The Islamic Impact on Western Civilization Reconsidered

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Introduction

The topic of the Islamic impact on western civilization has received a great deal of attention from various Muslim scholars, and some attention from western scholars. When discussing this topic, Muslims usually concentrate on providing a list of important scientific discoveries made by Muslims with the intent of proving that Muslims made the discoveries before the Europeans. For example: Ibn Sīnā' (d. 1036) used an air thermometer and Ibn Yūnus (c. 900) used a pendulum many centuries before Galileo, al Idrīsī (c. 1000) discovered and mapped the sources of the Nile River nine hundred years before the Europeans, and al Zarkayl proved that the planetary orbits were elliptical—not circular—many centuries in advance of Copernicus.

Whereas the historical authenticity of these claims cannot be questioned, such discussion does not shed much light on the Islamic impact on western civilization. It is entirely possible that even though the Europeans made the noted discoveries many centuries after the Muslims, they did so without having any knowledge of earlier Islamic works. Such is the case in the above-mentioned examples. Hence, the issue of the Islamic impact on the West cannot be discussed in this context.

Due to the shortcoming of the typical method of discussing the issue at hand, this paper will adopt an alternative method: the history of ideas and intellectual traditions in the Muslim world and the West. An attempt will be made to identify broad trends and characteristics of the western and Islamic intellectual traditions in order to discover possible links. The primacy of reason, logic, and the scientific method are the defining characteristics of the western intellectual tradition from the Renaissance to the present. Prior to the Renaissance, Christian theology determined exclu-

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sively the pattern of western intellectualism, and prior to Christian theology it was Greek thought. The paper will seek to prove that if the Islamic impact is discounted, one cannot establish an organic link between these two intellectual traditions and the Renaissance tradition. Evidence will be presented to substantiate the claim that it was the Islamic intellectual tradition that played a critical role in the emergence of Renaissance thought. The organic link between the Islamic and Renaissance intellectual traditions will be established by highlighting the contributions of key individuals and institutions in the transmission of the Islamic tradition to the West.

The Circumstantial Evidence

Speaking of the critical impact that Islam has had on the West, one scholar notes:

> It is highly probable that but for the Arabs modern European civilization would never have arisen at all; it is absolutely certain that but for them it would not have assumed that character which has enabled it to transcend all previous phases of evolution. For although there is not a single aspect of European growth in which the decisive influence of Islamic culture is not traceable, nowhere is it so clear and momentous as in the genesis of that power which constitutes the paramount distinctive force of the modern world and the supreme source of its victory—natural science and the scientific spirit.[1]

Briffault is stating that the Islamic influence upon the West is so far-reaching that it is traceable in every facet of European development. He goes even further and credits Islamic culture with endowing European civilization with the defining characteristic of modernity: the scientific spirit. This is a very bold and radical statement in light of the fact that Harry Barnes' statement regarding the Islamic impact on the West is representative of the majority view of western scholars. He states:

> In no sense did Islam directly encourage learning except as it might be incidentally involved in history, jurisprudence, philosophy, or theology of Islam . . . . The learning of both medieval Christians and Muslims was based chiefly on earlier pagan scholarship, particularly that of the Greeks, which Islam made less difficult to appropriate than did Christianity. Herein, chiefly, is to be found the key to Muslim cultural preeminence. It is a complete mistake to seek it in native Muslim genius, in the inherent superiority of Islam, or in any direct Islamic encouragement of scholarship and art.[2]

Another scholar is even more adamant in rejecting any connection between Islamic culture and learning. M. André Sevier states:

> What is called "Arab civilization," in so far as any manifestation of Arab genius is concerned, has never had any real existence. The civilization that passes under that name is due to the labor of other peoples who, subjected to Islam by force, continued to develop their aptitudes in spite of the persecution of their conquerors.[3]

Both Barnes and Sevier argue that Islamic culture has contributed nothing to the intellectual legacy of humanity. According to Barnes, the cultural preeminence of the Muslim world during the Middle Ages vis-à-vis the Christian West was rooted in the fact that Islam made it ". . . somewhat less difficult to appropriate" the pagan scholarship of the Greeks than did Christianity. For Sevier, one cannot even speak of an "Islamic–Arab civilization" because all of the cultural and intellectual achievements usually attributed to this entity were the result of Syrian, Persian, Jewish, Nestorian, and Hindu endeavors.

The argument that Islam did not encourage scholarship and had no impact on western civilization is very weak and borders on the absurd. George Sarton, in his monumental *Introduction to the History of Science*, divides human history into periods of fifty years, beginning with the fifth century BC.[4] For each period, he identifies the most influential scientist of the time and names the period as that scientist's "epoch." Consequently we have the epoch of Plato (450–400 B.C.), followed by those of Aristotle, Euclid, and Archimedes. The first Muslim name in Sarton's schema, al Jābir, appears in the 750–800 period. He is followed by al Khwarizmī, al Rāzī, Mas'ūdī, and Birūnī. The epoch of Muslim scientists continues uninterrupted from 750 to 1100. Gregory of Cremona and Roger Bacon interrupt this chain, but the Muslims reappear for another two centuries beginning with the epoch of Ibn Rushd (1200–1250).[5]

This period of Muslim preeminence in the scientific fields parallels directly the Dark Ages in Europe. The wide gap between the western and Islamic cultures during this time period is illustrated vividly by the following fact: al Ḥakīm (d. 975), a vizier in the Muslim government in Spain, had a private library collection of four hundred thousand books. The most famous library in Christian Spain at this time was in the Repoll Monastery, which contained a mere 192 books.[6] It is not hard to imagine the wide gap between a culture where private citizens could amass a private collection of four hundred thousand books and one in which the largest collection was a mere 192 books.

During the same century (922), a Muslim trader by the name of Ibn Faḍlān made the following observation on the hygienic practices of Scandinavian traders who he met on the lower Volga River during one of his many trading expeditions into the area. He states:

> Every morning a girl comes and brings a tub of water, and places it before her master. In this he proceeds to wash his face and hands, and then his hair, combing it out over the vessel. Thereupon he blows his nose, and spits into the tub, leaving no dirt behind, con-

> veys it all into this water. When he has finished, the girl carries the tub to the man next him, who does the same. Thus she continues carrying the tub from one to another, till each of those who are in the house has blown his nose and spit into the tub, and washed his face and hair.[7]

At a time when Europeans were washing their faces and hair in water used by others for the same purpose, Muslims in Cairo, Baghdad, Toledo, Granada, and other major cities were taking advantage of the numerous public baths that had been constructed by the government and private citizens alike. These baths were supplied by aqueduct systems, the likes of which even the Romans had not known.

The comparison between al Ḥakīm's library and that of the Repoll Monastery and the hygienic conditions of the Scandinavian traders and the Muslims is made in order to contrast the relatively advanced Muslim culture with that of the backward West. This wide gap between the two cultures needs to be noted, for their close proximity and constant interaction will cause one culture to influence the other. Such scholars as Barnes and Sevier, who claim that Islam had no impact on the West, have to counter the following argument put forth by Briffault:

> That a brilliant and energetic civilization full of creative energy should have existed side by side and in constant relation with populations sunk in barbarism, without exercising a profound and vital influence upon their development, would be a manifest anomaly. That no such suspension of natural law was involved in the relationship between Islam and Europe is abundantly attested in spite of the conspiring of every circumstance to suppress, deform, and obliterate the record of that relation.[8]

Here Briffault is merely stating a law of history that all historians accept as valid: two civilizations, one barbarian and one advanced, cannot exist side by side without the advanced civilization having a profound impact on its barbarian counterpart. The fact that western civilization was "sunk in barbarism" at the turn of the last millennium is testified to by the fact that this period is referred to as the Dark Ages of Europe. The fact that the Muslim world was a "brilliant and energetic civilization full of creative energy" is attested to by the fact that it produced the leading scientific minds in the world from 750 to 1100, as noted by Sarton. The fact that there was constant interaction between these two civilizations in trade, diplomacy, and war is too well-known to be detailed here. Hence, the three leading factors in Briffault's schema have been established, and, as he notes, it would be a "manifest anomaly" if the advanced (Islamic) civilization did not exercise a profound influence upon the barbarian (western) civilization.

Here we have circumstantial evidence that Islamic civilization had some sort of impact on the West. This circumstantial evidence is still far

short of justifying Briffault's thesis that the West was influenced in profound ways by the Muslims, to the extent that the scientific spirit itself is a Muslim legacy inherited by the West. Even though we have not presented enough evidence to prove Briffault's thesis, enough evidence has been presented to undermine seriously the thesis of the rejectionist school, as represented by Barnes and Sevier, which holds that Islam did not exercise any influence on the West whatsoever.

The Islamic Influence Manifested in Critical Institutions and Personalities

In order to obtain hard evidence of the Islamic impact on the West, we have to turn to those individuals and institutions that laid the groundwork for the European Renaissance of the fifteenth and sixteenth centuries. When their histories are studied, their intimate connection with the Muslim world becomes apparent. Foremost among these institutions is the college. The existence of such institutions of higher learning is evidence of that society's intellectual vitality and ferment. Such institutions can only appear if qualified individuals are available to teach therein and enough individuals are interested to enroll therein.

After the closure of the Academy of Athens by imperial decree in 529,[9] the first institutions of higher learning in Europe were established by the Muslims. The College of Cordova reached its peak in the middle of the tenth century. It was rivaled, in prestige and size, by the College of Toledo and the College of Granada in the tenth and eleventh centuries. According to Stanwood Cobb, these institutions have to be considered colleges by modern standards, for thousands of students were enrolled and they attracted lecturers and students from Spain, Persia, Central Asia, Egypt, and North Africa. With the passage of time, an increasing number of students from Europe also began to appear in their classrooms. The curriculum included medicine, theology, jurisprudence, mathematics, and philosophy. A gifted lecturer would attract hundreds of students to his regularly scheduled lecture.[10]

After the closure of the Academy of Athens, the first institutions of higher learning in Christian Europe emerged in the twelfth century. Five such colleges for advanced study were established between 1130 and 1200: 2 in Italy (Salerno and Bologna), 2 in France (Paris and Mont-pelier), and 1 in England (Oxford).[11] The close geographical proximity of these colleges, with the exception of Oxford, to Islamic lands should be noted. The precise historical circumstances surrounding their establishment is not very clear, but enough historical evidence exists to demonstrate the Islamic impact on their founding. Foremost among this evidence is Christian Europe's borrowing of two Islamic concepts, *waqf* endowments and *ijāzah li al tadrīs*, that helped establish institutions of higher learning.

Waqf Endowments: This refers to the decision of an individual Muslim to establish an endowment independent of the ruling political authority.

Even though various sultans and viziers established such endowments, they did so as private individuals, not as government officials. According to the Shari'ah, whoever establishes a *waqf* has the exclusive and inalienable right to determine its purpose.[12] This point is of interest for the present study because, as Makdisi notes, "[a]ll institutions of learning [in Muslim lands] were based on the law of *waqf*."[13] It follows naturally that all *madrassah*s (colleges) established in Muslim lands were based on *waqf* endowments that provided the physical property on which the *madrassah* was based and, in almost all cases, served as a source of income from which stipends were given to lecturers, students, and custodians.

At the turn of the millennium, there was no counterpart to this concept in Christian Europe. In terms of existing law, the person making a charitable contribution had nothing to say about how his/her contribution would be used, for all charitable work was done through the Church, which was often the political authority in the realm. Consequently,

> the *waqf* differs basically from the *pia causa* of Byzantium, and from the acts of charity in the Christian West, whereby donations were given to the Church for distribution among the poor.[14]

This point is of crucial importance, for the earliest colleges in Christian Europe were established by an act of sovereignty on the part of the founders, independent of all Church and political authority. In other words,

> the type of foundation that was the creation of a private individual without authorization from the sovereign, foreign to Roman law as it was to the Byzantine *pia causa*, was in fact the only kind of foundation known to Islam.[15]

Makdisi has presented a convincing argument that the "fondation" in France and the "charitable trust" in England are results of the Europeanization of the *waqf* concept. The earliest colleges in Christian Europe were founded as "fondations" and "charitable trusts."[16] In Europe, the institutions of charitable trusts evolved further into legal corporations, something that did not happen in the Muslim lands. Colleges that were incorporated came to be known as "universities." The evolution of the corporation in Europe happened independent of Islamic influences, for Islamic law "recognizes the physical person alone as endowed with legal responsibility," while a corporation "is an abstraction endowed with legal rights and responsibilities." Whereas the university is a genuinely European product, the roots of its precursor (the college) are to be found in the Muslim world.

Ijāzah li al Tadrīs: In classical Islamic scholarship, a student who had mastered a subject and demonstrated a satisfactory level of competence to his/her teacher would be granted a license to teach that subject by his/her teacher. The student's competence was measured by mastery of the authoritative texts in the particular field followed by an oral exami-

nation. During the course of the oral exam, "the candidate for the license defended a thesis or series of theses" in a "sophisticated disputation" with the teacher.

The granting of the license to teach was the sole preserve of "the learned man of religion" (*'ālim*). The *ijāzah* represented a "personal act of authorization from the authorizing *'ālim* to the newly authorized one." No third party, not even the person who had established the *waqf* endowment, was involved in the process of granting the *ijāzah*. It was by means of the *ijāzah* that knowledge was preserved and propagated by competent individuals in the Islamic lands. By the tenth century, this instrument had developed fully and had spread in the Muslim world.

In the twelfth century, the *licentia docendi* (license to teach) appeared in Christian Europe. This development is a curiosity, for

> Education in antiquity, whether in Greece or Rome, did not produce the license to teach. Nor was the license produced by Eastern Christian Byzantine education, which was a direct continuation of classical education. Nor was it produced by Western Christian Latin education, whether in the monastic, episcopal, or presbyterial schools. It first appeared in the Christian West in the second half of the twelfth century, *as one of a number of institutions without indigenous antecedents.*[17] (emphasis added)

Due to the fact that there are no European antecedents to the licentia docendi, one has to look elsewhere for its origins. The close geographical proximity of western Europe to the Muslim world, as well as the extensive intellectual and social interaction that had developed by the twelfth century, makes the Muslim world a prime candidate for having provided the antecedents of the licentia docendi. The adoption of this instrument by the earliest colleges in Christian Europe proved to be crucial not only for establishing a genuine tradition of scholarship, but also for preserving and propagating that tradition into the future. As with the Islamic *ijāzah li al tadrīs*, the European *licentia docendi*, according to Makdisi, "derived its legitimacy from two basic sources: 1) authority based on recognized competence in the field of knowledge involved; and 2) authority based on a recognized right to grant authorization to teach."

After giving a detailed list of the various stages (eight in all) through which one had to pass in order to obtain the *licentia docendi* and comparing it with the stages a student had to go through in order to obtain the *ijāzah*, Makdisi observes that

> these stages of development are so identical in nature and so well documented in the sources as to remove the likelihood of parallel development due to mere chance . . . the technical terms involved convey the same content and are, in most cases, exact translations of their Arabic antecedents.[18]

Borrowing the concept of *waqf* endowments and Europeanizing it helped Europe to establish the physical space in which colleges were built. The virtual copying of the procedure of granting the *ijāzah li al tadrīs* helped Europe establish a scholarly tradition that could be preserved and propagated. The concept of granting the *licentia docendi* is a precursor to the granting of the bachelor's, master's, and doctorate degrees in modern universities. The antecedents to both the "charitable foundation" and the *licentia docendi* are absent in the European tradition and are to be found in the Islamic realm.

In addition to borrowing key concepts from the Islamic tradition, the influence of Islam on the earliest Christian colleges can be demonstrated by looking at their individual histories. Of the five schools, the one at Salerno seems to be the one with the longest history. When the Normans reconquered Muslim Sicily in 1091, a flourishing school of medicine fell into their hands. The fame of this medical college was widespread, even in Christian Europe, in the last half of the tenth century,[19] due to the medical skill of its doctors and their prescription of successful cures.[20] Makdisi describes its Islamic pedigree in the following words:

> Imbued with Greco-Arabic medical and scientific learning, Salerno was deeply affected by the form as well as the content of that legacy; it was more spiritually akin to the loose organization of the Baghdad hospital than to the faculty organization of the European university.[21]

Even though it had already been in existence for several centuries, Salerno received official recognition from Frederick II in 1231 and thus cemented its reputation as the "most famous and foremost city of the art of medicine" in Christian Europe.[22] In due time, the legacy of Salerno, along with its Arab-Islamic component, was eventually "passed on to the professors of medicine at Paris, Bologna, and above all, at Montpelier."

The first college located in the Latin West was established in Paris in 1180.[23] Called the "College des Dix-Huit," its founder was John of London, who established it after he had "just returned from a pilgrimage to Jerusalem." The establishment of this institution

> appears to have been the first of its kind in its purpose: a place of lodging for poor scholars; and as such, he [John] may have been influenced by what he saw or heard while on a pilgrimage to Jerusalem.[24]

Before John of London established this college for "eighteen poor students,"[25] the founding of educational institutions for poor students by pious individuals had no precedents in Christian Europe. The concept of establishing such charitable trusts is almost certainly based on the Islamic *waqf* system. Unlike the traditional giving of charity to existing institutions, which would then distribute it among the needy, a *waqf* endowment

establishes a new institution (i.e., an orphanage, a hospital, a mosque, a college) to serve the poor. The fact that such an institution was first established by an individual who had just returned from a pilgrimage to Jerusalem in a place where no such institution existed before points strongly to the influence of Islamic civilization in the founding of the first Parisian college.

In 1220, a papal legate granted the college at Montpelier a charter, an event that marked the official recognition of an institution that had been in existence for almost one hundred years. The biographers of Adalbert, an archbishop of Mainz, note that he studied at a medical school in Montpelier in 1137. In the days of Adalbert, Montpelier was home to a "considerable Arabic as well as Jewish population" along with "Spaniards who had long resided among the Moors."[26] Much of the credit for establishing the school at Montpelier rests with this Arabized segment of the population. These individuals were conversant in Arabic, the language that could give them access to the vast quantity of classical Greek knowledge that had been translated into Arabic as well as to modern Arabic knowledge. Consequently, they were in the unique position to lay the foundations of a medical school that soon replaced Salerno as the most famous European school of medicine.[27] Evidence suggests that the media of instruction in the very early years at Montpelier were Arabic and Hebrew.[28] Commenting on the factors that contributed to the fame and prominence of Montpelier, Rashdall notes that

> we cannot be wrong in connecting the prominence of medicine at Montpelier with the comparatively advanced state of material civilization in the rich and prosperous commercial cities in the countries bordering upon the Mediterranean.[29]

In a cryptic manner, Rashdall is acknowledging, albeit grudgingly, the Islamic influences upon the college of Montpelier.

These early colleges in Christian Europe became the models on which subsequent colleges were established. This is most clear in the case of Oxford. Due to unfavorable political circumstances, a large number of students from England who were studying in Paris had to leave in 1167. Some of these students, after they reached England, settled in Oxford. It is to this group of returnees that the roots of Oxford University can be traced.[30] Oxford "in turn 'gave birth' to Cambridge in 1209."[31]

The Islamic influence upon the emerging tradition of scholarship in twelfth-century Christian Europe is not limited to providing concepts and institutions upon which this tradition was built. The nascent intellectual tradition in Europe was established or enriched by individuals who had graduated from the Muslim universities of Spain or Sicily or who had been taught by graduates of these universities. For example, Arnold of Villeneuve and Raymond Lully studied in Spain and taught at Montpelier; Campanus of Novara studied in Cordova and taught at Vienna; Daniel de Morlay studied in Cordova and lectured at Oxford; Grosseteste

studied in Spain and taught at Oxford; Fibionacci learned mathematics during his travels in Algeria and Muslim Spain and returned to Italy to produce his ground-breaking work.[32]

The prestigious College of Toledo deserves special mention in regards to producing the human resources that enriched the intellectual life of Europe.[33] Its influence can hardly be overestimated. After its reconquest in 1085, Toledo became the leading institution of European scholarship and translation of Arabic works into Latin. Under the direction of the Order of Preachers, the first School of Oriental Studies in Europe was established at Toledo in 1250. Its graduates went on to establish or enrich existing institutions of higher learning in Lorraine, Germany, England, Marseille, Cluny, and other parts of France.

Of all the individuals who were instrumental in making Europe aware of the wealth of wisdom and learning to be gained from the Islamic world, an enlightened Sicilian emperor deserves special attention. Frederick II expanded the college at Salerno, along with its famous medical school, and established colleges at Naples, Messina, and Padua. The college at Naples is acknowledged to be the first Christian college in Europe to be established by royal charter (1224).[34] Frederick II was known to his contemporaries as the "Baptized Sultan" due to his court's oriental character and his own oriental habits. He dressed in long flowing robes, wore a turban, and kept a harem. His Castel del Monte palace in Sicily was modeled on Jerusalem's Dome of the Rock mosque.[35] He was fluent in Arabic and was an avid patron of Arab scholars, philosophers, and artists.

More than any of his European contemporaries, Frederick II embodied a new spirit and worldview that was developing slowly in Europe during the twelfth and thirteenth centuries. Characterizing the environment at Frederick II's court, Hitti states that "this almost modern spirit of investigation, experimentation, and research which characterized the court of Frederick marks the beginning of the Italian Renaissance."[36] This appraisal is not exaggerated in light of the Pope's condemnation of Frederick II in the following words,

> He [Frederick] further claims with a loud voice—he dares to utter lies to the extent of saying that none but fools can believe that the all-powerful Creator of the worlds was born of a virgin. He maintains the heresy that no man can be born without the concourse of a man and a woman. And he adds to those blasphemies that which is proved by the law of things, and natural reason is alone worthy of belief.[37]

Pope Gregory IX excommunicated Frederick II from the Church in 1227. It is no coincidence that an individual so immersed in the spirit of Islamic culture and attuned so keenly to its intellectual tradition was at the leading edge of the Italian Renaissance. He was condemned by the Pope for asserting that only that which is based on natural law and reason is

worthy of belief. Again, it is not surprising that he established many of the universities in which the leading minds of this intellectual flowering would be trained.

The Arabic language is another major institution that bears testament to the Islamic impact on western civilization. Prior to the sixteenth century, one could not be a scholar of any import in Europe without having a thorough knowledge of Arabic. This was mainly due to the fact that almost all of the works of classical Greek civilization, as well as the most up-to-date discoveries in various fields, were available only in Arabic. Commenting on this, Sarton states that

> when the West sufficiently matured to feel the need of deeper knowledge, when it finally wanted to renew its contact with ancient thought, it turned its attention first of all, not to Greek sources, but to the Arabic ones.[38]

It is not the testimony of a scholar writing in the distant twentieth century alone that attests to the importance of Arabic in European scholarship during the medieval period. Roger Bacon, writing in 1292, acknowledges the fact that almost all of Aristotle's works are available in Arabic only, with only a small percentage having been translated into Latin.[39] Even in the ninth century, Alvaro, a Cordovan bishop, writes,

> All the young Christians who distinguish themselves by their talent, know the language and literature of the Arabs, read and study passionately the Arab books, gather at great expense great libraries of these and everywhere proclaim with a loud voice how admirable is that literature.[40]

Commenting on the prominent role of Arabic in twelfth-century Christian European scholarship, Haskins notes:

> The Latin world could have got its Aristotle and its Galen, its Ptolemy and Euclid, largely through . . . Graeco-Latin versions. It could have got much Greek science that way, but for the most part it *did not*. The current language of science was by this time Arabic. The whole scientific movement from Spain and Provence was Arabic in its origin, and so in part was that from Southern Italy.[41]

When we look at the personal histories of leading medieval scholars, evidence of the Islamic impact becomes even stronger. Adelard of Bath (active between 1116 and 1142)[42] and Gregory of Cremona (1114 and 1187) vie for the distinction of being the leading European scholarprior to Roger Bacon. As mentioned earlier, Sarton identifies Gregory as the leading scholar of his time. He spent fifty years in Cordova, first mastering Arabic and then translating Arabic books into Latin. Eighty-

five works of translation are attributed to him. Some of the scholars whose work he translated include Aristotle, al Fārābī, al Kindī, al Khwarizmī, Euclid, Archimedes, Ptolemy, and al Rāzī.[43] Ade-lard of Bath traveled widely in the Muslim world, first in Syria and later in Spain. He also spent time in Sicily. During his travels in Spain he gathered a "large collection of books and much doctrine," which he promulgated actively in France and England.[44] It was from his rendition of Euclid's works that all subsequent editions were to appear in Latin until the sixteenth century.

Thomas Aquinas is considered the leading Christian theologian of the medieval period, and his *Summa Theologica* is a classic in the field. As the study done by Eugene Myers proves, this work is no more than a restatement of al Fārābī's *al Jāmi'*, which was written almost three centuries before Aquinas was born. The scholastic theology outlined in the *Summa* attempted to prove religious doctrine by appealing to reason. This was a vast improvement over traditional theology, which demanded acceptance based on blind faith alone,[45] as illustrated by St. Augustine's famous saying: "I believe in order to understand."

Just as the links between the leading medieval theologian and the Muslim world were intimate, the same can be said for Roger Bacon, the leading scientist of this period. In the introduction to his *Philosophae*, he states that without Arabic, Greek knowledge would never have reached the Europeans.[46] Knowledge of Arabic was essential not only for access to classical Greek sources but also for access to the work of leading Muslim scholars. Bacon's *Magnus Opus* is no more than a plagiarized version of Ibn Haytham's *Opticae Thesaurus*.[47] He also studied the works of al Rāzī and al Kindī in great detail and with great interest.[48] Speaking of Bacon's admiration for the intellectual tradition of the Arabs, a contemporary scholar writes that "[Bacon] worshipped the Arabs for their works in all fields of science and in the 'pseudosciences' astrology and alchemy, and for their method of experiment and observation."[49] The impact of Muslim scholars on Bacon cannot be overestimated, and much of his genius derives from his familiarity with these sources.

The life history of leading early medieval European scholars, of whom Gregory, Adelard, Aquinas, and Bacon are representative, presents ample evidence of the Islamic influence on the West. In almost all cases, this connection was the result of the European scholar having spent substantial time in Muslim countries/colleges. And in all cases, without exception, this connection was established by the European scholar's familiarity with Arabic/Islamic sources.

Commenting on the conditions in Europe that led to the rise of the universities, Haskins notes:

> The occasion for the rise of universities was a great revival of learning, not that revival of the 14th and 15th centuries to which the term is usually applied, but an earlier revival, less known

> though in its way quite as significant, which historians now call the Renaissance of the 12th century.[50]

This Renaissance of the twelfth century was initiated by Europeans educated in Muslim colleges/countries, intimately familiar with the works of Muslim scholars, fully conversant in Arabic, and immersed in Muslim culture. The groundwork for the Renaissance of the fifteenth century was laid in the twelfth century by individuals educated in institutions founded on Islamic models and ideals.

The impact of Islam on western civilization is now coming into focus. Although we have reached the point where we can state with confidence that Barnes and Sevier have advanced a thesis that runs contrary to historical fact, we cannot yet say that Briffault's bold statement—that the scientific spirit itself originated in the Islamic world—is justified.

Examining the Intellectual History of Europe and the Muslim World

The Renaissance of the fifteenth century marked the triumph of the scientific method over speculative philosophy and Scholastic theology as the supreme source of knowledge. The genius of modern western civilization is rooted in its adherence to the scientific method based on experimentation. As the European father of the scientific method states:

> Of the three ways in which men think that they acquire a knowledge of things, authority, reasoning, and experiment, only the last is effective and able to bring peace to the intellect.[51]

This new epistemological approach allowed the human mind to break the chains of dogmatism, speculation, myth, and magic. In order to justify Briffault's bold statement, we will have to prove that this epistemological approach is rooted in the Islamic intellectual tradition. Before going on to discuss the connection between the scientific spirit and the Islamic intellectual tradition, a review of western intellectual history would be useful.

Prior to the rise of the scientific spirit, the western epistemological tradition had been based on Christian theology, and, prior to that, on Greek philosophy. It is often assumed that the Scholastic philosophy of medieval Europe made no significant contribution to modern thought, and therefore the credit for reawakening the European intellect from its long slumber is often given exclusively to classical Greek thought. But a careful examination reveals that medieval philosophy made a significant contribution to modern thought and that classical Greek thought is much more incompatible with the scientific spirit than is usually assumed. In the context of the present discussion, these are important points to be noted.

The Contributions of Medieval Scholasticism to Modern Thought

For almost all western scholars, medieval Scholasticism is an obscurantist and backward philosophy that contributed virtually nothing to modern thought. But Alfred North Whitehead has argued that there are certain aspects of medieval thought, especially in the field of theology, that are indispensable to the emergence of modern scientific theory. According to him, the "greatest contribution of medievalism to the scientific movement" is the "inexpungable belief that every detailed occurrence can be correlated with its antecedents in a perfectly definite manner, exemplifying general principles. Without this belief the incredible labors of the scientists would be without hope."[52]

A belief that, in spite of appearances, each observed phenomenon has a cause and that cause is discoverable is the motivating principle behind research and experiment. If one looks for the origin of this attitude among the medieval Europeans, one finds it in medieval theology.

Whitehead insists that this attitude "must come from the medieval insistence on the rationality of God." God is viewed as a rational being far removed from arbitrary and frivolous action. He is the master of a universe that is not only ordered but one in which each detail is monitored and supervised by Him. In other words, God is the prime cause on which all subsequent effects are dependent. This concept of God naturally gives rise to the attitude that "the search into nature could only result in the vindication of the faith in rationality." Consequently, the "scholastic divines" preached that reason must be used in order to support and strengthen one's faith and that there is no conflict between reason and faith. This emphasis on reason being a companion of faith is extremely significant, because, as Whitehead notes "[f]aith in reason is the trust that the ultimate natures of things lie together in a harmony which excludes mere arbitrariness."

The concept that orderliness in the universe is a reflection of God's nature is a radical departure from Greek thought, which could not reconcile an orderly universe with the arbitrariness of divine actions caused by the jealousy, rage, and revenge that were all too common on Mt. Olympus. If one follows Whitehead's line of argument, it is not difficult to agree with his contention that "faith in the possibility of science, generated antecedently to the development of modern scientific theory, is an unconscious derivative from medieval theology."[53]

At this point, it is worth noting that Christianity went through a paradigm change in the twelfth to thirteenth centuries: the Augustinian paradigm was replaced by the Thomist paradigm. This meant that a Christian theology formulated by St. Augustine in the light of neo-Platonic thought gave way to a Christian theology formulated by Thomas Aquinas in the light of Aristotelian thought. When Whitehead speaks of a "faith in the possibility of science" being "an unconscious derivative from medieval theology," he is actually referring to the Thomist paradigm. Goldstien con-

curs with Whitehead's opinion that modern science owes a great deal to the medieval tradition. He notes that in its earliest days, western science matured in a setting "steeped in the traditions of the Medieval Church."[54] After identifying the contributions of the Franciscan Roger Bacon and the Dominican Thomas Aquinas, Goldstien concludes:

> As an intellectual system, Western science began neither in the workshops nor in the marketplace. It developed in the seats of Medieval learning, which by the twelfth century were the cathedral schools.[55]

Picking up on Whitehead's argument, Dawson develops the line of reasoning further by providing more evidence to support the original argument. He begins by stating that "the [Scholastic] Schoolmen were the schoolmasters of our civilization and they were largely responsible for the training and formation of the Western mind."[56]

Dawson identifies Scholasticism as being "nothing else but the educational tradition of the medieval schools" based on the study of the seven liberal arts, especially grammar, rhetoric, and dialectics. The whole endeavor of the Scholastic movement was committed to reconciling Aristotelian metaphysics with divine revelation. The degree to which Scholasticism represented a new intellectual stream in Europe is evidenced by the fact that it emerged in the faculty of arts of medieval colleges and not in the faculty of theology, which was the stronghold of the Augustinian tradition and exhibited an openly hostile attitude to the new intellectual current.[57]

This new intellectual current's appeal revolved around Aristotelian logic, which "formed an essential part of the scholastic program of studies." The use of dialectics in matters of theology was resisted strongly by the traditionalists, who were wedded to the Augustinian paradigm. But in the final analysis, they were "powerless to prevent the application of dialectics to theology, for it found its justification in the theological tradition itself."

Dawson argues that this emphasis on dialectics as an indispensable epistemological tool marks the beginning of a new era in European thought. He notes that "the passion for dialectics and the spirit of philosophic speculation had begun to transform the intellectual atmosphere of Christendom"[58] in the medieval period. All questions, "from the most obvious to the most abstruse," were considered as answered acceptably only after they had been "masticated by the teeth of disputation," to use the words or a medieval scholar. The significance of using dialectics/disputation as a means of ascertaining "the truth" is summarized by Dawson in the following words:

> [T]his process of [dialectical disputation] not only encouraged readiness of wit and exactness of thought but above all developed that spirit of criticism and methodic doubt to which Western culture and modern science have owed so much.[59]

When Whitehead's and Dawson's arguments are combined, one sees that the contribution of medieval Scholastic thought to modern thought is twofold. Firstly the medieval thinkers put forth the idea that the whole universe is the product of a prime cause and that all subsequent effects can be traced back to this prime cause. This view emerged from the medieval conception of a God who was not arbitrary or irrational, unlike the classical Greek view. It logically follows that one did not have to put faith above reason, but could use reason in order to support and strengthen one's faith. At this point, the western mind was taught to "accept the rationality of the universe and the power of human intelligence to investigate the order of nature." The second contribution of medieval thought is its emphasis on dialectics and disputation as legitimate means of arriving at the truth. Even though this emphasis on dialectical disputation was often carried to extremes, it did produce "a period of great and fruitful intellectual achievement." Not only did the idea that "the truth" was knowable emerge in medieval Europe, but a method that could be used in the pursuit of this endeavor was also formulated. Both were the product of medieval Scholastic philosophy.

The Islamic Impact on Medieval Scholastic Thought[60]

Dawson and Goldstien recognized the influence of Islamic thought on the intellectual currents of medieval Europe, but only in the general context of the movement of ideas. Regarding the specific question of the Islamic contribution to Scholastic philosophy, both scholars offered only vague and general remarks to the effect that medieval scholars were familiar with earlier works of Muslim scholars. Whitehead was altogether silent on this issue. If the work of Robert Hammond is considered, it becomes difficult to escape the conclusion that Scholasticism is actually rooted in the Islamic tradition. In the preface to his seminal *The Philosophy of Alfarabi and Its Influence on Medieval Thought*, Hammond states that if the reader is convinced of two facts after completing the book, then the efforts that went into writing it have been rewarded amply. The first of these is the fact that al Fārābī (d. 950) was

> well acquainted with Greek philosophy; so well acquainted, in fact, that he was able, through diligent study, to perfect some of its old theories and work out new ones. Second, that the [Scholastic] Schoolmen borrowed from him a great amount of material which hitherto has been regarded by many as a product of their speculation, while in reality it is not. In all justice to Alfarabi and other Arabian thinkers, we should candidly admit that [medieval] Christian philosophy owes a great deal to them.[61]

In the context of the present discussion, it is important to note the influence of al Fārābī on St. Thomas Aquinas, especially as regards the attributes of God and the proofs of His existence. Al Fārābī puts forth three main arguments for the existence of God: a) the proof of motion, b) the proof of efficient cause, and c) the proof of contingence.[62] As Hammond notes, all of these arguments fall under the category of the "cosmological" argument, which is based on the premise that all effects must have a cause. But as this process cannot proceed ad infinitum, thus the First Cause is God. He goes on to note that the proofs put forth by Aquinas for the existence of God are virtually identical to those put forth by al Fārābī. Hammond proves this point by quoting both scholars on each of the three proofs and juxtaposing the quotes on the same page. This format allows the reader to compare easily the ideas of the two thinkers. After such a comparison, it becomes difficult to contest Hammond's assertion that

> [t]he proofs of causality and contingence as given by St. Thomas are merely repetition of Alfarabi's proofs. This is said, not because of any bias against St. Thomas, but rather because this is evident to anyone after studying the works of both Alfarabi and of St. Thomas.[63]

Here it must be noted that al Fārābī's proofs for the existence of God are a significant improvement over Aristotle's singular proof. The only proof that Aristotle gave for the existence of God identified Him as "the immovable mover," but this argument leads to the conclusion that "God is a designer and not a creator," a proposition that is unacceptable to Muslims and Christians alike. Al Fārābī's original thought manifests itself in the fact that "he improved on the Aristotelian proof of the first mover, adding to it two other proofs, that of efficient causes and contingence."

Similarly, when one compares al Fārābī's description of the attributes of God with that of St. Thomas, one can see clearly the influence of the former on the latter. The proofs given by St. Thomas for God's unity, infinity, immutability, and simplicity are virtual repetitions of the proofs put forth by al Fārābī almost three centuries earlier. Besides these issues, which are related to theodicy, Hammond notes the influence of al Fārābī on the "Latin Schoolmen" as regards the doctrine of the simplicity of being, the problem of universals, and the issue of the active intellect.

At this point, it is worth recalling that, according to Whitehead,

> the greatest contribution of medievalism to the formation of scientific thought . . . [is] the inexpungable belief that every detailed occurrence can be correlated with its antecedents in a perfectly definite manner, exemplifying general principles.[64]

In the absence of the belief that each effect has a cause, "the incredible labour of scientists would be without hope." The theodicy in which this "inexpungable belief" is rooted was articulated originally by al

Fārābī, copied by St. Thomas, and then passed on to the rest of Europe. The implication on scientific thought of identifying God as the Prime Cause and the Ultimate Contingency is so obvious as to be apparent to Hammond himself, who is neither a scientist nor a philosopher/historian of science. Hammond notes that "if the principle of causality is validly used by the scientists to explain the phenomena of physics, likewise it must be regarded as validly employed by the philosopher to explain the universe."[65] The only correction one could make to this is that the philosophers used this proof many centuries before the scientists. In fact, the scientists learned this principle from the philosophers.

It should be noted that al Fārābī is not the only Muslim thinker whose ideas shaped the Scholastic movement. Ibn Sīnā' (d. 1036), another prominent Muslim scholar who influenced medieval Scholastic thinkers, was considered by Roger Bacon as "the chief authority in philosophy after Aristotle."[66] One scholar discusses Ibn Sīnā's influence on two prominent Scholastic Schoolmen in the following words: "It is remarkable to what extent the thinking of Albertus Magnus and Thomas Aquinas was influenced by Ibn Sina'." The influence of al Ghazālī (d. 1111) on medieval Christian theology has been so profound that a western scholar argues "the personal influence of Al Ghazali on the science of theology was greater than that of St. Thomas Aquinas."[67] The evidence to support Hammond's argument that medieval Christian theology owes a great deal to al Fārābī and other Arab thinkers is quite compelling.

In addition to borrowing ideas that are the hallmarks of Scholastic thought, medieval Europeans also borrowed the fundamentals of Scholastic methodology from the Muslims. The contribution of dialectical disputation to the sharpening of the European intellect has been noted already. Attention will now be focused on the Islamic origin of this method.

The great jurist al Shāfʿī (d. 820) taught the subjects of discussion and disputation as a regular part of his curriculum, which also included the Qur'anic and hadith sciences. As Makdisi notes, orthodox Muslim scholars had to rely upon dialectics in their confrontation with the Mu'tazilite theologians, who had adopted this method from the Greeks. In order to counter the heterodox camp effectively, traditionalists employed the very weapon that the Mu'tazilites were wielding to defeat them. By the time the defeat of the Mu'tazilites had been assured, the art of dialectical disputation was part of the orthodox Islamic tradition. In Makdisi's words,

> while the traditionalists triumphed, traditionalism did not escape being influenced by its adversaries, the rationalists. The weapons of dialectics were gradually absorbed into law. For excellence in law was achieved through disputation built on expertise in two essential fields: *khilaf*, disputed questions, and *jadal*, dialectics.[68]

By the beginning of the tenth century, dialectics was a fixture in the curriculum of all institutions of learning in the Muslim world. The insti-

tutionalization of this method is reflected in the fact that a student had to defend orally a proposed thesis before being licensed to teach a particular subject by the teacher. Mastery of this subject was essential, especially for students of law, for they had to defend their legal opinions "against jurisconsults who held opinions to the contrary." Makdisi points out the importance of dialectics in classical Islamic education:

> [Scholasticism] was a *method* taught in the colleges of law, drummed into the students, rehearsed over and over again, the method of teaching it being part and parcel of the method of teaching the legal sciences.[69]

In the concluding chapter of his book, Makdisi states that a number of western scholars have been perplexed by the sudden appearance of dialectical disputation in Europe. They are puzzled by the fact that there are no indigenous European antecedents to account for the emergence of this trend in Europe. He notes that the first person to use the *sic et non* (scholastic) method in eastern Europe was Photius, the Byzantine ambassador to Baghdad. In the West, this distinction goes to Bernold of Constance, who flourished around the year 1100. Makdisi presents a strong argument that this method was adopted by the West, like numerous other ideas, from the Muslim world during the intellectual ferment that was taking place in Europe around the twelfth century. The wholesale borrowing of important Scholastic ideas by European scholars from the Muslim world has been illustrated already. In addition, it is more than likely—almost certain—that they also borrowed the Scholastic method from the Muslims. Commenting on this point, Makdisi writes:

> Khilaf [dialectical disputation] is a specifically Islamic institution, a core component of the scholastic method, *influencing the fundamental structure of the West*.[70] (emphasis added)

Having looked at the contribution of medieval thought to the emergence of modern thought, as well as the influence of Islamic thought on medieval thought, attention will now be focused on classical Greek thought. Along with the Christian tradition, classical Greek thought is the dominant factor that has shaped Europe's intellectual legacy. Moreover, the vast majority of western scholars find the roots of the modern scientific method in classical Greek philosophy. But as was noted above briefly, the Greek idea of gods and goddesses given to impulsive and erratic behavior mitigates against the emergence of a rational and orderly world that could be subject to disciplined scientific enquiry. This point will be demonstrated further in the following section.

The classical Greek intellectual tradition begins with Homer's (c. 750 B.C.) two epics, *The Iliad* and *The Odyssey*. In these poems, Homer addresses the issues of humanity's relations with the gods, moral ethics, and humanity's place in the universe.[71] The fact that leading Greek

thinkers continued to quote Homer's works and write commentaries on them long after his death is evidence of his lasting impact on classical Greek tradition. His worldview, as outlined in these two poems, can be characterized correctly as a "mythological worldview" in which empiricism and observation play almost no role. Simply stated, Homeric epistemology is based almost exclusively on the world of myth and legend: there is hardly any appeal to observation and/or experience. From the very outset, Greek thought is at odds with the scientific spirit, because a mythological worldview is not compatible with an epistemology based on observation and experience.

The almost total lack of appeal to observation and experience in Homer's thought was not lost on later Greek philosophers, who criticized him for neglecting these valid sources of knowledge. Beginning in the sixth century B.C., a "naturalist" movement emerged in Greek philosophical circles in opposition to the traditional Homeric school of thought. The naturalists argued that knowledge has to be based on observed phenomenon and actual experience, not merely on traditional myths and legends. Anaximander (c. 610–c. 540 B.C.), Heracleitus (fl. 500 B.C.), Xenophanes (580–480 B.C.), and Herodotus (484?–420 B.C.), who were among the leading proponents of the naturalist school, argued that all things in nature are products of matter. In order to understand the world around us, therefore, we have to observe the multitude of phenomenon that take place in the material world and base our knowledge of the world on our accumulated experience. By noting that the naturalist philosophy is much closer to the scientific worldview than the Homeric outlook is stating the obvious. Due to the importance that the naturalists attached to observation and experience, some have labeled them as the first scientists. But this is an exaggerated appraisal of naturalist philosophy, because, as Terrance Irwin says, the

> simple-minded appeal to the value of observation could hardly vindicate the naturalists against Homer. For many naturalists do not study the phenomena they can observe . . . . They [did] not characteristically argue from observation and experience about how things actually [did] happen. . . . Many of their actual appeals to observation are fairly speculative.[72]

For the naturalists, the principles of observation and experience remained abstract philosophical principles and did not actually impact on the epistemological methodology of the Greeks.

With the advent of Platonic philosophy (c. 428–347 B.C.), even the theoretical concession of the naturalists—allowing observation and experience to be valid sources of knowledge—was challenged. According to Plato, the material world is only an imperfect manifestation of true reality. In order to gain true knowledge, one has to understand true reality. However, as true reality is not a part of the material world, it follows logically that the one striving after true knowledge has to speculate on the

nature of an unseen realm. Commenting on Plato's view of reality, a scholar has noted that, for Plato, "reality is no longer that which constitutes the substance of the physical world . . . nor yet a law which governs the flux of things. It is not even the persistence of the flux."[73]

By separating reality from the material realm, Plato can dispense easily with observation and experience as valid epistemological agents. When we analyze his views on the characteristics of true philosophers, we see that he is arguing against considering observation of the material world and experience gained from this observation as legitimate sources of knowledge. Paul Shorey summarizes Plato's view of philosophers in these words:

> Philosophers are lovers of wisdom—of true wisdom—not of curious sights and sounds. By true wisdom Plato means thought, abstract ideas, general conceptions—a systematic and coherent philosophy of life such as can be achieved only through the severest discipline of the higher mental faculties.[74]

In contrast to a philosopher, a scientist has to be very concerned with "curious sights and sounds," for true scientific insight cannot be gained "only through the severest discipline of the higher mental faculties"—it has to be complemented by prolonged and assiduous observation of the "imperfect" material world. The fact that Platonic philosophy is not conducive to an epistemology centered on the visible material world is obvious, and that it would be inimical to the scientific method is thus a logical corollary. Plato's proposed course of study for the intellectual elite who would eventually become the "philosopher kings" offers further proof that Platonic philosophy is hostile to the scientific method. Shorey, aware of the antiempirical and antisensory thrust of Plato's ideas, makes the following disclaimer before detailing the proposed course of study: "[Plato] is not assailing modern experimental science."[75] While he may not be assailing experimental science explicitly, it is practically impossible to imagine how an epistemology based on experimental science can be constructed without first demolishing one based on Platonic philosophy.

Aristotle (384–322 B.C.) departs from Plato somewhat on the role of the senses in the search for knowledge. He asserts that there are two kinds of knowledge: the particular and the universal. In this categorization, the human senses can be used only to ascertain the validity of particular knowledge. According to Aristotle, "sensory qualities" can affirm whether something is red, sweet, loud, or round, but when it comes to determining "universal ways of behaving," these qualities fail us.[76] In his view, true knowledge is to be gained through speculative reasoning, with the role of observation being secondary and something which "reinforce[s] purely deductive reasoning." Here we can see that Aristotle's allowance for observation and experience as valid epistemological tools is extremely narrow. The possibility of a genuine scientific methodology emerging from Aristotelian philosophy is extremely implausible, for "Aristotle

believes that sensory perception is always of particulars, whereas scientific understanding is of universals."

As the foregoing discussion shows, Greek distrust of the human senses, the material world, and accumulated human experience is well ingrained in the philosophies of leading Greek thinkers. For the Greeks, pure speculative thinking is the surest way of grasping the truth about reality, whether the principles of this speculative thought are rooted in Platonic "dialectic" or Aristotelian "deductive reasoning." Scientific epistemology cannot possibly take root in the soil of Greek philosophy because of the Greek emphasis on speculative thinking.

Greek thought is hostile to the scientific spirit on another account: it focused largely on the human world alone as a subject of study, in isolation from the natural world. Historically speaking, almost the totality of the Greek intellectual endeavor deals with philosophy, mathematics, the mechanical arts, and medicine. The natural world receives almost no attention whatsoever. Keenly aware of the fact that the Greeks were experts in sciences dealing with "lines, surfaces, and solids," Plato argued that they should concern themselves more with the natural world.[77] Shorey quotes Plato as having said that "the popular notion that the study of nature and astronomy is impious is the reverse of the truth." The fact that the study of nature was actually considered "impious" shows the degree of antipathy that the Greeks had for the world of trees, insects, animals, and so on.

In spite of the fact that Plato urged his countrymen to study nature, the Platonic dichotomy between the imperfect material and the perfect immaterial itself mitigates against such study. It should be noted here that Renaissance thought was committed "to putting nature on the rack, and forcing it to reveal its secrets," an attitude directly contrary to Greek thought. Characterizing the nature of Greek epistemology and the type of intellectual endeavor it undertook, Briffault asserts:

> The Greeks systematized, generalized, and theorized, but the patient ways of investigation, the accumulation of positive knowledge, the minute methods of science, detailed and prolonged observation and experimental enquiry were altogether alien to the Greek temperament.[78]

Islam's Revolt against Greek Philosophy

Only by rebelling against speculative philosophy could the Muslims establish "the patient ways of investigation, . . . the minute methods of science, detailed and prolonged observation and experimental enquiry." Ibn Ḥazm (d. 1064) devoted a whole book to cataloging the shortcomings of Greek speculative philosophy. His *Scope of Logic* stands as a landmark work that takes the Greeks to task for their rejection of sense perception as a valid source of knowledge. He refuted the arguments of Euclid and Ptolemy that the human eye and mind are the source of all

perception. Being an accomplished scientist, he showed that a beam of light travelling from the object to the eye is the real source of perception, as opposed to a beam travelling from the eye to the object as the Greeks believed.[79] Al Ghazālī (d. 1111) dealt a mortal blow to Greek speculative philosophy in the Muslim world when he wrote his *Incoherence of the Philosophers*. The work became the most direct and lucid refutation of the Greek rejection of empiricism and acceptance of speculation. Ibn Taymīyah (d. 1328), author of *The Refutation of Logic*, argued that inductive reasoning, and not speculative philosophy, is the only reliable form of argument.

This revolt against Greek philosophy naturally meant that "the search for a surer method of knowledge" had to be undertaken by the Muslims. Al Ghazālī developed the theory that "the principle of 'doubt' [is] the beginning of all knowledge." Taking this as the starting point, Muslim scientists/philosophers tore down all elements of Greek thought that hindered the development of the scientific mindset. As already mentioned, Ibn Ḥazm rejected the Greek notion that sense perception is not a valid source of knowledge. Al Khawarizmī's (d. 850) movement from the arithmetic of the Greeks to algebra marks the emergence of the concept of numbers as representing pure relation, not merely pure magnitude.[80] Building on Khwarizmī's work, al Birūnī (d. 1048) developed the notion of the "function" that "turns the fixed into the variable, and sees the universe not as being but as becoming." This is possible because the notion of "function" divorces numbers "from their static and purely spatial character and links them to Time." Al Birūnī lay to rest the Greek belief of a static and unchanging universe and thus ushered in a change of perception that would have a revolutionary impact on the human intellect.

The following quotation is taken from a treatise put forth by the Ikhwān al Ṣafā', a group of intellectuals who flourished around the year 1000:

> Plants preceded animals in existence in point of time, and the less developed animals preceded the more developed animals, which only came into being after a long period . . . . Water animals existed before land animals in point of time. And all animals preceded man.[81]

Not only were the Greeks incapable of putting forth such observations, but due to their view of the universe, they could not have comprehended such a thesis. For them, the universe was static and unchanging, and hence all plants, animals, and human beings had existed in their present forms since the beginning. The notion that certain types of living organisms preceded others in point of time can only be accommodated by an intellect able to view the universe as dynamic and changing, not as static and unchanging. If the Europeans had inherited pure Greek thought without the original contribution of the Muslims, it is anybody's guess how long the Renaissance would have been delayed.

The powers of inductive reasoning and observation were cultivated and prized by Muslim scientists. The degree to which such characteristics of modern science had developed among the Muslims is indicated by the following quotation from Ibn Ṭufayl (c. 1150), who wrote that:

> The sun does not communicate his heat to the earth after the same manner as hot bodies heat those other bodies which are near them . . . . Nor does the sun first heat the air, and so the earth, because we may observe in hot weather that the air which is nearest the earth is hotter by much than that which is higher and more remote. It remains therefore that the sun has no other way of heating the earth but by its light, for heat always follows light, so that when its beams are collected, as in burning glasses, it fires all before it.[82]

In this brief discussion, we can see clearly how the scientific spirit has been internalized by the Muslims. In the method of stating the issue and also looking at various explanations, Ibn Ṭufayl employs a very systematic and logical approach. When the works of al Birūnī (c. 1000) and al Khāzinī (c. 1100) on the specific gravity of various substances are studied, one notes the remarkable fact that their results are almost identical to those established by modern scientists. Establishing the specific gravity of a certain solid requires acute attention to detail and specific measurements. The fact that Muslim scientist nearly a millennium ago were able to obtain results that match modern figures—sometimes up to the fourth decimal place—is a testament to the fact that the scientific method was highly developed among them. This is even more so the case in light of the fact that the instruments of measurement available were far more primitive than those available today.

In citing the works of the Ikhwān al Ṣafā', Ibn Ṭufayl, al Birūnī, and al Khāzinī, we are not referring to obscure scholars who were unknown to their contemporaries. On the contrary, these individuals were prominent scientists whose works were known, whose methods of investigation were copied, and whose conclusions were challenged. Their methods and intellectual endeavors are representative of the currents of their time. Considering their work, and the larger group of Muslim scientists from the classical period, one can see why Briffault says:

> What we call science arose in Europe as a result of a new spirit of inquiry, of new methods of investigation, 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.[83]

At this point in our discussion, we have reached a juncture where it can be stated with confidence that the scientific spirit was born and cultivated in the Muslim world and eventually passed on to Europe. The Muslim contribution to medieval Scholastic thought has been outlined,

and the Islamic influence on that aspect of medieval thought that contributed to the emergence of modern thought has also been illustrated. The fact that classical Greek philosophy is incompatible with the scientific spirit, and hence with the spirit of the Renaissance, had to be established before the main thesis could be established—for classical Greek philosophy is practically the only alternative explanation for the development of the scientific spirit. Having reached this point, it is logical to ask: If the scientific spirit is not rooted in classical Greek philosophy, what accounts for its development among the Muslims?

The Qur'anic Influence on Islamic Epistemology

Muhammad Iqbal writes that "it is clear that the birth of the method of observation and experiment in Islam was due not to a compromise with Greek thought, but to a prolonged intellectual warfare with it."[84] He explains further that all religions have a sacred text towards which the believer's attention is directed in order to know the divine will. The truth is to be found in this book, with the result that all other sources of knowledge are suspect.

Although Islam is no different from other religions in this regard, it does have one distinguishing feature: the Qur'an itself is regarded as the source of truth. Once the believer's attention has been turned toward the Qur'an in hope of guidance and enlightenment, it instructs him/her to redirect his/her attention outward toward the natural world, for the divine will and divine laws are to be found not only in the pages of the Qur'an but also in the working of the universe, the history of humanity, and even in the nature of the individual. A typical Qur'anic verse that manifests this characteristic is 2:164, in which the Creator says:

> Assuredly, in the creation of the heavens and the earth; and in the alternation of night and day; and in the ships which pass through the sea with what is useful to man; and in the rain which Allah sends down from heaven, giving life to the earth after its death, and scattering over it all kinds of cattle; and in the change of the winds, and in the clouds that are made to do service between the heavens and the earth are signs for those who understand.

The seed of intellectual stimulation that eventually sprouted into the flowering tree of Muslim scientific genius is rooted in this divine challenge to find the divine will in the natural and the visible worlds. While the Greeks believed that studying the world of nature could in no way enhance humanity's understanding of itself, the Qur'an exhorts the believers to study the natural world in order to better understand their place in the universe. By the same token, whereas Plato taught that the study of the visible material world could only lead to an imperfect understanding of reality, the Qur'an makes the study of the visible material world a necessity for understanding true reality. As Iqbal said: "It was a great

point to awaken the empirical spirit in an age which renounced the visible as of no value in men's search of God."[85]

Just as the Qur'an contains *āyāt Allāh* (lit. the signs of Allah), a phrase usually translated as "verses," the natural world itself is an *āyāt Allāh*. The Qur'an refers to the innumerable workings in the animal and the plant worlds, in the world of natural phenomenon (i.e., rain, thunder, and shadows), in the world of stars, planets, and sky as *āyāt Allāh*. In the context of this discussion, the observations of a contemporary western scholar are worth noting. Commenting on the Qur'anic view of nature and its utility in humanity's search for God, Karen Armstrong notes:

> The Koran constantly stresses the need for intelligence in deciphering the "signs" [ayat] or "messages" of God. Muslims are not to abdicate their reason but to look at the world attentively and with curiosity. *It was this attitude that later enabled Muslims to build a fine tradition of natural science*, which has never been seen as such a danger to religion as in Christianity. A study of the natural world showed that it had a transcendent dimension and source [God], whom we can talk about only in signs and symbols.[86] [emphasis added]

One cannot speak of the Islamic genius in the scientific realm without citing the spirit of the Qur'an, which encouraged—nay demanded—an empirical investigation of the natural world. Just as an investigation of the *āyāt Allāh* (verses) of the Qur'an would lead one to better understand the divine will, so would an investigation of the *āyāt Allāh* in the natural world. This spirit of enquiry engendered by Qur'anic exhortations led the Muslims to establish a scientific epistemology based on observation and experimentation. After four centuries of distillation and maturation in their hands, it found its way to Europe. The genius of the Renaissance is indebted to this spirit of enquiry that was cultivated by the Muslims, not to the speculative philosophy of the Greeks.

The Islamic impact on western civilization is of such magnitude that even some of those scholars who wish to dismiss it eventually end up acknowledging it, albeit grudgingly. Barnes, who claimed earlier that Islamic cultural preeminence during the Middle Ages was not due to "any direct Islamic encouragement of scholarship and art" but was based "chiefly on earlier pagan scholarship, particularly that of the Greeks,"concludes his discussion on the topic by quoting Baron Carra de Vaux:

> The Arabs kept alive the higher intellectual life and the study of science in a period when the Christian West was fighting desperately with barbarism . . . . From the 12th century everyone in the West who had any taste for science, some desire for light, turned to the East or to the Moorish West . . . . When at the Renaissance the spirit of man was once again filled with the zeal for knowledge and stimulated by the spark of genius, if it was able to set

> promptly to work, to produce and to invent, it was because the Arabs had preserved and perfected various branches of knowledge, kept the spirit of research alive and eager, and maintained it pliant and ready for future discoveries.[87]

A Final Word

Speaking of the intellectual ferment in the beginning of the medieval period, a European scholar writes that "the intellectual growth of the West between the tenth and the twelfth centuries has its inner reasons and independent drives . . . ."[88] Referring to the conditions that led to the rise of colleges and universities in Christian Europe, another western scholar argues that "the universities sprang from a spontaneous movement of the human mind."[89] The underlying assumptions, as well as the explicit wording of these views, bear a remarkable resemblance to the ancient Greek theory of "spontaneous generation," which states that life emerged "spontaneously" from such inorganic matter as rocks and mud due to some mysterious process. Similarly, many prominent western scholars are of the opinion that the European mind, after being virtually dead for eight centuries, suddenly came to life in the eleventh to twelfth centuries due to "inner reasons and independent drives," or, in other words, due to a "spontaneous" process.

Another point on which this theory resembles the old Greek theory is the likelihood of its plausibility. The evidence presented in this brief survey shows that the birth of modern Europe is the result of a long and complicated process in which the influence of the Muslim world proved to be of critical importance. Commenting on the reasons for the European dismissal of the Islamic influence and the need for constructing a correct view of history, Watt states:

> Because Europe was reacting against Islam it belittled the influence of the Saracens and exaggerated its dependence on its Greek and Roman heritage. So today an important task for us western Europeans, as we move into the era of the one world, is to correct this false emphasis and to acknowledge fully our debt to the Arab and Islamic world.[90]

Following the line of argument that has been presented here in order to illustrate the Islamic impact on western civilization, one is left with a puzzling question: Why did the industrial/scientific revolution take place in Europe and not in the Muslim world? An adequate response to this question requires a great deal more resources than are available to the present author, and thus a few remarks will have to suffice.

The implicit logic contained in this question assumes that once a civilization has surpassed another in terms of intellectual/technological achievements it should maintain this advantageous position indefinitely. If this were the case, history would be an exceedingly boring subject. Human

history is an unfolding story of the rise and fall of civilizations, and flux and change, not stability and continuity, are the governing principles. A young and vibrant civilization absorbs the intellectual heritage of a declining power, modifies it to suit its own tradition, and in turn is modified by the new ideas—this is the general pattern found in the intellectual history of humanity. There is no reason why the relationship between Islam and the West, whether in the past or in the future, should be exempt from this general rule. In spite of their cultural, technological, and scientific backwardness (of which they were keenly aware), medieval Europeans did not hesitate to adopt, modify, or reject various intellectual currents originating in Muslim lands. It remains to be seen whether Muslims in the modern period can demonstrate the same courage, conviction, and vision that medieval Europeans demonstrated and not shrink from opening up to new ideas emanating from foreign lands.

Endnotes

1. R. Briffault, *The Making of Humanity* (London: Allen & Unwin Publishers, 1921), 190.

2. H. Barnes, *The Intellectual History of Mankind* (New York: MacMillian, 1936), 404.

3. Sevier, quoted in Barnes, *Intellectual History*, 404.

4. A detailed discussion of Sarton's methodology is to be found in the introductory chapter of his seminal work *Introduction to the History of Science* (Baltimore: The Williams & Wilkins Co., 1927) 2-volume.

5. Sarton, *Introduction,* vol. 1 and vol. 2, part 1.

6. S. Cobb, *Islamic Contributions to Civilization* (Washington, DC: Avalon Press, 1963), 42.

7. A. Cook, "Ibn Fadlan's Account of Scandinavian Merchants on the Volga in 922," in *The Islamic World and the West 622-1492*, ed. Archibald Lewis (New York: John Wiley & Sons, 1970), 18.

8. Briffault, *Making of Humanity*, 189.

9. E. Myers, *Arabic Thought and the Western World in the Golden Age of Islam* (New York: Frederick Unger, 1964), 8.

10. Cobb, *Islamic Contributions*, 32.

11. Sarton, *Introduction,* vol. 2, 351.

12. G. Makdisi, *The Rise of Colleges: Institutions of Higher Learning in Islam and the West* (Edinburgh: Edinburgh University Press, 1981), 35.

13. Makdisi, *The Rise of Colleges,* 34.

14. Makdisi, *The Rise of Colleges,* 226.

15. Makdisi, *The Rise of Colleges,* 227.

16. Makdisi, *The Rise of Colleges,* 226-34.

17. Makdisi, *The Rise of Colleges,* 272.

18. Makdisi, *The Rise of Colleges,* 276.

19. H. Wieruszowski, *The Medieval University* (Princeton: D. Van Nostrand, 1966), 173-74.

20. Wieruszowski, *The Medieval University*, 75.

21. Makdisi, *The Rise of Colleges,* 261.

22. Wieruszowski, *The Medieval University,* 78.

23. H. Rashdall, *The Universities of Europe in the Middle Ages,* eds. F. M. Powicke and A. B. Enden (Oxford, UK: Oxford University Press, 1964), 501.

24. Makdisi, *The Rise of Colleges,* 228.

25. This is the meaning of "College des Dix-Huit."

26. Rashdall, *The Universities of Europe*, vol. 2, 119-20.
27. Wieruszowski, *The Medieval University,* 79-80.
28. Sarton, *Introduction*, vol 2, 352.
29. Rashdall, *The Universities of Europe*, vol. 2, 121.
30. Wieruszowski, *The Medieval University,* 53-54.
31. M. Nakosteen, *History of Islamic Origins of Western Education* (Boulder, CO: University of Colorado Press, 1964), 189.
32. Briffault, *Making of Humanity,* 199.
33. P. Hitti, *History of the Arabs* (New York: MacMillian, 1956), 588-89.
34. Wieruszowski, *The Medieval University,* 88.
35. A. Ahmed, *A History of Islamic Sicily* (Edinburgh: Edinburgh University Press, 1975), 85.
36. Hitti, *History,* 609-11.
37. Briffault, *Making of Humanity,* quoting Gregory, 203
38. Sarton, *Introduction*, vol. 2, part 1, 6.
39. R. Landau, *Arab Contributions to Civilization* (San Francisco: American Academy of Asian Studies, 1958), 27.
40. Briffault, *Making of Humanity,* 198.
41. C. Haskins, *The Renaissance of the Twelfth Century* (Cambridge, MA: Harvard University Press, 1927, reprint 1982), 301.
42. Sarton, *Introduction*, vol. 2, 167.
43. Myers, *Arabic Thought,* 85-87.
44. Briffault, *Making of Humanity,* 199.
45. Myers, *Arabic Thought,* 11-16
46. Landau, *Arab Contributions*, 27.
47. O. Farrukh, *The Arab Genius in Science and Philosophy* (Ann Arbor, MI: American Council of Learned Societies, 1956), 66.
48. Hitti, *History*, 587.
49. Wieruszowski, *The Medieval University*, 61.
50. C. Haskins, *The Rise of Universities* (Binghamton, NY:Vail-Ballou Press, 1959), 4.
51. Barnes, *Intellectual History*, 488.
52. A. N. Whitehead, *Science and the Modern World* (New York: Macmillian, 1964), 1928.
53. Whitehead, *Science,* 19-24.
54. T. Goldstien, *Dawn of Modern Science* (Boston: Houghton Mifflin, 1988), 62.
55. Goldstien, *Dawn,* 64.
56. C. Dawson, *The Formation of Christendom* (New York: Sheed and Ward, 1967), 229.
57. Dawson, *Formation,* 232-38.
58. C. Dawson, *Religion and the Rise of Western Culture* (New York: Image Books, 1958), 190.
59. Dawson, *Religion,* 190.
60. It is difficult to address this issue from all the angles involved, for such an endeavor would take up many pages. Hence we will concentrate our attention on the most famous of the medieval Scholastic theologians, St. Thomas Aquinas, and identify the influence of Islamic thought on him. Others will be mentioned only in passing. In spite of this limitation, the influence of Islamic thought on Aquinas will be shown to be profound enough to justify the basic argument as it is stated in this subheading.
61. R. Hammond, *The Philosophy of Alfarabi and Its Influence on Medieval Thought* (New York: The Hobson Book Press, 1947), "Preface."
62. Hammond, *The Philosophy of Alfarabi,* 19-21.
63 Hammond, *The Philosophy of Alfarabi,* 21-22.
64. Whitehead, *Science,* 19.
65. Hammond, *The Philosophy of Alfarabi,* 21.
66. Myers, *Arabic Thought,* 34.
67. Myers quoting George F. Moore, *Arabic Thought*, 39.

68. Makdisi, *The Rise of Colleges*, 80.
69. Makdisi, *The Rise of Colleges,* 109.
70. Makdisi, *The Rise of Colleges,* 289.
71. T. Irwin, *A History of Western Philosophy: Classical Thought* (Oxford, UK: Oxford University Press, 1989), 61.
72. Irwin, *A History of Western Philosophy*, 30.
73. G. Boas, *Rationalism in Greek Philosophy* (Baltimore: The Johns Hopkins Press, 1961), 131.
74. P. Shorey, *What Plato Said* (Chicago: The University of Chicago Press, 1934), 226.
75. Shorey, *What Plato Said,* 236.
76. Boas, *Rationalism,* 206.
77. Shorey, *What Plato Said,* 386.
78. Briffault, *Making of Humanity*, 191.
79. M. Iqbal, *The Reconstruction of Religious Thought in Islam* (Lahore, Pakistan: Iqbal Academy Pakistan, 1986), 103.
80. Landau, *Arab Contributions,* 31.
81. Farrukh, *Arab Genius,* 58.
82. Farrukh, *Arab Genius,* 61.
83. Briffault, *Making of Humanity,* 191.
84. Iqbal, *Reconstruction*, 102.
85. Iqbal, *Reconstruction,* 11.
86. K. Armstrong, *A History of God: The 4000-Year Ouest of Judaism, Christianity, and Islam* (New York: Alfred K. Knopf, 1994), 143-44.
87. Barnes, *Intellectual History*, 499.
88. R. Lopez, *The Birth of Europe* (New York: M. Evans and Co., 1967), 180.
89. Gabriel Compayré quoted by Makdisi, *The Rise of Colleges,* 295.
90. M. Watt, *The Influence of Islam on Medieval Europe* (Edinburgh: Edinburgh University Press, 1987), 84.