# THE QUEST FOR KNOWLEDGE IN
# IRAN

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( Translated from Farsi by Mr. Faramarz Amjadi )

In the Name of Iran

Zarathushtra's Gatha has influenced the quest for knowledge and science in Iran during her entire history. Gatha is the "philosophy of life".  One of Gatha's versus says: "where there is knowledge, there can be no lies".

Let's find out what the status of science was in ancient Iran. There are many scholars who ask whether scientists of "Faaraabi" and "Abou Ali Sina's" calibre ever lived in pre-Islamic Iran. If yes, what has happened to their books? Professor Fazlollah Reza, has recently written in an article that - he does not find an Iranian equivalent of "Oghlidous" or "Apolinious" in geometry. He even doubts the existence of science and technology in ancient Iran. I am going to have a brief review of Iranian ancient history to show the extent of Iranian pre-Islamic knowledge and to talk about Iranian scientists of that era.

I can proudly claim that we Iranians have used the solar calendar ever since we reckoned the need to keep track of our days. While even today there are many communities that use a lunar calendar despite the fact that urban and agricultural societies need a solar calendar to be able to function scientifically. Even Omar Khayam has cited that he has used ancient sources for designing his "Jalali Calendar". Which is a more accurate solar calendar than the "Gregory Calendar" which was designed 200 years after the "Jalali Calendar". The "Gregory Calendar" is the basis of today's Christian calendar and its margin of error is 3 days every ten thousand years. The margin of error for Khayam's "Jalali Calendar is two days every ten thousand years. Although Khayam has not specifically named his sources he has mentioned that his calendar has the same base as the missing Sasanian's calendar "Zeeg e Shahriar" (meaning King's Chart). In the post-Islamic Iranian literature, there is one other reference to "Zeeg e Shahriar".  "Abou Reyhan e Beerooni" in his "Aasaar ol Baghieh" quotes two sentences from it. Therefore, "Zeeg e Shahriar" existed at that time and was available to "Beerooni" from which he has quoted, but it is missing now.

Here is why these sources vanished. When Arab's invaded Iran, they massacred Iranians and confiscated their belongings. All Iranian cities were looted repeatedly. To explain the extent of devastation; I will mention what happened to two Iranian cities.

The first city was "Sistan" and the story is from "Taarikh e Sistan" (meaning History of Sistan, the author is unknown, it was written in the year 400 of Islamic Lunar calendar). In an open field in front of the city's gates bodies of the dead was piled up like a hill. The commander of the conquering Arab army climbed to the top of this hill and ordered the leader of the city to come forward. An elderly man in a white dress showed up, he looked at Arab commander standing on the dead bodies and shouted at the commander "By God I have finally seen Satan". In the same book it says that despite the sorrow and anguish in the city, a traveller passing by, invited the inhabitants to rejoice because it was "Nourooz" (Iranian new-year).

"Kharazm" was another city conquered by the Arabs. On the second day of his victory, "Ghotaibeh" the Arab commander addressed the population in an open field asking them to present 4000 educated people from among themselves. Then he ordered them to form 4 groups of 1000 each and line up on each side of where he was standing and then beheaded all of them. (Many years later Gangiz Khan and Teymour Khan requested the same formation but banished the educated people). He banned people from speaking Farsi ordering his soldiers to cut off the tongue of anyone who dared to speak Farsi. That is how people of "Kharazm" stopped speaking Farsi and forgot their own mother tongue after a few years. That is why today there is no trace of the "Kharazmi" dialect except for a few words. That is how the popular "Kharazmi" dialect vanished. That is why in Arabic Iranian people are called "Ajam", meaning mute. These massacres were one of the reasons that Iranian books and resources vanished.

Another fact:
"Taaher e Zolyaminain" was an Iranian commander who helped the "Abbaasian's" dynasty in taking power. He sent his nephew to rule "Kerman" and collect "Jaazieh", the head tax that every non-Muslim citizen must pay to the Muslim government. This nephew ordered people to bring their ancient books as "Jaazieh". People

were warned of severe retribution; they had to present books to the tax collector. So from their collection of books they tried to save at most their religious book "Avesta". Instead they sacrificed mathematics and philosophy books to save their lives and the lives of their children. That is how our scientific resources were destroyed.

Another example is the city of "Kazeroun" the birthplace of "Salman e Parsi". The Prophet Mohammed promised "Salman" that his city and its citizens will have immunity in a war and will be spared. Yet, the newly converted conqueror of "Kazeroun" ordered to behead one thousand non-Muslims everyday. What do you think was the population of Kazeroun that every day a thousand were beheaded? That is how along with its population Iranian books and references also vanished.

After the third Islamic century, traces of the remaining Iranian books were found in the greater "Khorasaan" area, which was less affected by the Arab domination. From that time on, the Iranians started to revive their ancient knowledge. Very many of the great Iranian scientists and philosophers such as "Abou Reyhan e Beerooni", "Abou Ali Sina", "Khayam", "Khaajeh Naseereddin e Toosi", "Aboulvafaa ye Boozjaani", and others who were born in "Khorasaan" after the third century were instrumental in the revival.

"Aboulvafa ye Boozjaani" was a top mathematician and was born in "Boozjaan - Khorasaan" some 1100 years ago. He learnt the basic sciences from his uncles, became famous, and later on moved to "Baghdaad". "Boozjaan was ruined and now on its place the city of "Tourbat e Jaam" is built. I visited "Tourbat e Jaam" last year. Its population is poor and uneducated. Did "Aboulvafaa's" uncles teach him Greek sciences? No, they used their Iranian resources. Iranians were tormented but they treasured their culture generation after generation.

"Maahaani" is another example of Iranian scientists. He was born in "Maahaan", which is a township close to "Kerman", some 110 years ago. He got his education in "Maahaan", became famous, and was summoned to "Baghdaad". "Fazl e Neirizi" who is from "Neiriz – Fars" is another example. He was another great mathematician who was taken to "Baghdad".

These all indicate that Iranians treasured their culture within their families for along time. I believe that people like "Abou Reyhan" and "Ebn e Sina" and others tried hard to adopt Islam with philosophy. But "Mohammed e Ghazaali" stopped them. "Ghazaali", himself a scientist, reasoned that learning mathematics is wrong. He justifiably argued that one who learns mathematics or philosophy will discover a world based on reasoning and logic. Such a person may think that religion's pillars are placed on the same base. With no logic and reasoning in religion, the pupil becomes infidel. "Gazaali" concluded that mathematics and philosophy should be banned.

Now lets talk about the books and references, which could lead us to the extent of science in pre-Islamic Iran. "Plutarch", a Roman historian (or a fellow traveller) who became a Roman army commander, happened to pass through "Hamedaan" which was called "Hekmataaneh", in 700 BCE. In "Hekmataaneh", he came across a school (university). The Head of the faculty was called "Siineh" who had one hundred students. In the faculty they learned astronomy, medicine, philosophy and mathematics. Very many of the world greatest scholars and physicians visited him at the university. "Plutarch" mentioned of similar schools in all Iranian cities. If science did not prevail in ancient Iran, then what were these people studying? What happened to that knowledge?

"Plotinus", a Greek historian who visited Iran in 100 BCE, wrote, " When I was in Iran, they were measuring the radius of the Earth and its curvature". Other references to the spherical shape of the Earth can be found in "Yasht's" especially in "Aabaan Yasht". To measure the Earth's radius you have to be familiar with astronomy and mathematics. This was when the Greek still assumed that Earth was a flat land surrounded by water. "Homer" in his epic "Iliad" expressed the following vision of the Earth: " My lover's home is in the centre of Athena, Athena is in the centre of Greece, and Greece is in the centre of the world. Therefore, all planets, stars, and the sky move around my lover's home". Certainly it is a romantic expression of love, but not a very scientific view. Comparing "Homer's" "Iliad" with the more ancient "Gatha" shows the level of knowledge that prevailed in ancient Iran.

Let's go back to "Siineh". He became a legend after his death. The word "Sinaa" is a derivative of "Siineh" and means "the unconditional physician". "Siineh" has the same roots as "Shahnameh's" legendary bird "Simoorgh" (meaning the healing physician). "Ebn e Sinaa" means son of "Sinaa". Historians gave Arabic names to five generations of his ancestors and then called his sixth generation "Pour Sina". I believe that is not true. "Ebn e Sinaa" means son of a physician and my understanding is that he is a descendant of the 700 BCE "Siineh" and was born in a physician family. In those days it was customary to call someone who spent

his time wandering on the oceans, son of the ocean. By the same token, he was called "Ebn e Sinaa". What I cannot understand is his other name: "Abou Ali Sinaa" (meaning - Sinaa father of Ali). He never had an offspring!

"Phisaghorous", (Pythogarus) the Greek philosopher and mathematician, is another example. His biography says that he spent 20 years in Iran and "Babylon" (which was a part of the ancient Iranian Empire) and learnt the knowledge of the "Moughan" (Magi). His philosophy of light was under the influence of Iranians who believed in spherical Earth rotating around the central Sun. However, there is no mention of the originators of these thoughts.

In ancient Iran there was a great philosopher named "Estaans e Raazi". He was from "Ray" and his nickname was "Mass e Moughan" meaning head or leader of Moughan. He was also referred to as the "Zartosht" of his time. During the reign of "Khashayarsha" he migrated to Egypt, which was part of the Iranian Empire, and settled in the "Memphis Temple". He had few pupils among them "Dimocrit" or "Zimeghraatis". "Dimocrit" is the founder of atomic philosophy and particles science. He learnt it from his teacher.

There is an ancient Greek thesis from somebody named "Paapoos" He cited "Estaans" the Moughan as a naturalist philosopher believing in "self management and self-recycling power of nature provided that humans do not destroy it". This philosophy is still valid and we have to take care of our environment. In his thesis, "Paapoos" also referred to "Estans's" philosophy of particles. This is the same philosophy that "Dimocrit" ("Estaans's" student) registered. Now, did we have no "Oghlydous"? Did we have no philosopher? It may surprise you to learn that "Oghlydous" was an Iranian who was born in Asia Minor and migrated to "Eskandarieh" (Alexandrian) to work and never lived in Greece.

Another example in geometry is the famous "Phisaghorous" (Pythogarus) theory on right angle triangles. Today, it is a known fact that the theory did not belong to "Phisaghorous" and was named after him later. Towards the end of "Ghajaar" era, French archaeologists found some documents in "Elaam" and later on published them in France. Among them were 17 cases of the right-angle triangles with different dimensions and calculations similar to those of "Phisaghorous". Apparently, they were looking for a single solution and it is possible that they found it.

Having mentioned all these facts, I think there is a misunderstanding of the "history of science". History of science does not include only abstract sciences. Neither it includes only applied sciences. It has evolved through successive stages of both abstract and applied science.

Let's elaborate. Before the Greek era, from the beginning of civilisation till 600 BCE, when humans had significant advancements, everything was applied science initiated by needs. Enhancement of astronomy and mathematics was to find practical solutions to daily chores. This type of applied science was not error free. For example in ancient Egypt, in the pre-Aryan Elaam, and in Babylon there was a mathematical way to calculate the area of a rectangle. They would take half of the length of two similar sides and multiply it by the half of the length of the other two sides. This method is only applicable to rectangles and squares but does not apply to other geometric shapes. They used this analysis to divide their land for irrigation. Since most agricultural lands were almost rectangular, the error was insignificant. However, such inaccuracies motivated some of them and our Elaamies mastered geometry before Babylonians did.

In the pre-Greek era, applied sciences in physics, chemistry, mathematics and even philosophy were more common. As they observed inaccuracies and errors, they paid more attention to the abstract sciences. The era of abstract sciences lasted 1000 years, 600 years in Greece and 400 in Eskandarieh. This era is known as Greek era but in reality all nations contributed to abstract sciences. The abstract era had its own difficulties and abstract sciences were not able to address it. The Greek did not have a numeric system. They used alphabets for numbers. "Araashmidous" the greatest mathematician of ancient Greece, wrote a book to represent a big number, and called it his masterpiece. However, thousands of years before the Greek, Elaamians had a numeric system similar to what we have today. For example to represent 185, the Greek starting from the right, first put 100, then 80, and then 5. (5,80,100) In Elaamian system each figure had its own meaning in its own place meaning that for 555 each 5 had its own weight. First 5 represented 5, second represented 50 and third one signified 500.

Babylonians were using a numeric system at the same time. They even discovered zero. In those days and even till some time after that, the Greek did not have any progress in calculation and mathematics. They had nothing to offer in Algebra, math, and trigonometry. Instead, they used geometry. For instance, we know that $5^2 = 25$ or $5^3 = 125$. The Greek would use the rectangle of 3 and 5 to simply multiply 3 by 5. They used

geometry to solve everything. When they faced practical obstacles in their calculations, then they revisited the era of applied science and tried to use the ancient methods.

Now, lets look at an Iranian example. "Khaarazmi ye Majoosi" was an Iranian scientist who lived in 3<sup>rd</sup> Islamic century. The fact that he was called "Majoosi" indicates that either him or his ancestors was Zarathushties. Interesting enough they not only gave him a Arabic name but renamed a few generations of his ancestors with Arabic names. When someone converted to Islam, they even named his long dead ancestors with Arabic names. "Khaarazmi" is the first person that wrote an algebra book and called it "Algebr olmoghabeleh". His book had two parts. The first part was purely abstract where he explained how to solve equations. In the second part he talks about problems such as dividing an inheritance or applying a will. The Islamic administration encountered this sort of problems, which required equation-solving skills, causing confusion among religious leaders.  For instance he cited the case of a dead head of family who had willed to pass a certain portion of his inheritance to each living family members and set another portion aside for charity. "Khaarazmi" wrote that in order to divide the inheritance as per the will, a second-degree equation must be solved.

"Aboul Vafa ye Boozjaani" who was living around the same time as "Khaarazmi" is another example. He almost discovered the entire trigonometry and even spherical trigonometry.  Then Europeans continued his work, which was not limited to trigonometry. Then there was "Jamsheed e Kaashaani" who calculated Sinus of three degrees (Sin 3°). He then applied a third degree equation to calculate Sin 1°. He solved the equation from both the algebraic and geometric perspectives. I will not go into the mathematical details of his work. Two or three centuries later an Italian named "Kaardan" copied from the work of one of his countrymen who had reproduced "Kaashaani's" achievements using a third degree equation and took all the credit for himself. Today, the formula is known as "Kaardan's Formula" and is taught in all schools and universities. No one refers to "Jamsheed e Kaashaani" who formulated it over 200 years before "Kaardan".

In our books it is recorded that the word for Sinus of an angle was first transferred from Iran to Europe. Sinus is a French word. The Iranian equivalent of it was "Jaib" which is the same as word "gareebaan". "Jaib" in Pahlavi language is "Jeip" meaning measuring column (deerak). It is not known why the Pahlavi word "Jeip" is converted to "Jaib" and later to Sinus, but it seems that in ancient Iran they used this column and its shadow for problem solving.

To conclude, philosophy of mathematics and astronomy moved from applied science to abstract at times and switched back at other times. From the 16<sup>th</sup> century onward abstract sciences became dominant again till mid 20<sup>th</sup> century when applied sciences prevailed. Meaning that capitalism will not pursue a non-applicable endeavour.

The truth is that there were both scientists and scientific books in ancient Iran. Many volumes of such books were looted, many others, were burnt. Even we burnt many of our books out of fear. From the 7<sup>th</sup> century onward we can find many reference books in math and astronomy that are said to have been translated from Greek to Arabic. These have been valuable resources for scientists. It is now clear that all these books were translated from "Pahlavi" and "Seryani" to Arabic. There were no direct translations from Greek to Arabic. "Seryani" was an Iranian language and was used in Iran.

God be with you and long live Iran.

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