Medical education in the first university of the world, the Jundishapur Academy

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ABSTRACT

The Academy of Jundishapur was the world’s first university established during the Sassanid Empire in old Persia. Some of the important features of this scientific center of the ancient world include a policy of tolerance, conducting annual international congresses, compiling the first comprehensive medical textbook, doing the hospital rounds, physician licensure exam, special attention to the ethics, and using an educational curriculum. Moreover, its unique style of education made Jundishapur a brilliant school in the history of science. This outstanding academy maintained its impact on the scientific movement of that era for four centuries. It finally declined after transmission to Baghdad medical school. In this study, we have discussed the features of the Jundishapur school which made it a successful model for medical education.

Keywords: Academy, history of medicine, Jundishapur, medical education, Persian medicine

Introduction

As an important part of the history of science, the progress of the medical sciences has a vicissitudinous history. During the various evolving episodes of paradigm shift in different historical eras, several distinct schools of medicine have emerged. In this regard, only those academic centers remained in the history which had their unique style of education and made an important contribution in the field of science. Some of these schools are such brilliant that even today they can be considered as successful models of education. The current models of medical education suffer from some deficiencies which have caused some critical issues. Many a time, medicine is not considered as something more than a kind of business. However, someday it was sacred and only those knowledgeable people who had the required ethical characteristics were permitted to learn this branch of science. In addition, the holistic viewpoint which considers various aspects of human health and its relation with the nature has been missed. It has caused, somehow, a tunnel vision in the current models of medical education and practice. Meanwhile, the emergence of “life-style medicine”, “spiritual medicine”, different branches of traditional, complementary and alternative medicines and their integration to the mainstream medicine, are examples of recent revivalistic endeavors for compensation of such deficiencies in modern (Western) medicine.

Jundishapur is one of the brilliant academies which played an important role in the progression of various branches of science, especially medical sciences. With its rich curriculum and unique style of education, Jundishapur served as the first academic...
center of the world closest in foundation to the modern-day concept of “University”. It provided a perfect ground for training the students in various disciplines with different religions and nationalities. One of the most important roles of Jundishapur was that it laid the foundations of “Persian Medicine” school since the pre-Islamic era through the Islamic Golden Age. This holistic health-based school of medicine has a great emphasize on prevention (rather than treatment) to keep the people healthy. The Jundishapur scholars believed in the consciousness and intelligence of the nature and its reaction to our behaviors. They considered the spiritual aspects of human health in their holistic approach and their goal was firstly maintaining the health.

It is worth mentioning that this center was introduced as the world oldest university at the 39th general annual conference of Nations Educational, Scientific and Cultural Organization (UNESCO) at Paris in 2017. In the following, and for celebrating the greatness of Jundishapur University, the 1750th anniversary of its foundation was included in the official list of the anniversaries with which UNESCO was associated in 2018-2019. Its ruins are still remained as an archaeological site located near the Shahabad village, 14 km Southeast of Dezful city, Khuzestan province, Iran (Figure 1).

In this article, we have discussed the unique features of this scientific center in order to provide an introduction of the medical education model in the world’s first university.

Foundation of Jundishapur city

Jundishapur is one of the cities of Khuzestan province in Southwest of Iran. The name of “Khuzestan” is adopted from the name of an ethnic group known as “Khuz” who were living there. It also seems to be the name of a group of physicians in Jundishapur school. This is an ancient city dating back to the prehistoric times. In point of fact, the Sassanid King Shapur I (241-271 AD) who was the son of Ardashir Babakan (the founder of the Sassanid Empire), rebuild the city after defeating the Byzantine Emperor, Valerian. He named it “Veh-AZ-Andev-Shapur” in Pahlavi language which means “Shapur better than Antioch”.

Also known as “Nilat” or “Nilab” by the Khuzis, its name gradually changed to Gundishapur and then Jundishapur in Arabic. The next Persian King of Sassanid Emperor, Shapur II (310-382 AD), chose the city as his capital. Consequently, Jundishapur became a more important city and a famous cultural and scientific center in addition to its value as the focal point of silk production in Iran.

Jundishapur school

It seems that the Jundishapur school was first established by Shapur I in 271 AD. In addition to the school, a teaching hospital and a library were also founded to provide the primary basement for this scientific center. After that, Shapur II played an important role in its promotion by reconstruction of the complex (including school, hospital and library). During his reign, Jundishapur School gained a worldwide fame absorbing more than 100 physician, scholar, and philosopher. They were from different nations including Greece, Rome, Egypt, India, and China. Shahpur II welcomed them all and provided facilities more than their homelands. It caused a significant progress of school not only in medicine, but also in other fields including philosophy, mathematics, astronomy, and physics. Other than medicine, surgery, psychiatry, pharmacy, and veterinary medicine were also taught in Jundishapur. The motto which was engraved on its entrance gate well describes the function of the school: “knowledge and virtue are superior to sword and strength”.

The golden age of Jundishapur is during the reign of Khosrow I (501-579AD). In addition to development of university and hospital, this Sassanid Emperor invited more scientists and masters to Jundishapur. It has been said that at the time of Khosrow Anushirvan, about 500 professors and 5000 students were engaged in Jundishapur University.

Khosrow I was a knowledge-loving Sassanid king. He sent his special physician, Borzuya, with a group of Iranian physicians to India in order to bring medical texts to Jundishapur and translate them to Persian. In point of fact, it was one of the policies to enhance the scientific level of Jundishapur school by collecting scientific sources and elite scholars from other regions.

Conducting annual international congresses in Jundishapur was another unique event in this center. In 550 AD, the first congress was held by the order of Khosrow Anushirvan. In these congresses that he himself was participating, physicians and scholars from different countries were attending. Such a special event provided the opportunity for knowledge and experience exchange between scholars of various nations.

Instructors of Jundishapur were collecting different opinions about any topic and then, after many discussions and investigations, they were choosing the best model for education of the students. That is why many assume that medicine in Jundishapur was superior to the Greek or Indian medicine. It should be noticed that one of the first comprehensive medical textbooks has been written by the “Khuzi” professors of...
Jundishapur named as “Jame Al-Khuz” (Khuz’ Comprehensive Book).\[13\]

Ethnomedicine had a very important value amongst the Jundishapur scholars. They used to collect the ethnomedicinal knowledge and experiences of the people to work on them. In fact, one of their aims was to make the knowledge of people more scientific and evidence-based. They were doing their best to solve the problems of the society in a logical and scientific manner to meet the needs of their community.

They also loved their homeland and had a great effort to improve it as much as possible. It was not easy for a Jundishapur scholar to live and work anywhere else. Their immigration to other cities was usually by force and order of the Caliph. For instance, when Caliph al-Mansur invited Jurjis ibn Bukhtishu to Baghdad, first he refused and then he forced to leave the school and hospital to his son, Bukhtishu ibn Jurjis. He went to Baghdad and cured the Caliph. After four years, Jurjis became sick and asked the Caliph to let him return to his homeland. His coming back to Jundishapur made Jurjis healthy.\[12\]

Another important point about Jundishapur is the policy of tolerance and avoidance of ethnic and religious prejudices. During the reign of Khosrow Anushirvan and after the closure of the Academy of Athens by the Emperor Justinian in 529 AD, a group of Nestorian Christians from Edessa and Nisibis in Mesopotamia including philosophers such as Diogenes, Damascius, Hermias, Siplicius, Priscianus, Eulamius, and Isidore left their homeland and came to Jundishapur.\[10,18\] Scholars who were forced to be relocated due to the religious persecution, found Jundishapur a peaceful land where they can safely and freely live and continue their scientific career. In fact, other than Persian Zoroastrians, Jews, Greeks, Indians, Christians, and later Arab Muslims were living and working together in Jundishapur School. Religious disputes and debates had no place there and the “science” was the common language among them. This is one of the most important features of Jundishapur school which helped its scientific development.

Importance of ethics

In addition to all of the aforementioned features, ethics had a special importance in Jundishapur school. Students paid special respect to their professors. Persian physicians not only themselves were committed to the medical ethics, but also did their best to promote the ethical principles.

The Jundishapur authorities were reluctant to permit children of merchants to learn medical sciences.\[15\] They believed that the profession of medicine possesses a special holiness and anyone who wants to learn this science must have the required ethical characteristics, in addition to necessary talent for this position. Those with mundane goals, even the children of merchants, had been deprived. For example, Hunayn ibn Ishaq (Johannitus) was dismissed from medical education by his master, Yuhanna ibn Masawaih, for the very reason that Hunayn was from the family of merchants.\[12\]

Educational style

Indeed, the style of education in Jundishapur was unique. Its features made it to continue its productive scientific life for about 400 years. For instance, the professors have the right to choose their students. In fact, a special highhanded selection policy had been implemented by the masters to accept only those with the highest merit. The motive of the masters and pupils was very important. Anyone who wanted to learn medicine had to be knowledgeable with transcendental motives to serve the people.

Medical education in Jundishapur was research-based. As a pioneer of evidence-based research in medicine,\[14\] Rhazes (865-925 AD)\[18\] performed animal research for testing the effects and toxicities of the drugs prior to their prescription for the patients.\[10\] Moreover, he conducted an early design of clinical trials while treating a group of patients with meningitis.\[17\] His other important innovation was in medical education. For the first time, he did the hospital rounds for visiting the patients and discussing about their medical care with a group of his students.

On the other hand, an integrative approach had been applied in Jundishapur for a clinical-based education. It was necessary for the students to involve with the clinic from the beginning of their education beside learning the basic sciences. They had a full-time residence in the hospital assisting the expert physicians. Their other responsibility was keeping the medical treatment records of the patients to be reviewed and edited further by the master physicians.\[18\]

It is interesting to know that teaching music knowledge to the medical students was one of the novelties that had been done in Jundishapur. Music therapy methods (specially using Oud) had been applied in Jundishapur for treating a variety of ailments specially for depression and other psychiatric disorders.\[18,19\]

Another important method of medical education in Jundishapur was conducting the sessions of debate and discussion. The related documents, which are the first ones in the field of medical education, indicate that such sessions had been held by the order of Khosrow II in 610 AD while the grand physician himself had been participated.\[20\] This method was also applied in the hospital for discussing about the patients forming the “hospital rounds”.

It is estimated that the duration of education in Jundishapur school has been three years following the model of Nusaybin school. In the first year, students had to study the basic sciences including logic, philosophy, mathematics, and geometry as their preparatory course.\[21\] Then, they have to study the books of Galen and Hippocrates. In point of fact, other than learning the medical sciences and scientific thinking, they had been educated to be able to build and manage their own hospitals.\[20\]
It is worth mentioning that a specific writing style had been used in Jundishapur for medical education. In fact, it was a strategy to protect the sacred science of medicine from the fraud. This writing style which was named as “Nim-Kashtaj” had 28 alphabets and used for medical and philosophical writings [Figure 2].

Regarding the language, it was Pahlavi which was using as the general language in Jundishapur. However, it seems that other languages have also been used at the same time for each specific field: Greek and Syriac for medicine, and Pahlavi for pharmacology.

At the end of this three-years educational program, the students had to pass a two-step comprehensive exam for graduation. First step was for testing the preparatory sciences including logic, literature, and physiology. By passing this step, students were examined in their specialized medical fields. Receiving the graduation certificate of Jundishapur school was obligatory for medical practice. In point of fact, it was an advanced feature of school to consider a physician licensure. Moreover, it was being considered as a high level of credit knowing that most of the imperial physicians were graduates of Jundishapur.

Great scholars of Jundishapur

Jundishapur University had many distinguished professors and students who have been engaged in research, teaching and learning in various scientific fields. They have left many scientific works in different fields. An important characteristic of their scientific works is that they integrated the discursive aspect of Greeks with the experimental method of Indians. So, they have a deductive-analogical approach in their education and practice.

The remarkable number of professors and the astonishing volume of their writings, the abilities and skills of physicians and professors, the manufacture of various medicines, and the development of botany, all indicate the greatness of this university.

The following are some of the distinguished professors of this university, especially those who are prominent in the field of medicine and pharmacy:

The Bukhtishu family: They were eleven physicians in six generations during 7th to 9th centuries AD. Some of them were masters of Jundishapur school and personal physicians of Caliphs. Jurjis ibn Bukhtishu was one of the directors of Jundishapur hospital who went to Baghdad in 765 AD and cured the gastric ailment of Caliph al-Mansur. He is the author of “Jurjis’s Konash” which was translated from Syriac to Arabic by Hunayn ibn Ishaq (Johannitus). He also translated many books from Greek to Arabic by the order of Mansur. His son, Bukhtishu II, was surrogate of the father in Jundishapur. He treated the headache of the Caliph Harun al-Rashid (763-809 AD) and became his physician-in-chief. Jabril ibn Bukhtishu was another great physician in this family who served in the court of Abbasid Caliphs. He advised Harun al-Rashid to build the first hospital in Baghdad in the same model of Jundishapur.

Shapur ibn Sahl was another Persian Christian physician who was working in Jundishapur hospital. He wrote one of the first pharmacological books called “Aqrabadin-fi-al-Bimarestanat” which was using as an herbal pharmacopoeia in the Bimarestan (hospital). He also authored some other books about foods and sleep medicine.

Yuhanna ibn Masawaih (777-857 AD) is one of the great scholars who went to Baghdad and became the personal physician of five Abbasid caliphs after 30 years of medical practice in Jundishapur. He compiled many books and treatises including the oldest remained book in ophthalmology, “Daghal al-Ayn”. Hunayn ibn Ishaq was his most famous student.

Hunayn ibn Ishaq (809-873 AD), also known as Johannitus, was a scholarly physician and the most important translator of his era. He became the head of Bait al-Hikma (The House of Wisdom) in Baghdad and mastered a group of translators who had a great impact on the science transmission to the Islamic world. Johannitus authored more than 100 books on various subjects. His “Kitab al-Ashr Maqalat fil-Ayn” (Ten Treatises on the Eye) contains the oldest illustration of the eye structure.

Daishatuk was one of the famous physicians who was the head of the Jundishapur hospital for a while. When he was asked for coming to Baghdad and managing its medical school, he refused and said that he did not have any salary and the government does not the previous supports of Jundishapur hospital; I and my nephew, Mikha’il, are managing the Jundishapur hospital for the sake of God.

Borzouyeh (Perzoes) who was the personal doctor of the Sassanid King, Khosrov Anushirvan, played an important role in the progression of medical sciences in Jundishapur. He brings the medical textbooks from India to the Jundishapur. He also translated the Sanskrit book of “Panchatantra” to Pahlavi language adding one of the first medical ethics texts to its introduction. He believes that best physicians are those who do not use the science firstly as a means for gaining wealth.

Hospital (Bimarestan)

As a part of the school, Bimarestan or hospital was managed by a master physician called “dorostbed”. Meanwhile, he was the director of the school, too. As this leading physician was the best
in the country, he was usually the imperial physician of the King or Caliph and court's head doctor.\textsuperscript{[25]}

The hospital had provided a 24-hour hoteling for the patients benefiting from proficient physicians with various religions and nationalities. Interestingly, there was a considerable level of specialization for various clinical fields and each physician was practicing in his more experienced specialty. They also did consult with other specialists whenever it was needed; something similar to the modern consultation system.\textsuperscript{[28]} Such an advanced medical center has been considered as “the first teaching hospital in the history of medicine”.\textsuperscript{[29]}

The Jundishapur hospital was used as a model for building next hospitals during the Islamic Caliphates. The Caliph Harun al-Rashid invited Jabril ibn Bukhtishu from Jundishapur to become the head of the new Bimarestan in Baghdad. In addition to this hospital which named as “Rashidi”, others such as “Baramaked”, “Seyyedeh”, and “Moghtaderi” were established in the next years according to the pattern of Jundishapur.\textsuperscript{[7]}

The importance of the Jundishapur hospital is to the extent that Dr. Elgood (1892-1970 AD) believes that: “to a very large extent the credit for the whole hospital system must be given to Persia”.\textsuperscript{[30]}

**Pharmacology Laboratory**

A laboratory for pharmacology and making the medicines was also a part of the Jundishapur school. Some of the physicians who were leading scholars in pharmacology as well such as Ibn Masawaih and Shapur ibn Sahl were working in the laboratory. They had a tradition of writing reference books in this field called “Qarabadin” or “Aqrabadin” (means pharmacy).\textsuperscript{[24,31]} These pharmacopeias contain valuable information and experiences about making the compound drugs with animal, herbal, and mineral sources.\textsuperscript{[32]} They also include numerous innovations in the science of pharmaceutics introducing a vast range of dosage forms and applying as modern concepts as drug targeting.\textsuperscript{[33‑35]}

**Library**

Jundishapur had one of the largest libraries in the ancient world [Figure 3]. This library with a capacity of four hundred thousand books played a very important role in promoting science and expanding the frontiers of knowledge in the history of science. It had included various titles in the fields of medicine, veterinary medicine, botany, pharmacology, philosophy, mathematics, and astronomy mostly in Pahlavi, Syriac, Greek, and Sanskrit languages. In addition to the clerks for maintaining the books, there were groups of scribes. They had relations with the city of Rayshahr near Jundishapur, most probably due to being a center of paper production and book copiers.\textsuperscript{[36]}

**Conclusion**

The school and hospital of Jundishapur is very important in the cultural history of Iran. This scientific center has had a great contribution in transferring Greek, Iranian and Indian medical knowledge to the Islamic world. This institution had a great contribution in the production and promotion of science in the various fields of medicine, pharmacology, mathematics, astronomy, and philosophy. This success was achieved by the presence of scholars with different religions and ethnicities from other countries and thanks to the wisdom, pacifism, and avoidance of dogmatism by Iranians. Jundishapur had a large library full of various scientific works in the multiple languages of Pahlavi, Syriac, Greek and Sanskrit. This unique academic center is recognized and respected by cultural organizations such as UNESCO. Its outstanding features in medical education and ethics could still be considered as a model by modern-day academies.

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