”, indicates that Muslim science reached Europe before the 14<sup>th</sup> Century (the beginning of renaissance) as early as the 12<sup>th</sup> century, and that the establishment of universities in Europe was motivated in part by the big volume of information (learned from Muslims and the need for its systematic study).<sup>21</sup>

Often times Muslim discoveries were translated by Europeans who attributed such discoveries to themselves, or incorporated them in their works without due credit. For example, Kepler took the idea of atmospheric refraction from the earlier work of Ibn Al-Haytham. Isaac Newton derived the notion of gravity, not from a falling apple, but from the earlier work of Muhammad Ben Mousa who spoke about the force of attraction between the heavenly bodies.<sup>22</sup> It may be useful to provide a few specific examples of contributions to human knowledge stimulated by Islamic teachings. This is the focus of the next section.

## **VI SPECIFIC EXAMPLES OF SOME MAJOR CONTRIBUTIONS**

Let us now turn to some specific examples of Muslim contributions in some major disciplines:

### **1) Astronomy**

Astronomy was one of the earliest sciences that attracted the attention of Muslims as early as the 3<sup>rd</sup> century (AH). Among their achievements is the discovery of the sun's apogee (the points farthest from the earth in the orbit of the moon). They drew catalogue maps of visible stars and gave them Arabic names and corrected the sun and moon tables and fixed the length of the year. They were the first to use the pendulum to measure time and the first to build observatories. Ibn Yunus (11<sup>th</sup> century) invented the sun dial, which, according to John Draper was the most valuable of all chronometric improvements. They predicted sun

spots, eclipses and appearance of comets. Abul-Wafa discovered a major aspect of astronomy known as the 3<sup>rd</sup> Lunar inequality (irregularity of the moon's highest latitudes", the same discovery that was attributed nearly 1000 years later to the Danish Astronomer Tycho-Brahe. Among the luminaries in this field are Al-Batani (Albategnius), who is considered by some astronomers as one of the most famous twentieth century astronomers in the world; Al-Bairouni, who was the link between the schools of Baghdad and India (10<sup>th</sup> -11<sup>th</sup> centuries); and Ulug Beg, who made a comprehensive survey of the state of this science nearly a century before Kepler. Some works of other luminaries in Muslim Spain, such as Ibn Khaldoun and Ibn Rushd were lost at the time of inquisition. <sup>17</sup>

## 2) Chemistry

In a world that knew no stronger acid than concentrated vinegar, the 8<sup>th</sup> century Muslim chemist Jabir discovered Nitric acid and described the operations of distillation, sublimation, filtration, coagulation and crystallization.

Abu Bakar Al-Razi (Rhases) of the 9<sup>th</sup> century was the first to describe the properties of sulphuric acid. His contribution in his time is comparable, according to John Drager, to the contributions of Lavoisier and Priestley in the West, in their times.

Abu-Musa Al-Kufi who lived in the late 8<sup>th</sup> century contributed greatly to chemistry to the extent that some of his works were translated into Latin and French, some as late as the 17<sup>th</sup> century

The orientation of Muslim chemists was on the applied side. They knew about distillation of water, plasters, syrups, ointments and tampering of steel. Many English terms in Chemistry originated from Arabic terms such as: camphor, alcohol, elixir, al-kali and syrup.<sup>24</sup>

## 3) Mathematics

While the numerals are believed to have originated in India, Muslims popularized it. Muhammad Bin Ahmed of the 10<sup>th</sup> century invented the concept of zero (sifr or void from which the terms cipher and decipher were derived). This did not only replace the cumbersome Roman numerals, but it was a new revolution in Mathematics. It was nearly 300 years later before Europe began to know this concept (13<sup>th</sup> century).

Algebra, or calculation by symbols came from the Arabic word Al-Jabr which literally means uniting the broken parts (or bones). Likewise, Algorithm comes from the name of the famous Muslim mathematician Muhammad Bin Musa Al-Khawarizmi of the 9<sup>th</sup> century, who was described by George Sarton (An Introduction to the History of Science) as "one of the founders of analysis or algebra as distinct from geometry." Al-

Khawarizmi's work was completed early in the 10<sup>th</sup> century by Abul-Wafa who also worked on quadratic equations.

Muslims' works in Mathematics were translated into Latin and made available to the West through Robert of Chester, Adelard of Bath and John of Seville. Had it not been for Muslim scholars, the famous works of Euclid would have been lost. Al-Tusi (13<sup>th</sup> century) had a major influence on the development of non-Euclidean Geometry.

In line with Muslims scholars' emphasis in the applied side, they were the first to develop trigonometry in its post-Greek form. They were the first to use the Sine and Co-sine due to their interest in Astronomy. They also wrote on spherical trigonometry. Their works on Trigonometry of tangents were not known in Europe until five centuries later. According to George Sarton: "During the thirteenth century, trigonometrical progress was entirely due to Muslim efforts." <sup>25</sup>

#### 4) Physics

Sarton described the famous Muslim physicist Al-Hasan Ibn Al-Haytham (Alhazen) of the 11<sup>th</sup> century as:

"The greatest Muslim Physicist and one of the greatest students of optics of all times." His book Al-Manazir, "exerted a great influence upon Western science and showed a great progress in experimental method." <sup>26</sup>

In fact his works were the beginning of the science of optics long before Bacon and Kepler. The inventions of the microscopes, telescopes, and cameras are indebted to him.

Contrary to the mistaken Greek belief that vision occurs because of a ray, which proceeds from the eye to the object, he indicated that the light emanates from the object to the eye. John Draper expressed his amazement that Abn Al-Haythem wrote in the 11<sup>th</sup> century:

"We determined that the retina is the seat of vision and that impressions made by light upon it are conveyed along the optic nerve to the brain." <sup>27</sup>

For several centuries Ibn Al-Haytham's work on optics was the main source of study in Europe.

Another practical contribution of Muslim physicists was the invention of the compass. While the Greeks knew about the properties of magnets, and while the Chinese discovered its directive properties, Muslims were the first to apply this knowledge and use the compass for navigation.

Other contributions to physics include the investigation of hydrostatics (early in the 9<sup>th</sup> century) and improvements in the use of water wheels. Abdul-Rahman Al-Khosaini wrote Mizan-ul-Hikman, which according to Sarton was:

“One of the main physical treatises of the middle ages. It contains tables of specific gravities of liquids and solids and various physical facts and theories.”<sup>28</sup>

## 5) Medicine

Muslim interest in health care relates to Islamic teachings. Ethically, the human body is a trust from Allah which should not be destroyed (e.g. By suicide) or abused (e.g. By drugs and intoxicants). Both preventative and remedial aspects of medicine are covered in Islamic teachings.<sup>29</sup> Some early works in Muslim medicine go back to the 8<sup>th</sup> century (Ibn Al-Muqaffa'). Greater progress was achieved, however, in the 9<sup>th</sup> century. Of the luminaries of that century is Fakhr-al-Deen Al-Razi (Rhazes), chief physician in Baghdad and the greatest physician in the “Middle Ages.” He wrote what Draper called “an immense medical encyclopedia” which remained among the most important medical references in Europe for 600 years. His treatise on measles and smallpox was translated several times until the 18<sup>th</sup> century. According to Sarton: “*Many contributions to gynecology, obstetrics and ophthalmic surgery can be traced back to him.*”<sup>30</sup>

In the 10<sup>th</sup> century Areeb Ibn Saad was the first one to write, systematically, on Pediatrics. His works were translated into Latin and Hebrew. About the same time Al-Mardeeni who live in Egypt excelled in the preparation of drugs. He “compiled a dispensatory which was immensely popular in medieval Europe. For centuries it remained the standard work on the subject.”<sup>31</sup>

Ibn Sina (Avicenna) who lived in the 11<sup>th</sup> century wrote a five volume work called “Canon (or Precepts) of Medicine” dealing with physiology, hygiene, pathology, therapeutics and Materia Medica. For at least 600 years his writings were the supreme authority in the “Middle Ages” and the basis of medical standards in Italian and French universities. In fact some of his works were translated and reprinted in Latin and Hebrew as late as the 18<sup>th</sup> century.

Early in the 11<sup>th</sup> century Muslim physicians treated cataract, hemorrhage and used cauterization. Among the famous surgeons was Abul Qasim who lived in Cordoba (Muslim Spain) in the late 11<sup>th</sup> and early 12<sup>th</sup> centuries. Sarton considers him as one who “exerted a very deep influence upon the development of European surgery down to the renaissance.” John Draper states that Abul Qasim’s surgical works were used in Europe until 1497. In the writing of Ibn Rushd we find “illustrations of sections of brains and eyes, eye nerves and surgical instruments.” They even administered anesthesia using an extract of the “darnel” plant. Other contributions included works on Bronchotomy, dislocations and fractures and the treatment of skin diseases (Ibn Zuhr, Avenzoar), psychopathology and psychological treatment and the demonstration of the circulatory system (Ibn Al-Nafees of the 13<sup>th</sup> century) nearly 300 years before William Harvey, to whom this discovery is attributed.<sup>32</sup>

Both mobile and permanent hospitals were known.<sup>33</sup> In peace time, mobile and permanent hospitals toured rural areas offering medical help. During the seljuk rule, some mobile hospitals required forty camels to carry physicians, drugs, medical equipment, food and clothes. First aid stations were established and in Ibn Tulun's mosque in Cairo, a physician came every Friday to give medical care and prescribe drugs dispensed from the mosque's pharmacy. It is believed that the first permanent hospital was built in Baghdad in the first half of the 8<sup>th</sup> century during the caliphate of Al- Waleed Ibn Abdul-Malik. Hospitals had two wings, one for males and the other for females. Each department had a chief, and the hospital had a physician-in-chief, in addition there were support staff (nurses, cleaning and food services). After physicians visited their patients, they met with their students in big lecture halls to discuss their diagnosis. Food was served to patients in covered trays. Some hospitals had their own gardens to grow fresh vegetables and fruits for the hospital's use.

It is interesting to note that the human and artistic touch was not absent in terms of layout, furniture and even entertainment for patients in the form of skits and story telling. At one time, a special trust was established in Tripoli, Syria to employ two persons whose job was to pass by patients pretending to be talking to one another in a manner that is audible to the patient, saying, "Look at his sparkling eyes, the redness of his face and the improvement in his health!" This reflects the awareness of the psychological element in treatment.

These are indications that medical care, including hospitalization, was free and universally available to all, including strangers, travelers and visitors. When the patient entered the hospital, he/she was examined; if there was no need for admission, the person was given medication and sent home. If admitted, the person was registered, asked to take a bath and given clean clothes. When the patient improved, he/she was moved to a convalescent hall. The sign of improvement was his ability to eat a chicken and a loaf of bread. At the time of discharge, the poor patient was given new clothes, and if needed, some money to help until he is able to resume work. Those who preferred to be treated at home were allowed to do so, in which case, drugs were sent to them. If the person was poor, food also was sent to them. One assessment of the 12<sup>th</sup> century hospital of Baghdad is that: "It appears to have been built under conditions which, from the point of view of hygiene, were greatly superior to our present day establishments. They were enormous, and air and water circulated in them quite freely."<sup>34</sup>

## **6) Geography**

Like Astronomy, Geography was related to Muslim devotional acts such as prayer and pilgrimage. It was also related to the sense of duty to communicate the message of Islam to the world, thus necessitating travel all over the world. Discovery of the Americas is thought to have been aided by Muslim contribution to Geography.

E. Renan, in his book "Averroes and Averrossism", mentions a letter written by Columbus in October 1498 in which he admits that one of the sources which led him to assume the existence of the "New World" was the work of Ibn Rushd (Aventuez) of the 12<sup>th</sup> century.<sup>35</sup>

Inspired by the Qur'an, Muslim geographers knew that the earth was spherical.<sup>36</sup> As Sarton put it: "Needless to say that all the Arabic geographers believed in the sphericity of the earth."<sup>37</sup> While Europe was insisting that the earth was flat, Muslims were using globes to study geography.<sup>38</sup> Writing in the 12<sup>th</sup> century, the Muslim geographer, Al-Idrisi said: "The earth is round like a sphere and water adheres to it through a natural equilibrium which suffers no variations."<sup>39</sup>

Even before Al-Idrisi, the caliph Al-Ma'moon of the 9<sup>th</sup> century estimated the circumference of the earth to be 2400 miles, a very close figure to one arrived at by the most modern means today.<sup>40</sup> It was Al-Ma'moon also who ordered the drawing of a large map of the world. The volume *Al Mamalik Wal Masalik* (Roads and Provinces) written in the 9<sup>th</sup> century was: "An important source of historical topography. It was translated into French in the late 19<sup>th</sup> century. Equal in importance was Al Yacoobi's *Kitab Al-Bildan* which was full of topographic details."

Several Muslim geographers excelled also in the 10<sup>th</sup> century, especially Al Mas'oodi, whose works are best, described as an encyclopedia arranged in geographical order. No wonder, George Sarton considers him as one of the greatest geographers of all time.<sup>42</sup>

Prominence of Muslim geographers continued for several centuries. Important works included Abdul-Lateef's (12<sup>th</sup> century), which produced one of the most important geographical works in the Middle Ages. Al-Yaqooti's "Mu'jam-ul-Bildan" is considered by Sarton to be: "An immense compilation of geographical facts listed in alphabetical order."<sup>43</sup> Even "Mathematical Geography" was addressed in the 13<sup>th</sup> century in the works of Abul-Hassan Al-Marakishi which contained, among other data, coordinates of 130 places. About Al-Marakishi, Sarton says: "No medieval writer has taken equal pains to explain the scientific method and instrument."<sup>44</sup>

## 7) Agriculture

Muslim scientists described many plants. At the end of the 12<sup>th</sup> century, Al-Awwam described 585 plants and explained the cultivation of several fruits. Some studied plants on their long journeys to pilgrimage like Abul-Abbass Al-Nabati.

On the practical side, they improved the methods of irrigation, used organic fertilizers and improved the breeds of cattle. Introduction of peaches, apricots, cotton, rice, bananas and sugar cane to the west is owed to Muslims. In Muslim Spain, artificial lakes to raise fish for food, were commonplace.<sup>45</sup>

## **8) Industry**

Advancements were made in the manufacturing of fabrics (silk, cotton, wool), leather, glass and steel. Chemistry was applied in making drugs and perfumes. Due to their interest in learning, a paper-making factory was established in Baghdad in 794. The term “Ream” came from the Arabic “Rezma” which means bundle. <sup>46</sup>

## **9) Commerce**

Some historians narrate that at one time up to 850 Saracen ships docked in the port of Canton (China). Early writings on trade and commerce go back to the 10<sup>th</sup> century.

According to Camille Castorina, some Saracen coins were found in Scandinavia. A golden Anglo-Saxon coin carried the name of the King Offa Rex of Mercia on one side; on the other side it carried the Muslim testimony of faith. A system of cheques (from the Arabic Sakk) and form letters of credit were used as well. <sup>47</sup>

## **10) History**

While many Muslim historians focused on the collection and presentation of facts and information, some used critical judgement, and approach adopted in the West later on.

Among the most famous historians are Al-Tabari (late 9<sup>th</sup> century) who wrote a most brilliant universal chronicle, Al-Mas'oodi who wrote 20 big volumes on history which were lost, and whose work “Morooj Al-Dhahab” (Golden Pastures) was preserved, and Ibn Al-Atheer (13<sup>th</sup> century) who wrote a universal chronicle up to his time (1231). <sup>48</sup>

## **11) Art and Architecture**

While Muslim heritage in this area is rather diverse due to the fusion of various cultures, which came under Muslim rule, there is some element of unity in it based on Islamic teachings. A good part of such a heritage was destroyed in 1258 by the Mongols. A touch of that remained in Spain especially in Al-Hambra and the Cordoba mosque.

The influence of Muslim Architecture and Calligraphy was so great that one of the doors of the Cathedral at Puy is decorated with the Arabic inscription (Masha'Allah). In fact, an Islamic-Style mosaic was found in a number of churches in Auverge (France). In the British museum, an Irish cross from the 9<sup>th</sup> century is decorated in the middle with the inscription "Bismillah" or "In the name of Allah." <sup>49</sup>

## 12) Other Disciplines

Equally important contributions were made in other areas such as political science and sociology. In the 10<sup>th</sup> century Al-Farabi wrote about the model city: "Perfectly organized state is one which assures its citizens perfect government and happiness after death."

A more practical work was Al-Mawirdi's "Al-Ahkam Al-Sultaniyyah" (Book of the Rules of Power) written around the end of the 10<sup>th</sup> century and the beginning of the 11<sup>th</sup> century.

The famous Muslim sociologist Ibn Khaldood (1332-1406) is regarded as one of the greatest sociologists of all times. He was the first one to write on the philosophy of History in a comprehensive and conceptual way.

Long before modern Sociology Ibn-Khaldoon studied: "The evolution of the human society and gave a rational explanation of the progress of history. In his Al-Moqaddima, one finds for the first time a reflection of history, diverse forms of civilization and social institutions, sciences and arts they foster."

## Lost or Belittled Heritage

It is unfortunate that most of the rich and voluminous works of Muslim scholars were lost or ruined during the assaults on the Muslim world. The Mongols cast in the river Tigris, (in Baghdad) enough books to make a bridge over which they crossed. The ink from such destroyed books blackened the river for a long time.

During the crusades in Syria, nearly 3 million books were destroyed. When Muslims were defeated in Grenada (Spain), 1 million books were burned by religious fanatics in one day. Cardinal Zimones of Cicily (15<sup>th</sup> century) burned more than 80,000 Arabic volumes in the main square of his city of Franda. <sup>51</sup>

No excuse, however, can be granted to some historians and writers who tried to deliberately hide Muslim contributions, and in some cases attributed them to European scientists who were born many centuries later. Among the more fair Western writers is John Draper, who states:

"I have to deplore the systematic manner in which the literature of Europe has contrived to put out of sight our scientific obligations to the Mohammedans.

Surely they cannot be much hidden. Injustice founded on religious rancor and National deceit cannot be perpetuated forever." <sup>52</sup>

## CONCLUSION

Two conclusions seem to emerge from this analysis, on the conceptual and applied levels. Conceptually, Islam is a complete and comprehensive way of life founded on divine guidance. It makes no distinction between the religious and material aspects of life. Its teaching focus on the human, as he/she is a spiritual, intellectual and physical being. Islam does not assume an inherent conflict and disharmony between these three elements of human existence.

This broad approach to life is reflected in Islam's attitude towards learning, science and balanced human progress. The Qur'an constantly urges humankind to think, learn, observe and explore the bounties created by Allah for human use in fulfillment of the human's trusteeship role on earth.

On the historical and practical level, we have seen how the flourishing civilization sparked by Islamic teaching dominated the world of science and learning for nearly 600 years and continued its significant contributions for many more decades. It acted as a bridge between the past and present; preserving ancient learning, adding considerably to it, and paving the way for the European renaissance. Without this crucial role, modern scientific and technological development would not have taken place as fast as it did.

This considerable, Qur'anically inspired interest in learning was only matched by the attitude of tolerance; tolerance which recognized and encouraged, not only Muslim scholars, but others as well, regardless of their ethnic backgrounds or religious conviction.

The world has never seen a similar shining example of tolerance, justice, progress and cooperation for the benefit of all. Surely, human mistakes are to be found, and human deficiencies can be pointed to. This is to be expected in a world less than that of angels. Yet the main question remains this:

What was the main inspiring force behind the lightening speed of the rise of Islamic civilization, and its continued prominence for so long, in spite of internal problems and external invasions? The answer is: the Qur'an. One question remains unanswered, though: If this is the orientation of Islamic teachings, and if these teachings were possible to implement successfully for several centuries, why is it that Muslim civilization began to decline at the time of European awakening from the "Dark Ages"? Why are Muslims today less advanced than others? Is not that an indication of weakness?

Sure, it is an indication of weakness. However, it is the weakness of Muslims and not of Islam, Allah's straight path. While external problems and invasions may explain part of the reason, the internal weakness of Muslims and weakening commitment to their faith is perhaps the major cause.

An ideal civilization requires two elements:

- 1) Divine guidance, which gives it a firm foundation, an incentive and a framework, which gives progress a sense of direction and an ethical orientation.
- 2) Secondly, an ideal civilization requires hardwork, creativity and dynamism (not just wishful thinking or boasting past glories).

A civilization devoid of divine guidance may flourish due to hard work. Yet the absence of the firm foundation of faith and ethics leads to aberrations and eventual fall. It may enable us to leap on the moon without helping us to avoid limping on earth.

Likewise, a civilization, which pays lip service to its basic precepts and fails to fulfill its duties, may fall as well, not because of the weakness of its principle, but because of the failure to adhere to those principles.

Should Muslims, jointed by others, move forward towards this inexhaustible source of strength, history will repeat itself and a better world can be built for the benefit of all. Maybe we can leap on earth as we did on the moon.

## ENDNOTES

1. Briffault, Rob, **The Making of Humanity**, quoted in K.A. Waheed, **Islam and The Origins of Modern Science**, Islamic Publication Ltd., Lahore, Pakistan, 1978, pp.25-26.
2. Several excerpts were adopted and/or adapted from two papers by the author, J. Badawi, "The Application of Tawheed in the Natural and Social Order", in Humanomics, vol.? No. I, Barmarick Publications, N.Humberside, England, 1991, p5-18 and Badawi, Jamal A., "The Earth and Humanity" in John Hick and Edmund Meltzer(Eds.), Three Faiths: **One** God, Macmillan, London, UK, 1989, p88-91
3. See for example the **Qur'an** 21:107, 9:34, 48:28, 61:9, 34:28.
4. "O mankind! We created you from a single (pair) of a male and a female, and made you into nations and tribes, that ye may know each other (not that ye may despise each other). Verily the most honoured of you in the sight of Allah is (he who is) the most righteous of you. And Allah has full knowledge and is well acquainted (with all things)." Qur'an 49:13.  
"And among His Signs is the creation of the heavens and the earth, and the variations in your languages and your colours; verily in that are signs for those who know." Qur'an 30:22,
5. "O ye who believe! Enter into Islam wholeheartedly; and follow not the footsteps of the Evil One; For he is to you an avowed enemy." Qur'an 2:208

6. "But seek with the (wealth) which Allah has bestowed on thee, the Home of the Hereafter, nor forget thy portion in this world; but do thou good as Allah has been good to thee and seek not (occasions for) mischief in the land: for Allah loves not those who do mischief." Qur'an 28:77.
7. In praising seven categories of the pious Prophet Muhammad (P) included "...and a person who gave a charity in secret so that his left (hand) would not know what his right (hand) spent..." (Narrated by Bukhari and Muslim) as quoted in A. Al-Nawawi, **Riyadh Al-Saliheen**. Dar Al-Warraq, Riyadh, 1991, Hadeeth #376, p155.
8. Al-Timidhi, **Al-jami' Al-Sahih**, Al-Maktabah Al-Tijariyyah, Makkah, N.D Vol.3, Hadeeth #659, p39.
9. Quoted in M. Alnubarak, **Nizam al-Islam-Al-Iqtisad**. Dar Al-Fikr, Beirut, Lebanon, 1974, p39.
10. Narrated by Muslim in **Mukhtasar Sahih Muslim** (Ed. by M.N. Al-Albani), 3rd printing, Al-Maktab Al-Islamia, Damascus, Syria, 1977 (Hadeeth #978, p258)
11. Narrated in Ahmad and Ibn-Majah and quoted in A. Sabiq, **Fiqh us-Sunnah**. American Trust Publications, Indianapolis, Ind., USA, 1985, Vol. I, p33
12. **Birnamij Silsilat Kunuz Al-Sunnah I**, Al-Jami' Al-Sagheer Waziyadatih, First Edition, 1410 A.H. [computer software], Ahadeeth #3914, 6298, 4212, and 6297 respectively.
13. The Arabic term nutfah in (23:13) literally means a minute amount of liquid clinging to a cup after water is emptied from it, and indication that only a small part of the seminal fluid, even one sperm is all that is need to fertilize the ovum. The term alagah in (23:14) literally means something that clings or a leech, both are accurate descriptions to the way in which the fertilized ovum clings to the lining of the uterus, and derives its nourishment thereof. Mudghah given in (23:14) as the next stage means a lump or a chewed-like substance. It is interesting to not that in that embryonic stage the fetus looks exactly like that due to the emergence of "somites" or early formation of the spinal column. These observations and others were addressed by authors such as Keith Moore, **The Developing Embryo: Clinically Oriented Embryology** **The Developing Embryo: Clinically Oriented Embryology**, Third Edition, with Islamic additions, Dar al-Qiblah for Islamic literature with permission from W.B. Saunders Co., Jeddah, 1983, Maurice Bucaille, **The Bible, The Qur'an and Science**, American Trust Publications, Indianapolis, IN, 1978 and Muhammad A. Al-Barr, **Khalq Al-Insan Baynal Tibb Wal Qur'an** (in Arabic), Third edition, Al-Dar Al-Saudiah, Jeddah, 1981.
14. Briffault, Rob, **The Making of Humanity**, quoted in K.A. Waheed, **Islam and The Origins of Modern Science**, Islamic Publications Ltd., Lahore, Pakistan, 1978, p. 29
15. Waheed, **Ibid**, p. 30
16. Bammate, Haider, **Muslim Contribution to Civilization**, Islamic Center, Geneva, Swizerland, 1962, p. 17 and Draper, **History of the Intellectual Development of Europe**, **op. Cit**, Vol II, p. 49

17. Draper, John, History of The Intellectual Development of Europe, Revised Edition, Harper and Brothers, N.Y., 1876, vol. I, pp. 386-387.
18. Wells, H.G., Outline of History, Garden City Books, N.Y., 1956, pp. 270-271
19. Whitehead, A.N., Science and The Modern World, Macmillan, N.Y., 1957, p. 27
20. Waheed, op. Cit., Vol I, pp. 30-31
21. Sarton, George, An Introduction to the History of Science, The Williams & Wilkins Company, Baltimore, MD, 1950, vol. II, part I, p. 350
22. Waheed, op. Cit., p. 27
23. Bammate, op. Cit., pp. 19-22 and Sarton, op. Cit., Vol. I, pp. 530-531, 585-586, 597-603, 630-632, 663-667, Vol. II, pp. 122-123, 170-171, 204-206, 295-296, 300-401, 504-506, 621-624, 753-755, 998-1021.
24. Draper, op. Cit., p. 26-27
25. Sarton, op. Cit., Vol. II, p. 12 and Draper, J., History of the Conflict Between Religion and Science, Henry King & Co., London, 1875, pp. 115-116. See also references to Sarton's volumes I and II listed in endnote # 17.
26. Sarton, Ibid., Vol. I, p. 721
27. Draper, History of the Intellectual Development of Europe, Op. Cit., Vol. II, pp. 45-46.
28. Sarton, op. Cit., vol, II, p. 26
29. Prophet Muhammad (P) said: "Seek medication for Allah did not create a disease without creating a cure for it.", Birnamij Silsilat Kunuz Al-Sunnah, op. Cit., Hadeeth #7934
30. Sarton, op. Cit., Vol. I, p. 609
31. Ibid., Vol. I, p. 680, p. 699
32. Sarton, op. Cit., Vol. II, Part 2, p. 1100
33. Al-Siba'i, Mostafa, Min Rawa'i Hadaratina (in Arabic), Al-Maktab Al-Islami, Beirut, Lebanon, Vol. 2, 1977
34. Ibid.
35. Renan, Ernest, Averroes and Averroism, 1825, quoted in Bammate, op. Cit., p. 46.
36. See for example the Qur'an 79:30 and 29:5
37. Sarton, op. Cit., Vol. II, part I, p.44
38. Draper, History of Conflict Between Religion and Science, op.cit., p. 109
39. Castorina, Camille P., Saracen Economic Thought: A Prelude, Presented at the Sixth Annual Conference of the History of Economics, May 1979 at the University of Illinois, Champaign, II, p. 1
40. Draper, John, History of The Conflict Between Religion and Science, op. Cit., p. 109
41. Sarton, op. Cit., Vol. I, p. 607
42. Ibid., Vol. I, p. 622
43. Ibid., Vol. II, p. 41
44. Ibid., Vol. II, pp. 41-42
45. Draper, History of Intellectual Development of Europe, op. Cit., Vol, II, p. 33, and Draper, History of the Conflict Between Religion and Science, op. Cit., p. 117

46. New Webster Dictionary, Lexicon Publications, N.Y., 1991 under "ream."
47. Castorina, op. Cit., p. 12-13, see also Hitti, Philip, History of the Arabs, St. Martin's Press, 10<sup>th</sup> edition, 1973, p. 316. The date in the above coin is 774
48. Sarton, op. Cit., vol. I, p. 637-638, 642 and Vol. II, part 2, p. 527.
49. Bammate, op. Cit., p. 57-59
50. Bammate, op. Cit., p. 52
51. Amari, Michelle, Storia Dei Musulmani Di Sicilia, 3 Vol. (2<sup>nd</sup> Ed., Catania, Romeo Prampolini, 1923, Vol. I, p. 2, quoted in Castorina, op. Cit., p. 5
52. Draper, J, The Intellectual Development of Europe, op. Cit., Vol. II, p. 42

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