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iv

### CONTENTS

Page

|   |         |
|---|---------|
| The Contribution of Christ Apostolic Church to Spiritual and Moral Development in Nigeria<br>Olusegun Ayodeji Peter <b>Alokan</b> , Ph.D ... ..                                       | 1-18    |
| The Contributions of the Muslim Arabs to the Development of Science<br>Lateef Oluwole <b>Abbas</b> , Ph.D.... ..  | 19-32   |
| Implication of the Concepts of Human Right and Freedom for Justice<br><b>Surakat</b> , Ajibola Moruph... ..   | 33-46   |
| Assessment of Cash-less Policy in Nigeria<br><b>Adeosun</b> , Titilayo H. and <b>Adewoye</b> , Jonathan O... ..   | 47-58   |
| Investment in Fixed Assets and Firm Profitability: Empirical Evidence from the Nigerian Banking Sector<br><b>Olatunji</b> , Toyin E. Ph.D and <b>Adegbite</b> , Tajudeen A ... ..     | 59-71   |
| In Search of an Effective Management Model for the Performing Arts and Culture Industry: the Musical Society of Nigeria (MUSON) as an Example<br>Stanley <b>Ohenhen</b> , Ph.D.... .. | 72-87   |
| The Effect of Age on Age Grades Fabric Selection, Accessories and Dress Style in Ojude Oba Festival, Ijebu- Ode<br><b>Braide</b> , Olufunmilayo and <b>Labode</b> Jamiu ... ..        | 88-105  |
| Commercial Motorcycle Operations in Nigeria: Friend or Foe<br>Christopher Adesola <b>Wajuade</b> .... ..  | 106-120 |

v



*The Contribution of Christ Apostolic Church to Spiritual and Moral Development in Nigeria*  
Olusegun Ayodeji Peter ALOKAN (Ph.D)

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## The Contributions of the Muslim Arabs to the Development of Science

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### Abstract

There are two laws in the course of human existence that Physical Science briefly termed as science, otherwise called law of gravity and divine laws designed to govern the conduct of man. Unlike the physical laws, divine laws from Islamic point of view are not implemented under compulsion (Q. 2:256). The laws of Islam are, in fact, the scientific laws of human nature. Man is however influenced by his environment which may lead to his deviation from the tendencies of his nature and the right path of Islam. To teach man his natural duties, prophets were sent by God periodically. Thus, while physical laws can be discovered by experience, Islamic laws are revealed to the prophets by God for transmission to human beings.

Man is honoured by virtue of knowledge over and above other creatures and this made him the vicegerent of Allah to execute the divine laws on earth. Man is endowed with particular faculties of mind to enable him discover the physical laws, and to harness all the resources of the earthly life to his best advantage. The fact that everything has been made subservient to man is a great incentive that provided for easy exploitation of all resources for the welfare of mankind. He, however, needs to acquire the knowledge of both physical science and divine laws for him to make appropriate utilisation of the earthly resources. That is why Islam has declared acquisition of knowledge as compulsory for all Muslims<sup>1</sup>. It is this mantra that propelled Muslims to want to actualize an orderly human civilisation based on unity devoid of racial, ethnic and religious



discrimination. This fact is in their quest to learn from earlier civilisations and also to incorporate their science and culture<sup>2</sup>.

Though the study of various aspects of sciences and arts that flourished in the apogee of their civilisation might not have been standardised, it, however, brought development and honour to humanity. They contributed to subjects like Mathematics, Physics, Medicine, Astronomy, Chemistry, Geography and Agriculture among others in arts and sciences.

### **Introduction**

Islam as a religion teaches recognition of Allah as the Supreme being behind the creation of the heavens and earth and all the creatures within them. As a way of life, Islam guides one to understand his mission in life and to make use of other creatures to ease his activities. For instance, some animals are useful for transportation of human and goods, some are used for hunting and security purposes while some others are for human consumption.

There are vegetations for human nourishment and medication and some for shelter. The sun and moon, darkness and day light, are all divinely provided for the welfare of man. There are set laws, in the Qur'an and Hadith<sup>3</sup>, guiding the use of the above enumerated creatures. The Qur'an explains how Allah has honoured man over and above other creatures, such that he is empowered to go into the sky and deep into the sea (Q.17:70). Ability to undertake and accomplish all these is hinged on knowledge and that underscores the obligation Islam puts on seeking for knowledge. The importance of knowledge cannot be overemphasized and that, perhaps, was the reason the very first revelations of the Qur'an (Q.96:1-5) deal with reading, creation and the use of pen. It is noteworthy that the Qur'an is the basis of all knowledge sought after by Muslims from earliest time as we shall see later in this paper.

Prophet Muhammad (SAW), though unlettered, having been divinely taught, encouraged his disciples to acquire literacy. Thus, it was as a result of Islam that the Arabs became the touch bearers of science and learning. The Persians who had created a great

civilization before the rise of Islam nevertheless produced much more sciences and learning in the Islamic period than before. Islam was responsible for the creation of a world civilisation in which people of many different ethnic backgrounds participated, but it played a central role in developing intellectual and cultural life on a scale not seen before. For some eight hundred years, Arabic remained the major intellectual and scientific language of the world<sup>4</sup>.

During the centuries following the rise of Islam, specifically the Ummayyad Dynasty commencing from 616 C.E. which gave rise to Muslim dynasties ruling in various parts of the Islamic world<sup>5</sup>. The period attested to the flowering of Islamic culture and thought formation. In fact, this tradition of intellectual activity got eclipsed only at the beginning of the modern times when Muslims showed lowest level of faith in addition to external domination. However, this activity has begun anew in many parts of the Islamic world now that the Muslims are regaining their political independence<sup>6</sup>. Besides the various prophetic proclamations urging Muslims to search for knowledge, there are divine hints in the Qur'an calling Muslims' attention to scientific imports of divine revelations.

The Holy Qur'an had laid good foundation for all aspects of knowledge and administration. For example, human reproduction is taught in some areas of the Qur'an e.g.

And indeed we created man (Adam) out of an extract of clay (water and earth). Thereafter we made him (the offspring of Adam) as a sperm in a safe lodging (womb of the woman) then we made the sperm into a clot, then we made the clot into a little lump of flesh, then we made out of that little lump of flesh bones, then we clothed the bones with flesh and then we brought it forth as another creation. So blessed is Allah, the best of Creators (Q.22:12-14).

It is on this, and others that the Arabs based their observation and practicabilities. Upon the death of the Prophet (SAW), he was succeeded by four caliphs namely: Abubakr, Umar, Uthman and Ali. During his ten year tenure, Umar gave the community a high level of



administration, an experience gathered from the prophet. Among his initiatives was the establishment of the first Public Treasury and a sophisticated financial administration<sup>7</sup>. The two famous Muslim dynasties, Umayyad and Abbasid- followed when Spain was taken over by the Muslims, it heralded the golden age of Islam. Then Cordova was established as the capital and soon became Europe's greatest city, not only in population but in cultural and intellectual life. For over two centuries did Umayyad rule.

### **Muslims Contributions to Science**

One of the core areas of Muslims' contribution to the development of human race is science. We shall contend in this paper with few of the most important discoveries Muslim Scholars have made to science and which have exerted a notable influence on western thought. These shall be discussed in turn.

#### **Astronomy**

This is a science of formation of heavens and in particular, the structure of the heavens, the number and configuration of the stars, the distances of the stars etc. The Arabs were attracted to this study having worshipped heavenly bodies like the stars, the sun, the moon and the like<sup>8</sup>. And also, because they were dwellers of the desert who preferred to travel at night for economic purposes. They also found the direction of their journey with the help of stars. They used the advantage of the clear sky of the desert to make precise observations. At the advent of Islam, the Muslims' interest in astronomy arose in the necessity to determine the time of prayers (Salawat) and the direction of the ka'abah to turn to when praying. There was need to know the altitude of the sun and the latitudes and longitudes of the abode of the Muslims. The same need arose for the orientation of the mosque. This gave a religious impetus to the study of astronomy, Geography and even Mathematics.

To develop the knowledge of astronomy, the second Abbasid Caliph, al-Mansur, began its study in Baghdad during the 8<sup>th</sup> century. It was al-Ma'mun, the seventh Abbasid caliph that improved

tremendously on it and even encouraged research on astronomy and mathematics. His research centre, as it were, known as bayt al-Hikmah carried out translation of existing Indian, Persian and Greek astronomical works into Arabic. In order to facilitate this study and application of astronomy, he established many observatories. At this time, the interest of studying astronomy was of paramount importance in Muslim lands hence the rise in the number of Muslim astronomers employed by al-Mamun. In the 11<sup>th</sup> and 12<sup>th</sup> centuries, astronomy flourished in Muslim Spain resulting in a good deal of creative and original work of this branch of science<sup>9</sup>.

The Muslim scientists attached great importance to accuracy in observations and calculations, without caring for the length of time it would take. Their research sometimes takes upward of forty years to complete. For their desire for accuracy, they did not accept any astronomical tables without subjecting it to serious scrutiny. By the end of the 11<sup>th</sup> century, the Muslim astronomers had taken the lead in this subject area. Not until the 12<sup>th</sup> Century when Christians and Jews scholars started to translate the works from Arabic into Latin and Hebrew, and begun to conduct research in this field<sup>10</sup>. Aside from compiling the astronomical tables, Muslims were known to have made celestial globes on which the positions of the stars were represented. They also wrote comprehensive books on astronomy and mathematics and they in addition composed treatises on various branches of this science. They prepared the star maps in order to preserve the old astronomical knowledge to aid travel, navigation and meteorology<sup>11</sup>.

A book on astronomy written by Muhammad Ibn Ibrahim called *Sind Hind al-Kabir*<sup>12</sup> became a manual that was useful to Astronomers of the time. It was extensively used for reference purposes by students and scholars outside the Muslim lands. One of the greatest astronomers of Islam was Abdullah Muhammad Ibn Sinan al-Battani. Through his research, he was able to determine many astronomical co-efficient with precision. His book was translated into Latin and Spanish in the 12<sup>th</sup> and 13<sup>th</sup> centuries. The



book enjoyed wide acceptability among the European scholars of the middle ages.

### Chemistry

Another scientific subject which enjoys significant Muslim impacts is Chemistry. It is a science that deals with the composition and properties of substances and the changes they undergo. It has been divided into organic and inorganic. This division in modern chemistry was done by a Muslim scientist called al-Rāzī. His classification of chemical substances were into mineral, vegetable and animal<sup>13</sup>. In his contribution to research on chemistry, another great Muslim chemist of the 8<sup>th</sup> century, Jabir Ibn Hayyan (Geber in Latin), modified the Aristotelian doctrine of the four elements, and presented the sulphur-mercury theory of metals. According to this theory, metals differ essentially because of different proportions of sulphur and mercury in them. He also formulated the theory of geologic formation of metals<sup>14</sup>.

Unlike in the earlier Greek works, Jabir performed experiments to reach certain conclusions. His most important discovery was the preparation of sulphuric acid which is one of the most important elements in chemistry. Other element prepared by him is Nitric acid. He wrote many books on the subject and about one hundred chemical works were attributed to him. Many of his works in Arabic language were translated into Latin. Jabir formed some technical terms which have passed through Latin into European languages. Some of them are alkali from *alqali*, antimony from *ithmad*, alembic from *'al-anbia*<sup>15</sup>.

Dhu'l-Nun and al-Jahiz were two other important Muslim chemists of the same era. The former dealt mostly in the art of transmutation of metals while the latter prepared ammonia from animal offals by dry distillation<sup>16</sup>. Abu Mansur, another scholar, made a distinction between sodium carbonate (matrum) and potassium carbonate (qali). He also had knowledge of arsenious oxide, cupric oxide<sup>17</sup>, silicic<sup>18</sup> acid etc. He knew the toxicological effects of copper

and lead compounds, then the composition of plaster and its surgical use.

Other notable Muslim chemists were Ibn khaldun (d.1406), though popular for his *al-Muqaddimah*. Al-farabi, Ibn Sina and Abul-Qasun Muhammad al-'Iraqi among others. These Muslim chemists applied their chemical knowledge to a large number of industrial art which to a large extent, have helped the development of modern chemistry.

### Medicine

It is a general knowledge that medicine is as old as man. This is because the early people got themselves cured of diseases using the available materials like leaves, roots and stems. This is of course at personal and micro levels. Knowledge of medicine becomes complex with the gradual complexity of man and his environment. There is no doubt that centuries before the advent of Islam had seen Arabs practising their own system of medicine in form of herbs and shrubs<sup>19</sup> based on their experience. The arrival of Islam, no doubt, heralded more knowledge and confidence in the preparation and administration of medicine. In early Islam, not much attention was paid to medicine except those approved and practised by the prophet<sup>20</sup>. The study of medicine proper began during the Umayyad period and the first Arab physician was Luqman while the second was Khuzaym. Both and others that followed were inspired by Greek medicine on which they translated a lot of materials. In addition, Khalid Ibn Yazid Ibn Mu'awiyah got both Egyptian and Greek books translated which served as impetus to the study of medicine by the Arab Muslims.

Aside from the translation of various medical books of foreign authors, they made new valuable discoveries in the theory and practice of medicine. Through the combination of their new discoveries and the materials sorted out of these systems, they evolved an entirely new system of medicine. When the European learnt this system from the Muslims, through the Arabic medical literature, they called it Arabian Medicine acknowledging the contributions of the Muslim scientists to medicine<sup>21</sup>.



The study of Islamic medicine was made for centuries in all the Western Europe, particularly in France, and the Arabic medical writings formed the core of the European medical literature. It should be noted that until the 17<sup>th</sup> century, these writings were included in the syllabi of the European universities. A renowned western scholar, Robert Brifault - had attested to the fact that Arab's medicine serves as basis of Europe and modern medicine<sup>22</sup>.

The Arab Muslims' areas of specialisation in medicine cover anatomy, physiology, bacteriology. Their investigations on the causes, symptoms and effects of some diseases were highly remarkable. For example, Al-Razi was the first physician to differentiate between smallpox and measles. Al-Tabari was the first physician to discover tuberculosis as an infiltration. His research revealed that the disease not only affect the lungs, but also other organs of the body. In the area of surgery, Muslim scientists had made much advancement. They introduced many surgical instruments and adopted many methods for the treatment of these diseases. Names like Ibn Zuhr, Abu Qasim al-Zahrawi and al-Tasrif among others were notable surgeons who had originally founded methods of treating many diseases. Many books were written by the Muslim physicians on those branches of medical science. Among the books were medical treatise on leprosy written by Yuhanna Ibn Maswaih, al-Razi's books on smallpox and measles, Abu Musa Ibn Isa's books on piles and the books on sudden death by Qusta Ibn 'Uqa<sup>23</sup>.

In aid of medical research, and to actualize their theoretical and practical accomplishment, hospitals were built beginning from the Umayyad period. During the Abbasid era, improvements were made on hospitals and efforts were also made to attach gardens to some of them where medical plants were cultivated<sup>24</sup>. These hospitals served as models for those established in Europe, particularly in Italy and France.

#### Agriculture and Botany

The Arabs being in a desert area had no choice than to learn about the vegetation surrounding them which would be adequate for their

animals. They also needed to know the type of soil suitable for planting for animals' graze. Having succeeded in herbs for drugs and medicines, they were encouraged to study the kind and types of soil suitable for different kinds of vegetation. They also embarked on irrigation with their experience in Spain where they had introduced irrigation that transformed into garden.

Many agricultural products like cotton, rice, sugar-cane etc. were brought from outside and cultivated in Spain. Much experience was gotten from Romans and Persians and their botanical names were translated into Arabic. When eventually they became experts in the field, they began to write books on the subjects and related ones. One notable scholar in this area was Abu Saheed Abdul Malik Ibn Quraib al-Asma'i. Ahmad Ibn Daud Ibn Wanad also wrote on plants. He was also called al-Hashshab (the herbalist)<sup>25</sup>.

#### Geography

By the nature of the Arabs, in the olden days, they travelled a lot on trade missions and for effective administration of their vast area. There was need therefore to know the terrain of their land and its topography. The need for the determination of direction principally spurred them to study geography of the area. In particular, the hajj period made knowledge of geography compelling in order to help disseminate information to the pilgrims who journeyed to Arabia from all over the world.

The experience of hajj also taught them to travel wide to enable them know many parts of the globe. This propelled their interest in studying geography and indeed other subjects like religion, history, economics and even politics. As a result, a number of books on geography were produced by Muslim geographers and travelers. Translations of these books were made for European use years after<sup>26</sup>.

Christopher Columbus was reported to have used the works of Muslim geographers through which he transmitted a lot of ideas to Europe. Such ideas like sphericity of the earth are being denied by Christian theologians<sup>27</sup>. Vasco Dagma was another explorer who made sea journey to India with the help of a Muslim Arab pilot called



Shihabud-Din Ahmad Ibn Magid, Caliph al-Ma'mun in his interest of geography appointed seventy scholars to draw for him a large map of the world<sup>28</sup>. Many books of map were written by Muslim geographers. One of the famous ones amongst them, Ibrahim Ibn Muhammad al-Istakhri travelled through Arabia to Indian territories and reached the Atlantic regions. One of his books called *Suwarul-Aqalim* (maps of regions), contains a coloured map of each country. It became a reference book for many times later.

The greatest geographer of the middle age was Abu Abdullah Ibn Abdullah. Apart from geography, he specialised in history, literature, botany and was also a traveler and poet. He wrote a book on world geography which he completed in 1154. It was entitled *Nuzhat al-Mustaq fi ikhtiraq al-faq*. It ranked first among the medieval works on history and geography. The book gave a vivid description of Europe and other works derived their source mostly from it<sup>29</sup>.

### Mathematics

Mathematics (*hisab*) means much to the Arabs and their desert environment. Just as geography and astronomy were important to them, mathematics was also used to calculate both the mundane and spiritual life of man. Even up till today, many scholars specialize on calculation to determine the spiritual stage of individual as well to determine what could befall one in the nearest or distant future. This situation may have influenced the Muslim Arabs' interest in the subject.

The Abbasid regime in the second half of the 8<sup>th</sup> century saw the achievement of the Muslim scientists being second to none in the area of mathematics<sup>30</sup>. Though Greek and Indian works served as impetus for the Arabs, the creative and dynamism of the Arabs raised the study tremendously such that up till the 11<sup>th</sup> century almost all the works on mathematics written by the Muslims were copied and studied in Arabic language by non-Muslims in Europe and other lands.

The use of numerals for counting as against the cumbersome Roman figures were developed by the Arabs in addition to the introduction of zero for ease of counting. Thus arithmetic was made simple and easily applicable to daily life in the area of commerce, trade and sharing of inheritance. The zero is very important in arithmetic without which it would be difficult to indicate figures like tens, hundreds etc. The Arabic numerals have come to affirm the Muslims' contribution to mathematical science<sup>31</sup>.

The popular logarithm in mathematics has its origin from al-khawarizmi (a native of khawarizm), a distinguished mathematician, astronomer and geographer of the 9<sup>th</sup> century. Up till the end of the 18<sup>th</sup> century, the science of numeracy was called algorism named after its Muslim founder. A lot of books were written by Muslims on arithmetics and algebra. Most popular of these was *Kitabul-Jabr wal-Muqabalah* (the book of restitution and comparism) written by al-khawarizmi<sup>32</sup>.

Abu Yusuf Ya'qub Ibn Ishaq (*Alkindi*) wrote about 270 works, mostly on mathematics and so did others. Another scholar is Abul-wafa whose contribution to the development of trigonometry is remarkable. He was the first to show the sine theorem relative to spherical triangle. He advanced works on sine and cosine. Research on mathematics by the Muslim Arabs went on even up to the 13<sup>th</sup> century. Abul-Abbas Ahmad Ibn Muhammad, a Moroccan, wrote about 74 works mostly on mathematics and astronomy. The most popular of his work was known as the book on *takhlis al-Hisab*. The book was used for at least two centuries and was translated into French and other European languages.

### Conclusion

Knowledge generally is the basis of development and this is emphasised by Islam through the Qur'an and tradition of Prophet Muhammad. The two sources encourage Muslims to read in order that they may discover themselves and the hidden treasures of their environment. It was this call to duty that the early Muslims answered by venturing into serious learning. There is no area of knowledge they



did not specialise on. That explains their establishment of universities and other educational centers. It is unfortunate however that their efforts and excellence in educational research and development have, over the centuries, waned to such an extent that their initiatives have almost been forgotten while the West that learnt from them have taken over. While we continue to accord them their deserved honours for efforts of the past, we should also urge Muslims not to forget the importance of education as enumerated by the Qur'an, that is, from infancy to death.

Muslims particularly in this part of the globe should study past efforts of their brothers in all fields of knowledge and thus be encouraged to brace up for the challenges of the modern day. Even for effective propagation of Islam, knowledge is mostly required for effective and impactful delivery.

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