CHAPTER IV

Part III

Muslim Scientists and Their contribution

It has been exhibited by citing a lot of verses from the Quran, in the preceding chapter how did the Quran invite people to consider the signs presented in the nature to understand nature and natural phenomenon.

Then, Science, itself found a place in the Quran, in the form of so many facts and concepts, has been revealed to educate people and develop a taste of knowledge so as to shape their mentality into scientific mindedness. The teachings of the Quran actually developed scientific attitude in the followers:

"The Muslims have been taught not only to observe and study nature and natural phenomenon; to disclose the mysteries of nature and observe the creation of the Creator but also it is expected of them that they should study the History and anthropology of old nations and their rise and fall and study the ruins of their cities and abode."

The Quran and the Prophet, both emphasised learning and acquisition of knowledge. The prophet has gone to the extent of saying learning is enjoined upon Muslims.

"The teachings of the Holy Quran and the traditions of the Prophet created such a spirit in the Muslims that Muslims took it enjoined upon them to get themselves educated."

It is true that, the early followers of the Quran consulted the Greek treasure of knowledge coming from Thales, Pythogorus, Democrats, Hypogrotous, Aristotle, Galen, Archimedes, ptolemy

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1 Ziaul Hasan Farooqi "Musalmanon Ka Ta'ali mi Nizam" (New Delhi : Maktaba Jamia, 1992) P-12
2 Ibid P-6
etc. . But, it was a knowledge of those days when science itself had not found its cradle. To quote Bertrand Russel:

“What has survived of Aristotle’s physics; Ptolemy’s Astronomy and Galen’s medicine: About two books of Aristotle; i.e. ‘Physics’, and ‘On Heaven’, Berternd Russel writes, “In the light of modern science whatever is written in these books, we find not a single sentence, practicable.”

The Greeks followed the methods of speculation and did not conduct practical activity. It was to the early Muslim Arabs who discovered this method after the advent of Islam. Ziaul Hasan Farooqui writes:

“The sun of Islam rose in the land of Arabia and the world around it got lit up. Egypt, Syria, Mesopotamia and Persia were among the first to receive this light. These areas were developed in the period of their glory naturally such an environment was created which gave a boost to intellectual development and practical activities.” This developed an awakening in them and made them curious and investigating. The term used in the Islamic period was ‘Hakeem’, and not the scientist. But anybody who was well versed in knowledge and arts, possessed a special position among the learned was called as “Hakim.”

It was obligatory for a Hakim to study astronomy, Chemistry, Anatomy, then he should be a physician, Pharmacologist and should also be a master of so many other things required of the people. It was a beginning of a scientific age.

An Egyptian Scholar Hussein Nasr Observes:

“The Muslims nurtured love of nature along with the academic and research aspect of physical science. While benefiting from the natural they recognized the enlivening and faith developing spirit by

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3 Ali Ezzat Begovich “Islam and the west” (Urdu) (Delhi : Students’ Islamic Publication :1992)
4 Op cit P-5
5 Ibrahim A. Nadvi “Musalman sciencedan aur Unki Khidmat” (Delhi : Maktaba Al Hasnat : 1985) P-14
evolving paradise looking gardens, they materialized the garden of heavens on earth.

They saw the darling of the nature in its natural setting and in the lush green gardens of Persia and Audlusia (Spain) where the beauty of nature was captured in the form of 'Khayban-O-chaman'. (Perks and Parks) through planning and strategy. Every where the Muslim eye, by enjoying the sight of the charming nature got the satisfaction of heart and the wealth of acquaintance to God. The administration of impact of the heavens was always prevailing on them, wherever they had to observe the nature. This developed in them that equilibrium and satisfaction which found or expressed in their art of Islamic buildings.

Precisely, observation of nature, saved the muslims from that negative and despairing attitude that was prevailing on Christianity during the middle ages. Observing nature, was a source of growth and happiness for them. A sense of happiness and intuition is observed in their scientific approach and literary style of writing. The same is felt in their fine arts which progressed under the shade of Islamic Civilization.\(^6\)

Sometimes it appears then why did a reversal occurred. The answer lies here,

"The Muslims, developed mathematics as they developed other sciences but because of miss appreciation of times; and above that the carelessness of their offspring's their many of contributions got destroyed accidentally and those which are saved have become the decorative of the libraries of Europe."\(^7\)

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\(^7\) Shabbir Ahmed Khan"Riyaziyat ki Taraqqui main Musalmon ka Hissa", (Pata : Khuldabakhsh Oriental Library : 1986) P-283
“The most striking quality of Islamic science was to pass theories and laws through various observational, mathematical and experimental tests\textsuperscript{8} so as to make them authentic and applicable.

But it was Quran, that nurtured, cultivated and gave a shape to the Muslim mind. To quote Karandikar,

“As a scripture, the Koran stands out from other scriptures because of its constant appeal to the reader’s intellect. It asks him to think, to consider and ponder over the number of arguments and similitude’s therein.”\textsuperscript{9}

The spirit that Quran maintained in them made them to develop new and newer things and to go to newer places and they marched to the zenith, so much so that it is unimaginable.

“The heights achieved by the Arabs in arts, science and literature were the real foundations of the vast empire that was established in the three continents. The success in this fields was, in a way, the result of the appeal of the Koran to human reason.\textsuperscript{10}

The verses of the Quran, have a universal appeal to human intellect, human reason and human feelings. It touches to the bottom of heart by making one to observe the vast horizon of nature and natural phenomenon present in and around us.

“Allah has invited people in the Holy Quran to ponder over the mysteries of the universe and has emphasized vehemently that they should study the book of nature keenly so that they should firstly recongnize the creator and secondly get benefited abundantly from them as God has created them for their own benefit and he has made them surrendered for them.”\textsuperscript{11}

The result of all these efforts was the\textsuperscript{arousal} and advent of people related with scientific activity, people observing the universe,

\textsuperscript{9} Karandikar M.A. “Islam In India’s Transition to Modernity” (New Delhi : Orient Longman’s : 1968) P-63
\textsuperscript{10} Ibid
people investigating and enquiring natural phenomenon. So we have a large number of scientist, thinkers, philosophers, astronomers, physicians, Mathematicians, Geographers, Voyagers, historians, arising and standing out on the basis of their merit and serving the society. It is a long list but the researcher has designed to make a brief mention of some of them reaching to a number of hundred only.

But before this, a mention of George Sarton will be useful who has done a monumental work by authoring a history of Science.

"George Sarton, in his book, "History of Science", has designed chapters according to the most preminent scientist of the age. From the eight century (A.D.) to the eleventh, we find a total of seven Muslim scientists, after reach period of fifty years farming the chapter like 'Al – Khwarizmi’s period’, ‘Al-bairunis period’, etc. George Sarton has entitle about one thousand scientists and gave details about their contribution".12

The free state policy was also responsible for the development of science in Islamic age. Islamic civilization prospered under a state which procured every protection and freedom to it. This policy consist of enrichment of Arabic, a series of translation from Greek and other languages, establishing libraries and erecting observatories, providing patronage to scientific and technological research and organizing and administering state industries and projects.13

The productive result of this state policy for science culminated in the mushrooming of academies, observatories, schools and libraries. An academy of the same type was the famous "Baitul – Hikmah", founded in 833 A.D. in Baghdad.14 This academy acquired a lot of books translated into Arabic in the domain of science philosophy, astronomy, medicine etc.

13 Ibid P-17.
The services of Abbassides shall always be appreciated because of this academy which they had established for writings and translations. Lot of books from Rome were imported. Famous historian, Ibn Nadeem relates.\(^\text{15}\)

"One night, the Caliph Mamun, saw Aristotle in dream, urging him to get his work translated. Mamun, immediately forwarded a royal letter to the emperor of Rome to transport the books, existing there in. Early the emperor refused to do so but later on agreed upon it. A lot of books were obtained and got translated into Arabic opening the doors of Greek intellect for Arabic wisdom. This academy was a live example of forebearance and fraternity comprising of scientists, translators, calligraphers and binders. Among the members, Banu –Musa brothers were Muslims, Hunain bin Ishaq was a Christian, and saabith bin Qurrrah was a Sabi(Gnostic). There were two observatories affiliated to it, one in Baghdad and the other in Damascus."\(^\text{16}\)

There was a huge library, established earlier in Baghdad under the name "Khazanatul–Hikmah", where books were also rendered.\(^\text{17}\) There used to be Halls in Royal palaces where debates and assemblies of learned people were held. Even the grammarians, traditionalists, Jurisprudents, logicians, physicians, astronomers and mathematicians used to conduct their meets in such halls, "Baitul – hikmah" was under the control of a renowned scholar who used to invite entire scholars in the seminars, regularly. Lectures were delivered on various topics of scientific interest and entry was free to one and all.\(^\text{18}\) The participants were granted the facility of reading and writing, pen and ink freely.

concerning "Baitul – Hikmah", it is related about Al-Khwarizmi that he prepared and forwarded a deeply thought over and
laboriously prepared thesis to this academy, in order to acquire its membership, which was dually accorded to him. It is the same procedure, adopted by universities even today to confer upon the doctoral degrees.\textsuperscript{19}

Regarding this air of knowledge and wisdom, the famous scholar Abul Hasan Ali Nadvi preludes,

"Due to the attitude of righteousness, truth and romance of knowledge and because of the emphasis of the Quran and the tradition of the Prophet, the Muslims developed in them an inspiration of studying the self and the universe which invited them to take a perusal of the events and incidents scattered all over the earth. This created an age of learning and research in the people. The Muslims of the medieval period looked critically upon the existing stock of knowledge and arts. They formulated new principles and theories and conducted practical activity and research instead of entering into the abstract business of philosophical and theoretical discussions.\textsuperscript{20}

Now, the researcher presents a compact profile of some hundred scientists and scholars who made valuable contributions in so many fields. A chronological order is tried upon for a limited study.

\textsuperscript{19} Ibrahim A. Nadvi “Musalman science dan aur Unki Khidmat” (Delhi : Maktaba Al – Hasnat : 1985) P-37
\textsuperscript{20} Ibid P-9
1. Khalid ibn Yazid

Khalid ibn Yazid was one of the earliest scientists of Islam. He has the distinction of being the first chemist of Islam. Khalid was born in 653 A.D. He died in 704 A.D. Khalid was a poet, astrologer and chemist. He wrote a large number of poems on chemistry which are preserved by historians in their books. Khalid was attracted to chemistry in order to convert base metals into gold. Though he did not succeed in producing gold, he produced more valuable things in the form of scientific experiments and books. Some of his books on chemistry are: Kitab al-sahifa aikabir (Great book of the scroll); Kitab al-sahifa al-saghir (Small book of scroll); Kitab al-wasiya (Book of testament), al-Sirr al-badi.\textsuperscript{21}

He had affection for astronomy and prepared a globe also.\textsuperscript{22}

2. Jabir ibn Hayyan

Jabir ibn Hayyan was the founder of modern chemistry. The probable date of his birth is 721 AD. He died around 815 AD. The massive literary output that bears his name amounts to 3,000 articles and books though not all were written by him. The main subject of his writings is chemistry. He also wrote on logic, philosophy, linguistics, metaphysics, cosmology, astrology, theology, medicine, agriculture, physics, technology and occult sciences. The origin of several ideas and objects are credited to him: discovery of aqua-regia mixture of nitric and hydrochloric acids capable of separating silver from gold - discovery of nitric acid, mineral acids, sulphuric acid, preparation of aluminium chloride, white lead, oxidation increases the weight of the metal. He believed in the possibility of the artificial production of natural objects including a mini-man.\textsuperscript{23}

\textsuperscript{21} Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-37.
\textsuperscript{22} Ibrahim Ammadi Nadvi “Musalman science dan aur Unki Khidmat” (Delhi : Maktaba Al – Hasnat : 1985) P-17
\textsuperscript{23} Abdur Rehman Sharif Op-cit
The origin of various chemical processes is credited to him such as sublimation, crystallization, filtration, oxidation and distillation, apparatus. He prepared mineral acids such as nitric acid.\textsuperscript{24}

In his books, he has mentioned methods of separation of lead, Arsenic & Antimony from their sulphicles, in detail.\textsuperscript{25}

His contribution of fundamental importance to chemistry includes perfection of scientific techniques such as crystalization, distillation, calcinations, submilation and evaporation and development of several instruments for the same.

Perhaps Jabir's major practical achievement was the discovery of mineral and others acids, which he prepared for the first time in his alembic (Anbique). He also developed a number of applied chemical processes, thus becoming a pioneer in the field of applied science. His achievements in this field include preparation of various metals, developments of steel, dyeing of cloth and tanning of leather, varnishing of water-proof cloth, use of manganese dioxide in glass making prevention of rusting, lettering in gold, identification of paints, greases, etc.

Based on their properties, he has described three distinct types of substances. He thus paved the way for such later classification as metals, non-metals and volatile substances.\textsuperscript{26}

3. Ishaq al-Mawsili

Ishaq al-Mawsili was one of the greatest musicians of his time who also made his mark as a musicologist. He was born in Ray in Iran in 767 A.D. and died in 850 A.D. at the age of eighty-five lunar years.

As a musical theorist, one of his major achievements was the systematization of Arabian music.

\textsuperscript{24} Ibrahim Ammadi Nadvi “Musalman science dan aur Unki Khidmat” (Delhi : Maktaba Al – Hasnat : 1985) Pp -23-24

\textsuperscript{25} Hameed Askari, “Namwar Muslim Science dan”, Lahore : Majlis Taraqui Adab : 1996, P-100

\textsuperscript{26} www.ummah.net
He was the first musician to use the falsetto, an unnaturally high male voice; was the originator of the earliest theory of melodic modes. He was a vocalist and an accomplished instrumentalist who could play perfectly even a lute thrown into disaccordance.

Ishaq al-Mawsjli wrote forty books, about half of them on music, musicians and songs such as Kitab al-aghani al-kabir and Kitab al-naghm wal-lqa.27

4. Al-Tabari

Ali Tabari was the author of Firdaus al-hikma, Abul Hasan Ali ibn Sahl Rabban al-Tabari was born at Marw, near Tehran in Iran, in a prominent Christian or Jewish family. It is believed that he was born in 775 A.D. Titles of fourteen of his books have come down to us, only half of which are available, such as Firdausal-hikma, al-Din wal-dawla and Hifz al-sihha.

Some of the subjects covered in its seven parts are: general philosophical ideas, nature, metamorphosis, genesis, decay; embryology, functions and morphology of different organs, emotions, hygiene; nutrition and dietetics; pathology from the head to the feet; taste, scents and colours; materia medica and toxicology; and climate in relation to health.28

He was the inventor of medicinal encyclopedia.29

He was the first to regard tuberculosis as an infiltration and stated that it affects not only lungs but also other organs.30

He wrote on Elucidation of the organs of the human body. Rules for keeping good health and comprehensive account of

27 Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-60
28 Ibid P-26
29 Ibrahim Amjadi Nadvi “Musalman science dan our Unki Khidmat” (Delhi : Maktaba Al-Hasnat : 1985) Pp -23-24
certain muscular diseases. Description of diet to be taken in conditions of health and disease.

All diseases right from head to toe, Description of flavour, taste, and colour. Drugs and poison.\textsuperscript{31}

5. Al-Jahiz

Though al-Jahiz is remembered principally as a great prose writer of Arabic, the fact is he was a great zoologist as well.

Abu Uthman Amr bin Bahr bin Mahboob al-Jahiz was born in Basrah, Iraq, in 776 A.D. and died in 869 A.D. at the age of ninety-six lunar years.

He has written a book Kitab al-hayawan is a book in seven volumes which deals with 350 animals, including large animals, birds, fish, reptiles and insects.

Al-Jahiz studied the evolution of species, influence of environment and climate on animals, migration, animal psychology language of animals and classification.

Al-Jahiz was also a political thinker, sociologist, anthropologist and literature. He wrote more than 200 books of which 80 have survived. Some of his famous books are: Kitab al-hayawan, kitab al-bayan wal tabyin and Risala finabyil tasbih.\textsuperscript{32}

6. Ziryab

Ziryab was a great musician and innovator who introduced Several new ideas in the field of music. Abul Hasan Ali ibn Nafi Ziryab spent his early life in Baghdad.

Ziryab was a musical innovator, hypnotic singer and accomplished instrument player. Ziryab was a colourful and multi-faceted person. He was also a poet, fashion designer, beautician

\textsuperscript{31} www.ummah.net
\textsuperscript{32} Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-60
and cultural innovator who greatly influenced the Spanish lifestyle. He established a beauty institute at Cordova where the art of good grooming was taught, application of cosmetics, body cleaning, removing superfluous hair, dress sense, hair dressing etc. He designed new clothes based on different fabrics, colour and styles for various seasons.\textsuperscript{33}

\textbf{7. Abu Mashar}

Abu Mashar was the most famous astrologer of Islam. Jabir ibn Muhammad ibn Umar al-Balkhi Abu Mashar was born in Baikh in North Afghanistan in 791 A.D., but spent most of his life in Baghdad.

Abu Mashar wrote about fifty books mainly on astronomy and astrology, a large number of which are still available. He was a great astrologer. Some of his important books are: al-Madkhal al-kabir, Zij al-hazarat, Kitab al-qiranat, Tahawil sini al-mawalid, al-Nukbat, Kitab al uluf etc.

He studied astrology beyond forecasts. He attempted an astrological interpretation of history which recognized various period under the influence of planets and their motions. He studied astrology of prices, and meteorological astrology. He also wrote on various other scientific subjects, like the rains, winds, weather and tides.

Abu Mashar had a great influence on European intellectual life.\textsuperscript{34}

\textbf{8. Siboway}

Abu Bashir Umro ibn Uthman Siboway was of Iranian origin. He died at the young age of less, than forty around 793 A.D. at Baida.

\textsuperscript{33} Abdur Rehman Sharif "100 Muslim Scientists". Mumbai, Arsh Publications, 2000 P-84
\textsuperscript{34} Abdur Rehman Sharif Ibid P-39
Siboway's Kitab al-nahw is a major contribution to Arabic grammar.

Siboway was called a grammarian, while his contemporary al-Khalil was considered a lexicographer. Kitab al-Nahw is a compendium of the rules of Arabic grammar.

Kitab al-nahw was very popular grammar of all times.35

9. Al-Khwarizmi (Mathematician)

The name of Al-Khwarizmi has become immortal in the words algebra and algorithm.

Abu Jafar Muhammad ibn Musa al-Khwarizmi was born in 795 A.D. in Khwarizmi, which is now known as Khiva.

Al-Khwarizmi wrote on all branches of mathematics – arithmetic, algebra, geometry and trigonometry. He also wrote astronomy, geography, history, music and astronomical instruments. His book Surat al-aridh is devoted to geography, Kitab al-zij to astronomy, and Kitab al-tarikh to history.

His favorite topics were the basics of algebra, six standard forms of algebraic problems, formulae for their solutions; the four arithmetic operations addition, subtraction multiplication, division, area of triangle, circle, square of cones, pyramids cubes etc.

Al-Khwarizmi influenced the development of mathematics more than any other mathematician in history.36

He was very much interested to become the member of science Academy. He introduced himself by submitting a thesis of his work on Mathematics. This method is adopted by universities of modern times to award Ph.D. degree.37

35 Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-69
36 Abdur Rehman Sharif Ibid P-3
37 Ibrahim Ammadi Nadvi “Musalmans scientific our Uniki Khidmat” (Delhi : Maktaba Al-Hasnat : 1985) P-37
After explaining the equation, he classified those equations, which include first and second degree equations, into six standard forms.

1) Square equal to roots \( ax^2 = bx \)
2) Square equals to a number : \( ax^2 = c \)
3) roots equal to a number \( ax = c \)
4) Square and root equal to a number \( ax^2 + bx = c \)
5) Square and number equal to a root \( ax^2 + c = bx \) and
6) Square equals to roots and numbers : \( ax^2 = bx + c \) ③⑧

10. Al - Kindi

Al-Kindi made important contributions to the development of philosophy and science.

Abu Yusuf Yaqub ibn Ishaq al-Kindi was born in 801 AD in Kufa in Iraq. He died in Baghdad in 866 AD. Al-Kindi studied almost all branches of learning available in his time. He wrote 350 books. Al-Kindi was an experimental scientist. He dealt with various scientific problems such as fundamentals of physics, matter, space, form, motion and time; causes of scarcity of rainfall, cause of clouds snow, lightning and thunder; cause of coolness of upper layers of the atmosphere; colour of the sky, cause of tides, etc. He was one of the early musicologists. Some of his books are : Rasail al-Kindi (philosophy); Aqrabadin (medecine) and Kitab al kimiya al itr. ③⑨

He wrote four books on the use of Hindi numerals and their properties. The writing of al-khwarizmi and al-Kindi were the main channels through which the numeral system become known to the west. ④①

③⑨ Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-69
He fixed the dosage of all medicines used at that time and also wrote a book on the same topic to solve the problems of pharmacology.\textsuperscript{41}

He performed valuable research on the Geometrical optics (a branch of Physics)\textsuperscript{42}

\textbf{11. Ibn Khurradadbih}

Ibn Khurradadbih was a pioneer of economic geography who devoted a major part of his book to economic and commercial aspects of geography.

Abul Qasim Ubaid Allah ibn Abd Allah Ibn Khurradadbih was born in 820 AD in Khurasan in present day Iran. He enjoyed a long life of about ninety years and died in 911AD.

Ibn Khurradadbih wrote about nine books on history, geography music and food. However, his most famous book is on geography - Kitab al masalik wal-mamalik. The book deals with descriptive, economic and political geography of not only the Islamic world but also the non-Islamic world of Europe, India, China, Japan, etc. A major part of the book is devoted to the description of the road systems of the world. He gives information about transportation, land and sea routes, ports, cities, posts and relays, stages of journeys, distances, commodities and taxation in Asia, Africa and Europe.\textsuperscript{43}

The book which is main work of Ibn Khurdadbih also contains brief narration of journeys of distant lands. It is an important source for the study of topography of the Muslim empire.\textsuperscript{44}

\textsuperscript{41} Hameed Askari, “Namwar Muslim Sciencedan”, Lahore: Majlis Taraqui Adab : 1996, P-195
\textsuperscript{42} Ibrahim Ammadi Nadvi “Musalman sciencedan our Unki Khidmat” (Delhi : Maktaba Al-Hasnat : 1985) P-37
\textsuperscript{43} Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-65
\textsuperscript{44} Muhammad Saud “Islam and Evolution of science”, (Islamabad : Islamic Research Institute : 1986) P-130
12. Thabit ibn Qurra

Thabit ibn Qurra was one of the great scientist of Islamic age. Thabit ibn Qurra al – Sabi al-Harrani was born in Harran, now in Turkey 826 AD during the reign of al Mamun.

Thabit died in Baghdad in 901 AD.

He wrote about 150 books on a wide-ranging subjects, such as astronomy, arithmetic, number theory, geometry, trigonometry, medicine, psychology, philosophy, logic,, ethics, physics, anatomy, music, etc. Some of his exceptional books are : Kitab mafrudat, Kitab fi talif al-nisab, Risala fi shakl al qita (on mathematics), Kitab fi sanat al-shams, Fi hisab ruyat al-ahilla (astronomy), Kitab fil qarastun, Kitab fi sifat al-awzan (mechanics / physics), al-Dhakhira fi ilm al-tib (medicine), masail suila anha... (philosophy)

In his mathematical works, he presented several original ideas which are considered very important in the history of mathematics.

Thabit paved the way for a number of important mathematical discoveries, such as the extension of the concept of numbers to real numbers, integral calculus, analytic geometry, etc. He was a founder of statics.\(^{45}\)

He proposed various ideas in mathematics such as principal for construction of amicable number, a geometric problem equivalent to the solution of quadratic equation.\(^{46}\)

He particularly determined the altitude of the sun and the length of the solar year.\(^{47}\)

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\(^{45}\) Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-43

\(^{46}\) Ibrahim Amjadi Nadvi “Musalman science dan aur Unki Khidmat” (Delhi : Maktaba Al – Hasnat : 1985) P-54

\(^{47}\) Muhammad Saud “Islam and Evolution of science”, (Islamabad : Islamic Research Institute : 1986) P-130
13. Al-Tabari (Historian)

Al-Tabari was one of the great historians of the world. Abu Jafar Muhammad Jarir al-Tabari was born in 839 AD at Amul in the region of Tabaristan in Iran. He died in 923 AD.

Tabari wrote on Quran, law Hadith and history. His commentary on the Quran, Jami al bayan fi tafsir al Quran has been highly admired for its collection of historical material relating to commentaries on Quran.

Tarih al-rusul ... begins with the creation of the world, history of the prophets and rulers of ancient times, stories about Biblical and Quranic peoples, History of Iran, Prophet Muhammad and the first four Caliphs. He recorded the facts as he received them without attempting to, give any interpretations of his own.\(^{48}\)

14. Al - Isfahani

Abul Faraj al-Isfahani is renowned for his monumental encyclopaedia on music and musicians, songs and singers, dance and dancers.

Ali ibn al-Husain ibn Muhammad ibn Ahmad al-Qurashi Abul Faraj al-Isfahani, or Isbahani, was born in Isfahan in Iran in 897 AD. He died in Baghdad in 967 AD.

Kitab al-aghani is a unique history of the social life of Arabs with accent on entertainment, from before Islam down to the author’s time. He writes about a large number of musical, instruments and covers both ancient and modern Arabian music. He wrote about the lives of the persons connected with the song. Kitab al-aghani is a stupendous work in twenty volumes containing over 6000 pages which took 50 years to complete. He also wrote a book on history : Maqatil al-Talibiyyin.\(^{49}\)

\(^{48}\) Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-44

\(^{49}\) Abdur Rehman Sharif Ibid P-86
15. Al-Dinawari

Abu Hanifa Ahmad ibn Dawud al-Dinawari was of Iranian origin. He died at Dinawar probably in 895 AD. Al-Dinawari wrote books on arithmetic, algebra, astronomy, botany, history philology, nature and the Quran.\textsuperscript{50}

Kitab al-nabat written in six volumes is devoted to botany and philology. It includes all the literary and political references traditions and stories then available in Arabic literature on plants. It gives a detailed description of plants. It classifies plants into three: classes Plants cultivated for food, fruit trees and wild plants. It also groups them as big and small trees, herbs, shrubs, creepers, etc. The book also mentions poisonous plants animal food meadows and foreign plants grown in the Islamic world.\textsuperscript{51}

His book was considered to be standard work on herbalism, medicine and lexicography, at a time when no one could become a physician or herbalist unless he had thoroughly studied this book.\textsuperscript{52}

16. Abu Kamil Shuja

Abu Kamil Shuja was one of the earliest mathematicians of Islam who made important contributions to the development of algebra.

Abu Kamil Shuja ibn Aslam ibn Muhammad ibn shuja Hasib al Misri lived during the third century 930 AD. His important books are: Kitab fil jama wal tafriq. (on algebra); Kitab al khataayn (on errors); al- Taraif fil hisab; Kitab al-wasaya bil judhur; Kitab al-mukhammas wal muashshar.

He presented a highly advanced study of indeterminate equations where the solutions were not restricted to integers, but were mostly rational forms.

\textsuperscript{50} Ibid
\textsuperscript{51} Abdur Rehman Sharif "100 Muslim Scientists". Mumbai, Arsh Publications, 2000 P-46
\textsuperscript{52} Muhammad Saud "Islam and Evolution of science", (Islamabad : Islamic Research Institute : 1986) P-120
Abu Kamil Shuja make a clear distinction between determined problems and indeterminate problems of algebra. Abu Kamil Shuja made a noticeable impact on a number of medieval European mathematicians.\(^5\)

He determined and constructed both roots of quadratic equations. He made special study of pentagon and decagon with algebraic treatment and of the addition and subtraction of radicals, corresponding to a particular formula.

He resolved system of equations up to five unknowns.\(^4\)

### 17. Ibn Wahshiya

Abu Bakr Ahmad ibn Ali ibn Mukhtar Ibn Wahshiya was born at al-Qussim, near Janbala in Iraq, in 860 AD

Ibn Wahshiya wrote on a large number of subjects such as astronomy, astrology, mysticism, numerology, medicine toxicology, natural history, alchemy, theology sorcery and idol worship.

Some of his other books are: Kitab al-sumum wal tiryaqat, Kitab al usul al kabir; Kitab al-shauq al-mustaham fi marifat rumuz al-aqlam kanz al-hikma and Tankalusha al-babili al-quqani fi suwar daraj al-falak wa mayadillu alaihi nim ahwal al-mauludin, Kitab al-sumum deals with the subject of poisons and their antidotes.

All later Islamic authors on agriculture toxicology were influenced by Ibn Wahshiya's writings.\(^5\)

In the tenth century he wrote on chemistry. His work may be helpful to understand chemical symbolism.\(^6\)

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\(^{53}\) Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-42

\(^{54}\) Muhammad Saud “Islam and Evolution of science”, (Islamabad : Islamic Research Institute : 1986) P-30

\(^{55}\) Abdur Rehman Sharif Op-citP-47

\(^{56}\) Muhammad Saud “Islam and Evolution of science”, (Islamabad : Islamic Research Institute : 1986) P-78
18. Al-Battani

Al-Battani was one of the great astronomers of the world who made great contributions to the development of astronomy.

Abu Abd Allah Muhammad ibn Jabiral Battani, was born in 858 AD in Harran, in the south of modern Turkey. He conducted, astronomical observations for over 40 years and wrote books on astronomy. His most famous book is Kitab al-zij, or simply the Zij. He laid emphasis on practical astronomy. The book contains 57, chapters in which he discussed various aspects of astronomy, and presented his views. It covers definitions, his own observations, planetary motions, length of seasons, sun's apogee, eras, astronomical tables, lunar parallax, distances of planets from the earth, astrology, astronomical, instruments, etc.

Al-Battani's detailed study of the motions of the sun and moon proved that the apparent sizes of the sun and moon are not fixed, but that they change from time to time. He found more accurate values for the length of the year, the seasons and the inclination of the ecliptic.

The modern world has paid its tribute to the great genius of Islam by naming a region of the moon after him as Albategnius.57

He proved that the concept of Trepidation of equinoxes is wrong. He put forward his theory that the orbit of the earth around the sun is not circulated but elliptical. His work includes trigonometry and sines of angle. He demolished the idea that the obliquity of the ecliptic is fixed as stated by Greek astronomer Ptolemy.58

Before him the Inclination of Ecliptic was considered to be 32 degree, 30 min. But he proved that it is 23 degree, 35 min.59

His well known discovery is the remarkably accurate determination of the solar year as being 365 days, 5 hours, 46

57 Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-9
minutes and 24 seconds, which is very close to the latest estimates. He found that the longitude of the sun’s apogee had increased by 16 degree, 47 min. since Ptolemy. This implied the important discovery of the motion of the solar apsides and of a slow variation in the equation of time. In mathematics, he was the first to replace the use of Greek chords by sines.60

19. Al-Razi

One of the topmost scientists of the world and undoubtedly among the top ten of Islam, al - Razi was a leading authority on medicine for several centuries, both in the East and the West.

Abu Bakr Muhammad ibn Zakariya al-Razi was born in Ray in Iran in 865 AD.

Al-Razi was the greatest clinical physician of Islam, a master of psychosomatic medicine and psychology, and an expert in chemistry. He made numerous original contributions to science. He was first to distinguish scientifically between small pox and measles first to identify several other important diseases and treat them successfully.

In his Kitab al-asrar he gave an account of about forty, chemical equipments and various chemical processes. He knew how to prepare caustic soda, sodium hydroxide and a process for producing glycerine from olive oil. He classified matter into minerals, plants and animals and ascertained the chemical properties of elements and their power to cure diseases. Along with Ibn Sina he was the most influential Islamic medical scientist in Europe where he was known as Rhazes.61

He, for the first time, introduced the ‘First Aid’, system. He had classified the matter into substances, plants and animals and also organic and inorganic substances. For accurate weighing of

60 www.ummah.net
61 Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-8
minute substances, he discovered 'Hydrostatic balance'. He prepared Alcohol and seton (a well known surgical instrument). 62

He found specific gravity of many things; for this he used a particular balance which he named as Mizan-e-Tabai i.e. Hydrostatic balance. 63

20. Al-Farabi

Al-Farabi was one of the most outstanding philosophers who had a profound influence on the course of Islamic philosophy. Abu Muhammad ibn Muhammad ibn Turkhan ibn Uzlagh al-Farabi was born in the village of Wasij, in the district of Farab in Central Asia, in 872 AD. He was of Turkish origin. Al-Farabi died in 950AD at the age of eighty years. 64

Al-Farabi wrote more than 100 books on various subjects, like philosophy, logic, ethics, physics, music, mathematics, metaphysics, political philosophy and sociology. Some of his important books are: Siyasa al-madaniya, Ara ahal al-madina al-fadila; Kitab al-musiqi al-Kabir; Ihsa al-ulum Tahsil al-saada; al-tawtiya; fil mantiq and Uyun al-masail.

One of his major philosophical achievements was harmonisation of philosophy and religion. For this, he explained rationally all that is believed to be beyond reason - God, creation, prophethood, revelation - and rationally established the essentiality of religion. 65

Al-Farabi's ideal state not only takes care of the well-being of its citizens in this world, but also in the next.

He had mastery over psychology, sociology politics and philosophy. He discussed the concept of education, prayer and its

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62 Ibrahim Ammadi Nadvi "Musalmam scientedan aur Unki Khidmat" (Delhi : Maktaba Al - Hasnat : 1985) Pp-60-61
63 Hameed Askari, "Namwar Muslim Scientadan", Lahore: Majlis Taraqi Adab : 1996, P-227
64 Abdur Rehman Sharif "100 Muslim Scientists". Mumbai, Arsh Publications, 2000 P-11
65 Ibid
impact on individual and society, impact of environment on mode of life of a nation, man and cultural values and good citizens and their merits etc. He worked on the Mental and social evolution of man. To the social evolution he divided into three units family, tribe & nation which constitute village, city and country.\textsuperscript{66}

In his book Al-Musiqui, he has written many secretes of music and he has also invented a new musical instrument to which he named as Qanun.\textsuperscript{67}

Farabi contributed considerably to science, philosophy, logic, sociology, medicine, mathematics and music. His major contributions seem to be in philosophy, logic and sociology and, of course, stands out as an Encyclopedist. First, one of the important contributions of Farabi was to make the study of logic more easy by dividing it into two categories viz, Takhayyul (idea) and Thubut (proof). In physics, in demonstrated existence of void. The book Kitab al-Ilsa al Ulum discusses classification and fundamental principles of science in a unique and useful manner. He was regarded the second teacher in philosophy for centuries and his work, aimed at synthesis of philosophy and sufism, paved the way for Ibn Sina’s work.\textsuperscript{68}

21. Ibn Muqla

Ibn Muqla was a great calligrapher of Islam. Abu Ali Muhammad ibn Ali Ibn Muqla was born in Baghdad in 886 AD. Ibn Muqla died in prison in 940AD. He made the most important contribution to the development of Islamic calligraphy. He studied the earlier styles of Arabic writing and invented a new and elegant style. It was called khat al-mansub, or the "proportioned script'.

\textsuperscript{66} Ibrahim Ammadi Nadvi “Musalian scientedan our Uniki Khidmat” (Delhi : Maktaba Al – Hasnat : 1985) Pp-70-75
\textsuperscript{67} Hameed Askari, “Namwar Muslim Scientedan”, Lahore: Majlis Taraqui Adab : 1996, P-253
\textsuperscript{68} www.ummah.net
Ibn Muqla set the principles of the art of calligraphy and gave a scientific base. His knowledge of geometry helped him in this matter with a sense of space, measurement and proportion. He framed three basic rules: a dot as a unit of measurement, a standard circle and a standard Alif.⁶⁹

22. Al-Farghani

Abul Abbas Ahmad ibn Muhammad ibn Kathir al-Farghani was a native of Farghana in Central Asia. He lived during the reigns of Caliphs al-Mamun and al-Mutawakkil. Al-Farghani wrote books on astrolabe (ustarlab), sundials (rukhmat) and astronomical Tables, in addition to the Jawami which is his most important book.

Al-Farghani made a comprehensive study of astronomy based on Ptolemy's Almagest, improved, upon Ptolemaic astronomy presented a few of his own ideas and employed an easy and organised pattern to present the complex subject of astronomy.

Some of the ideas presented by al-Farghani are inclination of the ecliptic - 23°33' for 829 AD at Baghdad against Ptolemy's 23° circumference of the earth 20,400 miles and diameter of the earth - approximately 6,500 miles; the slow eastward motion of the sphere of the fixed stars about the poles of the ecliptic through one degree every 100 years is common to spheres of the sun, moon and the five planets.⁷⁰

He determined the diameter of the earth to be 6500 miles, and found the greatest distance and also the diameter of the planets.⁷¹

He invented sundial and Nilometer which was used to measure the flow of water in the Nile and therefore to ascertainment the extent of flooding and storms.⁷²

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⁶⁹ Abdur Rehman Sharif "100 Muslim Scientists". Mumbai, Arsh Publications, 2000 P-50
⁷⁰ Abdur Rehman Sharif Ibid - P-23
⁷¹ www.ummah.net
⁷² Ibrahim A. Nadvi "Musalman sciencedan our Unki Khidmat" (Delhi : Maktaba Al-Hasnat : 1985) P-42
23. Al-Majusi

One of the great medical scientists of Islam. Majusi was the author of Kamil al-sinaa al-tibbiya.

He was born between 900-925 AD at Ahvaz, in the southwest of present day Iran. He died in 994 AD.

Al-Majusi gave an accurate and almost modern description of pleurisy (a disease of lungs).\(^7^3\)

He presented the proof of the motion of womb during parturition. He made significant observation that during child-birth the child does not come out by itself, but it is pushed out by muscular contraction of uterus.\(^7^4\)

24. Al-Suli

Al-Suli was the first person to study the game of chess on a scientific basis and to evolve a set of principles. Abu Bakr Muhammad ibn yahya al-Suli was born sometime during the last quarter of the ninth century AD. He died in poor conditions in 946AD.

Al-Suli was a poet, historian and author. His books included a history of the Abbasids, a history of the viziers and a collection of poems written by the descendants of the fourth Caliph Ali ibn Abi Talib But his fame rests on his mastery in chess and his book Kitab al-Shatranj. He has outlined a brief history of the game, discussed chess problems (mansubat) and mentioned the first class players of earlier times, such as al-Adli.

He divided the game into the same three stages into which the modern world has divided it Opening, Mid game and end game. He has given a number of his favourite Openings founded on definite principles, and End-games which he analysed and discussed in detail.\(^7^5\)

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\(^7^3\) Abdur Rehman Sharif "100 Muslim Scientists". Mumbai, Arsh Publications, 2000 P-45
\(^7^4\) Muhammad Saud."Islam and Evolution of science", (Islamabad : Islamic Research Institute : 1986) P-102
\(^7^5\) Abdur Rehman Sharif, Op-cit P-8
25. Al-Sufi

Abul Husain Abdal-Rahman ibn Umar al-Razial-Sufi was Persian by origin. He was born in Ray in 903 AD. He died in 986 AD. Al sufi is one of the most widely studied astronomers of Islam who made extensive observations of the stellar world. He recorded his findings in his famous book Kifab al-siwar al-kawakib al-thabita. The book deals with forty eight constellations in a detailed manner with a general description of all the stars in each of the constellations; their position, magnitudé and colour; identification of star table with longitude, latitude and magnitude; and drawings of the constellations. The book is marked by three factors : extensive personal observations, identification of several hundred stars, and maps. He also wrote books on the astrolabe, celestial globe and astrology. He was also an instrument maker. He constructed a silver celestial globe which was exhibited in the library of the Fatimid palace in Cairo.\textsuperscript{76}

His knowledge of both the Islamic and Greek astronomy, particularly uranometry was comprehensive. He was the first to observe the change of colour of stars, the change in magnitude of stars, the proper motion of star., the long period variable stars and the southern constellations which have been wrongly described by modern astronomers to later ones.\textsuperscript{77}

26. Ibn Nadim

Abul Faraj Muhammad ibn Abu Yaqub Ishaq al-Warraq al-Baghdadi was popularly known as Ibn Nadim. He was born between 930-35 AD in Baghdad. He died in 990AD.

Kitab al fihsrist. Ibn Nadim called his book a catalogue of books of all peoples Arab and foreign, existing in the language of the Arabs, as well as an account of scripts, sciences, authors, cities, etc.

\textsuperscript{76} Abdur Rehman Sharif "100 Muslim Scientists". Mumbai, Arsh Publications, 2000 P-70
\textsuperscript{77} Muhammad Saud "Islam and Evolution of science", (Islamabad : Islamic Research Institute : 1986) Pp-63-64
Kitab al-fihrist enjoys a high reputation as a thousand year old historical document containing thousands of titles of books, biographies of authors and essays on various subjects.

Ibn Nadim may be considered the inventor of scientific bibliography.\textsuperscript{78}

27. Al-Zahrawi

Al-Zahrawi was the greatest surgeon of Islam and one of the great medical scientists of the world. Abul Qasim Khalaf ibn Abbas al-Zahrawi was born in 936 AD at al-Zahra, near Qurtuba (Cordova).

Al-Zahrawi has been greatly admired for the surgical section of his book al-Tafsir liman ajiz an ql-taliif. A large number of inventions and innovations are attributed to him. The book is a medical encyclopaedia which discusses various aspects of medical science, such as materia medica, pharmaceuticals, dietics, medical chemistry, therapeutics, psychotherapy, mid-wifery, diseases, surgical operations, surgical instruments, etc.

Al-Zahrawi performed various types of operations, including, eye operations. He was first to recommend surgical removal of a broken patella (knee-cap), first to perform lithotomy on women, first to describe haemophilia, and first to describe tracheotomy. He described the removal of the dead foetus from the womb. He mentioned catheters, knives, scissors, probes, saws, needles, syringes, forceps, scalpels, hooks, lancets, etc.\textsuperscript{79}

He introduced the "Walcher position" for women in child birth. He gave method for crushing and removing the stone from the urinary bladder, the operation of eye and teeth, and cutting the organs of the body. He also discussed bandages and the treatment of the ulcer and wounds. He also gave an account of the paralysis

\textsuperscript{78} Abdur Rehman Sharif "100 Muslim Scientists". Mumbai, Arsh Publications, 2000 P-63
\textsuperscript{79} Abdur Rehman Sharif Ibid P-81
caused by some defect in spiral chord. He gave a description of various stages of embryo in the womb of mother.\textsuperscript{80}

The more important part of this series comprises three books on surgery, which describe in detail various aspects of surgical treatment as based on the operations performed by him, including cauterization, removal of stone from the bladder, dissection of animals, midwifery, stypics, and surgery of eye, ear and throat. He perfected several delicate operations, including removal of the dead foetus and amputation.

Al-Zahrawi was the inventor of several surgical instruments of which are notable: (i) an instrument for internal examination of the ear, (ii) an instrument for internal inspection of the urethra, (iii) and instrument for applying or removing foreign bodies from the throat. He specialised in curing disease by cauterization and applied the technique to as many as 50 different operations. He has also described in detail the application of such techniques as sublimation and decantation. He discussed the problem of non-aligned or deformed teeth and how to rectify these defects. He developed the technique of preparing artificial teeth and of replacement defective teeth by these. In medicine, he was the first to describe in detail the unusual disease, haemophilia.

The principles laid down by him were recognised as authentic in medical science, especially surgery and these continued to influence the medical world for five centuries.\textsuperscript{81}

Al Zahrawi wrote a medical encyclopaedia spanning volumes which included sections on surgery, medicine, orthopaedics, ophthalmology, pharmacology, nutrition etc. In the section on pharmacology and therapeutics, he covers areas such as cardiac drugs, emetics, laxatives, cosmetology, dietetics, materia medica, weights and measures and drug substitution. He describes chemical

\textsuperscript{81} www.ummah.net
preparation of tablet making, filtering of extracts and related pharmaceutical techniques.82

28. Abul Wafa

Abul Wafa was one of the greatest mathematicians of the world. He was born in Buzjan, near Nishapur, in Iran in 940 AD. He died in Baghdad in 998 AD.

Abul Wafa wrote on arithmetic, geometry, trigonometry, astronomy and music. But his main achievement was in the field of trigonometry. In his arithmetical work Abul Wafa made an, admirable study of fractions involving multiplication and division. Abul Wafa's books on mathematics and astronomy are: Kitab fi ma yahtaj al-kuttab wal ummal min ilm al-hisab and kitab fi ma yahtaj al sani min al amal al-handasa, kitab al-kamil. His work enjoyed great popularity and were used by later mathematicians and astronomers.83

He was first to solve a large number of geometrical problems by the method of compass with a single opening; division of a figure into parts satisfying certain conditions; problems relating to transformation of squares and problem of describing a regular heptagon in circle. He gave the method to determine sine of angle from 1degree to 90 degree. He proved that the sun has attraction and the moon is moving and put forward the phenomenon of Eviction.84

He is said to be the discoverer of the variations, the third in equality of the moon, a discovery which was later ascribed to Tycho Brahe.85

In geometry his contribution comprises solution of geometrical problems with opening of the compass; construction of square

82 www.ummah.net
83 Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-22
85 Muhammad Saud “Islam and Evolution of science”, (Islamabad : Islamic Research Institute : 1986) P-63
equivalent to other squares; regular polyhedra, construction of regular heptagon taking for its side half the side of the equilateral triangle inscribed in the same circle. Constructions of parabola by points and geometrical solution of the equations:

\[ x^4 = a \text{ and } x^4 + ax^3 = b \]

He was the first to show the generality of the sine theorem relative to spherical triangles. He developed a new method constructing sine tables, the value of \( \sin 30' \) being correct to the eighth decimal place. He also developed relations for sine \((a+b)\) and the formula;

\[ 2 \sin^2 \left(\frac{a}{2}\right) = 1 - \cos a, \quad \text{and} \]
\[ \sin a = 2 \sin \left(\frac{a}{2}\right) \cos \left(\frac{a}{2}\right) \]

He introduced the secant and cosecant for the first time, knew the relations between the trigonometric lines. In astronomy, he discussed different movements of the moon, and discovered variation.\(^86\)

**29. Ibn Umail**

Ibn Umail was one of the notable scientist of Islam who made valuable contributions to the development of chemistry.

Ibn Umail wrote several books on chemistry. He also composed long poems, called qasida, on the subject. Some of his books and poems are: *Risala_al shams ilal hilal*; *Ma al-warraqi waa ardh al najmiya*; *al Sifr al-Kibir fi hall al ashkal al birbawiyah wal tasawir*; *al-Qasida al-nuniya*; *al-Durat al-naqiya and Khawas al-bar wal bahr*.\(^87\)

Ibn Umail’s books are important from various point of views. They contain names of a large number of chemical scientists from

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\(^86\) [www.ummah.net](http://www.ummah.net)

\(^87\) Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-74
earlier times and their quotations. He has named, Egyptian, Greek and Islamic scientists, such as Hermis, Markunus (Egyptian), Socrates, Plato (Greek,\textemdash).Khalid ibn Yazid, Jabir ibn Hayyan.\textsuperscript{88}

30. Ibn al-Haytham

Ibn al-Haytham was one of the greatest scientists of the world who made remarkable contributions to physics, mathematics and astronomy. Abu Ali al-Hasan Ibn al-Haytham was born in Basrah, Iraq, in about 965 AD and died in Cairo in 1039 AD.

Ibn al-Haytham may be rated among the ten greatest scientists of Islam. He wrote more than 100 books on theology, poetry, metaphysics, politics, ethics, logic, music, physics, optics, astronomy and mathematics. More than fifty of his books are extant, including Kilab al-manazir, Maqala fi al-alam and dhaw al-qamar.

He states that it is the light from the object which reaches the eye to create the image of the object in the eye. With reference to light, objects are self luminous, illuminated by light from other objects opaque, translucent or transparent. He established the rectilinear propagation of light and the laws of reflection and refraction. He stated that light takes time to travel. His name is commemorated in the 'Al-hazen Problem' in physics and 'Al-hazen Plain' on the moon.\textsuperscript{89}

For the first time, he proposed the idea of Aswan Dam which today has came into existence due to cooperation of many countries.\textsuperscript{90}

After performing experiments on light, he gave certain principles which are proved helpful in the invention of camera. He performed experiments on light using spherical mirrors.

\textsuperscript{88} Abdur Rehman Sharif "100 Muslim Scientists". Mumbai, Arsh Publications, 2000 P-74
\textsuperscript{89} Ibid P-2
\textsuperscript{90} Ibrahim A. Nadi "Musalan sciedan our Unki Khidmat" (Delhi : Maktaba Al-Hasnat : 1985) Pp-101, 104
He has very important contribution in the field of physics, in which he derived the law of inertia.\footnote{Hussein Nasr, “Islam main Science Our Tehzeeb (Karachi : Hamdard Foundation : 1998) P-136}

In his book, Kitab al-Manazir, one interesting chapter is on eye, in which he explained all parts of eye which are correct and complete even according to present investigations.\footnote{Hameed Askari, “Namwar Muslim Sciencedan”, Lahore: Majlis Taraqui Adab : 1996, P-307}

31. ABU RAIHAN AL-BIRUNI

Al Biruni was a versatile scholar and scientist who had equal facility in physics, metaphysics, mathematics, geography and history, He learnt Hindu philosophy, mathematics, geography and religion from the Pandits to whom he taught Greek and Arabic science and philosophy. He recorded observations of his travels through India in his well-known book Kittab al-Hind which gives a graphic account of the historical and social conditions of the sub-continent, At the end of this book he makes a mention of having translated two Sanskrit books into Arabic, one called Sakaya, which deals with the creation of things and their types, and the second, Patanjal dealing with what happens after the spirit leaves the body. He observed that the Indus valley must be considered as an ancient sea basin filled up with alluvials.

Al-Biruni wrote his famous book Qanun-I Masoodi. The book discuss several theories of astronomy, trigonometry, solar, lunar, and planetary motions and relative topics. His other scientific contributions include the accurate determination of the densities of 18 different stones. He developed a method for trisection of angle and other problems which cannot be solved with a ruler and a compass alone. Al-Biruni discussed, centuries before the rest of the world, the question whether the earth rotates around its axis or not.
He ascertained that as compared with the speed of sound the speed of light is immense. He explained the working of natural springs and artesian wells by the hydrostatic principle of communicating vessels. He observed that flowers have 3, 4, 5, 6, or 18 petals, but never 7 or 9. He has been considered as one of the very greatest scientists of Islam and all considered one of the greatest of all times. His critical spirit, love of truth, and scientific approach were combined with a sense of toleration. His enthusiasm for knowledge may be judged from his claim that the phrase Allah is Omniscient does not justify ignorance.\textsuperscript{93}

He gave a very clear account of Arabic numerals and method for the trisection of the angle. He solved many problems which can not be solved with ruler and compass alone.\textsuperscript{94}

32. Al-Mawardi

Al-Mawardi was one of the principal writers on political science and state administration,

Abul Hasan Ali ibn Muhammad ibn Habib al-Mawardi was born in Basrah, Iraq, in 975 AD. He died in 1058 AD at the age of eighty-six years at Baghdad.

Some of his important books on political science and state administration are al-Ahkam al-sultaniya; Addb al-vazir; Siyasat al-malik; Tashil al-nasir wal tajil al-zafar. Al-Ahkam al-sultaniya is his most important book in which he has presented his political theories and system of administration.

He exhibited a daring pragmatism in dealing with the political realities confronting religious law. His theory was based more on Juristic considerations.\textsuperscript{95}

\textsuperscript{93} www.ummah.net
\textsuperscript{94} Muhammad Saud "Islam and Evolution of science", (Islamabad : Islamic Research Institute : 1986) P-35
\textsuperscript{95} Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-27
Al-Marwadi who also flourished under al-ma-mun made solar observations. 96

His contribution in political science and sociology comprises a number of monumenta books, the most famous of which are kitab al-ahkam al-Sultania, Qanun al-Wazarah, and Kitab Nasihat al-Mulk. The books discuss the principles of political science, with special reference to the functions and duties of the caliphs, the chief minister, other ministers, relationships between various elements of public and government and measures to strengthen the government and ensure victory in war. On the other hand, he has laid down clear principles for election of the caliph and qualities of the voters, chief among which are attainment of a degree of intellectual level and purity of character.

Al-Mawardi has been considered as one of the most famous thinkers in political science in the middle ages. His original work influenced the development of this science, together with the science of sociology, which was further developed later on by Ibn Khaldun. 97

33. Al-Khwarizmi (Encyclopaedist)

Though not a scientist in the true sense, Abu Abd Allah Mohammed Ibn Ahmed Al-Khwarizmi has secured a place in the history of science on account of his book Mafatih al ulum – Keys of the sciences.

Only one book written by al-Khwarizmi has reached us Mafatih al ulum – Keys of the sciences. As a dictionary of sciences and the basic terms used in various branches of learning, Mafatih al ulum occupies a special place in the history of science. 98

96 Muhammad Saud "Islam and Evolution of science", (Islamabad : Islamic Research Institute : 1986) P-61
97 www.ummha.net.
98 Abdur Rehman Sharif "100 Muslim Scientists". Mumbai, Arsh Publications, 2000 P-84
The major sciences discussed by al-Khwarizmi are: Islamic jurisprudence, theology, grammar, secretarial practices, poetry, history, philosophy, logic, medicine, arithmetic, algebra, geometry, astronomy, music, mechanics and chemistry. The book also contains brief history of various sciences, history of the region, administrative system of the Samanids, languages etc.99

The only book written by al-Khwarizmi is Mafatih al ulum. Even according to present terminology, it is an encyclopedia because all the information is arranged alphabetically.100

34. Ibn Sina

Ibn Sina is one of the greatest scientist-philosophers of the world who exerted a great degree of influence on the study of medicine and philosophy in the Islamic as well as the Western world. Abu Ali al-Husain ibn Abd Allah Ibn Sina was born in 980 AD at Afshana, near Bukhara, in present day, Uzbekistan.

One of the best minds of Islam, Ibn Sina produced 276 books and articles on medicine, philosophy, metaphysics, logic, ethics, Quran, mysticism, physics, magenetism, music, psychology, zoology, optics, chemistry, geology, astronomy, lexicography, etc. The two most famous of his books are: al Qanun fil tib and al-Shifa.

Other important works are: al-Nijat and al-Ishrat wal tanbihat. The Qanun is an encyclopaedic work covering philosophical principles of medicine anatomy, diseases; treatment, diagnostics, prognostics, pathology, pharmacopeia and pharmacology.

His influence has been noticed in a large number European scientists and thinkers.101

He introduced importance of psychology in the field of medicine and led stress on psychological treatment. He invented

99 Abdur Rehman Sharif "100 Muslim Scientists". Mumbai, Arsh Publications, 2000 P-84
100 Hameed Askari, "Namwar Muslim Sciencedan", Lahore:Majlis Taraqui Adab : 1996, P-254
101 Abdur Rehman Sharif Ibid- P-7
vernier scale of measurement. In the field of physics, he carried out extensive research on movement, force, light and heat.  

He has not only contributed in science but also in technology. He used air thermometer to find out temperature of air.

35. Ibn Hazm

One of the great thinkers of Islam, Ibn Hazm wrote, 4oo books, mainly on philosophy, theology, law, psychology and education. Ibn Hazm was born near Cordova in 994AD. He died in his native village Manta Lishamm 1064 AD.

Ibn Hazm was a great thinker who wrote on theology, philosophy, ethics, law, comparative religion, education, theory of language, logic and psychology. Some of his important books are Towq al-hamama, Madawat al-nafus, al-Muhalla, Kitab al-akhlaq wal siyar, Jamharat al-ansab al-arab, al Taqrib li had al mantig and al Fisal fil milal wal ahwa wal nihal. His remarkable knowledge of Quran and Hadith enabled him to evolve a, dynamic interpretation of the Islamic law.

He advocated the rights of women and the right of worker to the fruits of his labour. debunked magic and sorcery, said that in the next world men would experience the vision of God.

36. Ammar al-Mawsili

Ammar al- Mawsili was a great ophthalmologist of Islam who wrote a comprehensive book on ophthalmology. He was an eye surgeon who performed several eye operations the most important of which was operation for cataract.

The fame of Ammar al-Mawsili rests on his book on ophthalmology, al-Muntakhab fi ilaj al ayn. The book is marked by

103 Muhammad Saud “Islam and Evolution of science”, (Islamabad : Islamic Research Institute : 1986)
104 Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-41
clarity, brevity and a professional approach to the subject. The
diseases are listed according to the parts of the eye, like diseases of
the eyelid the conjunctiva, the cornea, the pupil, the albumen, the
diseases of the optic nerves, etc.

He also described six cataract operations. His most important
achievement was the operation for cataract by suction of the eye
lens through a hollow metal tube. He also invented surgical
instruments, like a fine metal tube with a hollow.\footnote{Abdur Rehman Sharif \textit{"100 Muslim Scientists"}. Mumbai, Arsh Publications, 2000 P-54}

\section*{37) \textsc{Abul Hasan Ali Al-Masu\textsuperscript{di}}}

One of the original thinkers and versatile writers of medieval
Islam, Al-Masudi has been recognized as a great historian and
geographer. His date of birth is not known. Towards the end of life,
around 945 AD, he settled at al-Fustat, old Cairo, where he died in
957 As.

Al Masudi wrote forty books on various subjects, such as
history, geography, theology, jurisprudence, ethics, philosophy,
genealogy, politics, administration, nature, people, etc. Two of his
books have survived – \textit{Muruj al-dhahab wa maadin al-jawwahar} and
\textit{al-tanbih wal ishraf}.

His geographical study included physical, mathematical,
human and descriptive geography. He had a critical approach to
past knowledge and rejected many old beliefs.\footnote{Abdur Rehman Sharif \textit{Ibid} -P-21}

At Basra he completed his book \textit{Muruj al-thahab}, in which he
has described in a most absorbing manner his experience of various
countries, peoples and climates. He gives accounts of his personal
contacts with the Jews, Iranians, Indians and Christians. He wrote
his second extensive book \textit{Muruj al-zaman} in thirty volumes. In this
book he has described in detail the geography and history of
countries that he had visited. He also prepared a supplement, called *Kitab al-Ausat*. in which he has compiled historical events. By presenting a critical account of historical events, he initiated a change in the art of historical writing, introducing the elements of analysis, reflection and criticism. With his scientific and analytical approach he has given an account of the causes of the earthquake of 953 C.E. as well as the discussions of the water of the Red sea and other problems in the earth sciences.

It is interesting to note that he was one of the early scientists who propounded several aspects, of evolution viz.. from minerals to plant, plant to animal and animal to man.¹⁰⁷

38. Al-Majriti

Al-Majriti was one of the notable scientists produced by Islamic Spain who is considered as a pioneer of commercial arithmetic. He is also noted for his work in chemistry. Abul Qasim Maslama al-Majriti was born in Majrit in Islamic Spain during the second half of the tenth century AD.

Al-Majriti wrote important books on astronomy, astronomical instruments, zoology, chemistry and mathematics. Some of his books are: *Ghayat al-hakim*, on astronomy, astrology; *Rutbat al-hakim*, on chemistry; *al-Muamalat*, on commercial arithmetic.

His book, *Rutbat al-hakim*, has been admired fontsstudies in chemistrv in it the author discusses various chemical processes and substances. He describes a chemical experiment to produce mercuric oxide.

He has acquired a special position in the history of mathematics. This book deals with the principles of commercial arithmetic while covering geometry and algebra.¹⁰⁸

¹⁰⁷ www.ummah.com
¹⁰⁸ Ibrahim A. Nadvi “Muselman scientedan aur Unki Khidmat”
39. Al-Karkhi

Al-Karkhi was one of the great mathematicians of the world who greatly advanced the study of algebra.

Abu Bakr ibn Muhammad ibn al-Hasan al-Karkhi, flourished towards the end of the tenth century AD.

He was the first in the history of mathematics to offer a theory of extraction of the square root of a polynomial with an unknown; first to free algebra from the influence of geometry; first to give an account of the algebra of polynomials; and the first Islamic mathematician to offer a complete theory of algebraic calculus.

His *Inbat al-miya al-khafya* is an excellent book on hydraulic engineering, surveying instruments and the construction of qanat, the famous underground water supply system found in Iran and Afghanistan. His principal works are: *al-Fakhr al-jabr wal muqabla*, *al-Badi fil hisab*; *al-Kafi fil hisab Inbat al-miya al-Khafya*; and *Kitab al-uqud wal abniya*.

He gave with proof the complete solution of quadratic equations and also mentioned the reduction of the type $ax^{2p} + bx^n = c$ to quadratic equations. He also described the addition and subtraction of radicals. He gave the solution of Diophantine equations including twenty five problems which are not found in Diophanotes.\(^{109}\)

40. Ibn Wafid

Spanish Islamic scientist Ibn Wafid made notable contributions to pharmacology and pharmacy.

Abu al-Mutarrif Abd al-Rahman Ibn Wafid was born in 1007 AD at Talitala in Islamic Spain.

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\(^{109}\) Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-38

\(^{110}\) Muhammad Saud "Islam and Evolution of science", (Islamabad : Islamic Research Institute : 1986) P- 34
Ibn Wafid wrote several books on medicine, agriculture, botany, and pharmacology. *Kitab al-adwiya fil tib*, *Kitab al-rashshad fil tib* and *Kitab al-mughith* are the names of his books.

He conducted research to ascertain the properties of drugs. He discussed medicinal plants and their cultivation, simple and compound drugs with their properties and effectiveness. His other books include *Mujarrabat fil tib* and *Majmuat filaha*.¹¹¹

On the use of drugs, he propounded an interesting theory. He said that in the first stage a discussed should be tried upon with the help of diet. If diet fails to produce positive result simple drugs should be used. It is only when simple drugs fail that a compound drug should be used.¹¹²

He gave emphasis upon the treatment of diseases through food control. He discovered the treatment for epidemic jaundice and suggested a reasonable quantity of opium as the treatment of manic. For epistaxis they suggested pouring of cold water on the head.¹¹³

41. Al-Bakri

Abu Ubaid abd Allah ibn al-aziz ibn Muhammad al-Bakri was born between 1010 – 1020 AD. He died in 1064 AD. Al-Bakri wrote several books on religion, philology, botany and geography. His two geographical works are *Kitab al-Masalik wal mamalik* and *Mujam ma istajam*. The *Masalik wal mamalik* is his most important work. It deals with the geography and the peoples of the Muslim as well as the non-Muslim world.

Some of his other scientific works are *Kitab al-nabat*, *al-Tanbih ala awham Abi Ali fi kitab al-nawadir* and *Fasi al-maqal fi*

¹¹¹ Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-55
¹¹³ Muhammad Saud "Islam and Evolution of science", (Islamabad: Islamic Research Institute: 1986) P-92
sharh kitab al amthal.\textsuperscript{114}

He also composed a geographical dictionary chiefly of Arabia. It also treats geography of ancient Arabia and the habitats of tribes.\textsuperscript{115}

42. Nizm al-Mulk

Khwaja Abu ali Hasan ibn Ali ibn Ishaq Nizam al – Mulk Tusi was born in 1017 AD in Tus in Iran.

Nizam al-Mulk did not evolve a new political theory. Like his contemporary al-Mawardi, he offered legal protection for the existing political realities.

The Siyasat-nama, written in Persian, contains fifty chapters dealing with the appointment of the king, ministers and their departments, public grievances, taxation, judiciary, religious affairs, overlords, punishment of high officials, farmers, treasury, rebellions, ambassadors and spying.\textsuperscript{116}

43. Ibn al-Bawwab

Ibn al-Bawwab was one of the most outstanding calligraphers of Islam who perfected the style of Arabic writing called Khat al-mansub on scientific lines. He died at Baghdad in 1022 AD.

Ibn al-Bawwab is remembered for his contribution to the art and science of Islamic calligraphy. Before Ibn al-Bawwab, Ibn Muqla had invented a new style called khat al-mansub, or the perfect writing. Ibn al-Bawwab improved upon it and brought it to a level of perfection by providing a scientific basis to it. He framed new rules for the size and proportion of letters and dots, and defined curves. He made a square dot that a pen

\textsuperscript{114} Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-56
\textsuperscript{115} Muhammad Saud “Islam and Evolution of science”, (Islamabad : Islamic Research Institute : 1986) P- 56
\textsuperscript{116} Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-52
made as the unit of writing. His style is still in use in the Islamic world.\textsuperscript{117}

44. Al-Zarqali

Al-Zarqali was one of the several great scientists. Abu Ishaq Ibrahim ibn Yahya al - Naqqash al-Zarqali was born in Qurtuba in 1029 AD. Al-Zarqali wrote several books on astronomy and astronomical instruments. The most famous of his books is the Toledan Tables. It deals with various aspects of astronomy, like determination of the right ascensions, equation of Sun, moon, and planets, ascendant, parallax, eclipses, setting of planets, theory of trepidation, tables of stellar positions, trigonometrical tables, etc.

Al-Zarqali stated that the orbits of planets are elliptical, and not circular. This was five centuries before Kepler (d. 1630). He established that with reference to stars the solar apogee is variable. His two public water clocks set up at Toledo, evoked great admiration.\textsuperscript{118}

He was an expert of mechanics. He prepared an instrument called “Istarlab”, for the study of stars. “Istarlab”, was the first Telescope which was later modified by Gallilio.\textsuperscript{119}

He was a great astronomer, he explained the construction of trigonometric table.\textsuperscript{120}

45. Ibn al-Awwam

Ibn al-Awwam was a celebrated agricultural scientist of Islam who wrote the most important medieval work on scientific agriculture.

*Kitab al-filaha* is a large book running into thirty-five chapters. The first thirty chapters deal with agriculture and the last five with

\textsuperscript{117} Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-75

\textsuperscript{118} Abdur Rehman Sharif Ibid P-49

\textsuperscript{119} Ibrahim A. Nadvi “Musalmah sciences dan our Unki Khidmat” (Delhi : Maktaba Al-Hasnat : 1985) Pp – 18-19

\textsuperscript{120} Muhammad Sudd “Islam and Evolution of science”, (Islamabad : Islamic Research Institute : 1986) P- 36
other related subjects, like farm management and animal husbandry. He covers a wide range of topics, such as soil condition, irrigation, fertilizers, cultivation of grains, vegetables, flowers, fruits and spices improvement of the quality and quantity of crops, grafting, preservation of grains, gardening, methods of estimating future crops, etc. The author provides a scientific account of the formation of soil.

Ibn al-Awwam considered various methods to make plants produce curious results. By the methods of grafting and injecting certain elements into the branches and roots of trees, he obtained, the desired taste, fragrance, colour and shape of the fruits and vegetables.\textsuperscript{121}

46. Imam Ghazali

Imam Ghazali was one of the most dynamic thinkers of Islam. Hujjat al-Islam Abu Hamid Muhammad ibn Muhammad al-Ghazali was born in 1058AD in Tus, now Mashhad, in Iran. Imam Ghazali attained a high spiritual status and died in 1111AD. As a result of his teachings, the supremacy of Islam as a divine order was reaffirmed and the Islamic world underwent an intellectual transformation. Imam Ghazali was a prolific writer. About 400 books are attributed to him, mainly on tafsir, Hadith, fiq, philosophy, logic, mysticism and ethics. Some of his other important books are : \textit{Kimiya-i saadat, al-Munqad\textsuperscript{h} min al-dhalal, Maqasid al-filasafa, and al-filasafa.}\textsuperscript{122}

He classified education into six branches viz, Mathematics, Philosophy, Physics, Ethics & politics. He believed that intellect, knowledge and sharia were important to achieved the final goal of man.\textsuperscript{123}

\textsuperscript{121} Abdur Rehman Sharif "100 Muslim Scientists". Mumbai, Arsh Publications, 2000 P-87
\textsuperscript{122} Abdur Rehman Sharif Ibid P-24
\textsuperscript{123} Ibrahimm A. Nadvi "Musalm\textsuperscript{n} sc
ciencedan aur Unki Khidmat" (Delhi : Maktaba Al--Hasnat : 1985) Pp – 211,212
A number of Muslim philosophers had been following and developing several viewpoints of Greek philosophy, including the Neoplatonic philosophy, and this was assuming such excessive proportions as to avoid observance of obligatory prayers and duties of Islam. Based on his unquestionable scholarship and personal mystical experience, Ghazali sought to rectify these trends, both in philosophy and Sufism.

In philosophy, Ghazali upheld the approach of mathematics and exact sciences as essentially correct. With his clarity of thought, and force of argument, he was able to create a balance between religion and reason, and identified their respective spheres as being the infinite and the finite, respectively.

His theological doctrines penetrated Europe, influenced Jewish and Christian Scholasticism and several of his arguments seem to have been adopted by St. Thomas Aquinas in order to similarly reestablish the authority of orthodox Christian religion in the West.124

47. Al-Zamakhshari

Al-Zamakhshari was a highly admired philologist of Islam. Abul Qasim Mahmud ibn Umar al-Zamakhshari was Iranian by origin. He was born in 1075 AD at Khwarizm in Central Asia. He died at al-Jurjaniya, near Khwarizm, in 1144 AD.

Al-Zamakhshari possessed a remarkably rich knowledge of the Arabic language which he ably presented in his books. He wrote on grammar, philology, proverbs, syntax, dictionaries etc. He also wrote a tafsir of the Quran. He compiled a geographical dictionary called *Kitab al amkina wal Jibal* which was published in Germany in 1856. He wrote a series of books on proverbs, *Asas al-balagha*.

124 www.ummah.net
Al-Zamakhshari also wrote a book on grammatical puzzles. Taftazani, another great grammarian and scholar of Islam, wrote a commentary on his works.\textsuperscript{125}

48. Al-Shahrastani

Al-Shahrastani was one of the important social philosophers of the world. Muhammad ibn Abd al-Karim al-Shahrastani was born in 1076 AD at Shahrastan, a small town in the Khurasan region of Iran. Al-Shahrastani wrote several books on theology, metaphysics and biographies. But the book that made him famous is al-Milal wal nihal. Among his other books are: Nihayat al-iqdam fi ilm al-kalam, Musannat al-falasifa, and Tarikh al-hukama. Kitab al-milal wal-nihal is one of the most remarkable books on the study of religions and sects of the ancient and medieval times.

He studies Christianity, Judaism, Hinduism and Buddhism among the major religions. In his analysis of the religions, Shahrastani adopts a scientific approach with objectivity which has added to the value of the book.\textsuperscript{126}

49. Abu Barakat

Abul Barakat was a brilliant philosopher-scientist who excelled in physics, philosophy and psychology.

Abul Barakat Hibat Allah ibn Malka al-Bagdadi was born in 1077 AD at Balad, near Baghdad in Iraq.

In physics, he presented some important ideas. He was first to suggest the fundamental law of modern dynamics that a constant force gives rise to accelerated movement. The movement of a projectile is caused by a ‘violent inclination’, a force imparted by the projecting body to the projectile.

\textsuperscript{125} Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-89
\textsuperscript{126} Abdur Rehman Sharif Ibid P-34
In his writings, Abul Barakat treated philosophy, logic, psychology, metaphysics, physics and medicine. His most important book is *Kitab al-mutabar* which was published from Hyderabad in three volumes.

He changed the old pattern of writing philosophical books in a complex & hard language. He proposed that element does not lost its properties in any form.\(^{127}\)

In his book, Al-Mutabar, he explained that the water coming from wells and fountains, is the water absorbed during monsoon. Initially people believe that this water is result of cooling of vapour under the ground.\(^ {128}\)

**50. Ibn Zuhr**

Ibn Zuhr was a great clinical physician, medical scientist and author as well. Ibn Zuhr was born in 1091 AD in Ishbiliya (Seville) in Spain. He died of a malignant tumou in 1161 AD.

Ibn Zuhr wrote nine books, the most famous being *al- Taysir fil mudawat wal tadbir* in 30 chapters. His other books include *al-Iqtisad fi islah al-anfus wal ajasad; Kitab al-aghdhiya; Jami asrar al-tibb; al-Tiryaq al-sabina* and *al-Tadhkira*.

As a scientist, Ibn Zuhr believed in observation and experimentation. He wrote on physiology, diseases, therapeutics, prophylaxis, toxicology, diet, ecology, etc. He was the first scientist to describe mediastinal tumours, and pencycardial abscesses. He was one of the earliest to recommend tracheotomy, and to describe scabies and its agents as *sarcopites scabiei*. He also described intestinal erosions, paralysis of the pharynx and inflammation of the middle ear. He recommended the artificial feeding of the sick through esophagus or the rectum, and the use of cold water to

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reduce fevers. *Al-Taysir* is noted for its rich clinical observations on patients and diseases.\(^{129}\)

His third book, *al-Aghdhiyyah* deals with various kinds of food and their use according seasons, with simple drugs and hygiene.\(^{130}\)

Ibn Zuhr was one of the great physicians and clinician of the Muslim golden era. Contrary to the general practice of the Muslim scholars of that era, he confined his work to only one field medicine. He described correctly for the first time, scabies the itch mite and may thus be regarded as the first, parasitologist. Likewise, he prescribed tracheotomy and direct feeding through the gullet and rectum in the cases where normal feeding was not possible. He also gave clinical descriptions of mediastinal tumours, intestinal phthisis, inflammation of the middle ear, pericarditis, etc.

His, *Kitab al Iqtisad fi Islah al-Anfus wa al-Ajsad* gives a summary of diseases, therapeutics and hygiene written specially for the benefit of the layman.\(^{131}\)

### 51. Al-Idrisi

Al-Idrisi was one of the great geographers and cartographers of the world. Abu Abd Allah Muhammad ibn Muhammad al-Sharif al-Idrisi was born in 1100 AD in Sabtah in Morocco. He died in 1166 AD at the age of sixty six years.

The book *Nuzhat al-mushtaq fi ikhtiraq al-afaq* was planned as a key to the magnificent set of maps, gives descriptions of the earth as a globe, the hemisphere, climates and seas. A geographer and cartographer, Al-Idrisi influenced Europe for centuries.\(^{132}\)

He divided the earth’s surface into seven climatic zones and each zone was subdivided into ten longitudinal

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\(^{129}\) Abdur Rehman Sharif "100 Muslim Scientists". Mumbai, Arsh Publications, 2000 P-25

\(^{130}\) Muhammad Saud "Islam and Evolution of science", (Islamabad : Islamic Research Institute : 1986) P- 113

\(^{131}\) www.ummah.net

\(^{132}\) Abdur Rehman Sharif  Op-cit P-15
sections. He designated a large silver disc and inscribed on it the map of world with all its features.\textsuperscript{133}

He studied and reviewed all the literature on the subject, of medicinal plants. He collected plants and data not reported earlier and added this to the subject of botany, with special reference to medicinal plants. He has given names of the drugs in six languages, Syriac, Greek, Persian, Hindi, Latin and Berber. In addition to the above, he made original contributions to geography, especially as related to economics, physical factors and cultural aspects. He gave information not only on Asia and Africa, but also Western countries. Apart from botany and geography, Idrisi also wrote on fauna, Zoology and therapeutical aspects.\textsuperscript{134}

**52. Ibn Asakir**

Ibn Asakir has earned fame as a great historian. Abul Ali ibn Hasan Ibn Asakir was born in Dimashq 1105 AD. He died in 1176 AD. Though he wrote several books, his stupendous work *Tarikh al-Dimashq*. He wrote a large number of book mainly on theology, figh, Hadith, grammar and biographies. The book is not merely a history of Damascus as the title would suggest, It covers the history of Dimashti, Syria and the Islamic world. In addition, it gives biographies of hundreds of great men.\textsuperscript{135}

**53. Ibn Rushd**

Ibn Rushd, the Islamic thinker who 'enlightened the west' and inspired the European current of thought called 'Averrohisim' was a great philosopher, theologian and medical scientist.

\textsuperscript{133} Ibrahim A. NadVi "Musalmann scienteran Aur Unki Khidmat" (Delhi : Maktaba Al – Hasnat : 1985) Pp – 248-249
\textsuperscript{134} www.ummah.net
\textsuperscript{135} Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-92
Abul Walid Muhammad ibn Ahmad ibn Muhammad ibn Rushd was born in 1126 AD in Cordova, Spain. He died in 1198 AD at Marrakush.

His important works are: Fasl al-maqal wa taqrib ma bain al-sharia wal hikma min al-ittisal, Kashf al-manahij, Tahafut al-tahafut, Tafasir mabad al-tabiyat, Muqaddimat al-mumahhidat, al-Kulliyat.

Ibn Rushd attempted to solve the problem of relation between philosophy and the Islamic society with the help of theology, law and philosophy. He believed in a future life which he held was not against reason even though reason did not prove its features.136

Ibn Rushd has thrown light on various aspects of medicine, including the diagnoses, cure and prevention of diseases. In astronomy he wrote a treatise on the motion of the sphere. His books were included in the syllabi of Paris and other universities till the advent of modern experimental science.137

54. Al-Farisi

Kamal al-Din al-Farisi, is rated among the scientists who made original contributions to physics and mathematics. To study the formation of rainbow and other problems, Kamal al-Din al-Farisi conceived of a brilliant experiment and conducted it successfully. He showed that the primary rainbow is the result of two refractions and one reflection of light within the drop of water, while the secondary rainbow is formed by two refractions and two reflections.

Kamal al-Din al-Farisi's most important work relates to optics, particularly to the study of rainbow which is contained in his book Tanbih-manazir li dhawil absar wal basair. His other works are: al-Basair fi ilm al-manazir and Tadhkirat al-abbab.138

He gave an account of the refraction of light. According to George Sorton this account implies the following facts.

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136 Abdur Rehman Sharif "100 Muslim Scientists". Mumbai, Arsh Publications, 2000 P-12
137 www.ummah.net
138 Abdur Rehman Sharif Op-cit P-88
1) Speed of light is finite but very great.
2) Speed of light in different media is inversely proportional to the optical density.¹³⁹

55. Ibn Bajja

Ibn Bajja was one of the important thinkers of Islam. Abu Bakar Muhammad ibn Yahya ibn al-Saigh ibn Bajja was born towards the close of the twelfth century AD at Saraqusta (Saragossa) in Spain. His writings, Ibn Bajja dealt with philosophy, logic, physics, psychology, metaphysics, music, medicine, zoology, botany and astronomy. His works on philosophy and physics are highly admired. In physics, Ibn Bajja considered matter, form, dynamics, projectiles, force, and motion. If there is no medium, air or water, a body would move with the original velocity which is finite, and the velocity would decrease in proportion to the resistance offered by the medium. This theory influenced medieval European scholars. Some of his books are: Tadbir-al-mutawahhid; Kitab-al-nafs; Risala-al-ittisal al-aql bi al-insan and Risala al-wada.¹⁴⁰

56. Ibn Jubayr

Abul Husain Muhammad ibn Ahmad Ibn Jubayr was born at Balancia in Islamic Spain.

The travel account of Ibn Jubayr is called Tadhkira bil akhbar an ittefaqat al-asfar, or simply the Rehla ibn Jubayr. It is a very valuable document of its time covering history, geography and sociology of Egypt, Arabia, Iraq, Syria, Mesopotamia and parts of Mediterranean Europe. He has made special note of scientific and technological objects, such as the nilometre for measuring the

¹³⁹ Muhammad Saud “Islam and Evolution of science”, (Islamabad : Islamic Research Institute : 1986) P- 52
¹⁴⁰ Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-97
flooding of the Nile, bridges, canals, water works, and the wonderful public water clock of Damascus.\textsuperscript{141}

57. Al-Jazari

Al-Jazari was one of the great mechanical engineers and inventors of the world. He was born sometime around 1155 AD. His book *Kitab fi marifat al-hiyal al-handasiya*.

He divides machines into six main categories and fifty types: A twin-cylinder pump driven by a paddle-wheel, complicated clocks, fountains and water-raising machines, some combining utility and entertainment are some of the highly admired machines of Al-Jazari. Al-Jazan’s machines involved a large number of techniques and mechanisms of great significance to the development of machines, such as axles, segmental gear wheel, flume-beam swape, crank as part of machine, suction pipes, regulators and control systems, accurate calibration of small outlets, static balancing of wheels, one-way hinge, etc. A number of his machines were widely used in Europe from the thirteenth century onwards.\textsuperscript{142}

58. Fakhr-i-Mudabbir

Fakhr-i-Mudabbir wrote a book on warfare – *Aadaab al-harb*. Fakhr-i-Mudabbir was born in Ghazna about 1157 AD. He had his early education in Ghazna. Two of the books written by Fakhr-i-Mudabbir are available today. *Shajrah-i-ansab* is the history of his ancestors. His second book is *Kitab aadaab al-harb wal –Shuja*, principles of warfare and courage. The first part deals with the principles of state administration. The second part is devoted to warfare and weapons. He writes about the science and technology involved in the manufacture of weapons.\textsuperscript{143}

\textsuperscript{141} Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-66
\textsuperscript{142} Ibid P-20
\textsuperscript{143} Ibid P-78
59. Yaqut al-Hamavi

Shihab al-Din Abu Abd Allah Yaqut al-Hamavi al-Rumi was born in 1179 AD in Rum, now part of Turkey. He died in Halb in 1229 AD.

Yaqut al-Hamavi, wrote several multi-volume books on history, geography, genealogy, scholars and poets. His Irshad al-arib ... is a great dictionary of learned men. *Mujam al-buldan* is a large book on geography. He starts the book with a learned introduction in which he discusses mathematical, physical and political geography, magnitude of the earth, seas & mountain ranges, the division of the earth, definition of various geographical terms, such as longitude, latitude, degrees, minutes, mile; etc. He said he was inspired to write the book by the Quran. The main part of the book covers names of places - cities, towns, rivers, valleys, mountains, deserts seas, islands – arranged in an alphabetical order.\(^{144}\)

60. Al-Tifashi

Shihab al-Din Abul abbas Ahmad ibn Yusuf al-Tifashi was born in 1184 AD at a place called Tifash. He died at Cairo in the year 1253 AD.

Al-Tifashi’s fame rests on his book on mineralogy called *Kitab al-azhar al-afkar fi jawahir al-ajhar*. It is one of the most admired books on mineralogy, particularly on precious stones. *Kitab al-azhar*... is divided into twenty-five chapters, each devoted to one kind of precious stone. Thus the book discusses twenty-five different types of precious stones, and gives a lot of information about them under, five broad topics.\(^ {145}\)

He gave the following information about each precious stone:

Origin and generation of stone, location of mine where it is found,

\(^{144}\) Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-83

\(^{145}\) Ibid P-58
types and quality signs of purity, defect merits, commercial value and prices and application for medical purpose.\textsuperscript{146}

\textbf{61. Abul Fida}

Abul Fida wrote one of the most elaborate geographical works. He was born in 1273 AD in Dimashq / Damascus in Syria. Abu fida died in 332AD.

\textit{Taqwim al-buldan}, and \textit{Mukhtasar tarikh al-bashar} are two of his outstanding achievements, particularly the former. \textit{Taqwim al-buldan} is an exhaustive geography of the world which outclassed all earlier geographical works most of which were written by Islamic geographers. Abul Fida rightly states that as as one traveled around the world one gained or lost time depending on the direction of one’s journey. On account of earth’s rotation on its axis, time changes from one longitudinal zone to another. He stated that only one fourth of the earth’s surface was covered with land while the rest was covered with water.

His famous work, Mukhtasar tarikh al-bashar a universal history covering, the period from before the advent of Islam to his own times.\textsuperscript{147}

\textbf{62. Ibn Baytar}

Ibn Baytar was the greatest botanist and pharmacologist of Islam. Ibn Baytar was born in 1190 AD, at the port city of Malaqa in Spain. He died in 1248AD while analyzing a poisonous plant which he had sucked. Two of his books, al-Jami and al-Mughni, are massive works. Kitab al-jami li mufrada al adwiya wal aghdia is the most important book written by Ibn Baytar. It describes more than 2300

\textsuperscript{146} Muhammad Saud "Islam and Evolution of science", (Islamabad : Islamic Research Institute : 1986) P- 80

\textsuperscript{147} Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-35
drugs of animal, vegetable and mineral origin. He was a pioneer of botanical explorers.\textsuperscript{148} 

He was one of the most important Muslim botanists. He was the greatest expert of his time in identifying the plants. He conducted research on plants and acquired a good knowledge of name of plant and their species and places where they grew.\textsuperscript{149}

His major contribution, *Kitab al-Jami fi al-Adwya al-Mufrada*, is one of the greatest botanical compilations dealing with medicinal plants in Arabic. It enjoyed a high status among botanists up to the 16\textsuperscript{th} century and is a systematic work that embodies earlier works, with due criticism, and adds a great part of original contribution. The encyclopaedia comprises some 1400 different items, largely medicinal plants and vegetables of which about 200 plants were not known earlier. Besides Arabic, He has given Greek and Latin names of the plants, thus facilitating transfer of knowledge.\textsuperscript{150}

63. Ibn Abi Usaibia

Muwaffaqal-Din Abul Abbas Ahmad ibn al-Qasim ibn Khalifa ibn Yunus al-khazraj was born in Damascus in Syria after 1194 AD. He died in 1270 AD.

Ibn Abi Usaibia wrote several books medicine and was also a poet. he owes his fame to his book *Uyun al-anba fi tabaqat al-atibba*. It is a dictionary of medical scientists from the ancient times down to the, thirteenth century AD. It contains 432 biographies, mostly of physicians and medical scientists and refer s to hundreds of other authors. In addition to recording the life and achievements of medical scientists, the book covers various aspects of medical science as practised eight hundred years ago and earlier. It has preserved for all times the names and achievements of hundreds of

\textsuperscript{148} Abdur Rehman Sharif “100 Muslim Scientists”, Mumbai, Arsh Publications, 2000 P-14 \textsuperscript{149} Muhammad Saud “Islam and Evolution of science”, (Islamabad : Islamic Research Institute : 1986) P- 122 \textsuperscript{150} www.ummah.net
forgotten physicians who contributed to the development of medical science. *Uyun* is a unique and important book in the history of medicine.\footnote{151}

### 64. Al-Khazini

Al-Khazini was one of the most important Muslim physicists who made valuable studies in mechanics and hydrostatic. Though he wrote an important book on astronomy called al-Zij al-Sanjari, Al-Khazini’s fame rests mainly on *Kitab mizan al-hikma*, Book of balance of wisdom. He gives a detailed account of the theory of balances the specific gravities of various substances and the methods of measuring the specific weights of bodies made of one or two substances. He determined the specific weights of gold, mercury, copper, iron, lead, tin, precious metals, urine, blood, water, ice etc. His universal balance consisted of a six-foot-long iron beam with a cross bar, a suspension, an indicator, a running weight, and up to five scale pans hung on the beam. The balance was used for various purposes, such as ordinary, weighing, determining specific gravities, analysing alloys and detecting the genuineness of gems.\footnote{152}

### 65. Al-Tusi

Muhammad ibn Muhammad al-Hasan al-Tusi, also known as Muhaqqiq-i Tusi, was born at al-Tus in Iran in 1201 AD. Al-Tusi wrote about 150 books and risalas, about twenty in Persian and the rest in Arabic. His writings cover a wide range of scientific and other subjects, such as astronomy, astrology, arithmetic, geometry, trigonometry, mineralogy, medicine, logic, philosophy, theology, ethics, etc. His most admired works are on mathematics, astronomy,
ethics and theology. Zij-i Ilkhani, Tadhkira, Shakl al-qita, Tansukhnama, Akhlaq-i Nasiri, and Tajrid which is a very important work on Shiite theology and philosophy. He was first to study trigonometry as an independent branch of mathematics. Al-Tusi established the Maragha observatory in 1259 AD which became one of the most important observatories in the history.\textsuperscript{153}

66. Al-Qazwini

At-Qazwini was a celebrated cosmographer and geographer of Islam. He was born in 1203 AD. He died in 1283 AD.

Al-Qazwini was an astronomer, geographer, geologist, mineralogist, biologist, ethnographer, and cosmographer. Ajaib-al makhluqat wa gharai̇b al-mawjudat is devoted to the study of cosmography, the descriptions of the whole universe. In part one, he discusses the heavens, the moon, the sun, the stars, the angels, chronology. Arabic and Syrian calendars, etc. In the second part he treats the earth, the four elements, meteors, winds, cause of earthquakes, formation of mountains, division of the earth into climatic zones, seas, rivers, minerals, plants, animals, man and human tribes.

Ajaib al-buldan is devoted to the study of geography. It divides the earth into seven climatic zones, after the Greek geographer Ptolemy. Then, countries, cities, mountains and rivers from each of the seven climatic zones are described in alphabetical order. Al-Qazwini exerted a great influence on later Islamic cosmographer and geographers. Both his books have been widely studied in Europe during the last two centuries.\textsuperscript{154}

\textsuperscript{153} Abdur Rehman Sharif "100 Muslim Scientists". Mumbai, Arsh Publications, 2000 P-31
\textsuperscript{154} Ibid P-91
67. Ibn Nafis

Ibn Nafis discovered the pulmonary circulation of the blood four hundred years before William Harvey.

Ala al-Din Abul Hasan Ali ibn Abil Hazm Ibn Nafis was born at Qurashiya, a village Damascus in Syria. about 1208 AD. Ibn Nafis died in 1288 AD. The pulmonary circulation covers the circulation of the blood from the heart to the lungs and back. It is this part of the circulation which Ibn Nafis discovered in about 1240 AD. Ibn Nafis described the pulmonary circulation of the blood in two of his books, Shark tasrith al-qanun and Sharh al-qanun. Ibn Nafis clearly stated that the septum was solid and had no pores, visible or invisible. He was also proficient in philosophy, theology, fiqh, grammar and language. Some of his famous books on medical science are: Sharh al-qanun, Sharh tasrrih al-qanun, Al-Mujiz and Kitab al-shaamil fil sina al-tibbiya.¹⁵⁵

He was also a great ophthalmologist.¹⁵⁶

His major original contribution of great significance was his discovery of the blood's circulatory system, which was re-discovered by modern science after a lapse of three centuries. He was the first to correctly describe the constitution of the lungs and gave a description of the bronchi and the intersection between the human body's vessels of air and blood. Also, he elaborated the function of the coronary arteries as feeding the cardiac muscle. He book on ophthalmology is largely an original contribution and is also extant. Another famous book embodying his original contribution was on the effects of diet on health, entitled Kitab al-Mukhtar fi al-Aghdhtya.¹⁵⁷

¹⁵⁵ Abdur Rehman Sharif "100 Muslim Scientists". Mumbai, Arsh Publications, 2000 P-1
¹⁵⁶ Ibrahim A. Nadvi "Musalman sciencedan aur Unki Khidmat" (Delhi : Maktaba Al – Hasnat : 1985) P – 250
¹⁵⁷ www.urumah.net
68. Al-Marrakushi

Abu Ali al-Hasan ibn Ali al-Marrakushi was born in Morocco. He wrote books on astronomy and trigonometry. His most important book is Jami al-mabadi wal ghayat, deals with the practical aspects of astronomical instruments, trigonometry, gnomonics and longitude/latitude of places. In the second part of the Mabadi... al-Marrakushi discussed the methods of solving various astronomical problems with the help of instruments. The instruments were of two types - time-measuring instruments and purely astronomical instruments. He wrote about spheres, planispheres, ten kinds of astrolabes and several kinds of quadrants.\(^{158}\)

In work, he mentioned not only the sine and the versed sine but also he called it complementary sine, \(\sin(90-a) = \cos a\) and exceeding sin, \(\sin(a-90) = -\cos a\). He compiled the table of sines for each half degree and the table of versed sines and arc sines.\(^{159}\)

69. Safi al-Din

Safi al-Din Abd al-Momin was one of the greatest musicologists of the world. Safi al-Din Abd al-Momin ibn Yusuf ibn Fakhir al Urmawi al-Baghdadi was born in 1220-30 AD, in Baghdad. The major achievement of Safi al-Din was a new musical theory with a new scale which came to be called the ‘Systematist Theory’. Safi al-Din’s theories greatly influenced all subsequent musicologists of Islam and held sway for over three centuries until modernisation began to affect Islamic music. He wrote two books on music Kitab al-adwar and Risala al-Sharafiya fil nisab al-talifiya.\(^{160}\)

\(^{158}\) Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-59
\(^{159}\) Muhammad Saud “Islam and Evolution of science”, (Islamabad : Islamic Research Institute : 1986) P. 37
\(^{160}\) Op-Cit P-18
70. Ibn al-Quff

Ibn al-Quffis ranked among the top scientists of Islam for his important discoveries relating to the cardio-vascular system.

Amin al-Dawla Abul Faraj ibn Muwaffaq al-Din Ibn al-Quff was born at Karak in present day Jordan in 1233 AD. He died in 1286AD. He is remembered mainly for two books - Kitab al-umda fi jarahat and Jami al-gharadh fi hifz al-sihha. Kitab al-umda is one of the most comprehensive manuals on surgery in the history of medical science.

Ibn al-Quff was first to establish connection between arteries and veins with the flow of blood from the former to the latter at the tiny capillaries ‘unseen by naked eye’. He was also first to explain the physiology of the cardiac valves, their number and the direction in which they open and close. Certain cardiac valves open inside to allow entry and prevent out flow of the blood and others open outside to allow out flow and prevent inflow of the blood. These were remarkable discoveries which brought him everlasting fame.\(^{161}\)

71. Rashid al-Din

Rashid al-Din is considered as the first great universal historian. Fadhl Allah Rashid al-Din ibn Imad al-Dawal Abul Khayr was born in Hamadan in Iran in 1247 AD. In addition to the great history, Rashid al-Din wrote many other books on theology, Quran, mysticism and various-sciences. In his Kitab al-ahya wal athar, he discussed various scientific subjects, such as agriculture, architecture, ship-building, mining, metallurgy and meteorology. However, the book that brought him everlasting fame was his history of the Mongols and the world called *Jami al-tawarikh*. Volume I covers the history of the Turks and the Mongols. Volume II gives the

\(^{161}\) Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-33
history of the Eurasian peoples. Volume III describes the ruling dynasties of Jews, Arabs, Franks and Chinese.\textsuperscript{162}

In 14\textsuperscript{th} century, an intelligent group of writer began to reject the idea of transformation of metal by chemical means. One of such person was Rashid al-Din.\textsuperscript{163}

72. Al-Shadhili
Al-Shadhili is ranked among the great ophthalmologists of Islam. Al-Shadhili's book is called Kitab al-umda al-kuhliya fi amradh al-basariya. It is divided into five parts, each dealing with a separate subjects: anatomy and the function of the eye, general problems of ophthalmology, appargnt diseases and treatment, hidden diseases of the eye, and drugs for the treatment of eye diseases. He was first to mention about the widespread eye diseases among the Egyptians. Among the diseases of the eyelid, he recognized convulsion, corbuncle, cancer and twitching.\textsuperscript{164}

73. Al-Urdhi
Al-Urdhi was a renowned engineer and instrument maker. He was born after 1200 AD and died about 1270 AD. Al-Urdhi started his career as an instrument maker in Damascus. He made numerous astronomical instruments for the Maragha observatory which were known for their precision and craftsmanship. He also wrote a book, Risala fi kaifiya al-arsad.... In it he described the design, manufacture, method of use and purpose of the instruments. Some of the instruments made and described by al-Urdhi are armillary sphere, solstitial armil, equinoctial armil, Hipparchus diopter, an instrument with two quadrants. Al-Urdhi also wrote books

\textsuperscript{162} Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-93
\textsuperscript{163} Muhammad Saud “Islam and Evolution of science”, (Islamabad : Islamic Research Institute : 1986) P- 82
\textsuperscript{164} Op-Cit P-62
on the construction of the sphere - Risalafi amal al-kurra al-kamila.\textsuperscript{165}

Al-Urdhi was also the author of two other treatises, one on the construction of a perfect sphere and another on the determination of the distance between the center of Sun and the Apogee.\textsuperscript{166}

74. Al-Saati

Al-Saati was an engineer who earned great fame as the maker of a wonderful and monumental clock which was placed on the city gate of Damascus. Muhammad ibn Ali ibn Rustam al-Khurasani al-Saati was born in Khurasan in Iran. He remained in charge of the clock till his death in 1185 AD.

Muhammad al-Saari was an engineer who specialized in clock making. He made several clocks. But the one that brought him great fame and admiration was the public clock of Damascus. The clock was a large, complicated and wonderful work of engineering. It announced the passage of each hour by making a noise. It showed the passed hours of the day, or night, by closed windows and the remaining hours by open windows. The wonderful clock was a great attraction of Damascus.\textsuperscript{167}

75. Al-Safadi

Salah al-Din Khalil ibn Aibak al-Safadi was born in 296 AD at a place called al-Safad in the Palestine region. He died of plague in 1362AD in Damascus.

Al-Safadi was a prolific writer. Today, more than 30 of his works are available, including the enormous al- Wafi bil wafayat. He also wrote on geography, history and philosophy.

\textsuperscript{165} Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-98
\textsuperscript{166} Muhammad Saud “Islam and Evolution of science”, (Islamabad : Islamic Research Institute : 1986) P- 70
\textsuperscript{167} Op-Cit P-73
His Masalik al-absar fi mamalik al-amsar was on geography, while Tuftat dhawil albad described the rulers of Egypt upto his own times. He also wrote a wonderful book titled Nukat al-himyan fil nukat al-umyan. It is a large collection of biographies of scientists, writers and other famous persons. His most important book is al-Wafi bil wafayat. It contains biographies of more than 14,000 persons.\textsuperscript{168}

76. Ibn Batuta

Ibn Batuta has been called the greatest traveller in history.

Abu Abd Allah Muhammad ibn Abd Allah al-Lawati al-Tanjil Ibn Batuta was born at Tanger in Morocco in 1304 AD. He died in 1369-78 AD in Tanger. He described the cultivation and use of pan (betel leaf) and coconut in India, salt mines of Taghaza, pearl divers of Bahrain, extraction of 'honey' from wheat, tarcoal springs and hamams of Baghdad, and the various socio-religious waqfs of Damascus.\textsuperscript{169}

77. Al-Firozabadi

Al-Firuzabadi was one of the most important lexicographers. He was born in Kazirun, near Shiraz, in Iran in 1329 AD. He died in Zabid in Yemen in 1415 AD at the ripe age of eighty-eight years. He wrote more than fifty books, mainly on tafsir, Hadith, history and lexicography. He also wrote a biography of the Prophet in Persian, Sifra al-saada, which was Translated into Arabic. Qamus, a great dictionary of the Arabic language.

Al-Firuzabadi completed the Qamus while he was in Mecca. Though the work was based on the earlier dictionaries of al-Jawhari, Ibn Sida and Saghani, he added material from his vast experience and study. He adopted brief definitions and abbreviations so as to

\textsuperscript{168} Abdur Rehman Sharif “100 Muslim Scientists” Mumbai, Arsh Publications, 2000 P-94
\textsuperscript{169} Ibid P-17
include a vast vocabulary in his book. Brevity and vowel markings are the other qualities of his book.\textsuperscript{170}

\section*{78. Ibn al-Khatib}

Ibn al-Khatib has earned a permanent place in the history of medicine with his discovery of contagion. Abu Abd Allah Muhammad ibn Abd Allah Ibn al-Khatib was born at Loja near Gharnata in Spain in 1313 AD. Apart from being a minister, Ibn al-Khatib was a scientist and scholar. He was also a poet. His most famous books are on medicine and history, such as \textit{al-Hulal al-marquma, al-Ihata bi tarikh Gharnata, al-Yusufi fi sinaat al-tib, Amal man al-tibba liman habba, Manafaat al-sinaat anal maradh al-hial.}

\textit{Manafaat...} is a description of the plague which ravaged Granada in 1348.\textsuperscript{171}

In 14\textsuperscript{th} century when the great plague ravaged the world, and chief causes of it, based on superstitions, were said to be either the Jews or Volcanic eruptions or the birth of calf with two heads. Ibn – Khatib and Ibn Khatimah, two muslim doctors wrote on it treaties which were based on scientific observations.\textsuperscript{172}

He gave the term "Germ". He stated that the transmission of germ could be occurred through the agency of garments, vessels and even ear rings. He classified diseases and non contiguous diseases.\textsuperscript{173}

\section*{79. Al-Taftazani}

Al-Taftazani was one of the most celebrated scholars of Islam.

\textsuperscript{170} Abdur Rehman Sharif "100 Muslim Scientists". Mumbai, Arsh Publications, 2000 P-40
\textsuperscript{171} Ibid P-61
\textsuperscript{172} Muhammad Saud "Islam and Evolution of science", (Islamabad : Islamic Research Institute : 1986) P- 92
\textsuperscript{173} Ibrahim A. Nadvi "Musalman sciencedan aur Unki Khidmat" (Delhi : Maktaba Al – Hasnat : 1985) Pp – 254, 256
Saad al-Din Masud ibn Umar al-Taftazani was born in 1322 AD at Taftazani, a village in the Khurasan region of Iran. Al-Taftazani wrote about twenty books on grammar, philology, rhetoric, law, logic, theology, philosophy and quran. He also wrote on physics. His books on grammar, law, logic and philosophy acquired great popularity. His books on grammar include: Sharh tasrif al-Zanjani, Irshad al-hadi, al-Tartib al-jalil, Tarkib gharib wa tartib ajib, and al-Niam al-sawabigh fi sharh al-kilam al-nawabigh.

He wrote two books on logic: Sharh al-risalat al-shamiya and Tahzib al-matiq wal-Kalam. The true value of his contribution to physics in particular cannot be assessed.\(^{174}\)

### 80. Ibn Khaldun

One of the greatest thinkers of the world, Ibn Khaldun has been considered as the founder of the science of history and sociology. Wali al-Din Abd al-Rahman ibn Muhammad Ibn Khaldun was born at Tunis in Tunisia, in 1332 AD. He worked on his masterpiece the *Muqaddima*. The *Muqaddima* was the first major attempt to analyse the human society with reference to anthropology, history, geography, religion, politics, culture, economy, science, arts, crafts, psychology. His analysis of the cause, nature, effect and consequences of civilisations has evoked great admiration. He had a liberal view of the state. He studied political science as an independent subject, free from the influence of philosophy, ethics or religion. State has a religious or a non-religious foundation. The duties of the state are to guarantee security, peace and propriety of transactions in return for a moderate tax. *Muqaddima* the greatest work of its kind ... ever created by any mind in any time or place.\(^{175}\)

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\(^{174}\) Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-90

\(^{175}\) Ibid P-6
He was a violent opponent of the idea of transmutation of metals by chemical means.\textsuperscript{176}

Muqaddama or ‘Prolegomena’, was based on Ibn Khaldun’s unique approach and original contribution and became a masterpiece in literature on philosophy of history and sociology. The chief concern of this monumental work was to identify psychological, economic, environmental and social facts that contribute to the advancement of human civilization and the currents of history. In this context, he analysed the dynamics of group relationships and showed how group – feelings, \textit{al-Asabiyya}, give rise to the ascent of a new civilization and political power. His contribution to history is marked by the fact that, unlike most earlier writers interpreting history largely in a political context, he emphasized environmental, sociological, psychological and economic factors governing the apparent events. This revolutionized the science of history and also laid the foundation of Sociology.\textsuperscript{177}

\textbf{81. Ibn Qunfudh}

Abul Abbas Ahmad ibn Hasan.....Ibn Qunfudh was born in 1340 AD at Constantine in Algeria. Ibn Qunfudh was a great scholar who wrote twenty seven books on various subjects, like mathematics, astronomy, history, logic, grammar, biographies, jurisprudence, Hadith, qirat, His works include: \textit{Tahsīl al-motalib fi tādil al-kawākib}, \textit{Hatt al-niqab}, \textit{al-Farisiya fi mabadi-al-dawla al hafsiya} and \textit{Sharh al-talib fi asr al- matalib}. \textit{Hatt al-niqab ala wajh amal al-hisab}. The most remarkable aspect of the book is the use of symbols for various algebraic operations and ideas. For the unknown quantity he uses the Arabic letter Shin, or only the three dots of the letter.\textsuperscript{178}

\textsuperscript{176} Muhammad Saud "Islam and Evolution of science", (Islamabad : Islamic Research Institute : 1986) P- 80
\textsuperscript{177} www.ummah.net
\textsuperscript{178} Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-53
82. Al-Damiri

Al-Damiri produced the most comprehensive zoological work in Islam. alul Baqa Kamal al-Din Muhammad ibn Musa al-Damiri was born in Qahirah Cairo in 1341 AD. He died in 1405AD. He was well versed in theology, fiq, literature and zoology, and wrote in prose and verse. He wrote al-jauhar al-farid fi ilm al-tawhid. However, the book by which he is mainly remembered today is Kitab al-hayawan.

Kitab Hayat al-hayawan which was completed in 1372 AD. It is an encyclopaedic work dealing with about 1000 animals mentioned in the Quran and Islamic traditions. He packed the book with a lot of diverse information about animals which he had collected from various sources.\(^ {179} \)

83. Al-Jildaki

Al-Jildaki was one of the most important writers on chemistry. Izz al-Din Ali ibn Aidamur ibn al-Jildaki spent most of his life in Cairo and Damascus. He settled at Cairo in Egypt where he died 1360 AD. Al-Jildaki was one of the important chemists of Islam. He wrote about thirty books, about twenty of which were devoted to chemistry. The titles of some of his books are: Nihayat al-talab fi sharh al-muktasab. It is a large work in four parts dealing with chemistry and other subjects, al-Dur al-maknun fi sharh qasidah Dhul Nun, al-Misbah fi asrar ilm al-miftah. This is because he devoted his whole life to the study of chemistry, traveled for many years to meet the chemists of his time and collected a lot of books on the subject. He wrote commentaries on the works of other chemists, including an ancient Egyptian chemist, Apollonius. He also wrote a brief history of Islamic chemistry.\(^ {180} \)

\(^ {179} \) Abdur Rehman Sharif "100 Muslim Scientists": Mumbai, Arsh Publications, 2000 P-57
\(^ {180} \) Ibid P-99
84. Ulugh Beg

Ulugh Beg was the last great astronomer of Islam who made major contributions to astronomy. He was born in 1394 AD at Sultaniya. He was murdered in 1449AD. In order to promote the study of astronomy, Ulugh Beg established a college of astronomy and an observatory in 1420 AD. The observatory was a three storey building equipped with numerous instruments like the sextant, armillary sphere, triguetrum, astrolabe and an instrument called Shamila which was an astrolabe cum quadrant. After several years of observations and study, the book Zij Ulugh Beg or Zij Gurgani was prepared. It contains a preface in four parts covering a number of astronomical problems, a set of tables of trigonometry and planets, and a star catalogue.¹⁸¹

A catalogue of observational astronomy was prepared by Ulugh Beg in 15th century.¹⁸²

85. Al-Dawwani

Al-Dawwani was a great scholar of Islam who made notable contributions to the study of philosophy, logic and political science. Jalal al-Din Muhammad ibn Asad al-Dawwani was born in 1427 AD at Dawwan, near Shiraz in Southern Iran. He died on the way, in 1502 AD. Al-Dawwani provides an important link in the continuation of Islamic studies in philosophy, logic and political science. Akhlaq-i Jalali, or the Lawami al-ishraq fimakarim al-akhlaq is his most famous work. The book deals with political science in the Islamic tradition. It is divided into three sections – ethics, economics and politics. Al-Dawwani was also a great logician who wrote a number of books on logic. Particularly famous are his commentary

¹⁸¹ Abdur Rehman Sharif “100 Muslim Scientists”, Mumbai, Arsh Publications, 2000 P-96
¹⁸² Muhammad Saud “Islam and Evolution of science”, (Islamabad : Islamic Research Institute : 1986) P- 64
on Taftazani's book Tahzib al-mantiq wal kalam, and Risalat al-zawra. He was perhaps the greatest logician of his century.\textsuperscript{183}

86. Ibn Ghaibi

Abd al-Qadir Ibn Ghaibi was born at Maragha in Iran during the middle of the fourteenth century AD. He died at Herat in 1435 AD. His books contain theories, description of various instruments, commentaries, on earlier works and connection, of melodies and compositions. He was great composer, poet, painter and calligrapher. His book Kanz al-tuhaf has preserved some of his notated compositions. His other works are: Maqasid al-alhan and Sharh al-adwar Abd al-Qadir Ibn Ghaibi acquired considerable fame and success in his own life time mainly as a musician and musicologist.\textsuperscript{184}

87. Al-Kashi

Al-Kashi was one of the most prominent scientist of Islam who greatly advanced the study of mathematics astronomy. He was born in Kashan, Iran. Al-Kashi wrote a number of valuable books in which he treated arithmetic, algebra, trigonometry, astronomy, astronomical instruments and astronomical computations. About twenty of his books are available the most of important of which are: Risala al-muhittiya, Miftah al-hisab Risala al watar –wa jaib, Zij-i Khaqani and Risala dar sharh-I alat-i rasad. Al-Kashipresented a method of extracting roots of integers which is now known as Ruffini-Home method. He methodically studied decimal fractions in order to simplify their operations just like integers, and Discovered a method for the determination of unknowns in all the 65 types of fourth degree equations. Far surpassing all previous efforts, he calculated the value of \(2 \pi = 6.2831853071795865\).\textsuperscript{185}

\textsuperscript{183} Abdur Rehman Sharif "100 Muslim Scientists". Mumbai, Arsh Publications, 2000 P-80
\textsuperscript{184} Ibid P-95
\textsuperscript{185} Ibid P-32
88. Al-Suyuti

Jalal al-Din Abd al-Rahman ibn Abu Bakr ibn Muhammad al-
Suyuti was born in Cairo in 1445 AD. He died reciting the surah
Yasin (Quran : Ch : 36) 1505 AD. His important books deal with
Quran, Hadith, theology, philology, grammar and history. He wrote a
number of books such as; al-Munzir fi ulum al-lugha, an
encyclopaedic work on philology, al-Asbah wal nazair on grammer,
and Bughyat al-wuat on the history of grammarians. Al-Nukaya is an
encyclopaedia of knowledge covering fourteen branches of learning.
Some of his important works on history are : Badai al zuhir fi waqai
al-duhur on world history, Husn al-muhadhara fi akhbar Misr wal
Qahirah on history of Egypt, and Tarikh al-khulfa, a history of the
caliphs.\textsuperscript{186}

89. Pin Rais

Pin Rais was one of the most important cartographers of
Islam.He was born in 1470 AD in Turkey. He died in Qahirah / Cairo
in 1554 AD.
Pin Rais fame rests on his book on marine geography called Kitab-I
Bahriya and his two world maps which have a special place in the
history for cartography. Piri Rais completed his first world map in
1513 AD. It shows the eastern regions of America, the western
regions of Africa, Portugal, Spam, the Atlantic Ocean and various
islands;It shows cities, mountains, rivers, rocky regions, shoals, etc.
It also contains coloured pictures and notes on countries, peoples,
animals and plants.\textsuperscript{187}

90. Sinan

Sinan was one of the great architects / engineers of the world
who constructed more than 343 buildings. Sinan ibn Abd al-Mannan,

\textsuperscript{186} Abdur Rehman Sharif "100 Muslim Scientists". Mumbai, Arsh Publications, 2000 P-71
\textsuperscript{187} Ibid P-100
also known as Mimar Sinan, was born in Qaisariya in Anatolia in Turkey in 1489AD. Sinan died in 1578 AD at the advanced age of ninety years. He built his first non-military building in 1539 and the last in 1574. His buildings may be seen from Bosnia to Mecca. Names of 343 buildings built by Sinan are available which include 131 mosques, 62 schools, 34 palaces, 33 public baths, 8 bridges, 7 aqueducts and 17 caravanserais. His great mosques, palaces and tombs are marked by elegance, magnificence and power. All later Turkish buildings appear to have been inspired by Sinan’s style and concepts.\textsuperscript{188}

\textbf{91. Mulla Mahmud}

Mulla Mahmud al-Faruqi was one of the great scholars of Islam and certainly one of the greatest Islamic scholars of the subcontinent. Mulla Mahmud ibn Muhammad al-Jawnpuri al-Faruqi was born at the historic town Jawnpur in North India. Mulla Mahmud died in 1652 AD at the age of about forty years. In addition to religion, he wrote several books on philosophy and logic. He was also deeply interested in astronomy and, at one time, wanted to establish an astronomical observatory at Agra. Some of his important books are: al-Hikma al-baligha, al-Shams al-baligha, al-Faraid fi sharh al-fawaid, al-Farasid al-Mahmudiya, Risala fi jabr wal ikhtiyar and Risala fi ithbat al hayula al-Shams al-baligha which covers time, space, motion, numbers, astronomy and other subjects. His works have been included in the syllabi of the madrasas and religious colleges of the subcontinent. It is said that he never made a statement which he had to withdraw or contradict.\textsuperscript{189}

\textsuperscript{188} Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-76
\textsuperscript{189} Ibid P-79
92. Ahmad Lahori

Ahmad Lahori was a supremely gifted architect and engineer who created the world famous Taj Mahal. Ahmad was born, probably in 1591 AD. He died in 1649 AD after the completion of the Taj and Lal Qila.

The two great architectural achievements of Ustad Ahmad Lahori are the world-famous Taj Mahal at Agra and the Lal Qila/Red Fort at Delhi. The Taj Mahal is a mausoleum (maqbara) built for Mumtaz Mahal, the favourite wife of Mughal Emperor Shah Jahan. It is a masterpiece of architecture. The simplicity of its design, the proportion of its various parts, the purity of the white marble and the superb inlay work have made it an architectural marvel. The Taj combines technology and art in a mysterious way to create a thing of supernatural beauty. Taj also contains excellent examples of Islamic calligraphy showing Quranic verses. The Taj is a massive structure, yet it looks delicate.\(^{190}\)

93. Awlia Chelepi

Among Islamic travellers and travelogue writers, Awlia Chelepi occupies an outstanding position. Awlia Chelepi was born in 1611 AD in Istanbul in Turkey. He spent about forty years in traveling across Europe and the Islamic world. He wrote the account of his journeys, *Seyahatname*, in ten volumes in Turkish. A modern edition of the book covers 7,000 pages. The *Seyahatname* is a rich source of information on history, geography, culture, folk-lore and sociology of Europe and the Islamic world during the seventeenth century AD. The book covers Asia minor, Central Asia, Anatolia, Dagestan, Georgia, Crimea, Armenia, Iran, Turkey, Bulgaria, Romania, Albania, Bosnia, Czechoslovakia, Holland, Hungary, Germany, Poland, Yugoslavia, Austria, Spain, Italy, Greece, Crete, Rhodes, Syria, Palestine, Kurdistan, Arabia, Egypt, etc etc.. He

\(^{190}\) Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-19
gives a good account of cities that he visited writing about their history, geography, divisions, houses, forts, mosques, madrasas, libraries, baths, ancient monuments, etc. In view of its importance, the *Seyahatname* has repeatedly been published in recent times.\(^\text{191}\)

### 94. Abul Fadhl

Abul Fadhl was born in 1551 AD at Agra in India. He is the author of the monumental work *Akbarnama* which includes *Ain-i Akbari*. Broadly, the book covers four main subjects - Mughal history, Akbar's administration, palace life, and description of India. *Ain-i Akbari*'s section on India covers description, geography, climate, people, religion, sects, festivals, dress, music, dance, literature, weights and measurements, etc. He has given a good account of Indian philosophy, religion, arts, sciences and technology.\(^\text{192}\)

### 95. Ibn Yunus

Ibn Yunus was one of the greatest Muslim astronomers who made important contributions to the development of astronomy and trigonometry. Abul Hasan All ibn Abd al-Rahman ibn Ahmad ibn Yunus was born in Fustat, near Cairo, in Egypt in the 940s AD. *Zij al-Hakimi al-kabir* is one of the most important astronomical work. He prepared elaborate tables for various astronomical purposes, like a table for determining positions of the sun, moon and other planets for over 2,700 years from 622 AD a table of sines for each 0; 10° of arc, a table of cotangent functions and a set of highly accurate spherical astronomical tables for time keeping which was used in Cairo until the nineteenth century. He was probably the first to study the isometric oscillatory motion of the pendulum which led to the construction of mechanical clocks. Some of his ten books are: *Kitabghyat al-intifa*, *Kitab al-samt* and *Kitab al-tadil al-muhkam*. For

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\(^{191}\) Abdur Rehman Sharif "100 Muslim Scientists". Mumbai, Arsh Publications, 2000 P-77

\(^{192}\) Ibid P-67
his contributions to astronomy, modern world has honoured him by
naming a landscape on the far side of the moon after him.\textsuperscript{193}

Certain astronomical values determined by him proved to be
right such as inclination of ecliptic (23 degree – 35 minutes),
Longitude of sun’s apogee (86 degree, 10 minutes) and percession
of equinoxes (51.2 seconds). Further, he narrated that the axis of
earth is not static but moving slowly in a circular fashion.\textsuperscript{194}

96. Ibn Majid

Ibn Majid was the first writer on nautical science and
oceanography. He was born in 1432 AD in Jufar. He died in 1500
AD. He wrote about forty books on navigation and oceanography.
His most important book is \textit{Kitab al-fawa'id fi usul ilm al-bahr wal
qawa'id} - Book of profitable things on principles of navigation and
oceanography. Some of the admired features of the book are
description of the Red Sea, coastal survey of India, Arabian
Peninsula, etc, geographical information, and mechanics of the
monsoon. His other important books are: Hawiya, Dhahabiya, al-
Sofaliya, al-Hadiya and al-Malaqiya. Ibn Majid guided Vasco da
Gama’s ship from Africa to India.\textsuperscript{195}

97. Shah Shirazi

Shah Fath Allah Shirazi was a mechanical engineer at the
court of Akbar the Great. Shah Fath Allah Shirazi was born in Shiraz
in southern Iran, probably in 1520 AD. In 1590AD, Shirazi
accompanied Akbar to Kashmir where he fell ill with fever, and died.
Shah Fath Allah Shirazi was a highly learned person. He was a
theologian, astronomer, and, engineer. In addition to the \textit{tafsir}, he

\textsuperscript{193} Abdur Rehman Sharif, "100 Muslim Scientists". Mumbai, Arsh Publications, 2000 P-29
\textsuperscript{194} Ibrahim A. Nadvi “Musalmman scicedan aur Unki Khidmat” (Delhi : Maktaba Al-
Hasnat : 1985) Pp − 91- 92
\textsuperscript{195} Op-Cit P-16
translated Ibn Sina’s Qanun into Persian, wrote books on logic and
designed a new calendar called Tarikh-i Ilahi.

He devised a number of civil and military machines for Akbar
which have earned great admiration of modern scholars. Some of
the machines made by him are a mobile wagon mill, a multi-
barrelled gun a portable canon and a mobile luxury bath. The mobile
wagon mill, which was fitted on a carriage, powdered grains when
the carriage was moved by the animal.196

98. Ibn Shatir

Ibn Shatir was one of the outstanding scientists of Islam. Ala
al-Din Ali ibn Ibrahim Ibn al-Shatir was born in 1305 AD m
Damascus, Syria. He died in Damascus in 1375 AD.

He wrote books on the making and use of astronomical
instruments. He constructed sundials, quadrants and astrolabes. He
invented two types of quadrants called al rub al-alai and al-rub al-
tamm. Ibn Shatir’s major contribution was his planetary theories and
planetary models. Some of his important books are: Taliq al-arsad,
Nihayat al-ghayat fil amal al-falakiyat, al-Zij al-jadid / al-Zij Ibn al-
Shatir, Nihayat al-sul fi tashih al-usul, al-Naf al amm fil amal bil rub
al tam li mawaqit al Islam.

99. Omar Khayyam

The overwhelming Fame of Omar Khayyam as a poet would
make it difficult for many to accept that he was a great scientist as
well. Ghiath al-Din Abul Fath Umar ibn Ibrahim al-Nishapuri, also
known as Omar Khayyam, was born at Nishapur in Iran in 1048 AD.
In his last years, Khayyam returned to Nishapur where he died in
1131 AD. Khayyam was one of the great exponents of algebra which
he carried a few major steps forward. By applying geometry to solve

196 Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-72
algebraic problems Khayyam sought to unify algebra and geometry. The relation between algebra and geometry was established in the sixteenth century in Europe by such thinkers as Rene Descartes and Pierre de Fermat.\(^{197}\)

After completing his education from Nishapur, he wrote a book “Mukabat”, on mathmatics, in which he gave the methods of finding

According to him duration of solar year was 365 days. 5 hours and 49 Min. which differs by only 11.3 sec. from its present value i.e. 365 days 5 hours, 48 min., and 48.7 sec.\(^{198}\)

100. Iqbal

Muhammad Iqbal was born in 1876 in Sialkot, now a part of Pakistan. He knew Arabic, Persian, Urdu and English. After obtaining a master's degree, in arts (MA) in Lahore, he went to Cambridge, England, where he studied philosophy and law. Later, he went to Germany and did his Ph.D. in Munich. He returned to Lahore in 1908, where he started his legal practice. He also occasionally, taught philosophy. Meanwhile, his search for answers for metaphysical questions and solutions for the uplift of his community continued. The results of his search started appearing in the form of poetry in Persian arid Urdu. In 1928, he delivered a series of six lectures on the reconstruction of religious thought in Islam. He died in 1938 at Lahore.\(^{199}\)

Iqbal was a great philosopher-poet who used brilliant poetry to project his philosophy which was mainly aimed at revitalising a dormant but potential people, the Muslims. Iqbal believed that man, who reflected the divine will, was a master in relation to the universe, but a servant in relation to God.

\(^{197}\) Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-5
\(^{199}\) Abdur Rehman Sharif “100 Muslim Scientists”. Mumbai, Arsh Publications, 2000 P-64
He fully understood both the strength and weakness of the Western philosophy. Its systems secularism, socialism, communism, nationalism - suffered from a lack of universality unity with nature. He denigrated everything that made man passive and indifferent to happenings around him. He believed in a man of actions. For this purpose, he evolved the philosophy of the self, khudi. Through the development of self and determination of duties one could achieve an ideal society. His main works are: *Javidnama, Bal-I Jibril* and *Dharp-I Kalim*.200

**ACKNOWLEDGMENT OF MUSLIM CONTRIBUTION**

There are gloving examples of pioneer scholars in the field of knowledge, science and history who have not only acknowledged but also admired the contribution of Muslim Scientist. A few of them are cited here.

George Sarton has penned a huge history of science201, three volumes in five, mentioned very frequently the works and contributions of the Muslim scientists. Robert Briggault who died in 1948 did a pioneer work. “The making of humanity”202. Similar is the case of LeBon whose “Civilization de Arabes”203 appears in French but got also translated in Urdu first published by Mufide – Aam. Then a towering job is convened by John draper while compiling a history of intellectual development of Europe. The Joint venture of Arnold and Guillaume also deserve creditable mention for their ‘The legacy of Islam’204.

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200 Ibid
201 George Sarton ’ Introduction to the history of science (3 Vols) Baltimore.
203 Gustave Le Bon, Civilization de Arabes (Aqra, Mufide Aam, Press 1896)
A recently published ‘Dictionary of Scientific Biography’ lists at least a hundred scientists of the Muslim age whose contribution has become a yester tale. The present work includes an appendix on the same at the end of the thesis.

Dr. Hossein Nasar, sabwera, Sami and Hamarneh have also made contribution to this field. The researcher has frequently made access to the sources in Urdu, mentioned hither to in this work.

A great French scholar, Jolivet Castelot, in his book ‘LA LOI DE L’HISTOIRE’ (The Law of History) writes, “For centuries the Arabs were the torch bearers of knowledge and science and represented the disciplines related to philosophy. Astronomy, chemistry, medicine and metaphysical steams. They were not the academic leaders, inventors and discoverers but the servants of knowledge and science on the merit of their genius and they deserved that. Arabic civilization lived short but its impacts were for reading we can only grieve for that…..

Further he writes, “Europe is indebted to Arabic civilization when it was ruling over the world from the 10th century to 14th. Europe reaped the fruit of knowledge, philosophy and thought from it as it quelly affected it during the middle ages. We see it _______ and illiterate as compared to Arabic civilization.

Arabic knowledge an Arabic literature; Europe got benefited from the healthy environs created in those days because of Arab thought. In those four centuries, there was no civilization except the Arab civilization and the Arab scholars were its flag – holders.

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206 Syed Hossein Nassar ‘Islam main science our Tehzeeb (Karachi Hamdard Foundation Press 1988)